



BioXp™ 9600 system — User guide

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Terms and conditions	IMPORTANT — This agreement (the "Agreement") is a legal agreement between you and Codex DNA, Inc. By installing or otherwise using the BioXp™ 9600 system (referred in this agreement as the "Product"), you agree to be bound by the terms of this Agreement. If you do not wish to be bound by the terms of this Agreement, do not use the Product and promptly return the unused, unopened Product to the place of purchase for a full refund. The user is prohibited from reverse engineering the software or output files generated from the BioXp™ 9600 system.
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Disclaimer	The material in this manual is for informational purposes only and is subject to change without prior notice at any time. Codex DNA, Inc. and/or its affiliates assume no responsibility for any errors that may appear in this document.
Indications for use	The BioXp™ 9600 system is a device which is intended for the processing of DNA materials. The system is not approved for use other than that stated above.







Safety information

Manual symbols found in this guide

This manual describes the use and maintenance of the Codex DNA BioXp™ 9600 system. Read this manual completely before putting the instrument into service. The following icons are used in this manual:

	General Warning Indicates a warning concerning operations that may lead to personal injury or potential damage to the instrument if not performed correctly.
	Electrical Safety warning Failure to follow these instructions can cause harm to operators or subjects.
	Important note Failure to follow these instructions can lead to damage of the system or unexpected results.

Marking symbols on the equipment

	Electrical Safety warning Indicates a warning concerning operations that may lead to personal injury or potential damage to the instrument if not performed correctly.
	Caution, hot surface, do NOT touch
	Warning: Flammable Material
	Alternating current
	Waste Electrical and Electronic Equipment (WEEE) directive Do not dispose symbol. For more information, see Equipment disposal and WEEE compliance.
	Consult instructions for use.

Safety warnings



Installation

- The BioXp™ 9600 system is very heavy, 210lbs (95kg). Do not attempt to lift or move the instrument without the assistance and supervision by colleagues. Be certain to use appropriate moving equipment and proper lifting techniques (including but not limited to making certain that you have a secure grip on the instrument before lifting, keeping your spine in a neutral position while lifting with your legs, and coordinating lifting and moving movements with all appropriate personnel). Improper lifting can cause permanent back injury. The BioXp 9600 is fitted with four lifting straps at each corner. It's recommended to use four people to lift the system and for each to loop their wrist through the strap to ensure a firm grip on the strap before lifting. If possible, utilize a forklift or other lifting device to bring the crate to a comfortable level before lifting the instrument off the lower crate support.
- Use this product only as specified. If the instrument is used in a manner not specified by Codex DNA, the protection provided by the instrument may be impaired, resulting in personal injury or damage to the instrument.



Ground circuit protection

- Check the mains electricity supply plug, voltage, and frequency to confirm that the supply corresponds to the values shown on the instrument label.
- Ensure that the supply of power to the instrument is via a socket fitted with a protection device, such as a circuit breaker of the correct rating, to provide automatic power cut-off in the event of an insulation fault.
- Confirm that the mains wiring is grounded. Codex DNA declines all responsibility for any damages due to instrument non-grounding.



Main power switch

Do not position the instrument such that it is difficult to operate the main power switch.



Hazardous chemical warning

- Chemicals used with the instrument may be hazardous.
- Always wear protective gear including safety goggles, gloves, and a lab coat when handling chemicals.
- Exercise caution when handling flammable liquids.
- Take precautions, including but not limited to installing proper ventilation systems, to ensure that the BioXp™ system laboratory is safe and that operators of the instrument will not be exposed to hazardous levels of harmful chemicals.
- Follow all national, state, and local health and safety regulations and laws.
- Use proper waste disposal in accordance with all relevant regulations.
- Refer to applicable material safety data sheets (MSDSs).



Flammable liquids: Instrument warning

- Exercise caution when using flammable liquids in the BioXp™ system to minimize the risk of fire.
- Do not use any flammable liquids in the instrument except for the liquids required in the included procedure.
- Provide adequate ventilation for the instrument to prevent the accumulation of flammable vapors.
- All sources of ignition, such as open flame or electrical spark, are not permitted near the instrument or in areas where flammable vapors may travel.
- Ensure that the instrument, all neighboring equipment, and users of the instrument are appropriately grounded to minimize the generation of static electricity.
- Do not use the ethanol reservoir if it is cracked or the lid is damaged and not sealing correctly.



Flammable liquids: Solution handling warning

- Keep flammable liquids in covered containers when not in use.
- Provide means to promptly and safely dispose of any flammable liquid leaks or spills.
- Do not transfer liquids using air pressure.
- Read applicable MSDSs.
- Store flammable liquids in cool, well-ventilated areas away from corrosives, oxidizers, and ignition sources.
- Label containers and cabinets as “flammable materials” where applicable.
- Use only approved safety vessels for flammable liquid storage.
- Ground and bond flammable liquid containers to prevent static charge buildup.
- Never pour flammable liquids down a drain or sink.
- Dispose of empty flammable containers in an approved manner.
- Remove any unused flammable liquids from the instrument after completion of a run.



Electrical safety warning

- Do not attach the power cord to an extension cord or to a multiple portable socket. Doing so may compromise shielding and/or grounding.
- This equipment should not be used adjacent to or stacked with other equipment. If it becomes necessary to use the BioXp™ system under these conditions, the unit should be observed to verify normal operation in this condition.
- Use only grounded mains outlets to supply instrument.
- Do not remove any panels. Panels should be removed only by trained service personnel.
- The AC power cord is the primary disconnection device for the instrument. Ensure that the point of connection is easily accessible and free of any obstructions.



Important warning: Moving parts

- Do not override the door lock. When the door is locked, the moving parts of the instrument are operational. Never attempt to physically restrict movement of instrument components.
- Interfering with moving parts may cause personal injury. Keep hands clear of moving parts while operating the instrument.
- Do not move or shift the instrument during operation.
- If the instrument shows evidence of corrosion or wear, do not attempt to manipulate or tamper with components of the instrument.

