Microplate Spectrophotometer

Epoch™

Operator's Manual

BioTek®

Epoch™
Microplate Spectrophotometer

Operator's Manual

November 2015

Part Number 7201000
Revision E
BioTek® Instruments, Inc.

Notices

BioTek® Instruments, Inc.

Highland Park, P.O. Box 998

Winooski, Vermont 05404-0998 USA

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Contact Information

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Highland Park, P.O. Box 998
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Global Service and Support

BioTek instrument service and repair is available worldwide at one of BioTek's International Service Centers and in the field at your location. To arrange for service or repair of your instrument, contact the office nearest you; visit www.biotek.com for up-to-date contact information. For customer service, sales, and technical assistance, refer to the information below.

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
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Revision History

Revision	Date	Changes
A	8/2009	Initial release to Production
B	11/2010	*General:* Minor text and cross-reference corrections *Preface:* Updated regulatory information *Chapter 1, Introduction:* Updated wording for getting the shipping address in Product Support & Services *Chapter 3, Control Using Gen5:* Included instructions for setting up the Epoch as a Plug & Play reader *Chapter 4, Qualification:* Removed mention of Software Documentation, Wavelength Table Verification, and "Run Assay" tests Added an index
C	8/2011	*General:* Added information about support for the BioStack.
D	9/2012	*General:* Updated some terminology to reflect Gen5 v2.x interface. *Preface:* Updated date and revision; updated Intended Use Statement; under "Hazards," added "Service" and "Accessories" warnings; under "Precautions," added "Spare Parts" caution; updated CE text and added "if labaled for this use" to Directive 98/79/EC. *Chapter 2, Installation:* Added note that improper packaging that leads to instrument damage may lead to additional charges. *Chapter 4, Qualification:* Fixed typo in Absorbance Plate Test section to read that well A1 is in the left-rear corner of the carrier. *Appendix A, Specifications:* Removed "lamp life 1 billion flashes" from the Light Source information.
E	11/2015	*Preface:* Updated CE Directive 2006/96/EC to 2012/19/EU *Chapter 1, Introduction:* Added 340 nm Absorbance Test Plate PN 7260551 to the "Optional Accessories" section. *Chapter 3, Getting Started:* Changed title of chapter from **Control Using Gen5**, removed section "Setting Up Gen5" because this info is already covered in **Chapter 2, Installation**; reworked text to match other instruments' Getting Started chapters. *Chapters 4 and 5:* Reordered chapters so that the **Preventive Maintenance** appears before the **Instrument Qualification** chapter, to match the chapter order of other instrument manuals. *Chapter 4, Preventive Maintenance:* Clarified in Routine Cleaning

		Procedure and Decontamination not to use a "dripping-wet cloth"; reworked "Decontamination" section text to match other instruments' decontamination procedure. *Chapter 5, Qualification:* Added 340 nm Absorbance Test Plate PN 7260551 to the "Recommended Qualification Schedule" section; updated text of System Test and Liquid Test sections to match other instruments' Qualification chapters.

Document Conventions

This manual uses the following typographic conventions:

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

Intended Use Statement

The Epoch is a single-channel, automated, benchtop, general-purpose microplate monochromator that performs optical density measurements of samples in a microplate format. The user must evaluate this instrument with PC-based software in conjunction with the specific assay. This evaluation must include the confirmation that performance characteristics for the specific assay are met.

If the instrument has an "IVD" label, it may be used for clinical and non-clinical purposes, including research and development. If there is no such label, the instrument may be used only for research and development or other non-clinical purposes.

Quality Control

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

Warranty and Product Registration

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

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

Repackaging and Shipping

If you need to ship the instrument to BioTek for service or repair, contact BioTek for a Service Call Notice (SCN) number, and be sure to use the original packing materials. Other forms of commercially available packaging are not recommended and can void the warranty. If the original packing materials have been damaged or lost, contact BioTek for replacement packing.

Warnings

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

Bright light or strong incandescent light can reduce the linear performance range of the instrument.

Measurement values may be affected by extraneous particles (such as dust) in the microplate wells. A clean work area is necessary to ensure accurate readings.

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 may vary depending on the instrument type. See **Hazards** and **Precautions**.

Hazards

The following hazards are provided to help avoid injury:

Warning! Power Rating. The instrument'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 plug adapter to connect primary power to the external power supply. Use of an adapter disconnects the utility ground, creating a severe shock hazard. Always connect the power supply directly to an appropriate receptacle with a functional ground.

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

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

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 reader; 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 off the instrument. Wipe up all spills immediately. Do not operate the instrument if internal components have been exposed to fluid. Call BioTek TAC for assistance.

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

Warning! Reader Data Reduction Protocol. No limits are applied to the raw absorbance data. All information exported via computer control must be thoroughly analyzed by the operator.

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.

Precautions

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

Caution: Service. The instrument should be serviced by BioTek-authorized service personnel.

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

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

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

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

Caution: Carrier Shipping Bracket. The microplate carrier shipping bracket must be removed before operating the instrument and reinstalled before repackaging the instrument for shipment.

Caution: Disposal. This instrument contains printed circuit boards and wiring with lead solder. Dispose of the instrument according to Directive 2012/19/EU, "on waste electrical and electronic equipment (WEEE)" or local ordinances.

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

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), because these may interfere with the proper operation.

CE Mark

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

❖ 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: Class A for Radiated Emissions and Line Conducted Emissions. Verification of compliance was conducted to the limits and methods of EN 55011—CISPR 11, Class A. In a domestic environment it may cause radio interference, in which case you may need to mitigate the interference.

Immunity

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

EN 61000-4-2, Electrostatic Discharge
EN 61000-4-3, Radiated EM Fields
EN 61000-4-4, Electrical Fast Transient/Burst
EN 61000-4-5, Surge Immunity
EN 61000-4-6, Conducted Disturbances from RFI
EN 61000-4-11, Voltage Dips, Short Interruptions and Variations

Directive 2006/95/EC Low Voltage (Safety)

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

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

EN 61010-2-81, "Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes."

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

Disposal Notice: This instrument contains printed circuit boards and wiring with lead solder. Dispose of the instrument according to Directive 2012/19/EU, "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.
- EN 61010-2-101, "Particular requirements for in vitro diagnostic (IVD) medical equipment."
- Traceability to the U.S. National Institute of Standards and Technology (NIST)

Electromagnetic Interference and Susceptibility

USA FCC CLASS A

RADIO AND TELEVISON INTERFERENCE

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

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

Canadian Department of Communications Class A

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

Le present appareil numerique n'émet pas 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:

- **Underwriters Laboratories UL 61010-1**

  "Safety requirements for electrical equipment for measurement, control and laboratory use; Part 1: general requirements"

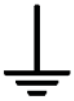
- **Canadian Standards Association CAN/CSA C22.2 No. 61010-1**

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

- EN 61010 standards, see **CE Mark**, starting on page xii

Safety Symbols

Some of the following symbols may appear on the instrument:

	Alternating current Courant alternatif Wechselstrom Corriente alterna Corrente alternata		Both direct and alternating current Courant continu et courant alternatif Gleich - und Wechselstrom Corriente continua y corriente alterna Corrente continua e corrente alternata
	Direct current Courant continu Gleichstrom Corriente continua Corrente continua		Earth ground terminal Borne de terre Erde (Betriebserde) Borne de tierra Terra (di funzionamento)
	On (Supply) Marche (alimentation) Ein (Verbindung mit dem Netz) Conectado Chiuso		Protective conductor terminal Borne de terre de protection Schutzleiteranschluss Borne de tierra de protección Terra di protezione
	Off (Supply) Arrêt (alimentation) Aus (Trennung vom Netz) Desconectado Aperto (sconnessione dalla rete di alimentazione)		Caution (refer to accompanying documents) Attention (voir documents d'accompanement) Achtung siehe Begleitpapiere Atención (vease los documentos incluidos) Attenzione, consultare la doc annessa
	Warning, risk of electric shock Attention, risque de choc 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		Warning, potential biohazards Attention, risques biologiques potentiels Warnung! Moegliche biologische Giftstoffe Atención, riesgos biológicos Attenzione, rischio biologico
	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
	Consult instructions for use Consulter la notice d'emploi Gebrauchsanweisung beachten Consultar las instrucciones de uso Consultare le istruzioni per uso		

Chapter 1

Introduction

This chapter introduces the Epoch, describes its hardware and software features, and provides contact information for technical assistance.

Product Description

The Epoch monochromator offers tunable wavelength selection and wavelength scanning without the need for interference filters. The single-channel reader is completely computer controlled using Gen5 software. Its key features include the following:

- A variety of read modes including endpoint, kinetic, multiwavelength, and spectral scanning.
- A monochromator for continuous wavelength selection from 200 to 999 nm in 1-nm increments, and a xenon flash lamp for both UV and visible light absorbance measurements.
- Superior optical specifications, with an extended dynamic range of up to 4.000 OD.
- Ability to read standard microplates from 6- to 384-wells, Terasaki plates (with adapter), BioTek's patented BioCell quartz vessel for 1-cm measurements, and the BioTek Take3 and Take3 Trio Micro-Volume Plate.
- Two reading speeds: normal and sweep.
- Some models of the Epoch are robot-accessible and compatible with the BioStack Microplate Stacker.

Package Contents

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

Item	Part #
Epoch Operator's Manual on USB flash drive	7201000
Power supply	01281
Power cord	varies according to country of use
USB cable	75108

Optional Accessories

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

Item	Part #
7-filter Absorbance Test Plate for absorbance measurement testing	7260522
Absorbance Test Plate for absorbance measurement testing at 340 nm*	7260551
Epoch Product Qualification (IQ-OQ-PQ) package	7200515
BioCell quartz vessel for 1-cm wavelength fixed pathlength absorbance measurements	7272051
BioCell adapter plate for containing up to eight BioCells	7270512
Terasaki plate adapter for 60-, 72-, and 96-well Terasaki plates	7220531
Take3 Micro-Volume Plate	TAKE3
Take3 Trio Micro-Volume Plate	TRIO
Some models of the Epoch are compatible with the BioStack Microplate Stacker. The BioStack rapidly and systematically transfers a "stack" of microplates to and from the Epoch's microplate carrier. Contact BioTek or visit our website to learn more (www.biotek.com).	

* The diagnostic feature in Gen5 version **2.08** and higher is compatible with the 340 nm Absorbance Test Plate BTI #7260551. If you are using an earlier Gen5 version, the test plate's instruction sheet explains how to manually conduct the tests and analyze results.

Materials for Liquid Tests	Part #
BioTek Wetting Agent Solution (PN 7773002)	7773002
BioTek QC Check Solution No. 1 (25 mL) *or* BioTek QC Check Solution No. 1 (125 mL)	7120779 7120782
β-NADH Powder (β-Nicotinamide Adenine Dinucleotide, Reduced Form)	Sigma #N6785-10VL (or BioTek PN 98233)
Phosphate-Buffered Saline (PBS) Tablets (pH 7.2–7.6)	Sigma #P4417

Product Support and Service

Technical Assistance Center (TAC)

If your instrument or software fail to function properly, if you have questions about how to use or maintain our products, or if you need to send an instrument to BioTek for service or repair, please contact our Technical Assistance Center (TAC).

TAC is open from 8:30 AM to 5:30 PM (EST), Monday through Friday, excluding standard U.S. holidays.

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 version (available via Gen5 by selecting **System > Instrument Control > Information**)
- For troubleshooting assistance or instruments needing repair, the specific steps that produce your problem, and any error codes displayed (see also **Appendix C, Error Codes**).

If you need to return an instrument to BioTek for service or repair, please contact the TAC for a Service Call Notice (SCN) number and the shipping address. Repackage the instrument according to the instructions at the end of **Chapter 2, Installation**.

Chapter 2

Installation

This chapter includes instructions for unpacking and setting up the Epoch, connecting to a PC, and repackaging the instrument.

Product Registration

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 (CRC) at www.biotek.com or by contacting BioTek Customer Care.

1: Unpack and Inspect the Instrument

Save all packaging materials! If you need to ship the reader to BioTek for repair or replacement, you must use the original materials. Using other forms of commericially available packaging materials, or failuire to following the repackaging instructions, may **void your warranty**. Improper packaging that results in damage to the instrument may lead to additional charges.

