## Mantarray

### Platform for Human-Relevant 3D Engineered Muscle Tissue Analysis



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	The Curi Bio Mantarray is designed to work exclusively with Curi Bio Mantarray Plate Kits. Use of kits that are not supplied by Curi Bio, Inc. may void the warranty. Use of the Mantarray Plate Kits are covered in section 2 and 3 of this manual, which discusses preparation and treatment of the consumables for use.
Conditions of Use	The Curi Bio Mantarray is for life science research use only. You are responsible for understanding and safely performing the protocols described within this guide. Curi Bio, Inc. does not guarantee any results you may achieve. These protocols are provided as Curi Bio, Inc. recommendations to you and does not constitute a guarantee of success.
Technical Support	Contact support@curibio.com for tissue casting protocols and other assistance.
Product Usage	Before using the instrument, carefully review the warranty information and guidelines in <b>Section 4: Warranty and Technical Specifications</b> . Ensure you are familiar with the entire manual. Any deviation from the specified procedures may affect the instrument's functionality.

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## Section 1: General Information

#### Thank You

Thank you for choosing Curi Bio to support your journey in 3D Engineered Tissue technology. The kit you have purchased exemplifies our commitment to making tissue engineering technology both accessible and user-friendly. We've carefully designed the enclosed information and protocols to ensure you have a seamless experience as you advance in your 3D experiments. Should you have any questions, please do not hesitate to reach out to us at support@curibio.com.

#### Instrument Overview

The Mantarray instrument consists of three main components: the Main Body, Power Brick, and Cooling Unit. The Mantarray Main Body is designed to be housed and operated within a standard cell culture incubator, while the Power Brick remains outside the incubator, allowing convenient operation and preserving valuable incubator space. Similarly, the Cooling Unit is positioned outside the incubator to maintain the Mantarray instrument's temperature within 0.7°C of the set value by efficiently dissipating excess heat out of the incubator.

This section summarizes the components and functions of each part of the Mantarray instrument.



Figure 1: Components and functions of each part of the Mantarray instrument.

#### 1. Mantarray Main Body

**Plate Recording Area:** Place your plate on this area to capture data. Ensure that well A1 is located on the back left (when looking at instrument from angle demonstrated in Figure 1) of the recording area. The casing of the main body is marked with a green triangle for where A1 should be adjacent to.



Figure 2: Components and functions of each part of the Mantarray instrument.

**Barcode Scanner:** If your plate is oriented correctly, the plate barcode will scan and populate in your Mantarray Controller software.

**Stimulation Ribbon Cable Connection:** Connect the ribbon cable to this port to allow the stimulation of tissues using a Curi Bio Stimulation Lid.

**Instrument Status:** This green light indicates what state your instrument is in. Interpret the status using the following list:

- Solid Light = your instrument is ready for data capture
- Rapidly Blinking Light = your instrument is actively collecting data
- Slowly Blinking Light = your Mantarray is connected to power, but is not connected to a computer

**Stimulation Status:** This blue light indicates the state of the stimulation feature. Interpret the status using the following list:

- Rapidly Blinking Light = a stimulation protocol is active
- Solid Light = power is connected, but no stimulation protocol is active

**Cooling Unit Connection:** Port where the Cooling Unit electrical communication cable connects. This plug can only be oriented in one way, shown by the notch on the cord's plug and groove on the main body's connection port.

**Cooling Unit Tubing Connection Ports:** Connect the tubing from the Cooling Unit here to allow the flow of water.

▲ **Apply Force**: Considerable force is required to connect the water lock mechanism that connects the tubing to its port.

**Mantarray to Computer Connection:** Micro USB that connects to the Mantarray laptop. This will be supplied with the Mantarray.

**Power Brick Connection Port:** Mantarray to Power Brick connection cord goes here.



Figure 3: Components and functions of the Mantarray Power Brick.



Figure 4: Components and functions of the Mantarray Power Brick.

#### 2. Mantarray Power Brick

**Power Brick:** Contains the power source for the Mantarray. The unit must be located outside of the cell culture incubator.

**Mantarray Connection Port:** Plug in your Mantarray to Power Brick connection cord here.

**Power Brick Status Light:** Indicates the power status. Green light will illuminate when the instrument is connected to power and the power switch is engaged.