**Important warning: Disconnecting the instrument**

- Disconnect power to the system before cleaning or performing maintenance.
- DO NOT remove any panels; they should be removed only by qualified service personnel.
- Do not disassemble unit.

Equipment specifications



Covers and exterior components which the operator may come in contact with during routine maintenance or calibration, shall operate at a voltage no greater than 25 V AC or 60 V DC.

**System components**

- Use of parts or materials other than those supplied with the instrument can degrade system performance and may cause safety hazards. Use only Codex DNA approved or supplied components.
- Use only Codex DNA supplied power cord. Use of other power cords may compromise electrical protection and could create a hazard.

Components of the BioXp™ system

- BioXp™ 9600 system
- Power cord
- RJ45 ethernet cable
- Reagent and recovery chiller thermal covers
- Ethanol reservoir
- MegaStrip holder
- Oligo Vault Removal Tool

Technical specifications

Product Name	BioXp™ 9600 System
Catalog Number	BX9600-01
Description	Automated synthetic biology workstation
Power input voltage	100 – 240VAC (50Hz /60Hz)
Power input current	10 A max
Operating temperature range	16 to 30 °C
Storage temperature range	0 to 45 °C
Operating and storage humidity range	10 to 90% (non-condensing relative humidity)
Operating altitude	Sea level to 1828 m [6,000 ft.]
Water ingress	Non-immersion; protection for damp wipe only IP10.
Weight	95 kg [210 US lbs]
Dimensions (W × D × H)	122 × 76 × 92 cm [48 × 30 × 36 in] with hood open

Site preparation and installation

System site preparation

For details on site preparation, safety precautions, uncrating, setup, and powering up, see the BioXp™ 9600 system remote installation and sign-off technical guide.

Getting to know the BioXp 9600 system

Hardware overview



Figure 1. Front view of the BioXp 9600 System

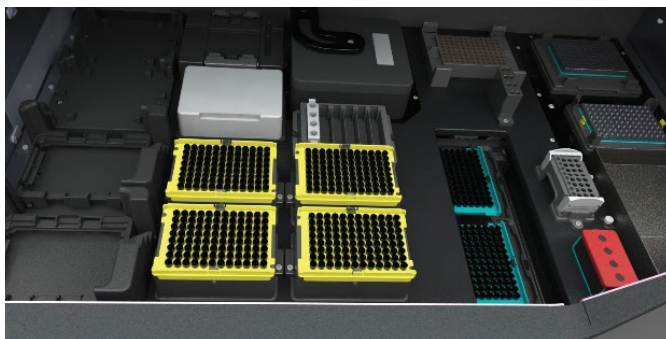


Figure 2. Inside Deck of the BioXp 9600 system

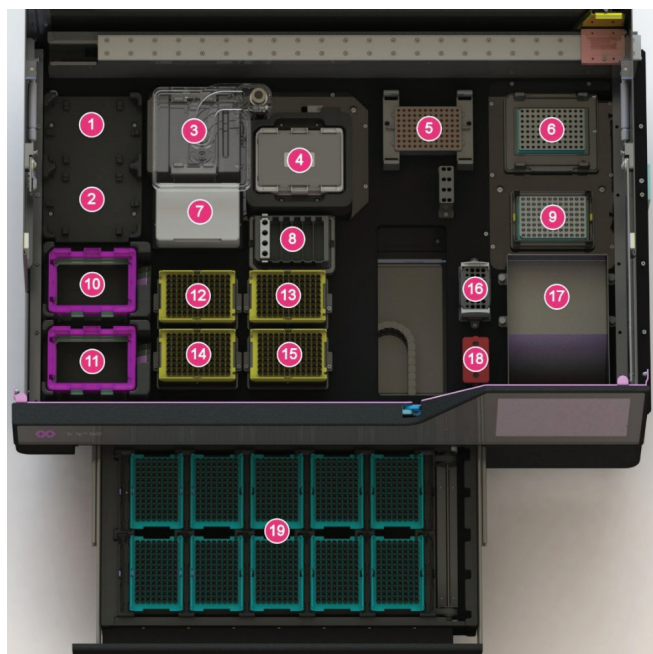


Figure 3. Example of the deck layout at the beginning of a run.

1. Temporary Plate and Lid Storage #1
2. Temporary Plate and Lid Storage #2
3. Output Chiller Cover Storage Location
4. Thermal Cycler
5. Magnetic Separation Station
6. Output Chiller
7. Reagent Chiller Cover Storage
8. Mega Strip Holder
9. Reagent Chiller
10. Input Plate Stack #1
11. Input Plate Stack #2
12. Tip Tray Storage #1
13. Tip Tray Storage #2
14. Tip Tray Storage #3
15. Tip Tray Storage #4
16. Strip Well Holder
17. Waste Chute
18. Ethanol Trough
19. Tip Drawer