During the unpacking process, inspect the packaging and reader for shipping damage. If the reader is damaged, notify the carrier and your BioTek representative. Keep the shipping boxes and the packaging materials for the carrier's inspection. BioTek will arrange for repair or replacement of your reader immediately.

1. Open the shipping box, remove the instrument from the box, and place it on a level, stable surface.
2. Place the packaging materials back into the shipping box for reuse if the instrument needs to be shipped again.

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

2: Select an Appropriate Location

Install the Epoch on a level, stable surface in an area where ambient temperatures between 18°C (64°F) and 40°C (104°F) can be maintained. The reader is sensitive to extreme environmental conditions. Conditions to avoid are:

- **Excessive humidity:** Condensation directly on the sensitive electronic circuits can cause the instrument to fail internal self-checks. The humidity must be in the range of 10% to 85%, non-condensing.
- **Excessive ambient light:** Bright light can reduce the linear performance range and affect the instrument's readings.
- **Dust:** Readings may be affected by extraneous particles (such as dust) in the microplate wells. A clean work area is necessary to ensure accurate readings.

- **Excessive vibration:** Do not place the reader on a surface that is shared with machines that cause the surface to vibrate.

❖ If you are installing the BioStack for operation with the Epoch, you may wish to seat the instruments in their aligning plates now. Refer to the *BioStack Operator's Manual* for more information.

3: Remove the Shipping Hardware

Remove and store all shipping hardware before you turn on the reader. See **Figure 1**.

1. Using a screwdriver, remove the shipping screw (PN 19502) and o-ring (PN 19608) assembly.
2. Using your fingers, remove the rubber plug (PN 19610).
3. Install the plug in the hole where the shipping screw was originally located, and insert the screw and o-ring in the hole where the plug was originally located. See **Figure 2.**

❖ The plug prevents light from entering the test chamber during operation.

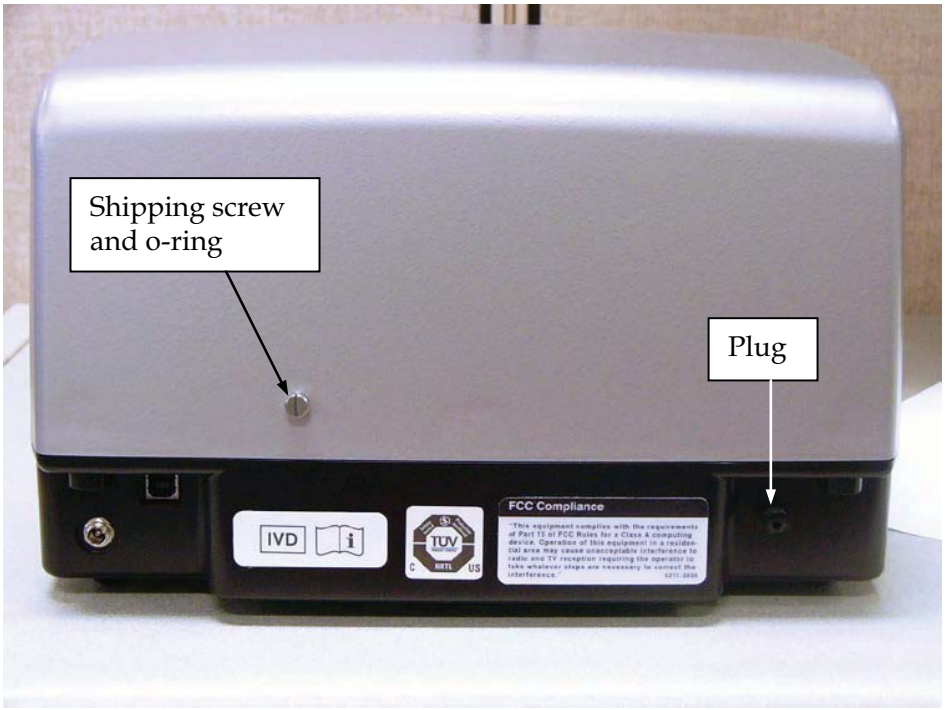


Figure 1: Shipping screw, o-ring, and plug in shipping position

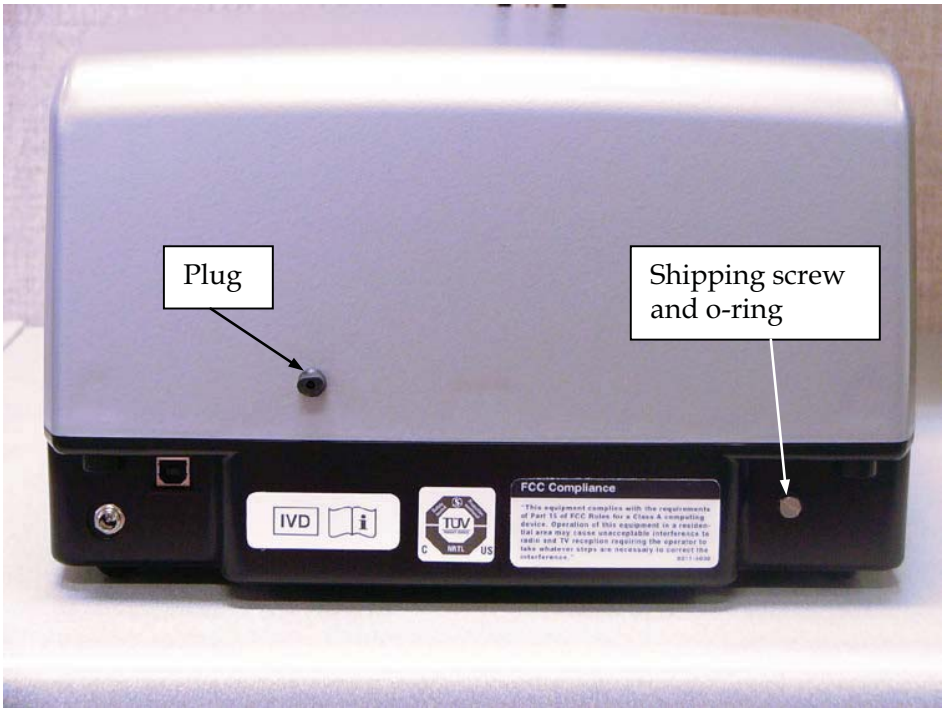


Figure 2: Shipping screw, o-ring, and plug in usage position

4: Connect the Power Supply

⚠	**Power Rating.** The instrument'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. **Electrical Grounding.** Never use a plug adapter to connect primary power to the external power supply. Use of an adapter disconnects the utility ground, creating a severe shock hazard. Always connect the power supply directly to an appropriate receptacle with a functional ground.

1. Connect the power cord to the external 24-volt power supply.
2. Connect the power supply's outlet plug to the 24-VDC connector on the rear of the instrument.
3. Tighten the plug barrel to retain the plug.
4. Plug the other end of the power cord into an appropriate power receptacle.

5: Connect the Host Computer

❖ The USB port is located on the rear panel of the reader.

1. If the reader is on, turn it off.
2. Using the supplied USB cable, connect one end of the cable to the USB port on the computer.
3. Connect the other end of the cable to the USB port on the rear of the reader.

6: Install the Software on the Host Computer

Turn on the computer and install Gen5 software on the computer. Refer to the *Gen5 Getting Started Guide* for software installation (and registration) instructions.

7: Turn on the Reader

1. Locate the power on/off switch on the front of the instrument, next to the carrier eject button. See **Figure 3** below. The power on/off switch has a green, internal LED lamp that is illuminated when the power is on. The carrier eject button, when pressed, ejects the carrier out of the reader or pulls the carrier back inside the reader to the carrier home position.
2. Turn on the power. The reader will perform an internal self-test and carrier homing sequence. The carrier will eject outside the reader, then retract to its home position inside the reader before it ejects again. Ensure that the reader performs the carrier homing sequence and that the LED light is illuminated while the power is on.
   - If the test is successful, the reader is ready for use.
   - If the test fails, note any error codes that are displayed in Gen5, and contact BioTek. **Appendix B, Error Codes**, contains a list of error codes that may appear in Gen5.

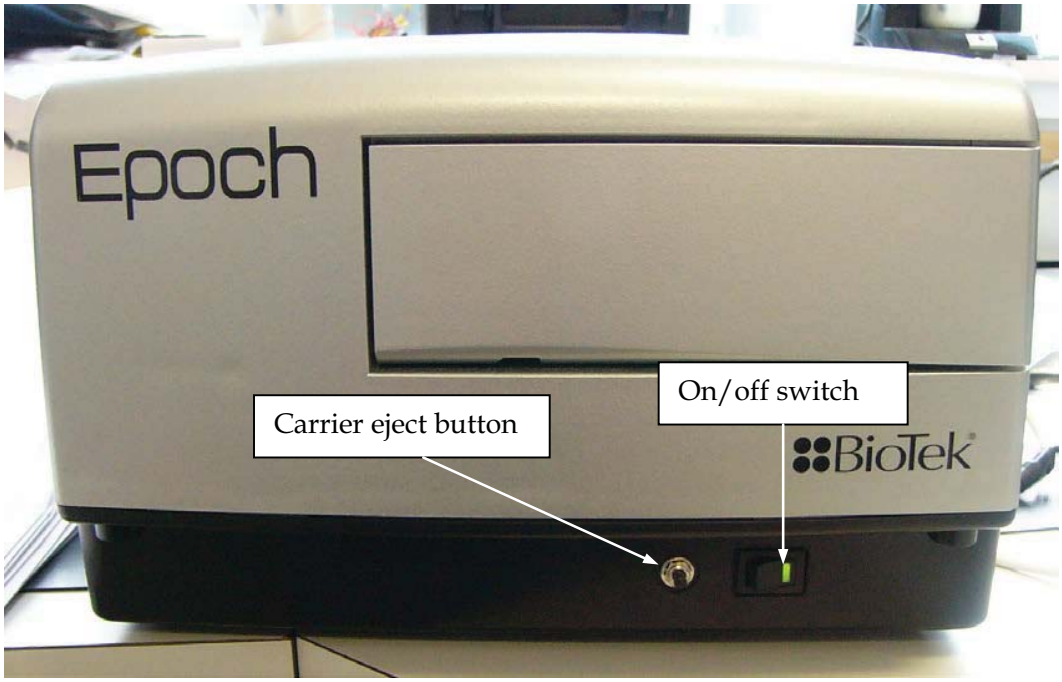


Figure 3: Power on/off switch and carrier eject button

8: Establish Communication

1. On the host computer, start Gen5 and log in if prompted. The default system administrator password is **admin**.
2. From the Gen5 main screen, select **System > Instrument Configuration** and click **Add**.
3. Set the Reader Type to **Epoch**.
4. Perform one of the following steps, as applicable:
   - Select **Plug & Play**.

❖ An Epoch must be connected via USB to the computer and turned on to appear in the Available Plug & Play Readers list.

   - Set the Com Port to the computer's COM port to which the reader is connected.

❖ The information can be found via the Windows Control Panel, under Ports in the Hardware/Device Manager area of System Properties (e.g., Serial Port(COM5)).

5. To verify that Gen5 can communicate with the instrument, click **Test Comm**. If the communication attempt is successful, Gen5 displays a success message. Return to the Gen5 main screen.

Communication Errors

If the communication attempt is not successful, try the following:

- Is the reader connected to the power supply and turned on?
- Is the communication cable firmly attached to both the reader and the computer?
- Did you select the correct Reader Type in Gen5?

USB Cable

- Try a different COM Port.
- Did you install the USB driver software?

❖ If you remain unable to get Gen5 and the reader to communicate with each other, contact BioTek's Technical Assistance Center.

Operational/Performance Qualification

Your Epoch was fully tested at BioTek prior to shipment and should operate properly following the successful completion of the installation and setup procedures described throughout this chapter.

If you suspect that problems occurred during shipment, if you received the reader back from BioTek following service or repair, and/or if regulatory requirements dictate that Operational/Performance Qualification is necessary, turn to **Chapter 4, Instrument Qualification** now to learn about BioTek's recommended OQ/PQ procedures for the Epoch.