**Power Switch:** On/Off switch that control power delivery to the Mantarray.

**Power Cord Connection:** 3-prong receptacle for the power cable.

#### 3. Mantarray Cooling Unit

The Cooling Unit contains a temperature-activated pump and water reservoir for cooling the interior of the Mantarray instrument. The Cooling Unit connects to the Mantarray main body via two silicone tubing water



#### Figure 5: Cooling Unit.

lines (input and output) and a communication cable. When overheating is detected, water is pumped through the cooling pad until the preset temperature is achieved. The unit can be left on indefinitely, but it must be located outside of the cell culture incubator. The bottom of the unit is magnetic, allowing it to mount onto the outside wall of most incubators providing easy access and control to the unit.

#### Instrument Service & Maintenance

The Mantarray instrument is generally designed to remain operational without the need for additional maintenance. Ensure you follow the two procedures below.

- 1. Always leave the Mantarray and Cooling Unit switched ON while not in use.
- 2. Please confirm on a monthly basis that the water level in the Cooling Unit stays within the range marked on the Water Level Window. If the water level drops below the marked range, please refill or contact Curi Bio at support@curibio.com for further assistance.

The Mantarray instrument contains no user-serviceable parts. Please refer to the Mantarray Warranty program you have purchased for questions regarding maintenance and repairs, or contact your Curi Bio representative.

▲ Never open the instrument case. Opening the instrument case will immediately void the warranty, as it may damage internal components and compromise the factory environmental seal.

Should you have any concerns regarding the instrument's functionality or

#### **Operating Software**

The Mantarray Controller is the designated software application used to operate the Curi Bio Mantarray. The Mantarray Controller is designed to exclusively operate on Windows 10 or 11, and is pre-installed on the laptop that accompanies your Mantarray Instrument. Operation of the software is briefly described in later sections of this manual. Should you need a copy of the software or more details on how to operate it, please contact your Curi Bio representative at support@curibio.com.



Figure 6: Mantarray Controller software.

# Section 2: Installing and Using the Mantarray

Before Installation	Before installing the Curi Bio Mantarray in an incubator, we recommend sterilizing the instrument by wiping it down with 70% ethanol and ultrapure water. Take care to avoid getting liquid into the cable ports, and ensure the instrument is completely dry before connecting any cables. While the electronics are sealed against liquid intrusion, excessive liquid, spraying, or immersion of any part of the Mantarray may damage the instrument.
Instrument Installation	Follow the steps below to install the Mantarray Instrument and Cooling Unit.
	<ol> <li>Place the Mantarray into incubator and give the instrument time to heat up to the temperature of the incubator. This takes 6+ hours. During this time, leave all cords unplugged (USB, Power, Cooling Tubes).</li> </ol>
	▲ Wait 6 hours: When your instrument is initially put in the incubator, condensation will accumulate on the instrument. Turning on the instrument with large amounts of condensation can break your instrument. Please wait 6 hours for your instrument to warm up to the incubator temperature.
	<ol> <li>After 6+ hours, you can plug the Power Brick to Main Unit connection cord, the Cooling Unit's silicon tubing (see below), and the USB connection cord. It is best practice to lead these cords out the back of the incubator.</li> </ol>
	<ol><li>Plug the Power Brick's power cord into the wall and leave the instrument off.</li></ol>
	▲ <b>Power Cord:</b> You must use the power cord provided by Curi Bio, to ensure appropriate earth grounding. Consult Curi Bio for acceptable alternatives if necessary.
	4. Attach the Cooling Unit to a flat, vertical, and stable surface, such as an incubator. The unit has magnets that allow it to attach to the side of the incubator hood. Ensure that the unit is upright, with the power button at the top and the silicone tubing port at the bottom.
	5. Use the included syringe and filling tube (a small section of tubing with a plastic fitting at the end) to fill the Temperature Control Unit with sterile water.
	6. Remove the black silicone plug at the top right of the Cooling Unit and attach the fitting on the end of the fill tube to one of the ports on