Instrument ports and power switch Location

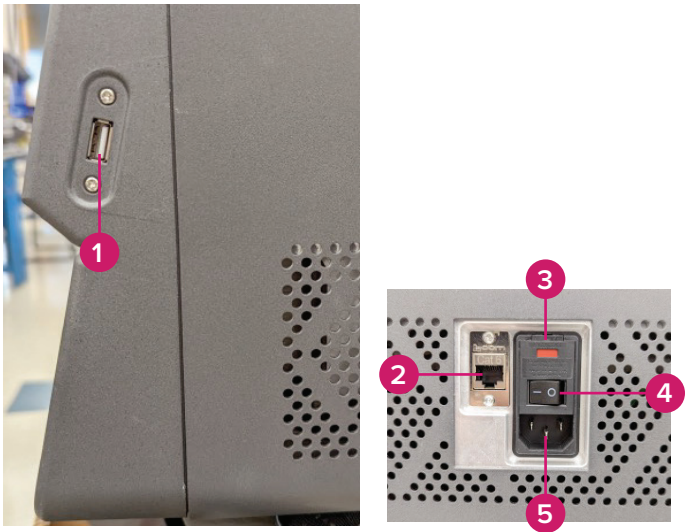
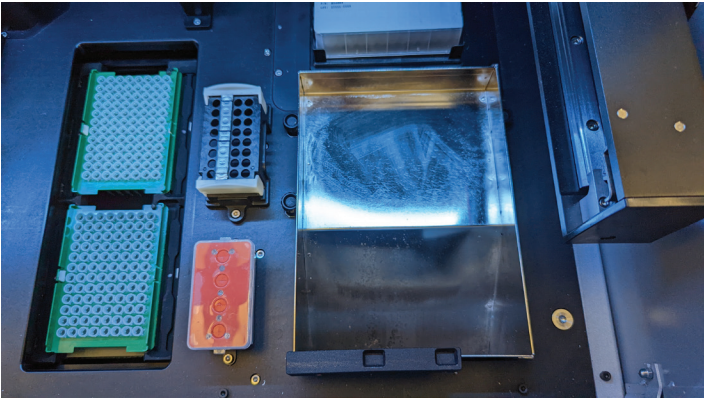


Figure 4. Power on/off switch and communications ports

Label no.	Port/inlet	Description
1	USB	The USB port is for instrument diagnostics and is for authorized service personnel use only
2	Ethernet	Connection to the Codex DNA server for system communication
3	Fuse	AC inlet fusing
4	Power switch	Switch power to the instrument <i>on</i> or <i>off</i> . Note: Leave the instrument <i>on</i> continuously.
5	Power inlet	Power the instrument

Waste chute

Proper installation of the waste chute on the deck is shown in the image below. The waste chute is removable with three thumb screws and can be lifted ‘up and out’ of the BioXp system for cleaning. Before beginning a run on the BioXp system verify that the waste chute is installed and that the thumbscrews have been properly tightened.



Setting up the BioXp 9600 system

Leave the BioXp 9600 system powered *On*

We recommend leaving the instrument on continuously. Only turn the instrument off when necessary, such as when moving the instrument to another location. If the instrument must be turned off, toggle the power switch to the *Off* position.

Ethernet setup

The BioXp system requires an internet connection to load jobs and to aid during service. Prior to connecting the instrument to the internet, be sure to test the connection. Connect the provided RJ45 ethernet cable to the ethernet port — located on the side of the unit — to an available ethernet wall jack.

In order for the BioXp system to communicate with the Codex DNA server, you must open the 80/443 ports through your network. In addition, the BioXp system will be making an outbound SSL connection (HTTPS/SSL) to logmein.com, codexdna.com and drive.google.com. Unblock or whitelist these sites.

During remote diagnostic testing or software updates, a Codex service representative may connect to the BioXp system using logmein to perform service operations. These updates will be done while the system is not in use.

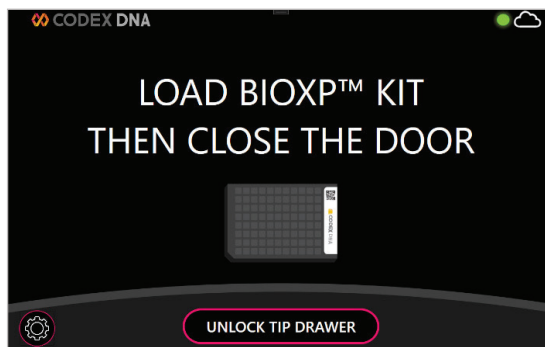
Start the BioXp 9600 system

1. Turn the instrument on using the power switch located on the side of the instrument.
2. Close the instrument door and tip drawer. The BioXp system will initiate a self-check process to verify the correct functionality of motion control and other internal systems of the instrument. If the instrument is unable to perform a successful self-check it will alert the user to the problem and will prevent the instrument from operating until the problem has been addressed. The self-check process has been carefully developed to ensure that the BioXp system is operating within optimal calibration ranges and that all systems are functioning correctly before initiating a run.

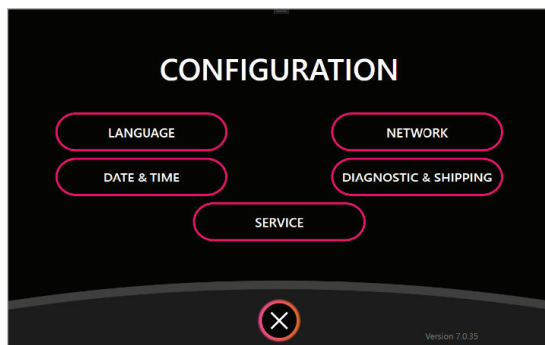


Configure the BioXp 9600 system

1. Press the **Configuration** gear icon in the lower left corner



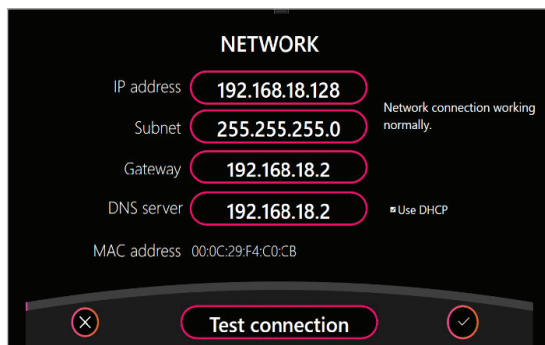
2. Press **Network**



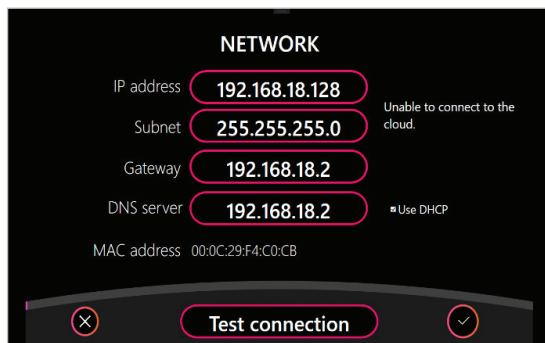
Test the network connection

3. Press **Test connection**

If the system displays Network connection working normally, the BioXp system is ready for use. If you are ready to load the instrument and begin a run, refer to the loading map included with your kit components.