❖ A Product Qualification and Maintenance (IQ/OQ/PQ) package for the Epoch is available for purchase (PN 7200515). Contact your local BioTek dealer for more information.

Repackaging and Shipping

Important! Please read all of the information provided below before preparing the Epoch for shipment.

	Contact BioTek Technical Assistance Center for a Service Call Notice (SCN) number and the shipping address before returning equipment for service.
	If the reader has been exposed to potentially hazardous material, decontaminate it to minimize the risk to all who come in contact with the reader during shipping, handling, and servicing. Decontamination prior to shipping is required by the U.S. Department of Transportation regulations. See **Chapter 5, Preventive Maintenance** for decontamination instructions. Remove the microplate from the carrier before shipment. Spilled fluids can contaminate the optics and damage the instrument.
	The instrument's packaging design is subject to change. If the instructions in this section do not appear to apply to the packaging materials you are using, please contact BioTek Technical Assistance Center for guidance. Replace the shipping hardware before repackaging the reader for shipment. Please contact BioTek if you have misplaced any of these items: • shipping screw (PN 19502) and o-ring (PN 19608) assembly • rubber plug (PN 19610) If you need to ship the Epoch 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**. The shipping materials are designed to be used no more than five times. If the original materials have been damaged, lost, or used more than five times, contact BioTek to order replacements.

Attach the Shipping Hardware

	The **shipping hardware** must be reattached to the carrier before the Epoch can be shipped.

1. If you have not already done so, retract the microplate carrier.

2. Turn off the reader, and unplug the power supply from the power outlet and from the power supply connector on the back of the reader. Remove the USB cable from the reader.
3. Using a screwdriver, remove the shipping screw and o-ring from the reader, and, using your fingers, remove the plug from the reader.
4. Insert the plug in its original hole and use the screwdriver to re-install the shipping screw and o-ring in its original position (see **Figure 1**).

Repackage the Instrument

Use the instrument's original shipping container and packaging material. This shipping system was designed to be used no more than five times. If the container is damaged and/or has been used more than five times, contact BioTek for a new set of shipping materials, and ask for PN 7203003.

The shipping box, accessories box, foam caps, and so on are included as a whole set under this part number and cannot be ordered separately.

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.

Ensure that the Epoch carrier shipping hardare has been attached to the reader's carrier as instructed in the preceding section, **Attach the Shipping Hardware**. Refer to **Figure 4** on the following page when performing these steps:

1. Place the foam cap into the bottom of the shipping container. Note the orientation of the foam cap in the box as illustrated in **Figure 4**.
2. Place the accessories box back into the shipping container.
3. Place the reader inside the original plastic bag and carefully lower the reader into the two foam caps in the bottom of the box. Note the orientation of the reader in the box.
4. Place two foam caps over the reader.
5. Bundle the power cord and place it into the accessories box as shown.
6. Place the power supply and USB cable in the accessories box.
7. Close the top of the box and secure it with shipping tape.
8. An **Service Call Notice (SCN)** number must be obtained before returning equipment for service. Contact BioTek's Technical Assistance Center for this number, then write "**SCN**" and the SCN number and shipping address in large, clear letters on the outside of the shipping container.

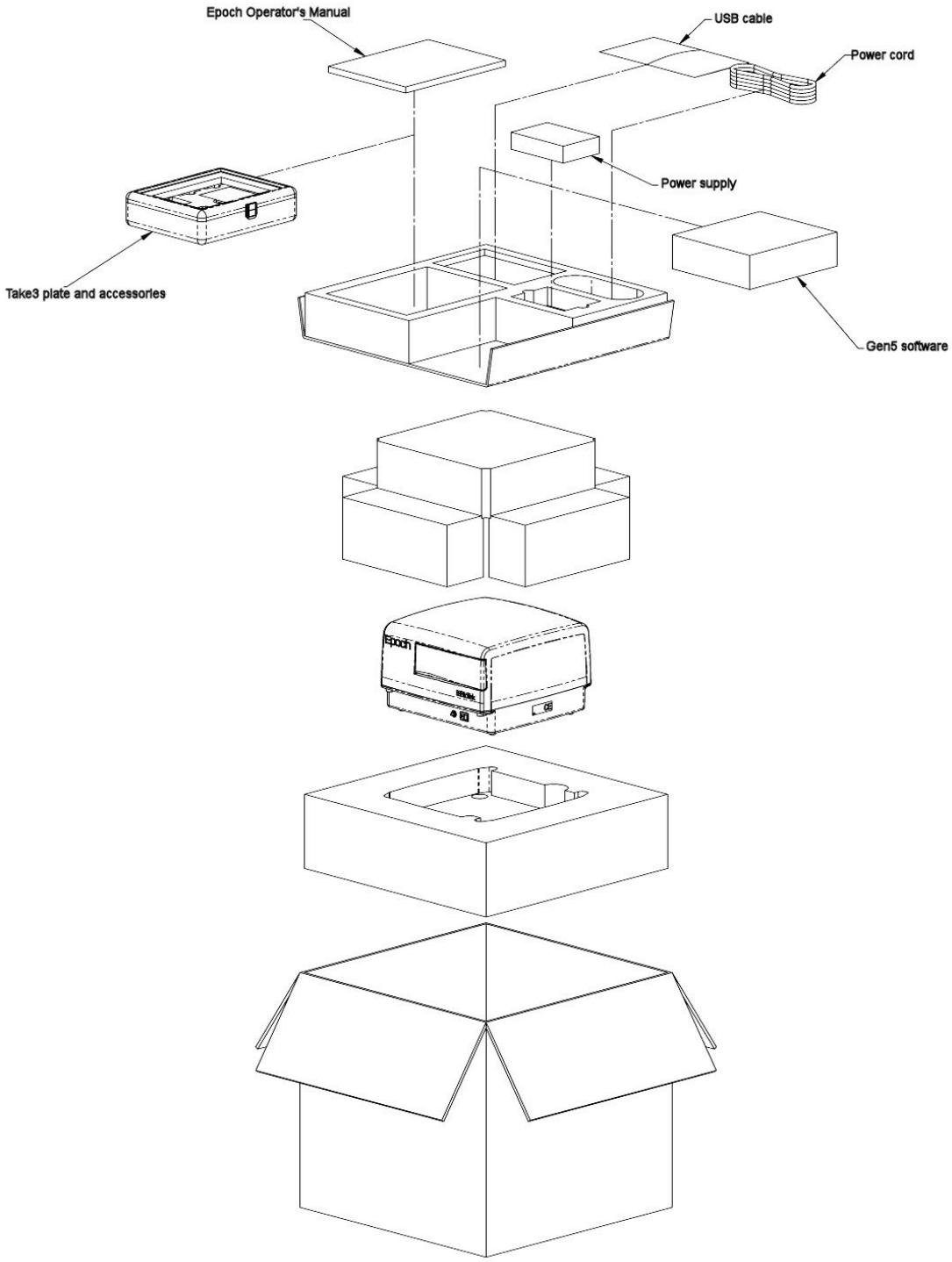


Figure 4: Packing the Epoch

Chapter 3

Getting Started

The Epoch can be controlled only using software installed on a PC connected to the reader via the computer's USB port. This chapter describes how to configure BioTek Gen5 to control the reader.

Gen5 Software

BioTek Gen5 software supports all Epoch reader models. This section provides brief instructions for working with Gen5 to create protocols and experiments. Refer to the Gen5 Help system for more information.

Protocols and Experiments

In Gen5, a protocol contains instructions for controlling the reader and (optionally) instructions for analyzing the data retrieved from the reader. At a minimum, a protocol must specify the procedure for the assay you wish to run. After creating a protocol, create an experiment that references the protocol. You'll run the experiment to read plates and analyze the data.

These instructions briefly describe how to create a protocol in Gen5. See the Gen5 Help system for complete instructions.

1. In the Gen5 Task Manager, select **Protocol > Create New**.
2. Open the Procedure dialog. If prompted to select a reader, select **Epoch** and click **OK**.
3. Select a Plate Type.

❖ Gen5 stores measurements and other characteristics for individual plate types in a database. It is essential that you select (or define) the plate type to match the assay plate. Otherwise, results may be invalid. See the "Plate Type Database" topic in the Gen5 Help for instructions.

4. Add steps to the procedure for reading the plate. Click **Validate** to verify that the reader supports the defined steps, and then click **OK**.
5. Optionally, perform any of these steps to analyze and report the results:
   - Open the Plate Layout dialog and assign blanks, samples, controls, and/or standards to the plate.
   - Open the Data Reduction dialog to add data reduction steps. Categories include Transformation, Well Analysis, Curve Analysis, and Qualitative Analysis.
   - Create a report or export template via the Report/Export Builders.
6. Select **File > Save** and give the file an identifying name.

These instructions briefly describe how to create an experiment and then read a plate in Gen5. See the Gen5 Help system for complete instructions.

1. In the Gen5 Task Manager, select **Experiment > Create using an existing protocol**.

2. Select the desired protocol and click **OK**.
3. Select a plate in the menu tree and click  .
4. When the read is complete, measurement values appear in Gen5. Select the desired data set from the Data list.
5. Select **File > Save** and give the file an identifying name.

Recommendations for Optimum Performance

General

- Microplates should be clean and free from dust or bottom scratches. Use new microplates from sealed packages. Do not allow dust to settle on the surface of the solution; use microplate covers or seals when not reading the plate. Filter solutions to remove particulates that could cause erroneous readings.
- Although the Epoch supports standard flat, U-bottom, and V-bottom microplates, the reader achieves optimum performance with flat-bottomed wells.
- Non-uniformity in the optical density of the well bottoms can cause loss of accuracy, especially with U- and V-bottom polyvinyl microplates. Check for this by reading an empty microplate. Dual wavelength readings can eliminate this problem, or bring the variation in density readings to within acceptable limits for most measurements.
- Inaccuracy in pipetting has a large effect on measurements, especially if smaller volumes of liquid are used. For best results in most cases, use at least 100 µL per well in a 96-well plate and 25 µL in a 384-well plate.
- Pipetting solution into 384-well plates often traps air bubbles in the wells, which may result in inaccurate readings. A dual-wavelength reading method usually eliminates these inaccuracies. For best results, however, remove the air bubbles by degassing the plate in a vacuum chamber or spinning the plate in a centrifuge before reading.
- The inclination of the meniscus can cause loss of accuracy in some solutions, especially with small volumes. Shake the microplate before reading to help bring it within acceptable limits. Use Tween 20, if possible (or some other wetting agent) to normalize the meniscus for absorbance measurements. Some solutions develop menisci over a period of several minutes. This effect varies with the brand of microplate and the solution composition. As the center of the meniscus drops and shortens the light path, the density readings change. The meniscus shape will stabilize over time.
- Use of liquids with concentrations of acids, corrosives, or solvents of 3% and greater can begin attacking the materials inside the instrument's chamber. Running

multiple plates with concentrations <3% in long kinetics may also have a destructive effect. If the experiment is incubated, it will accelerate the deterioration of chamber components. When in doubt about the use of acids, corrosives, or solvents; please contact TAC@biotek.com.

Chapter 4

Preventive Maintenance

This chapter contains the procedures for cleaning and decontaminating the Epoch.

Overview

A general preventive maintenance (PM) regimen for the Epoch includes periodically cleaning all exposed surfaces and decontaminating the instrument before storage or shipment. This chapter includes instructions for the following:

- **Routine Cleaning Procedure**, page 21
- **Decontamination**, page 22

Required Materials

- Mild detergent
- Deionized or distilled water
- Clean, lint-free cotton cloths
- Sodium hypochlorite (NaClO, or bleach) (decontamination only)
- Safety glasses
- Surgical mask
- Protective gloves
- Lab coat
- Biohazard trash bags
- 125-mL beakers
- Cotton swabs or paper towels

Warnings and Precautions

Please read the following before performing any maintenance procedures.

	**Warning! Internal Voltage.** Turn off and disconnect the Epoch 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.
	**Important!** Do not immerse the instrument, spray it with liquid, or use a dripping-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.