	the bottom of the Cooling Unit. Fill the Cooling Unit to 225 mL of water. Please ensure that the water level stays between the designated lines of the Water Level Window shown in Figure 7.
	<ol><li>If you need more than one syringe load, remove the filling tube and load the syringe before reattaching and filling.</li></ol>
	8. Place the Cooling Unit on the side of your incubator. Remove the filling tube and syringe when the water level reaches the top line of the water level window.
	9. Attach the Mantarray to Cooling Unit connection tubes to the ports on the Cooling Unit. It is suggested that you run these tubes through the back port of the incubator. Do not turn the Cooling Unit on.
	10. At this point, the Mantarray is fully installed. Before the instrument can be used, the Cooling Unit must be calibrated.
	▲ Cooling Unit Calibration: Please contact support@curibio.com for calibration assistance.
Syncing the Mantarray Controller with Your Pulse3D Account	Syncing the Mantarray Controller to your Pulse3D account is essential for automating and optimizing your Mantarray system. Successful synchronization ensures:
	2 Immediate Automatic Processing of recordings
	<ol> <li>Automatic Updates for both the Mantarray Controller software and Mantarray Instrument firmware.</li> </ol>
	▲ <b>Obtaining A User Account:</b> To sync your Mantarray Controller successfully, you must have a Pulse3D cloud user account. To obtain an account, please contact your cloud administrator or your Curi Bio representative.
	Steps to Enable Syncing
	1. Launch the Mantarray Controller application on the computer provided by Curi Bio.
	2. Under the 'Recording Options' menu, click the gear icon to open the User Settings. (fig. 7)
	Record Options

Figure 7: Click the gear icon.

3. Input your Customer ID, Username, and Password. Note: Ensure you have been granted a user account by your administrator. If you are the initial user, contact Curi Bio to set up your administrator and user account. (fig. 8)

User Settings				
	Select Customer ID			
	Select User			
	user account 1			
	Enter Password			
	****			
	*All fields required			
	Login			
	Recorded File Settings			
	Auto Upload Files to Cloud			
	Pulse3D Version v1.0.8 v			
	Show Snapshot After Recording			
	Save Changes Close			

Figure 8: Add your credentials.

4. Click 'Login'. A green indicator with a checkmark will confirm a successful login. (fig. 9)

▲ **Login fails:** If login fails or delays, ensure your computer is connected to the internet and that necessary network ports are open. Consult the "Troubleshooting Login Issues" section on page 13.

User Settings						
		Select C	ustomer ID			
	MyID					
		Selec	t User			
	MyUsername					
		Enter F	Password			
	Login V Logged in					
		Recorded	File Setting	IS		
	ullet	Auto Uploa	d Files to Cl	oud		
Pulse3D Version v1.0.8 v						
Show Snapshot After Recording						
	Save Cł	nanges	С	lose		

Figure 9: Click Login.

- 5. Select the radio button for 'Automatic Upload'.
- 6. Choose the correct version of the Pulse3D Peak Identification Algorithm from the dropdown menu to enable automatic processing. If unsure, select the most recent version. (fig. 10)

User Settings	
Select Customer ID	
MylD	
Select User	
MyUsername	
Enter Password	
•••••	
Login V Logged in	
Auto Upload Files to Cloud Pulse3D Version VI.0.8 V Show Snapshot After Recording	
Save Changes Close	

Figure 10: Enable Automatic Upload and choose a Pulse3D version.

7. Once you log in, the application will retain your Customer ID and username information, and will automatically connect to your account.

▲ **Multiple Instruments:** If multiple instrument users have access to the application, please ensure that user settings are checked and user credentials are updated each time the application is used.

#### **Troubleshooting Login Issues**

- 1. **Network Connection:** Verify the computer is connected to your network.
- 2. **Firewall Port:** Ensure the network's firewall permits connections, and port 443 is open.
- Domain Access: The application connects over TCP using HTTPS. Request firewall access for the following domains through your IT department:
  - a. \*.curibio.com
  - b. prod-pulse3d-uploads.s3.amazonaws.com
- 4. **Credentials:** Confirm your login credentials are correct by attempting to log in via a web browser at dashboard.curibio.com.

#### Data Recording

Follow the steps below to record data without applying synchronized stimulation.

▲ Verify You Are Not in Simulation Mode: If the controller does not detect an active instrument connection at startup (e.g., due to a faulty USB cable or an unpowered instrument), it will default to Simulation Mode. Data recorded in Simulation Mode is demo data and not collected from the instrument. To resolve this: (1) close the controller application, (2) ensure the instrument is powered on and properly connected to your computer, (3) relaunch the controller application. For more details about Simulation Mode, refer to page 28.

- 1. First, flip on Power Brick switch to turn on the Mantarray instrument and connect the instrument to the computer through the USB cable.
- 2. Once instrument is on, launch the Mantarray Controller Application on your computer, ensuring that the USB connection has been made with the computer.

▲ **Simulation mode:** If there is a connection issue, the software will indicate that it is in "Simulation Mode". Close the controller application and repeat step 2 to exit simulation mode. For more details about Simulation Mode, refer to page 28.