If the system displays *Unable to connect to the cloud* contact Codex DNA customer service at help@codexdna.com for assistance in resolving the connection.



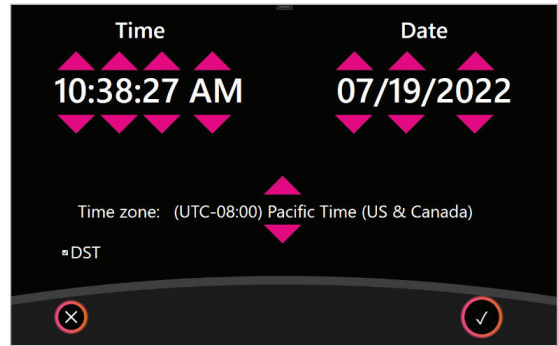
Change the clock

Press **Date and time**

Use the up and down arrows to set the time and date manually. Then press **OK**.

Notes:

- Time is displayed in hours : minutes : seconds and the date is displayed in month/day/year.
- Check DST to automatically update clock to daylight saving time.



Running the BioXp 9600 system

Obtaining BioXp Kits

To order custom BioXp application kits and reagents, visit the Codex DNA myBioXperience portal at codexdna.com. After creating an account, you will be able to upload sequences and place an order. For assistance with placing orders through myBioXperience, please reach out to orders@codexdna.com or 858-526-3080.

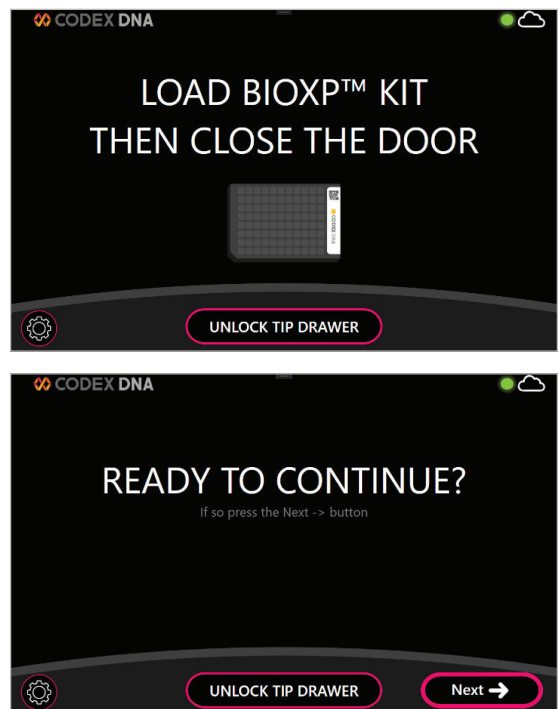
Once you've ordered and received your BioXp application project, running the BioXp system is as easy as loading the deck and pressing Start.

Loading the BioXp deck

Please refer to the site readiness guide for details on necessary equipment to prepare your BioXp kit reagents for loading.

Setting up the deck of your BioXp is unique to your application. We provide a detailed Loading map and checklist with each of your custom kits - simply refer to this document when you are ready to run your BioXp.

Press the Next-> button and the system will initialize.



Initiating a BioXp run

1. Once the deck and tip drawer is loaded, confirm that all components are securely seated.
2. Close the door and tip drawer.
3. Ensure there is a suitable waste container positioned in front of the waste chute.
4. Press the *Play* button. The run will initiate.

Tracking progress during a run

Time to completion

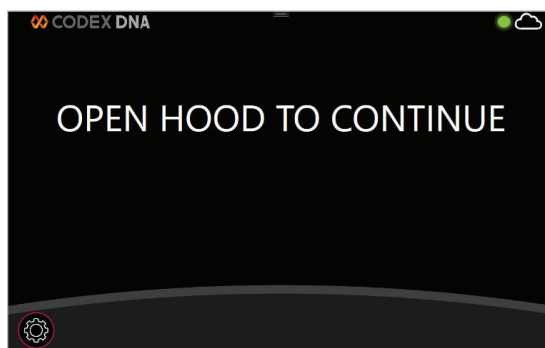
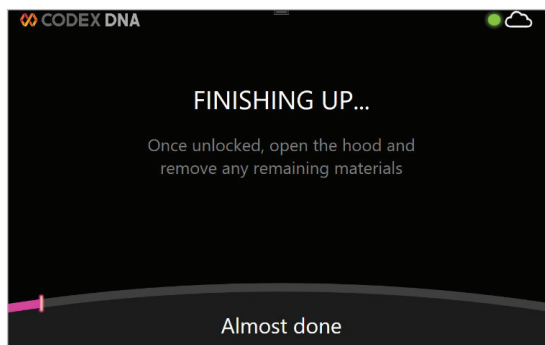
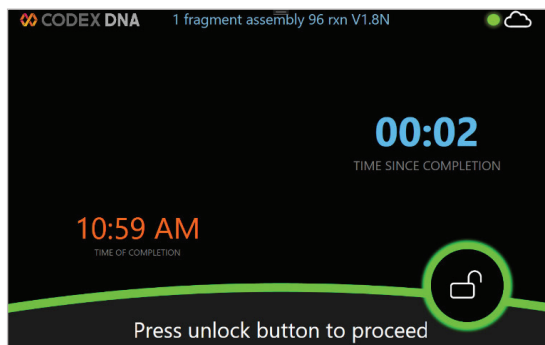
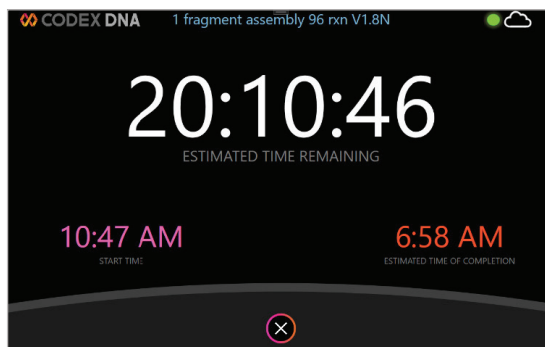
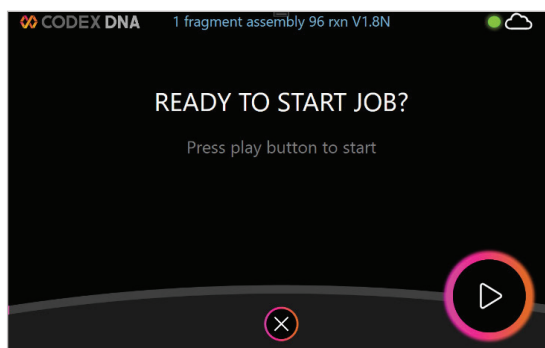
During a run, the instrument will display the projected time remaining for the run (in hours : minutes : seconds) The start time and the estimated time of completion.