Routine Cleaning Procedure

	Turn off the Epoch and disconnect it from the power supply for the cleaning procedure.

A regular cleaning regimen is recommended to keep the instrument free from dust and particulates that can cause erroneous readings. Exposed surfaces may be cleaned (not decontaminated) with a cloth moistened (not soaked) with water or water and a mild detergent.

Procedure

1. Turn on the Epoch and press the carrier eject button to eject the microplate carrier.
2. Turn off and unplug the reader from the power supply.

3. Wet a clean, lint-free cloth with water, or with water and the mild detergent, then thoroughly wring out the cloth so that liquid does not drip from it.
4. Wipe the plate carrier and all exposed surfaces of the instrument.
5. If detergent was used, wipe all surfaces with a cloth moistened with water.
6. Use a clean, dry lint-free cloth to dry all wet surfaces.

❖ If liquid is spilled inside the reader, call BioTek TAC for cleanup instructions.

Decontamination

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 in 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.

	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.
	**Internal Voltage.** Turn off and unplug the instrument for the decontamination procedure.
	Wear prophylactic gloves when handling contaminated instruments. Gloved hands should be considered contaminated at all times; keep gloved hands away from eyes, mouth, and nose. Eating and drinking while decontaminating instruments is not advised.
	Mucous membranes are considered prime entry routes for infectious agents. Wear eye protection and a surgical mask when there is a possibility of aerosol contamination. Intact skin is generally considered an effective barrier against infectious organisms; however, small abrasion and cuts may not always be visible. Wear protective gloves when performing the decontamination procedure.

Required Materials

- Sodium hypochlorite (NaClO, or bleach)
- 70% isopropyl alcohol (as an alternative to bleach)
- Deionized or distilled water
- Safety glasses
- Surgical mask
- Protective gloves
- Lab coat
- Biohazard trash bags
- 125 mL beakers
- Clean, lint-free cotton cloths

Procedure

The bleach solution is caustic; wear gloves and eye protection when handling the solution.

1. Turn on the Epoch and press the carrier eject button to eject the carrier.
2. Turn off and unplug the reader from the power supply.
3. Prepare an aqueous solution of 0.5% sodium hypochlorite (NaClO, or bleach). If the effects of bleach are a concern, 70% isopropyl alcohol may be used.

❖ Check the percent NaClO of the bleach you are using. Commercial bleach is typically 10.0% NaClO; prepare a 1:20 dilution. Household bleach is typically 5.0% NaClO; prepare a 1:10 dilution.

4. Wet a clean, lint-free cloth with the bleach solution, then thoroughly wring it out so that liquid does not drip from it. Do not soak the cloth.
5. Wipe the plate carrier and all exposed surfaces of the instrument.
6. Allow the instrument to dry for 20 minutes for thorough decontamination by the bleach.
7. Moisten a cloth with deionized or distilled water, thoroughly wring it out so that liquid does not drip from it, and wipe all surfaces of the instrument that have been cleaned with the bleach solution.
8. Use a clean, dry lint-free cloth to dry all wet surfaces.
9. Discard the used gloves and cloths, using a biohazard trash bag and an approved biohazard container.

Chapter 5

Instrument Qualification

This chapter contains procedure for qualifying the initial and ongoing performance of the Epoch.

Overview

This chapter contains BioTek Instruments' recommended Installation Qualification (IQ), Operational Qualification (OQ), and Performance Qualification (PQ) procedures for all models of the Epoch Microplate Reader.

Every Epoch reader is fully tested at BioTek prior to shipment and should operate properly upon initial setup. If you suspect that a problem occurred during shipment, if you have received the equipment after returning it to the factory for service, and/or if regulatory requirements dictate that you qualify the equipment on a routine basis, you should perform the procedures outlined in this chapter.

> ❖ A Product Qualification Package (IQ/OQ/PQ) (PN 7200515) for the Epoch is available upon request. Contact your local dealer for more information.

IQ/OQ/PQ

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

- The recommended IQ procedure consists of setting up the instrument and its components as described in **Chapter 2, Installation** and performing the system test.
- The IQ procedure should be performed **initially** (before the reader is used for the first time).
- The successful completion of the IQ procedure verifies that the instrument is installed correctly. The Operational Qualification procedure should be performed immediately following the successful IQ.

Operational Qualification confirms that the equipment operates according to specification initially and over time.

- The recommended OQ procedure consists of performing the system test, absorbance plate test, and a series of liquid tests.
- The OQ procedure should be performed **initially** (before first use) and then routinely; the recommended interval is **annually**. It should also be performed after any major repair or upgrade to the hardware or software.
- Although out-of-tolerance failures will be detected by the OQ tests, results should be compared with those from the routine Performance Qualification tests and previous OQ tests to monitor for trends.

- The successful completion of the OQ procedure, in combination with results that are comparable to previous PQ and OQ tests, confirms that the equipment is operating according to specification initially and over time.

Performance Qualification confirms that the reader consistently meets the requirements of the tests performed at your laboratory.

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

Recommended Qualification Schedule

The schedule shown below defines the BioTek-recommended intervals for performance testing for an Epoch used for one shift seven days a week.

> ❖ The risk factors associated with your tests may require that the Operational and Performance Qualification procedures be performed more or less frequently than shown below.

Tasks/Tests	IQ	OQ	PQ	
	Initially	Initially/ Annually	Monthly	Quarterly
All models:				
Unpacking, installation, setup, and verification	✓			
System Test	✓	✓	✓	
Absorbance Plate Test		✓	✓	
Absorbance Liquid Test 1 or Liquid Test 2*		✓		✓
(Optional) Absorbance Liquid Test 3 *or* 340 nm Absorbance Plate Test (using BTI #7260551)		✓		✓

* If you have Absorbance Test Plate PN 7260522, perform Liquid Test 1. Otherwise, perform Liquid Test 2.

System Test

Each time the Epoch is turned on, it automatically performs a series of tests on the reader's motors, lamp, and various subsystems. This test can take a few minutes to complete. If all tests pass, the microplate carrier is ejected and the green LED on the power switch remains on.

If any test results do not meet the internally coded Failure Mode Effects Analysis (FMEA) criteria established by BioTek, the reader beeps repeatedly and the green LED on the power switch flashes. If this occurs, press the carrier eject button to stop the beeping. If necessary, initiate another system test using Gen5 to try to retrieve an error code from the reader. Refer to Appendix B, Error Codes for information on error codes and for troubleshooting tips.

❖ If the power-up system test fails, when you initiate a system test using Gen5, Gen5 displays a message stating that the reader has a pending system test report. Click OK in the message box to review the report; it contains information obtained up to the point of the failure.

1. Turn on the reader and launch Gen5.
2. Select **System > Diagnostics > Run System Test**.

❖ If the test fails during execution, a message box appears in Gen5. Close the box; the test report contains the error code that was generated by the failure.

3. When the test is complete, a dialog appears, requesting additional information. Enter your user name and other information (if desired), and then click **OK**.
4. The results report appears. It shows either "SYSTEM TEST PASS" or "SYSTEM TEST FAIL *** ERROR (error code) DETECTED."
    - Gen5 stores the results in a database, so the results can be retrieved at any time.
5. If the test failed, look up the error code in **Appendix B, Error Codes**, to determine its cause. If the cause is something you can fix, turn off the reader, fix the problem, and then turn the reader back on and retry the test.

If the test continues to fail, or if the cause is not something you can fix, contact BioTek Technical Assistance Center.

```
                    Gen5 System Test Report
Reader:             Epoch  (Serial Number: 182843)
Basecode:           P/N 7200201  (v1.07)
Date and Time:      8/14/2015 12:02:36 PM
User:               Administrator
Company:            BioTek
Comments:



Test Results

Operator ID:_____________________________________________________

Notes:___________________________________________________________

_________________________________________________________________

SYSTEM SELF TEST

7200201  Version 1.07       Serial Number 182843

   Checksum #1 = CEF3,   Checksum #2 = 1D05

VOLTAGE TESTS
   24VDC PS V = 24.101
   +5VDC PS V = 4.933
   Flash 350V = 351
   Flash 400V = 400
   Flash 450V = 448
   Flash 525V = 526
   Flash 600V = 600



ABSORBANCE
   Noise Test (Dark Air, Flash On)
      Channel:          Ref    Meas
      Noise Max:       5392   16857
      Noise Min:       5392   16855
      Noise Delta:        0       2
   Wavelength 1: 200nm
      Cal Data:   Rst: 2   Gain: 1.07  Rst/Gain: 1.867
      Test Data:  Rst: 2   Gain: 1.12  Rst/Gain: 1.781
      Channel:          Ref    Meas
      Total Air:      14869   43719
      Dark Air (On):   5390    2399
      Signal Air:      9479   41320
   Wavelength 2: 352nm
      Cal Data:   Rst: 4   Gain: 1.94  Rst/Gain: 2.062
      Test Data:  Rst: 4   Gain: 2.08  Rst/Gain: 1.921
      Channel:          Ref    Meas
      Total Air:       8944   45824
      Dark Air (On):   5391    4411
      Signal Air:      3553   41413
```

```
   Wavelength 3: 620nm
      Cal Data:   Rst: 2   Gain: 1.97  Rst/Gain: 1.015
      Test Data:  Rst: 2   Gain: 1.96  Rst/Gain: 1.023
      Channel:          Ref    Meas
      Total Air:       9165   45154
      Dark Air (On):   5390    4140
      Signal Air:      3775   41014

   Wavelength 4: 790nm
      Cal Data:   Rst: 1   Gain: 1.38  Rst/Gain: 0.722
      Test Data:  Rst: 1   Gain: 1.36  Rst/Gain: 0.734
      Channel:          Ref    Meas
      Total Air:      11031   43909
      Dark Air (On):   5388    2890
      Signal Air:      5643   41019

   Wavelength 5: 860nm
      Cal Data:   Rst: 1   Gain: 1.94  Rst/Gain: 0.515
      Test Data:  Rst: 1   Gain: 1.94  Rst/Gain: 0.515
      Channel:          Ref    Meas
      Total Air:       9394   45433
      Dark Air (On):   5389    4098
      Signal Air:      4005   41335

   Wavelength 6: 962nm
      Cal Data:   Rst: 1   Gain: 2.12  Rst/Gain: 0.472
      Test Data:  Rst: 1   Gain: 2.13  Rst/Gain: 0.469
      Channel:          Ref    Meas
      Total Air:       9033   45624
      Dark Air (On):   5389    4503
      Signal Air:      3644   41121

TEST SENSOR

   Cal         13869
   Self-Test   13868
   Delta          -1

AUTOCAL ANALYSIS

   Upper Left Corner:  x =   287  y =15615
   Lower Left Corner:  x =   279  y =21835
   Lower Right Corner: x = 10034  y =21851
   Upper Right Corner: x = 10045  y =158630

   Delta 1:   287 -   279 =    +8
   Delta 2: 10045 - 10034 =   +11
   Delta 3: 15630 - 15615 =   +15
   Delta 4: 21851 - 21835 =   +16

MONOCHROMATOR
   A = +0.000000  B = -0.000390  C = -0.161696

SYSTEM TEST PASS

0000

Reviewed/Approved By:
Date: _________________
```

Figure 6: System Self-Test report

Absorbance Plate Test

This test uses BioTek's Absorbance Test Plate (PN 7260522) to confirm the mechanical alignment; optical density accuracy, linearity, and repeatability; and wavelength accuracy of the Epoch. The Absorbance Test Plate compares the reader's optical density and wavelength measurements to NIST-traceable values.

❖ An alternate method for confirming accuracy, linearity, and repeatability is Liquid Test 2, described on page 41.

To run this test, you need the BioTek Absorbance Test Plate (PN 7260522) with its accompanying data sheet.

- The Absorbance OD Standards section contains NIST-traceable standard OD values for the filters at several different wavelengths. We recommend testing at six wavelengths—those at or close to the wavelengths used in your assays.
- The Wavelength Accuracy Standards section contains Expected Peak wavelength values for the filter in position C6 on the plate. Each value has a valid test range and expected peak range recorded on the accompanying data sheet. For example, an Expected Peak value may be 586 nm with tolerance values of –6/+4 (or a test range of 580 to 590 nm).