3. Once the software is open, run the calibration procedure by clicking the Calibration icon, as shown in the figure 11 below by a yellow box. The tissue plate should NOT be loaded into the device at this point.



Figure 11: Click the calibration button.

4. When calibration is complete, this will be indicated by a green dot over the Calibration button (fig. 12). At this stage, you may place your tissue plate in the instrument.



Figure 12: Wait for the green indicator on the calibration button.

5. Make sure the A1 well is located adjacent to the green marking next to the plate loading area. A barcode should automatically populate if the plate is oriented correctly (fig. 13). If it is not oriented correctly, there will be a red box around the Plate Barcode section. Rotate the plate and wait a few moments until the Plate Barcode section on the Mantarray Controller Software shows green.

6. The barcode scanner should now automatically read the barcode number of the plate, which is displayed as shown below. For more information on the barcode numbers, please read the "Associated Consumables" section.

▲ Automatic barcode scanning fails: If the automatic scanning fails, you may click on the pencil icon and proceed to manually enter the barcode. You should enter the barcode number that is found on the plate lattice and ends in -2. (fig. 13)

▲ **Confirm successful barcode scan:** At any time, hover over the barcode number to display when it was last updated. (fig. 14)

Data Acquisition			
Plate Barcode: ML22001000-2			

Figure 13: Click the pencil icon to manually update the barcode.

Automatically scanned 0H 0M 1s ago.			
Plate Barcode:	ML22001000-2		

Figure 14: Hover over the barcode to check when it was last updated.

7. Clicking the "Live View" button, shown in figure 15, will make Mantarray waveform traces visible in the 6 on-screen graphs. If no trace is visible (or only some), zoom out on the Y-axis until all traces are visible.



Figure 15: Click on the 'Live View' button to intiate the Live View.

 The Mantarray is now ready to record. This will be indicated by the shade of the "Record" button, shown below in the yellow box in figure 16. Click this button to begin recording. Data from all 24 wells will be recorded, regardless of which 6 wells you are currently viewing. (fig. 16)



Figure 16: Click the grey 'Record' button to start recording.

9. The "Record" button will change shape/color to indicate that a recording is in progress. (fig. 17)



Figure 17: Click the red 'Record' button to end the recording.

- 10. Once you are done with your desired recording, press "Stop Recording" and a pop-up to save the recording will appear.
- 11. After finishing your recording, you will be given the option to see a "snapshot feature". Curi Bio suggests that you look at this snapshot feature as it will give you an indication of the level of magnetic noise in your recording. If there is a large amount of noise, you should consider recording your tissues again.

The recordings and log files from the recording sessions can be found in the following folders:

C:\Users\username\AppData\Roaming\MantarrayController\recordings

C:\Users\**username**\AppData\Roaming\MantarrayController\logs\_flask

where **username** is the name of your computer's user account.

#### Stimulation

▲ Verify You Are Not in Simulation Mode: If the controller does not detect an active instrument connection at startup (e.g., due to a faulty USB cable or an unpowered instrument), it will default to Simulation Mode. Stimulation will only be simulation, and will not be applied to your tissues. To resolve this: (1) close the controller application, (2) ensure the instrument is powered on and properly connected to your computer, (3) relaunch the controller application. For more details about Simulation Mode, refer to page 28.

#### Setting up the Stimulation Lid

To apply a Stimulation protocol, you will need to use a Stimulation Lid (Stim Lid). Please consult the Stimulation Lid section (page 43) on how to use and clean Stimulation Lids. Once the Stimulation Lid is in the Tissue Culture plate and is connected to the instrument, follow the steps below to set up your stimulation protocol.

1. Navigate to the "stimulation studio" drop down tab on the left to define stimulation protocols and stimulate tissues. (fig. 18)



Figure 18: The Stimulation Studio tab.

- 2. Place the culture plate with the Stimulation Lid onto the Mantarray instrument.
- 3. If oriented properly, the "Stim Lid Barcode" section will automatically populate and appear green. (fig. 19) If it remains red, confirm correct orientation, or manually enter the barcode by clicking on the pencil icon.



Figure 19: The Controller will automatically populate the stimulation lid barcode number.

#### **Creating a Stimulation Protocol**

You may now start building your stimulation protocols. Turn your attention to the right side of the screen.

1. You can build your protocol by dragging and dropping stimulation waveforms in the **protocol bar** - the empty space underneath the platemap. (fig. 20)



Figure 20: Drag and drop waveforms in the protocol bar to create protocols.