BioXp run completion

1. When the BioXp run is complete, the time of completion and the time since the completion will display along with a Unlock button.
2. Pressing the Unlock button will display a progress screen as the system prepares for opening.

Once the door unlatches and the screen displays the message to open the door you should refer to your Loading map and checklist for general information on run breakdown and final product locations.

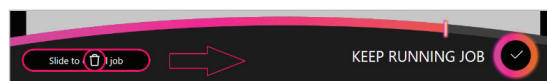
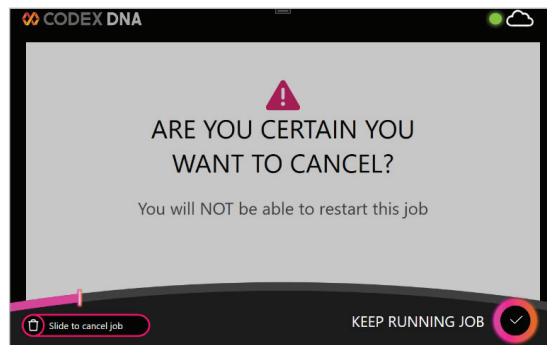
Refer to the Plate map for the location of each of your custom constructs. Both of these documents are provided with your BioXp kit™.



Cancelling a job during a run

IMPORTANT! You will not be able to reuse reagents if you cancel a job after the run has initiated and the reagent plate seal has been broken. Do not cancel a run unless absolutely necessary.

1. If you need to cancel a job during a run, press the 'X' icon at the bottom of the running screen. This will display the cancel job screen.
2. Sliding the Trash icon to the right before the progress indicator completes its travel will cancel the job. The latch will open and you will be able to remove the materials from the deck.



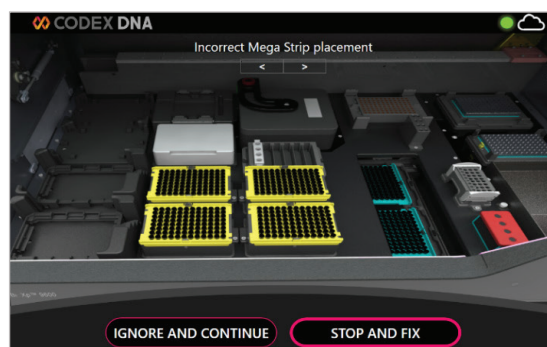
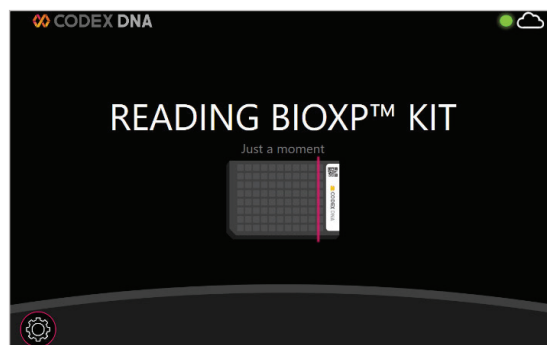
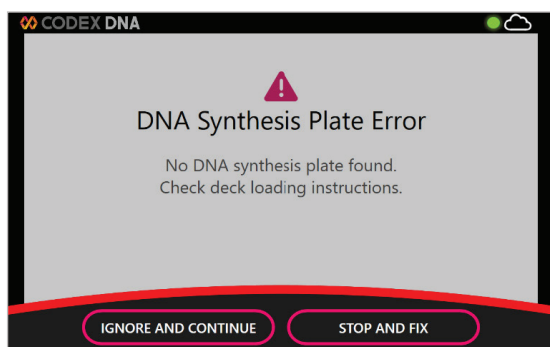
If you do not slide the trash icon to the right before the progress indicator completes or if you press the Check icon then the running screen will redisplay and the job will continue.

Troubleshooting

BioXp™ deck inspection error

After you load the deck and close the instrument door and start the run, the instrument performs a deck inspection, checking the location and orientation of the recovery plate, ethanol reservoir, reagent strip handles, reagent strips, tips, and system robotics.

If any anomalies are detected, the instrument displays a deck inspection failure message, similar to the screen shown below. If the system displays a deck inspection failure message, see the following table for recommendations.



Potential Issues

Deck inspection detected anomalies with one (or more) of the following:

- Plate found in purification station
- Recovery plate not found or is rotated
- Ethanol reservoir is missing or misplaced
- Strip handle not closed
- Not enough tips or other consumables loaded
- Incorrect sequence of input plate colors in the plate stack.