❖ BioTek's Absorbance Test Plate PN 7260551 can be used to confirm optical density accuracy, linearity, and repeatability at 340 nm and is offered as an alternative to conducting Absorbance Liquid Test 3. The diagnostic feature in Gen5 versions 2.08 and higher is compatible with this test plate. If you are using an earlier version of Gen5, refer to the test plate's instruction sheet to manually conduct the test and analyze results.

❖ The instructions provided below are guidelines. Refer to the Gen5 Help system for more information.

Define the Absorbance Test Plate Parameters

1. Obtain the certificates that came with the test plate.
2. Start Gen5 and from the main screen select **System > Diagnostics > Test Plates > Add/Modify Plates**.
3. Click **Add**. The Absorbance Test Plate dialog appears.
4. Select the appropriate Plate Type and enter the plate's serial number.

❖ Gen5 versions 2.07 and earlier do not support selection of the Test Plate PN 7260551.

5. Enter the Last Certification and Next Certification dates from the calibration sticker on the Test Plate.
6. If the wavelength values in the top row of the grid in Gen5 are appropriate for your tests, enter the OD values from the Standards Certificate into the grid. Make sure you enter the correct value for each well/wavelength combination.

❖ If you need to change the wavelength values, click **Wavelength List**. Click **Help** for assistance.

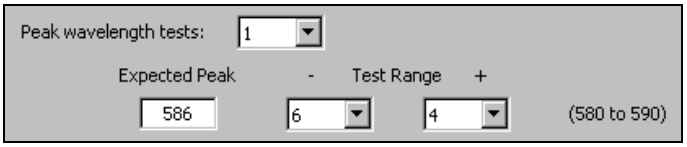
7. Select the number of Peak Wavelength tests to run (up to 4), based on the number of expected peak wavelength values provided on the certificate.
8. Enter the Expected Peak value(s) from the certificate and set the Test Range – and + values.

❖ The glass in each test plate is unique. Therefore, the expected peaks may differ slightly from plate to plate.

- If the C6 filter is Holmium or Erbium glass, the certificate contains two Spectral Bandpass tables. For the Epoch, which has a bandpass wider than 5 mm for wavelength >285 nm and close to 4 nm for 230–285 nm, we recommend using the **5.0 nm** table.
  - For the Erbium glass, any peak can be used.
  - For the Holmium glass, use the expected peak values closest to 242, 279, 362, 417, and 538 nm in the **5.0 nm** table. For example, if your certificate looks like the one below, you might choose to run the test at four of the five highlighted Expected Peak/Test Range combinations:

5.0 nm Spectral Bandpass	
Expected Peak	Test Range
242	***-5+5***
279	***-6+4***
288	-4+6
334	-5+5
362	***-5+5***
417	***-5+5***
485	-5+5
538	***-5+5***
643	-5+5

- If your C6 filter is Didymium glass, a single peak wavelength value is provided. Enter this value and set the Test Range – and + values so the range displayed in parentheses is 580 to 590, as shown here:



9. Review all of the values you entered, and then click **OK** to save the data.

The information you just entered is available in Gen5 each time the Absorbance Plate Test is performed. It may need to be modified after the annual recertification of your test plate.

Running the Absorbance Plate Test

1. From the Gen5 main screen, click **System > Diagnostics > Test Plates > Run**.
2. If prompted, select the desired Test Plate and click **OK**.
3. When the Absorbance Test Plate Options dialog appears, select **Perform Peak Wavelength Test**, if it is not already selected.
4. Highlight the wavelength(s) to be included in this test.

❖ You only need to select those wavelengths most appropriate for your use of the reader.

5. (Optional) Enter any Comments.
6. Click **Start Test**.
7. Place the Test Plate in the microplate carrier so that well A1 is in the left-rear corner of the carrier.
8. Click **OK** to run the test.
9. When the test of completed, the results report appears. Scroll through the report; every result should show "PASS".

When the test is complete, print the results. A sample test report is provided in **Figure 7**.

Absorbance Test Plate Results

Reader: Epoch (Serial Number: 182843)
Basecode: P/N 7200201 (v1.07)
Date and Time: 8/14/2015 8:49:39 AM
Absorbance Plate: 7 Filter Test Plate (P/N 7260522) - S/N 161259
Last Plate Certification: April 2012
Next Plate Certification Due: April 2013
User: Administrator
Comments:

Peak Absorbance Results

Well	C6
Reference	586
Tolerance	3
Read	586
Result	PASS

Alignment Results

Wells	B2	B12	G1	G11
Read	0.000	0.000	0.000	0.000
Tolerance	0.015	0.015	0.015	0.015
Result	PASS	PASS	PASS	PASS

Wavelength = 405 nm
Accuracy Results

Wells	C1	E2	G3	H6	F5	D4
Reference	0.147	0.618	1.133	1.701	2.279	2.945
Min Limit	0.124	0.586	1.090	1.647	2.168	#N/A
Max Limit	0.170	0.650	1.176	1.755	2.390	#N/A
Read 1	0.143	0.614	1.129	1.693	2.273	2.902
Result	PASS	PASS	PASS	PASS	PASS	#N/A

Repeatability Results

Wells	C1	E2	G3	H6	F5	D4
Read 1	0.143	0.614	1.129	1.693	2.273	2.902
Min Limit	0.137	0.603	1.113	1.671	2.200	#N/A
Max Limit	0.150	0.625	1.145	1.715	2.346	#N/A
Read 2	0.143	0.614	1.129	1.694	2.269	2.918
Result	PASS	PASS	PASS	PASS	PASS	#N/A

Wavelength = 450 nm
Accuracy Results

Wells	C1	E2	G3	H6	F5	D4
Reference	0.140	0.575	1.052	1.578	2.024	2.604
Min Limit	0.117	0.543	1.011	1.526	1.923	#N/A
Max Limit	0.163	0.606	1.093	1.630	2.125	#N/A
Read 1	0.136	0.571	1.047	1.570	2.016	2.591
Result	PASS	PASS	PASS	PASS	PASS	#N/A

Repeatability Results

Wells	C1	E2	G3	H6	F5	D4
Read 1	0.136	0.571	1.047	1.570	2.016	2.591
Min Limit	0.130	0.560	1.031	1.549	1.951	#N/A
Max Limit	0.143	0.581	1.062	1.590	2.081	#N/A
Read 2	0.137	0.571	1.047	1.570	2.017	2.589
Result	PASS	PASS	PASS	PASS	PASS	#N/A

Wavelength = 630 nm
Accuracy Results

Wells	C1	E2	G3	H6	F5	D4
Reference	0.136	0.568	1.040	1.560	1.865	2.400
Min Limit	0.113	0.537	0.999	1.509	1.808	2.284
Max Limit	0.159	0.599	1.081	1.611	1.922	2.516
Read 1	0.134	0.566	1.039	1.557	1.864	2.392
Result	PASS	PASS	PASS	PASS	PASS	PASS

Repeatability Results

Wells	C1	E2	G3	H6	F5	D4
Read 1	0.134	0.566	1.039	1.557	1.864	2.392
Min Limit	0.127	0.555	1.024	1.537	1.840	2.315
Max Limit	0.140	0.577	1.054	1.578	1.888	2.469
Read 2	0.134	0.566	1.039	1.557	1.864	2.390
Result	PASS	PASS	PASS	PASS	PASS	PASS

Reviewed/Approved By:
Date: _____

Figure 7: Sample output for the Absorbance Plate Test

Results and Troubleshooting Tips

- **Peak Absorbance:** When the test is performed, the C6 filter is scanned at the test range(s) defined by the user in the Absorbance Test Plate dialog. To verify wavelength accuracy, the wavelength of the maximum absorbance is compared with the peak wavelength value entered in the software, which comes from the Peak Wavelength Certificate supplied with the Test Plate.

The accuracy of the wavelength should be ± 3 nm (± 2 nm instrument, ± 1 nm filter allowance). If the reader fails this test:

- Make sure the information entered into Gen5 matches the Test Plate's Peak Wavelength Certificate.
- Verify that the Test Plate actually has a filter in location C6.
- Check the C6 filter to make sure it is clean. If needed, clean it with lens paper.

❖ Do not remove the filter from the Test Plate, and do not use alcohol or other cleaning agents.

- Make sure the Test Plate is within its calibration certification period. If it is out of date, contact BioTek to schedule a recertification.
- Check the microplate carrier to ensure it is clear of debris.

- **Alignment:** This test measures the alignment of the microplate carrier with the optical path. A reading greater than 0.015 OD represents an out-of-alignment condition.

  If the reader fails this test:

  - Ensure that the Test Plate is correctly seated in the microplate carrier.
  - Check the four alignment holes (B2, B12, G1, and G11) to ensure they are clear of debris.
  - Check the microplate carrier to ensure it is clear of debris.

- **Accuracy:** Accuracy is a measure of the optical density of Test Plate wells C1, D4, E2, F5, G3, and H6 as compared with known standard values contained in the Standards Certificate that accompanies each Test Plate.

  If the reader fails this test, review the following possible problems and solutions:

  - Verify that the filter calibration values entered in Gen5 are the same as those on the Test Plate's Standards Certificate.
  - Check the neutral-density filters on the Test Plate to ensure they are clean. If necessary, clean them with lens paper.

❖ Do not remove the filter from the Test Plate, and do not use alcohol or other cleaning agents.

  - Verify that the Test Plate is within its calibration certification period. If it is out of date, contact BioTek to schedule a recertification.

- **Repeatability:** Repeatability is a measure of the instrument's ability to read the same well with minimum variation between two reads with the well in the same location. If the reader fails this test:

- Check the filters on the Test Plate to ensure there is no debris that may have shifted between readings and caused changes.
- Check the microplate carrier to ensure it is clear of debris.

Linearity of the optical density readings is confirmed by default if the optical density readings are accurate. To further verify this, you can perform a regression analysis on the Test Plate OD values in a spreadsheet program such as Microsoft Excel. An R Squared value of at least 0.9900 is expected.

Liquid Testing

Conducting liquid tests confirms the reader's ability to perform to specification with liquid samples. Liquid testing differs from testing with the Absorbance Test Plate in that liquid in the wells has a meniscus, whereas the test plate's neutral density glass filters do not. The optics characteristics may differ in these two cases, thus alerting the operator to different types of problems.

- If you have the Absorbance Test Plate, you will need to perform only Liquid Test 1 for routine testing.
- If you do not have the Absorbance Test Plate, you can test the linearity, repeatability, and alignment of the reader by performing Liquid Test 2.
- BioTek offers a dye solution (PN 7120779, 25 mL; or 7120782, 125 mL) that can be used in the stock solution formulation for Liquid Tests 1 and 2, or, if you prefer, you may use the dye solution described in **Table 2** on page 39. The purpose of the formulation is to create a solution that absorbs light in a well-defined manner at ~2.000 OD full strength when dispensed at 200 µL in a flat-bottom microplate well.
- Alternatively, any solution that gives a stable color will suffice. (This includes substrates incubated with an enzyme preparation and then stopped with an acidic or basic solution.) Some enzyme/substrate combinations that may be used as alternates to the described dye are shown in **Table 1** below.
- If you must test the reader's performance at 340 nm, perform the optional Liquid Test 3 (see page 44).

Table 1: Typical Enzyme-Substrate Combinations and Stopping Solutions

Enzyme	Substrate	Stopping Solution
Alkaline Phosphate	o-nitrophenyl phosphate	3N sodium hydroxide
beta-Galactosidase	o-nitrophenyl -beta-D galactopyranoside	1M sodium carbonate
Peroxidase	2,2'-Azino di-ethylbenzothiazoline-sulfonic acid (ABTS)	citrate-phosphate buffer, pH 2.8
Peroxidase	o-phenylenediamine	0.03N sulfuric acid

Stock Solution Formulation

The stock solution for Liquid Tests 1 and 2 may be formulated from the chemicals listed below, or by diluting a dye solution available from BioTek. See **Procedure A** or **Procedure B** outlined below and on the following page for details.