2. Every time you add a waveform, you will be asked to fill out the stimulation parameter in a popup window as shown below. In this example, we are adding a biphasic stim pulse. Fill out the parameters and hit save. (fig. 21)

Stimulation Stu	Biphasic Pulse Details	Change color	Drag/Drop Waveforms
C       01       02       03         A       O       O       O         B       O       O       O         C       O       O       O	Phase 1       Stimulus Duration     10     milliseconds       Current     100     mA	Waveform Preview	
	Interphase 10 milliseconds	Current (b)	
A Protocol Name	Phase 2 Stimulus Duration 10 milliseconds	P Time	
Biphesic	Current mA	Waveform Key A. Phase 1 Duration B. Phase 1 Current	
100-	Pulse Frequency 5 Hz	C. Interphase Interval D. Phase 2 Duration E. Phase 2 Current	
• • • • • • • • • • • • • • • • • • •	Active Duration 1000 milliseconds *	F. Total Active Duration	
0 -100 - 0 10 20	Number of Cycles 5		
	Save	Cancel	

Figure 21: The popup window for defining a biphasic pulse.

3. In this example, we are adding a delay after the biphasic pulse. Drag and drop a delay waveform and fill out the parameters. (fig. 22)

Stimulation Studio				Drag/Drop Waveforms
	05 06 Delay	Create/Edit Stimulation F		
	Duration: 1 seco	Cleo • Expor	ar Selection	
	Save	Cancel		
A Protocol Name				
Bithinic Decky				
0 200 200	Time milliseconds	→ ⊕ ⊕		
	Save Changes Clear/Reset	: All Discard Changes		

Figure 22: The popup window for defining a delay.

- 4. You may double click on any placed waveform to edit it, duplicate it or delete it.
- 5. You may also create a loop drag and drop an already placed waveform on another placed waveform to trigger the loop function (fig. 23) and set the number of loops. (fig. 24)



Figure 23: Drop a defined waveform on another waveform to begin creating a loop.



Figure 24: Set the number of iterations of the loop in the popup that appears.

- 6. Once a loop is created, you can add more waveforms in it. Drop waveforms in the protocol bar, define them as in the previous steps and then drop them in the loop. You may also edit any of the components of a loop by double-clicking on them.
- 7. To finish creating a protocol, assign a name to it in the designated text box and click 'Save Changes' at the bottom. (fig. 25)

Stimulation Studio		Drag/Drop Waveforms
01         02         03         04         05         06           A         Image: Constraint of the state o	Create/Edit Stimulation Protocol Select/Create Protocol Create New	
	Apply to Selection Clear Selection Import Protocol(s) Export Protocol(s)	
A Biphasic Loop	Carrent Controlled Standardon • Standards Unit Stopped • every 🕫 millioneconds • 🗃	
	000 5,000 5,000 7,000 8,000 30,000 30,000 30,000	
Save Changes	Clear/Reset All Discard Changes	

Figure 25: Fill out the name of your protocol and click 'Save Changes'.

8. All created protocols are available in the dropdown menu to the right of the plate map. You may select a created protocol to assign or edit it. (fig. 26)



Figure 26: Created protocols are found in the shown dropdown menu.

9. To create a second protocol, choose the option 'Create New' from the aforementioned dropdown and then define and save the protocol using the exact same steps.

▲ I want my stimulation protocol to keep on repeating indefinitely until I stop it. This option is available and must be set for each one of the assigned protocols individually. Select the protocol of interest. Use the dropdown menu below and choose 'Stimulate Until Stopped' (fig. 27). Make sure to 'Save Changes' and re-assign the protocol. If you would like to add a pause between successive iterations of the protocol, input the pause duration in the text box to the right of the dropdown menu (fig. 27). If you'd like the protocol to repeat just once, choose 'Stimulate Until Complete'. Note that it is possible to choose different settings for each one of the assigned protocols. Make sure you review your protocol settings to all protocols are applied as intended.



**Figure 27:** Use the highlighted options to set your protocols to repeat until manually stopped.

▲ **Can I save a protocol for later use?** Yes. Once you have defined all your protocols, click the 'Export Protocols' button to export them into a single, locally saved file. You will be prompted to save the protocol as a file at your preferred path. You may later load them back to the Mantarray Controller application by using the 'Import Protocols' button and selecting the file you exported.

▲ My protocol list is getting long. How do I remove protocols? To remove a protocol from the dropdown menu, click the trashcan icon next to the protocol name in the dropdown menu. Alternatively, select the protocol from the dropdown and click on the trashcan icon on the right side of the protocol bar.