Possible solution and recommendations

Press **Stop and fix**

- Open the door and correct the deck inspection issue.
- After fixing the error, close the door to initiate a second deck inspection.
- If the deck inspection error message persists after you have corrected any issues, email: help@codexdna.com

Error messages

If you observe an error screen during operations, follow the screen instructions. If directed or if the problem persists, make a note of the screen and email help@codexdna.com

General troubleshooting

Codex DNA technical services: help@codexdna.com

Potential Issues	Possible solution and recommendations
Touchscreen does not light up	<ul style="list-style-type: none">• Confirm that the power switch is in the ON position.• Confirm that the instrument is plugged into a working electrical outlet.• Verify that the plug is securely connected to the side of the instrument.• Contact Codex DNA technical services.
Power failure occurs during the run	Contact Codex DNA technical services.
Difficulty operating the touchscreen	

Cleaning and maintenance

Cleaning instructions

- Clean the exterior of the BioXp system with standard cleaners and a damp cloth.
- Clean the internal surfaces periodically using a mild detergent or 70% ethanol. Spray the cleaner onto a cloth and then use the damp cloth to wipe instrument surfaces. Do not spray any cleaners directly into the instrument.
- You can remove the waste chute for cleaning by removing the three retaining thumbscrews.



Do not use abrasive or caustic cleaners on internal or external instrument surfaces.

Spills

Take every precaution to ensure that no liquids are spilled in the instrument. Wipe up accidental spills in and around the instrument immediately. If ethanol spills, dispose of ethanol-saturated towels according to your institutional guidelines.

In the event of hazardous material spillage

In the event of spillage of a hazardous material, the BioXp system user is responsible for decontamination of the hazardous material on or inside the instrument.

Before using a cleaning or decontamination method other than a recommended cleaner, contact Codex DNA to verify that the proposed decontamination method will not damage the equipment.

Calibration

Calibration of the motion control system is performed by the manufacturer. Yearly verification of the system calibration is recommended for optimal performance. The instrument will perform a self check each day. A log of the self check is stored on the system and may be used by Codex DNA service technicians should any issue arise. Keeping the BioXp system connected to the internet ensures optimal use and analysis of the calibration log.

Preventative maintenance

The BioXp system requires periodic cleaning and lubrication of the motion system. This procedure is ideally performed annually and is included in the optional service contract. Contact customer service for warranty and service contract inquiries.

Repair

Each BioXp system has been manufactured and calibrated to specifications. Do not attempt to disassemble any part of the system. Any such action will void the product warranty. In the event you should experience a product failure, call Codex DNA technical services at 858.228.4115.

Loading and setup

Loading

Proper loading of the BioXp system begins with gathering the provided the materials received in your reagent kit.

To start, open the hood and examine the interior of the BioXp system – make sure any materials or waste plates from a prior run have been removed before you begin loading the new consumables and reagents into the BioXp system. Refer the image on page 8 of this document - you will need to verify that all locations have been emptied of any materials or empty tip trays from the prior run. Verify that the waste chute is not blocked and any waste receptacle under the waste chute is empty and ready to receive the waste from the next run.

NOTE: Not all loading steps described below are applicable for every protocol type. These are general guidelines to provide guidance on the loading process. Some protocols have unique preparation steps such as thawing on ice or centrifugation before loading. Be sure to follow the guidelines in the specific loading guide provided with the kit being loaded.

Installing the Oligo Vault™ into the Thermal Cycler (location 4)

The Oligo Vault™ is keyed and will only fit into the thermal cycler in one orientation. The keyed component is in the top left corner of the Oligo Vault once placed into the thermal cycler, gently press the Oligo Vault into the thermal cycler to verify proper placement, ensure the aluminum cover is centered in the vault – see right.



Installing the DNA Synthesis Plate into the Reagent Chiller (location 9)

The DNA Synthesis Plate (NOTE: some loading instructions refer to this as the RNA Synthesis Plate) is keyed on the left front corner and 'snaps' into the reagent chiller. Once placed into the chiller be certain to gently press down on the top of the plate to seat it into the retention clamps – see right.



Installing frame strips into the Strip Well Holder (location 16)

If your protocol includes frame strips, install them into the strip well holder on the deck as seen below. There are two retention clamps that must be opened before a frame strip can be installed. Pay special attention to align the small hole in the frame strip with its corresponding positioning pin in the strip well holder. The strip positions will be specified in the loading instructions provided for the protocol of your order. The positions are numbered from 1 to 4 (left to right) of the holder. For example, we are loading this framestrip into location 2 of the strip well holder:



Press the framestrip into the holder and verify the location of the positioning pin and corresponding hole.



The clamp assembly of the framestrip holder snaps into place to retain the framestrip. After installing all the framestrips necessary for your protocol – gently close the clamp assemblies to retain the framestrips. Due to the low volume of reagent in the frame strips, this must be done carefully, without disrupting reagents pooled in the bottom of the tubes.



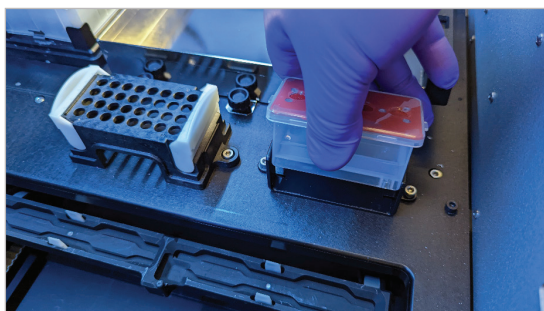
Installing Ethanol Trough (location 18)

Skip if your protocol does not require the ethanol trough for washing step.

The trough is easily removed by lifting it free from the deck (it is retained magnetically) and then unsnapping the removable 'pierceable' cover to allow for ethanol to be poured into the trough.

The trough can hold up to 60ml. Fill the trough as directed by the loading instructions with the proper amount and concentration of ethanol for the protocol you are running and restore the pierceable lid – this should snap onto the trough and be securely retained. Once secured, place the whole assembly back onto the deck in the holder.