Procedure A

Required Materials:

- BioTek QC Check Solution No. 1 (PN 7120779, 25 mL; or 7120782, 125 mL)
- Deionized water
- 5-mL Class A volumetric pipette
- 100-mL volumetric flask

Preparation of Stock Solution:

1. Pipette a 5-mL aliquot of BioTek QC Check Solution No. 1 into a 100-mL volumetric flask.
2. Add 95 mL of DI water; cap and shake well. The solution should measure approximately 2.000 OD when using 200 µL in a flat-bottom microwell.

   The OD value will be proportional to the volume in the well and the amount of QC Check Solution No. 1 used. You can use a larger or smaller well volume, or add more Check Solution or water to adjust the stock solution.

Too small a well volume may result in increased pipetting-related errors.

Procedure B

Required Materials:

- Deionized water
- FD&C Yellow No. 5 dye powder (typically 90% pure)
- Tween 20 (polyoxyethylene (20) sorbitan monolaurate) or BioTek wetting agent, PN 7773002 (a 10% Tween solution)
- Precision balance with capacity of 100 g minimum and readability of 0.001 g
- 1-liter volumetric flask
- Weigh boat

Table 2: Stock Solution Formulation for Liquid Test 1 and 2

FD&C Yellow No. 5 powder	0.092 g
Tween 20	0.5 mL
Deionized water to bring volume to:	1000 mL

Preparation of Stock Solution:

1. Weigh out 0.092 gram of FD&C No. 5 yellow dye powder into a weigh boat.
2. Rinse the contents into a 1-liter volumetric flask.
3. Add 0.5 mL of Tween 20, or 5 mL of BioTek's wetting agent.
4. Make up to 1 liter with DI water; cap and shake well.

   This should create a solution with an absorbance of about 2.000 OD when using 200 µL in a flat-bottom microwell. The OD value will be proportional to the volume in the well and the amount of FD&C No. 5 dye used. You can use a larger or smaller well volume, or add more dye or water to adjust the solution.

Too small a well volume may result in increased pipetting-related errors.

Liquid Test 1

Liquid Test 1 confirms repeatability and alignment of the reader when a solution is used in the microplate. If these tests pass, then the lens placement and optical system cleanliness are proven.

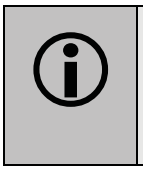
Materials

> ❖ Use a new microplate; any fingerprints or scratches may cause variations in readings.

- New 96-well, clear, flat-bottom microplate (Corning Costar #3590 recommended)
- Stock Solution A or B (see page 38)

Prepare the Plate

1. Using a freshly prepared stock solution (see **Procedure A** on page 38 or **Procedure B** on page 39), prepare a 1:2 dilution using deionized water (one part stock, one part deionized water; the resulting solution is a 1:2 dilution). The concentrated stock solution should have an optical density of approximately 2.000 OD or lower.
2. Pipette 200 µL of the **stock** solution into column **1**.
3. Pipette 200 µL of the **diluted** solution into column **2**



After pipetting the diluted test solution into the microplate, we strongly recommend waiting 20 minutes before reading the plate to allow any air bubbles in the solution to settle and the meniscus to stabilize.

Read the Plate

1. Read the microplate five times at 405 nm using normal read mode, single wavelength, no blanking. Save the data after each read ("Normal" plate position).
2. Rotate the microplate 180 degrees so that well A1 is in the H12 position. Read the plate five more times saving the data after each read ("Turnaround" plate position).

   The ten sets of raw plate data can be exported to an Excel spreadsheet using Gen5. The mathematical computations described below may then be performed and the template kept for future data reduction.

Calculations:

1. Calculate the mean value for each physical well location in columns 1 and 2 for the five plates read in the Normal position, and then again for the five plates read in the Turnaround position. This will result in 32 mean values.
2. Perform a mathematical comparison of the mean values for each microwell in its Normal and Turnaround positions (A1/H12, A2/H11, B1/G12, B2/G11, and so on). In order to pass this test, the differences in the

compared mean values must be within the accuracy specification for the instrument.

For example:

If the mean value for well A1 in the Normal position is 1.902, where the specified accuracy is ± 1% ± 0.010 OD, then the expected range for the mean of the same well in its Turnaround (H12) position is 1.873 to 1.931 OD.

1.902 * 0.01 + 0.010 = 0.029; 1.902 – 0.029 = **1.873**; 1.902 + 0.029 = **1.931**

Repeatability Specification:

± 1% ± 0.005 OD from 0.000 OD to 2.000 OD

± 3% ± 0.005 OD from 2.000 OD to 2.500 OD

Accuracy Specification:

± 1% ± 0.010 OD from 0.000 OD to 2.000 OD

± 3% ± 0.010 OD from 2.000 OD to 2.500 OD

Liquid Test 2

The recommended method for testing the instrument's alignment, repeatability, and accuracy is to use the Absorbance Test Plate (see page 31). If the test plate is not available, however, Liquid Test 2 can be used for these tests.

Materials

- A new 96-well, clear, flat-bottom microplate (Corning Costar #3590 is recommended)
- Ten test tubes, numbered consecutively, set up in a rack
- Calibrated hand pipette (Class A volumetric pipette recommended)
- Solution A or B (see page 38)
- A 0.05% solution of deionized water and Tween 20

Prepare the Dilutions

- Create a percentage dilution series, beginning with 100% of the original concentrated stock solution (A or B) in the first tube, 90% of the original solution in the second tube, 80% in the third tube, all the way to 10% in the tenth tube.
- Dilute using the 0.05% solution of deionized water and Tween 20. This solution can also be made by diluting the BioTek wetting agent 200:1.

Test Tube Dilutions for Liquid Test 2

Tube Number:	1	2	3	4	5	6	7	8	9	10
Volume of Original Concentrated Solution (mL)	20	18	16	14	12	10	8	6	4	2
Volume of 0.05% Tween Solution (mL)	0	2	4	6	8	10	12	14	16	18
Absorbance expected if original solution is 2.0 at 200 µL	2.0	1.8	1.6	1.4	1.2	1.0	0.8	0.6	0.4	0.2

❖ The choice of dilutions and the absorbance of the original solution can be varied. Use this table as a model for calculating the expected absorbances of a series of dilutions, given a different absorbance of the original solution.

Prepare the Plate

- Pipette 200 µL of the concentrated solution from Tube 1 into each well of the first column, A1 to H1, of a new flat-bottom microplate.
- Pipette 200 µL from each of the remaining tubes into the wells of the corresponding column of the microplate (Tube 2 into wells A2 to H2, Tube 3 into wells A3 to H3, and so on).

Linearity and Repeatability Tests

1. Using Gen5, read the microplate prepared above **five times** using Normal mode, dual wavelength at 450/630 nm. Save the data after each read.

❖ Do not discard the plate; you will use it for the Alignment test.

2. Print out the five sets of Delta OD data, or export them to an Excel spreadsheet.
3. Calculate the results for Linearity:
   - Calculate the mean absorbance for each well, and average the means for each concentration.
   - Perform a regression analysis on the data to determine if there is adequate linearity.

     Because it is somewhat difficult to achieve high pipetting accuracy when conducting linear dilutions, an R Square value of at least 0.9900 is considered adequate.

4. Calculate the results for Repeatability:

   - Calculate the mean and standard deviation for the five readings taken in Step 1 at each concentration. Only one row of data needs to be analyzed.

   - For each mean below 2.000 OD, calculate the allowed deviation using the repeatability specification for a 96-well plate of ± 1.0% ± 0.005 OD. If above 2.000 OD, apply the ± 3.0% ± 0.005 specification.

   - The standard deviation for each set of readings should be less than the allowed deviation.

     Example: Absorbance readings of 1.950, 1.948, 1.955, 1.952, and 1.950 will result in a mean of 1.951, and a standard deviation of 0.0026. The mean (1.951) multiplied by 1.0% (1.951 x 0.010) = 0.0195, which, when added to the 0.005 (0.0195 + 0.005) = 0.0245 OD, which is the allowable deviation. Since the standard deviation is less than this value, the reader meets the test criteria.

   Repeatability Specification:

   ± 1.0% ± 0.005 OD from 0.000 to 2.000 OD

   ± 3.0% ± 0.005 OD from 2.000 OD to 2.500 OD

Alignment Test

1. Using the plate prepared for the Linearity Test on the previous page, conduct a Turnaround test by reading the plate **five times** with the A1 well in the H12 position. Save the data after each read.

   This test results in values for the four corner wells that can be used to determine alignment.

2. Calculate the means of the wells A1 and H1 in the Normal plate position (data from Linearity Test) and in the Turnaround position (from Step 1).
3. Compare the mean reading for well A1 to its mean reading when in the H12 position. Next, compare the mean values for the H1 well to the same well in the A12 position. The difference in the values for any two corresponding wells should be within the accuracy specification for the instrument.

   Example: If the mean of well A1 in the normal position is 1.902, where the specified accuracy is ± 1.0% ± 0.010 OD, then the expected range for the mean of the same well in the H12 position is 1.873 to 1.931 OD. (1.902 x 1.0% = 0.019 + 0.010 = 0.029, which is added to and subtracted from 1.902 for the range.)

If the four corner wells are within the accuracy range, the reader is in alignment.

Accuracy Specification:

± 1% ± 0.010 OD from 0.000 OD to 2.000 OD

± 3% ± 0.010 OD from 2.000 OD to 2.500 OD

(Optional)Liquid Test 3

This test verifies operation of the reader at 340 nm and is provided for sites requiring proof of linearity at wavelengths lower than those attainable with the Absorbance Test Plate. This test is optional because the reader has good "front end" linearity throughout its wavelength range.

> ❖ BioTek Absorbance Test Plate PN 7260551 is offered as an alternative to conducting Liquid Test 3.

Materials

> ❖ Manufacturer part numbers are subject to change.

- New 96-well, clear, flat-bottom microplate (Corning Costar #3590 recommended)
- Calibrated hand pipette(s)
- Beakers and graduated cylinder
- Precision balance with readability to 0.01 g
- Buffer solution described below

Buffer Solution

- Deionized water
- Phosphate-Buffered Saline (PBS), pH 7.2–7.6, Sigma tablets, #P4417 (or equivalent)
- β-NADH Powder (β-Nicotinamide Adenine Dinucleotide, Reduced Form) Sigma bulk catalog number N 8129, or preweighed 10-mg vials, Sigma number N6785-10VL (or BioTek PN 98233). Store the powder according to the guidelines on its packaging.

1. Prepare a PBS solution from the Sigma tablets.
2. In a beaker, mix 50 mL of the PBS solution with 10 mg of the β-NADH powder and mix thoroughly. This is the **100% Test Solution**.
3. (Optional) Read a sample of the solution at 340 nm; it should be within 0.700 to 1.000 OD. If low, adjust up by adding more powder. Do not adjust if slightly high.

Prepare the Plate

1. Prepare the **75% Test Solution** by mixing 15 mL of the 100% Test Solution with 5 mL of the PBS Solution.
2. Prepare the **50% Test Solution** by mixing 10 mL of the 100% Test Solution with 10 mL of the PBS Solution.
3. Carefully pipette the three solutions into a **new** 96-well microplate:

   - 150 µL of the **100%** Test Solution into all wells of columns 1 and 2
   - 150 µL of the **75%** Test Solution into all wells of columns 3 and 4
   - 150 µL of the **50%** Test Solution into all wells of column 5 and 6

Read the Plate

1. Using Gen5, read the microplate **five times** using Normal mode, single wavelength at 340 nm, no blanking. Save the data after each read.
2. The test generates five sets of raw data. Perform the calculations described below.

Analyze the Results

1. For each well, calculate the Mean OD and Standard Deviation of the five readings.
2. For each mean calculated in step 1, calculate the allowed deviation using the repeatability specification for a 96-well plate: ± 1% ± 0.005 OD (Mean x 0.010 + 0.005). For each well, its standard deviation should be less than its allowed deviation.

   Example: Five readings in well A1 of 0.802, 0.802, 0.799, 0.798, and 0.801 result in a mean of 0.8004 and a standard deviation of 0.0018. The mean multiplied by 1.0% (0.8004 * 0.010) equals 0.008, and when added to 0.005 equals 0.013; this is the allowed deviation for well A1. Since the standard deviation for well A1 is less than 0.013, the well meets the test criteria.
3. Calculate the results for Linearity:

   - For each of the three dye concentrations, calculate the average Mean OD for the wells containing that solution (mean of wells A1 to H2, A3 to H4, and A5 to H6).
   - Perform a regression analysis on the data to determine if there is adequate linearity. The three average Mean OD values are the "Y" values. The solution concentrations are the "X" values (1.00, 0.75, 0.50).

Because it is somewhat difficult to achieve high pipetting accuracy when conducting linear dilutions, an R Square value of at least 0.9900 is considered adequate.

Appendix A

Specifications

This appendix contains BioTek's published specifications for the Epoch.

General Specifications

Microplates
The Epoch accommodates standard 6-, 12-, 24-, 48-, 96-, and 384-well microplates with 128 x 86 mm geometry, and the BioTek Take3 and Take3 Trio Micro-Volume Plates.

Hardware & Environmental	
Light Source	Xenon flash light source, 10W maximum average power (not user-changeable)
Dimensions	12.5" D x 12" W x 7.7" H 31.8 cm D x 30.5 cm W x 19.6 cm H If installing a BioStack with the Epoch, see **"Select an Appropriate Location"** in **Chapter 2, Installation**.
Weight	< 15 lbs. (6.804 kg) (without power supply)
Environment	Operational temperature 18ºC to 40°C (65ºF–104ºF)
Humidity	10% to 85% relative humidity (non-condensing)
Power Supply	24-volt external power supply compatible with 100–240 V~; +/- 10% @50–60 Hz
Power Consumption	< 40W maximum

Read Specifications

❖ All read speeds are +/– 2 seconds.

Endpoint Measurements			
96 Well			
Mode	**Delay Time**	**630 nm**	**630/450 nm**
Normal	100 msec	49	95
Normal	0 msec	38	75
Sweep	N/A	15	30
384 Well			
Mode	**Delay Time**	**630 nm**	**630/450 nm**
Normal	100 msec	169	333
Normal	0 msec	131	257
Sweep	N/A	31	56

Kinetic Measurements		
96 Well		
Mode	**Delay Time**	**630 nm**
Normal	100 msec	50
Normal	0 msec	42
Sweep	N/A	13
Mode	**Delay Time**	**630 nm**
Normal	100 msec	169
Normal	0 msec	129
Sweep	N/A	30

Optical Performance

Accuracy, Linearity, Repeatability
All qualifications were conducted using 96-/384-well, flat-bottom and round-bottom microplates. *For the performance described here, the Gain on the Optics Test should be equal to or less than 5.0.*
Measurement Range: 0.000 to 4.000 OD **Resolution:** 0.0001 OD
Accuracy **96-well plate, normal read speed, 100-ms delay after plate movement** 0.000–2.000 OD +/-1% +/-0.010 OD 2.000–2.500 OD +/-3% +/-0.010 OD **384-well plate, normal read speed, 100-ms delay after plate movement** 0.000–1.500 OD +/-2% +/-0.010 OD 1.500–2.000 OD +/-5% +/-0.010 OD **96-well and 384-well plate, sweep read speed** 0.000–1.000 OD +/-1% +/-0.010 OD
Linearity **96-well plate, normal read speed, 100-ms delay after plate movement** 0.000–2.000 OD +/-1% +/-0.010 OD 2.000–2.500 OD +/-3% +/-0.010 OD **384-well plate, normal read speed, 100-ms delay after plate movement** 0.000–1.500 OD +/-2% +/-0.010 OD 1.500–2.000 OD +/-5% +/-0.010 OD **96-well and 384-well plate, sweep read speed** 0.000–1.000 OD +/-1% +/-0.010 OD
Repeatability **96-well plate, normal read speed, 100-ms delay after plate movement** 0.000–2.000 OD +/-1% +/-0.005 OD 2.000–2.500 OD +/-3% +/-0.005 OD **384-well plate, normal read speed, 100-ms delay after plate movement** 0.000–1.500 OD +/-1% +/-0.005 OD 1.500–2.000 OD +/-3% +/-0.005 OD **96-well and 384-well plate, sweep read speed** 0.000–1.000 OD +/-2% +/-0.010 OD

Optics	
λ range	200 to 999 nm
λ accuracy	± 2 nm
λ repeatability	± 0.2 nm
λ bandpass	5 nm
Detector	Photodiodes (2). Measurements are reference channel-corrected for light source fluctuation.

Appendix B

Error Codes

This appendix lists and describes Epoch error codes that may appear in Gen5. If an error is displayed, refer to **Product Support & Service** in **Chapter 1**.

Overview

An error code is displayed in Gen5 as a four-digit identifier. The first character will be a number or the letter A.

The letter A indicates an error condition that cannot be resolved by user actions. The instrument will no longer function, the LED status light will flash, and the beeper will sound until the unit is depowered. The codes are listed as Fatal Errors on page 62; if an error of this type is displayed, contact BioTek's Technical Assistance Center for further instructions (refer to the **Product Support & Service** section in **Chapter 1** for contact information).

Error codes marked with a asterisk (*) will stop an assay from running but will continue to allow the Epoch to communicate with the controlling software and run system and calibration tests. When these errors are first encountered, the status LED will flash and the beeper will sound; however, for these nonfatal errors, you can disable the beeper by pressing the carrier in/out button or by twice requesting the instrument status from Gen5.

Diagnostics

If any error code is displayed, conduct a System Self-Test for diagnostic purposes. In Gen5, select **System > Diagnostics > Run System Test**. Refer to the Gen5 Help system for more detailed instructions.

General Errors

❖ A lowercase letter in the code indicates a variable numeral.

Code	Description and Probable Causes
***0210**	**The x-axis home opto sensor failed to change as expected.**
***02x1**	**A y-axis opto sensor failed to change as expected.** **x = 1 for the home sensor.** **x = 2 for the test sensor.** **Possible causes:** • Dirty axis rail where the bearings are worn and cause too much friction. • Defective or broken optical sensors or connection. • Defective motor, motor controller, or connection. • Broken or untensioned drive belt. • Obstruction in read chamber. • Check that the shipping screw has been removed. **Note:** In cases where a sensor is not functioning, the motor may drive the axis to its mechanical stop and generate substantial noise but will not cause permanent damage.
***0212**	**The order sorting filter wheel's home opto sensor failed to change as expected.** **Probable causes:** • Filter wheel is loose. • Filter wheel gearing is worn or dirty. • Defective or broken optical sensor or connection. • Defective motor, motor controller PCB, or cable.
0233	**Monochromator not able to locate home.** **Probable causes:** • Misaligned flash lamp • Disconnected photodiode cable

Code	Description and Probable Causes
***0400**	**Carrier x-axis failed positional verify.** Motor x-axis failed to reach the same position when moved a known number of steps from the home position and back. **Probable causes:** • Dirty linear bearing. • Obstruction in read chamber.
***0401**	**Carrier y-axis failed positional verify.** • Dirty linear bearing. • Obstruction in read chamber
***0402**	**Order sorting filter wheel failed positional verify.** • Filter wheel is loose. • Filter wheel gearing is worn or dirty. • Defective or broken optical sensor or connection. • Defective motor, motor controller PCB, or cable.
***0403**	**Monochromator failed positional verify.** **Probable causes:** • Defective measurement diode PCB or connection. • Defective mechanics or optics • Defective flash lamp. • Defective motor/power PCB or connection to it. • Flash lamp is missing flashes or is not flashing. • The optic system does not detect the saturation. • Defective monochromator (low probability).

Code	Description and Probable Causes
***05cr**	**A/D input is saturated** This error indicates the light signal level reached full scale A/D output (65,535) for a particular channel (c = 0 for the reference channel and c = 1 for the measurement channel) and for a particular readset r = 1–6 or self-test wavelength r = 0–5 **Probable causes:** • The order sorting filter is not at the correct position and too much light is present. • The measurement or reference diode PCB or connection to it is defective. • The A/D circuitry on the Main PCB is defective.
***0600**	**Gain Calibration error** This error indicates that the measurement channel signal gain has reached its maximum or the signal itself is greater than 60000 at the wavelength being calibrated. This normally occurs only during a factor gain calibration procedure. **Probable causes:** • The absorbance analog PCB is defective. • The flash lamp connector is arcing, causing it to miss flashes. • The monochromator is defective.
***0700** ***0710**	**Reference channel failed noise test greater than 20 counts.** **Measurement channel failed noise test greater than 20 counts.** This error indicates significant variations in background electronic noise were detected, when blocking the light and increasing the gain to maximum. **Probable causes:** • Electrical noise may be penetrating the measurement chamber. The bottom and top shrouds are part of the electrical shielding. • There may be an ambient light leak. Ensure that the plate carrier door is properly closed. • Detector PCB or connection failure. • Internal electronic noise may be caused by a faulty analog PCB or faulty internal grounding.

Code	Description and Probable Causes
***0800** ***0810**	**Reference channel failed noise offset < 10 and > 32000.** **Measurement channel failed noise offset < 10 and > 2000** This error indicates that the background electronic signal detected is outside of acceptable limits at maximum gain when blocking the light. **Probable causes:** • Detector PCB or connection failure yielding a noise reading of zero. • Detector PCB is too noisy.
***09c0** ***0901-0906** ***0911-0916**	**The reference (c = 0) or measurement (c = 1) channel dark range is < 100 or > 32000 during spectral scan.** **The reference channel dark range is < 100 during optical test (readset 1–6).** **The measurement channel dark range is < 100 during optical test (readset 1–6).** The reference channel dark current value has changed since the last optics test measurement by more than 10%, or the dark value is less than 100. The last number in the error code is the lambda table position number used during the failure. **Probable causes:** • The photo-detector is more sensitive to temperature changes. • Ambient light leakage during the read.
0C00	**24VDC voltage error** The 24VDC power to the motors was below the level needed to assure correct performance. **Probable causes:** • Defective power supply, power cable, connection or Main PCB.
0D00	**Wavelength calibration data is missing.** The gain/reset data for one or more wavelengths is missing. This data is collected during factory calibration and saved in nonvolatile memory. An error indicates that the internal software may be corrupted or the hardware has failed.

Code	Description and Probable Causes
0E01–0E06	**Wavelength not found in table (readset 1–6).** This error indicates that the specified wavelength is not detected in the instrument's filter table. During the read, verify that the lambda table has the wavelengths loaded into the instrument from the controlling PC software. Compare the contents of the lambda table with the software's filter table.
0F0r	**The reference channel air/dark out of range.** If this occurs while reading absorbance data, it indicates the correction factor provided by the reference channel is out of range, presumably because of a defect in the reference channel optics. r = 0 in spectral scans, readset = r = 1–6 for all other absorbance reads. If this occurs while doing self-test or reading blank data, it indicates the reference channel signal is < 125 for readset = r = 1–6 (0 during self-test).
0F1r	**The measurement channel air/dark out of range.** If this occurs while doing self-test or reading blank data, it indicates the measurement channel signal is < 3162 for readset = r = 1–6 (0 during self-test). **Probable causes:** • The flash lamp may be out of alignment. • The monochromator entrance or exit aperture is defective. • The order sorting filter is dirty or degraded and does not allow enough light energy to pass through. • Dirty or damaged reference channel optics. • The reference channel photodiode detection circuit is defective.
***110x**	**Failed configuration checksum test (1 = UI processor, 2 = MC processor).** **Probable causes:** • One of the processors on the PCB contains a defective corrupt flash memory. The basecode software and/or assays may need to be redownloaded. • Main PCB failure.