NOTE: there is no specific orientation for the trough assembly, and it is not recommended to fill the ethanol trough while installed into the BioXp system. The cover for the trough must be fully snapped onto the trough or it may become dislodged during a run causing a failure



Do not attempt to fill the ethanol trough while still installed on the deck of the BioXp! Fully remove the trough and fill on an appropriate lab bench or fume hood.

Installing Mega Strip Holder and Mega Strips (location 8)

If your protocol requires Mega Strips for reagent delivery these are installed into the Mega Strip Holder which is a removable component and can be placed (along with the mega strips) into a centrifuge for preparation – then placed into the mounting system permanently installed on the deck of the BioXp system.

The bottom left corner of the mega strip holder is keyed and when properly mounted into the BioXp system the spring clips on the right and left of the holder will snap the holder into the retaining holder. Each of the locations is labeled from 1 – 6. The loading instructions will designate which location the Mega Strip(s) will need to be inserted to.

NOTE: To more easily remove the mega strip holder, depress one (or both) of the spring clips and lift the mega strip holder from the mounting system.



The mega strips are keyed on the ends and can only be inserted in one orientation (wide tab) to the front of the BioXp system.



Installing Reaction Plates into the Input Plate Stacks (location 10 and 11)

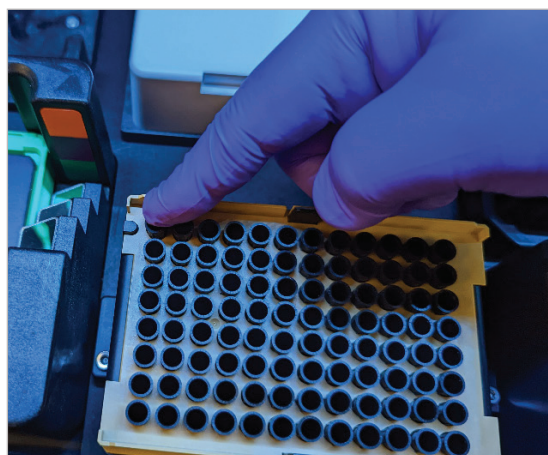
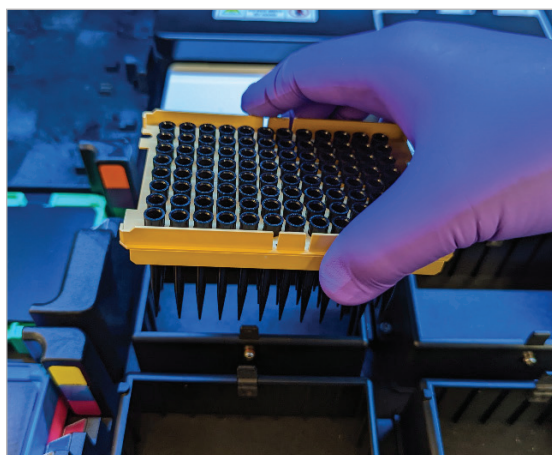
If your protocol requires reaction plates to be installed into the two input plate stack holders these are keyed in the top left corner and are color coded. The loading instructions for the protocol will identify the reaction plates for the job, you should install these based on the color of the carrier into one of the two plate stack holders. The colored label on the right side of the plate stack holder will guide the order of the reaction plate assemblies to be installed. NOTE: each of the reaction plate assemblies will include an aluminum cover – when placing the reaction plate assemblies into the plate stack holders verify that the aluminum cover is centered into the carrier before adding the next plate to the stack.



Load tips into the deck tip storage (location 12 – 15)

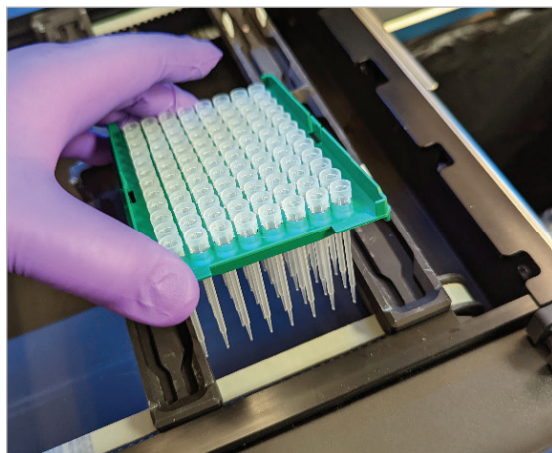
If the protocol requires tips to be loaded into the deck tip tray storage the loading instructions will include the number and size of tips required. The tip trays are keyed with a notch on the left rear side of the tray, installing these into the deck you will have to align the fingers which reach through the tip tray and the notch while pressing down into the holder.

NOTE: Always visually verify that the notch is engaged with the tray, and that you do not have the tray reversed in the holder.