Code	Description and Probable Causes
***120x**	**Carrier Autocalibration data missing.** **Probable causes:** x = 0 or x = 1 Main PCB or software is defective. x = 2 Insufficient light: • The PCB was changed and the flash memory does not have the calibration values loaded. • Flash lamp, optics, measurement diode PCB, or filter wheel is defective. • Autocalibration needs to be run. • Main PCB failure.
***1300** ***1301** ***1302**	**Carrier not homed in the x-axis.** **Carrier not homed in the y-axis.** **Order sorting filter wheel not homed.** This error is usually only seen if an error 0210/02x1/0212 is ignored. See the probable causes for 0210/02x1/0212.
1600	**PC Command format error.** **Probable causes:** • The wrong version of Gen5 is being used. • The USB driver or cable connection is defective.
1700	**Interval too short for selected options.** This error indicates that the kinetic interval in the current assay is too short. Increase the kinetic interval.
1900	**Memory allocation failed.** This error is typically used only for software development purposes. If it occurs, however, try turning the instrument off, waiting 30 seconds, and then turning it on again. If the error persists, contact BioTek TAC.
1F0r	**Overlap error in PC command definition.** This error indicates that the largest wavelength minus the smallest wavelength is larger than the wavelength interval in the assay definition command from the PC for readset = r = 1–6.

Code	Description and Probable Causes
21nn	**Invalid parameter value selected.** This error indicates that a particular parameter in the assay definition command from the PC is incorrect. An invalid assay configuration was sent to the instrument.
2401	**Y-axis test sensor position incorrect.** This error occurs at the start of an assay if the carrier fails to find the test sensor where it is expected. Usually this is because the carrier was pushed or restricted on its way into the instrument. Restart the read.
2500	**Sweep mode read missed well location.** While attempting to sweep read a row of wells, the X-axis motor passed the location where it was supposed to read too soon. This is most likely the result of a main PCB hardware failure.
2600	**Area scan or custom well defined outside valid plate limits.** The combination of the Gen5 plate definition and the read mode (area scan or endpoint) being used results in dimensions that cannot be used by this reader. • Check of nonstandard plate dimensions. • Reduce the number of data points in an area scan. • Reduce the well diameter used with an area scan.
2900	The system measures the following voltages to determine if they are correct. Voltages and limits are listed on the self-test report. **24V power supply out of range during self-test.** • The AC main circuit may be overloaded and not providing adequate or constant voltage or current capacity for the instrument power supply. • Verify that the external power supply is correctly connected. • If error is intermittent, replace the external power supply and/or the main PCB.

Code	Description and Probable Causes
2901	**5V power supply out of range during self-test.** • The AC main circuit may be overloaded and not providing adequate or constant voltage or current capacity for the instrument power supply. • Verify that the external power supply is correctly connected. • If error is intermittent, replace the external power supply and/or the main PCB.
2902–6	**Flash lamp reference (lowest to highest) is out of range during self-test.** Failure indicates there is a defect on the Main PCB assembly.
2907	**Flash voltage scale error—done as part of self-test.** Failure indicates the flash module is not connected or there is a defect on the Main PCB assembly.
2Dnn	**Assay error.** This error indicates that something about the assay that is being attempted is wrong. Refer to the list of assay errors that follows. The most probable cause of these errors is something in the Gen5 protocol or instrument selection.
2A0x	**Plate jam error.** Motor "x" (0 = X, 1 = Y, 2 = F, 3 = M) has hit something and lost steps. Usually this is because the carrier was pushed or restricted on its way into the instrument. Restart the read.

Assay Errors—For 2Dnn Error Code

Error Code	Description
00	SAMPLE_START_LATE—missed start of well mode sample
01	INVALID_READSETS—number of readsets defined invalid
05	INVALID_MODE—invalid mode selection received
06	ASSAY_DEF_NOT_SET—validated assay not defined
07	INVALID_ROW_COL—invalid number of rows and columns
0B	INVALID_EVENT_COUNT—total events defined invalid
0C	INVALID_EVENT_TYPE—invalid event type received
0E	PLATE_START_LATE—missed start of plate mode event
12	INVALID_WELL_DATAPTS—number of samples out of range

Error Code	Description
13	INVALID_WELL_INTERVAL—well mode kinetic interval out of range
14	INVALID_PLATE_DATAPTS—specified # of plate mode reads out of range
15	INVALID_PLATE_INTRVAL—plate mode kinetic interval out of range
16	READ_START_LATE—missed start of read
17	INTERVAL_START_LATE—missed start of kinetic interval setup
43	INVALID_DIRECTION—initial row or column direction is invalid
44	DEBUG_MODE—unit is in debug mode; self-test may not have been run

Fatal Errors

Fatal errors indicate conditions that cannot be resolved by user actions. The instrument will no longer function. If a fatal error is displayed, contact BioTek's Technical Assistance Center for further instructions (refer to the **Product Support & Service** section in **Chapter 1**). {data} indicates a parameter in the second-lowest digit of the error code. <data> indicates a parameter in the lowest digit of the error code.

Code	Description
A100	**Task control block not available.**
A200	**Dual Processor Code Version Mismatch.**
A300	**OS <Device> not available.**
A400	**Flash write timed out.**
A500	**Read did not match write (test) <chip>.**
A600	**Data flash write timed out.**
A700	**Read did not match write (test) <chip>.**
A800	**<Test type> power supply level error.**
A900	**Memory allocation heap corrupted.**
AA00	**Absorbance A/D converter never saw the ready signal.** **Probable causes:** • Analog PCB. • Motor/power PCB.
AB00–ABFF	**Fatal errors related to internal dual processor architecture.**
AC00	**External RAM test failure.**
AD00	**Operating System StackCheck error in <processor> 0=UI, 1=Sa, 2=Sb, 3=Sc**

Appendix C

Instrument Dimensions

This section shows the location of the microplate carrier in reference to the exterior surfaces of the Epoch and the mounting holes on the bottom. Use the illustrations to facilitate system setup with a robotic instrument, such as the BioStack Microplate Stacker. Dimension are in inches.

BioStack users: Special alignment hardware is included in the BioStack alignment kit for the Epoch. Refer to the *BioStack Operator's Manual* for instructions for alignment of the BioStack with the reader.

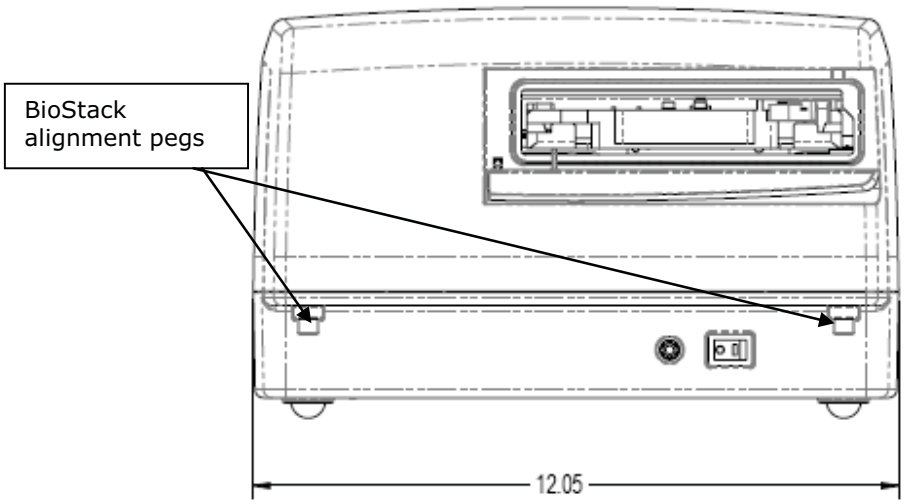


Figure 1: Front view of reader

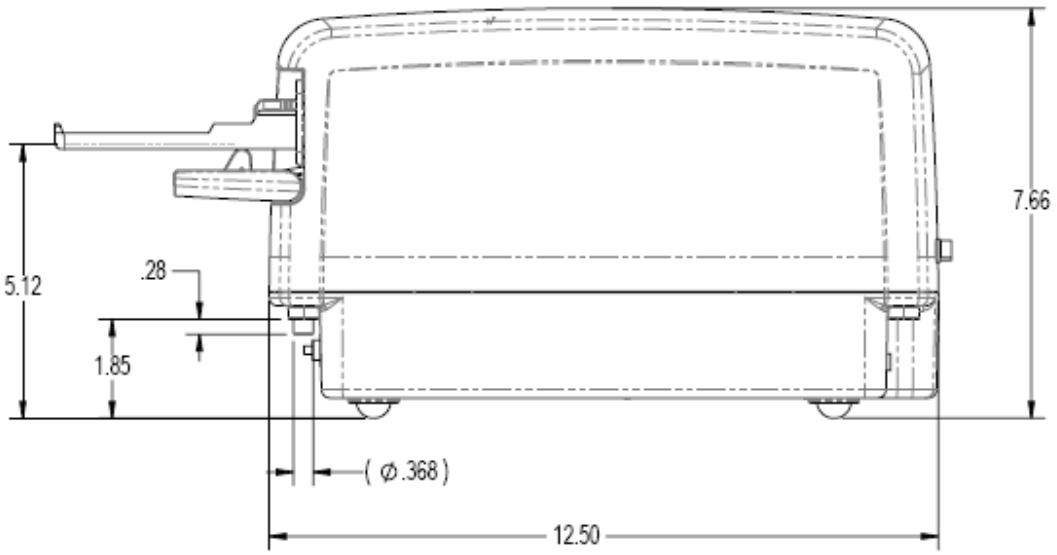


Figure 2: Side view of reader

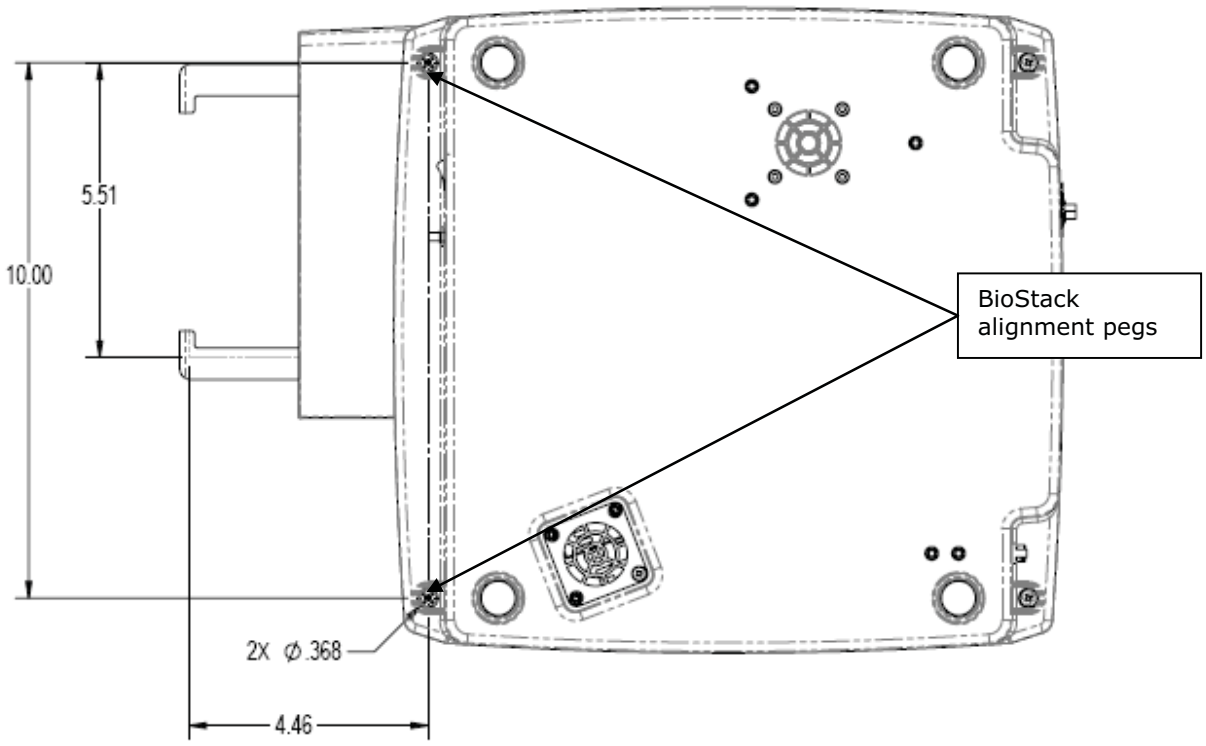


Figure 3: Bottom view of reader, illustrating mounting holes for aligning caps (for operation with BioStack)