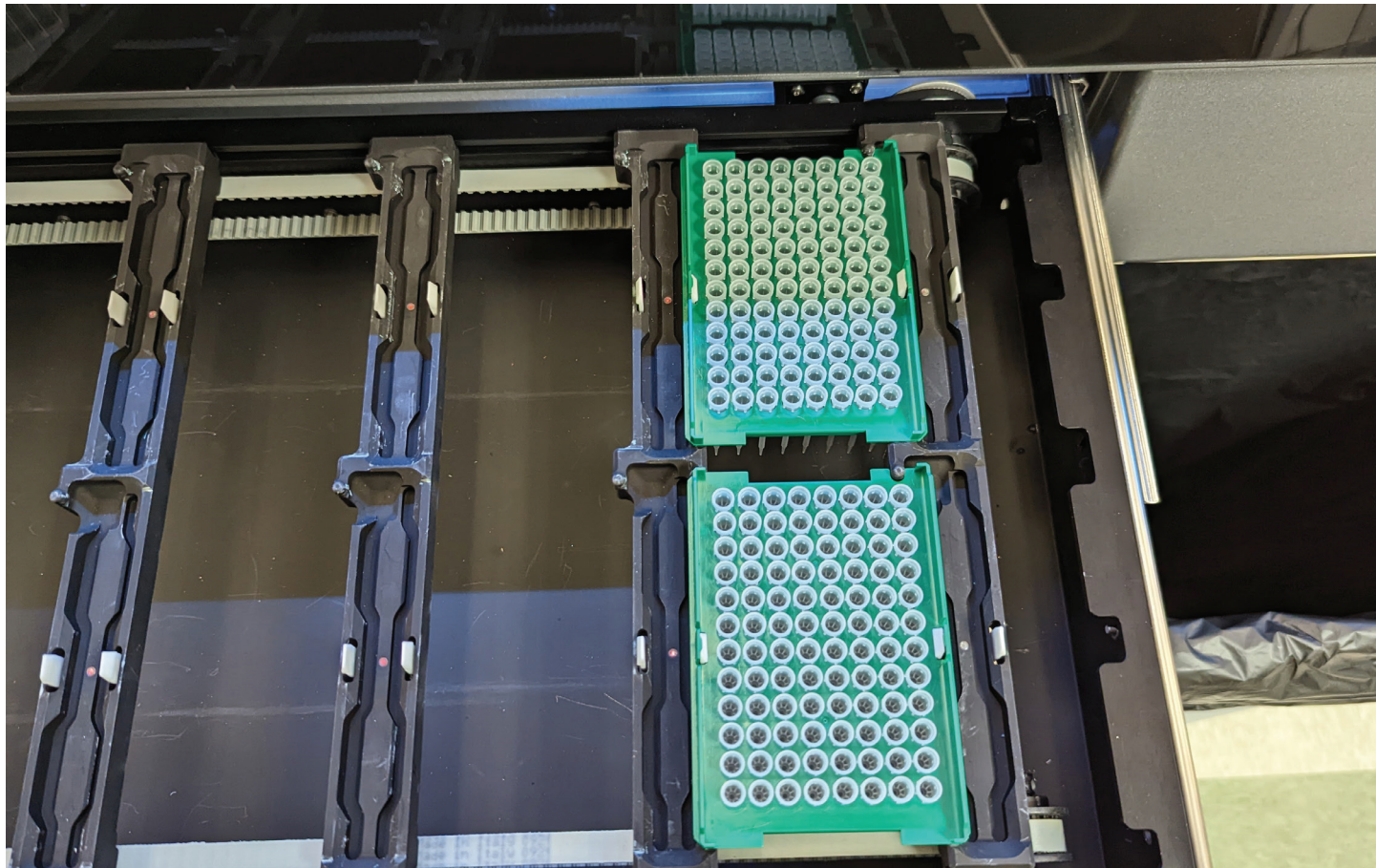
Installing tips into the Tip drawer (location 19)

If the protocol requires tips to be loaded into the drawer you may need to press the unlatch drawer button in the user interface to cause the drawer to open. Pull the drawer out completely to more easily install the tip trays into the loading bars. NOTE: the tip trays are installed in a portrait orientation with the notch at the top right corner now. Ensure the tip trays are fully snapped into the white retainer clips.



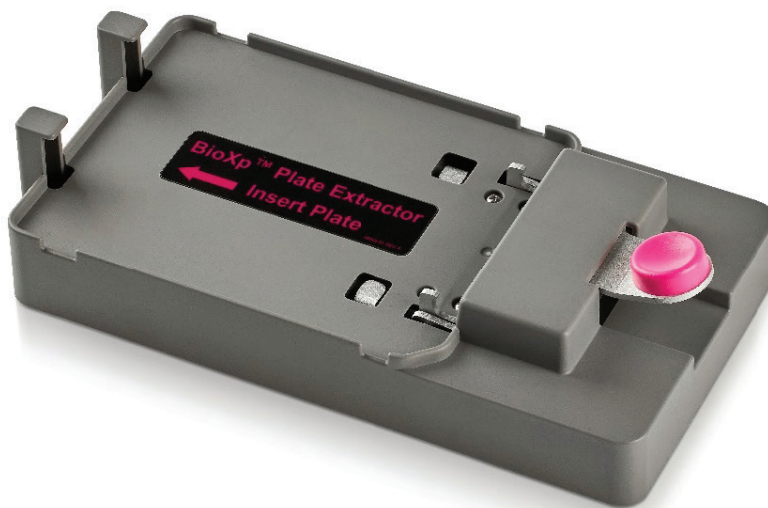
Load the tips into the drawer as directed by the loading instructions. NOTE: some protocols load more than one size of tips into the drawer.

Pay careful attention to the loading instructions for the tip trays in the drawer.



Using the BioXp Plate Extractor

A specialized tool has been created to help remove the 96 well semi skirted PCR plate from the carriers used by the BioXp system.



To use the plate extractor tool a reaction plate assembly is inserted into the retaining fingers on the left side of the extraction tool and pressed into the guidance ring. NOTE the plate extractor tool is keyed to provide proper orientation for the reaction plate assembly that is being extracted.



Remove the aluminum plate cover if still in place. Hold the reaction plate assembly down with one hand and then depress the pink button extraction lever with the other hand. Then gently lift the released PCR plate free from the carrier.



Equipment disposal

This product has parts that contain a small amount of mercury and lead in some components. Disposal of these materials may be regulated in your community due to environmental considerations. Follow local regulations for disposal of equipment or equipment accessories at the end of their life.

WEEE compliance



The BioXp™ system complies with the European Union's Waste and Electrical and Electronic directive. For disposal or recycling information, contact your local authorities or the electronic industry alliance: www.eiae.org.

Codex DNA, Inc.

9535 Waples Street, Suite 100
San Diego, CA 92121-2993
USA

Technical assistance:

help@codexdna.com

858.228.4115