▲ Choosing Monophasic vs Biphasic Stimulation. Although monophasic stimulation is widely used in scientific literature, Curi Bio strongly recommends selecting biphasic pulses for stimulation. Monophasic pulses deliver current in a single direction, which can result in charge buildup at the media-electrode interface. This buildup may (1) accelerate electrode aging and degradation, and (2) disrupt the ionic balance of the media, potentially compromising tissue health and longevity. In contrast, biphasic stimulation delivers current sequentially in opposite directions, effectively neutralizing charge buildup. This process helps maintain electrode stability, preserves the ionic environment, and supports tissue viability over time.

#### Assigning Stimulation Protocols to Wells

Once you have defined a protocol, you may assign it to any of the wells using the platemap interface on the top left of the Stimulation Studio (fig. 28). You may assign up to 24 protocols in a single platemap (one protocol per well). Running the stimulation will apply all assigned protocols at the same time. To assign a protocol:



**Figure 28:** Choose a protocol from the dropdown list and assign it to wells using the platemap interface.

1. Select the protocol you want to assign from the dropdown list (fig. 28)

- 2. Select the wells you would like to apply the protocol to using the platemap interface. (fig. 28 and fig. 29)
  - a. Click on the '+' sign to select the entire well.
  - b. Click on any of column numbers on the top side of the platemap to choose an entire column.
  - c. Click on any of the row letters on the left side of the platemap to choose an entire row.
  - d. Click on any of the wells to select the well.
  - e. **To make multiple selections** with any of the above methods, hold the "Shift" button.
  - f. Hold "Shift" and click any of the buttons to deselect already selected wells.



Figure 29: Select and deselect wells using the platemap interface.

3. Click the 'Apply to Selection' button to assign the protocol to the selected wells. (fig. 30)

▲ What about empty wells? Assigning a stimulation protocol to a well that does not contain any kind of ionic liquid (e.g. cell culture media, PBS) will cause the configuration check (see below) to fail. Assign protocols only to filled wells.

- 4. To assign a new protocol, select the protocol from the dropdown list and repeat the above process.
- 5. To change the protocol in a well, simply select the wells and apply the new protocol using the 'Apply to Selection' button.
- 6. To remove the protocol from a well, select the well and click 'Clear Selection'. (fig. 30)



**Figure 30:** Use the 'Apply to Selection' and 'Clear Selection' buttons to add and remove protocols in selected wells.

#### **Configuration Check**

Before starting a stimulation you have to ensure the stimulation circuitry is fully functional.

1. Click the "Configuration Check" button in the Stimulation Studio tab on the left. (fig. 31)



Figure 31: The configuration check button.

2. The instrument will automatically run the configuration check and will report the outcome in a popup window.

3. If the configuration check succeeds (fig. 32), you may run the stimulation protocol as described next.



**Figure 32:** A successful configuration check will yield this popup window.

#### 4. Alf the configuration check fails and reports an open circuit:

- a. Ensure all wells of the Mantarray plate with an assigned protocol are filled with media and the carbon electrodes of the Stimulation Lid are submerged in the media. You may use PBS for wells that do not contain tissues, or remove the assigned protocols from empty wells.
- b. Ensure the ribbon cable connectors on the cable, the instrument and the Stimulation Lid are intact and don't have signs of physical damage.
- c. Ensure the ribbon cable is properly connected to the Stimulation Lid and to the instrument. Try unclipping and reclipping the cable if necessary.
- d. Ensure all carbon electrodes are intact and do not bear marks of significant damage. Read the 'Stimulation Lid' subsection of Section 3 to learn how to evaluate the health of a Stimulation Lid.
- e. Try running the configuration check again.
- f. If the issue persists, try using a new Stimulation Lid and/or ribbon cable.
- g. If the issue still persists, contact Curi Bio.

#### 5. Alf the configuration check fails and reports a short circuit:

- a. Ensure the ribbon cable connectors on the Stimulation Lid, the instrument and the cable are dry and do not have signs of physical damage.
- b. Replace the stimulation lid with a new one.
- c. Try running the configuration check again.
- d. If the issue persists, please stop using the Mantarray instrument and contact Curi Bio immediately.

#### **Running a Stimulation Session**

The Stimulation Lid has been registered by the Mantarray Controller, Stimulation Protocols have been created and assigned to wells, and the Configuration Check was successful. You are now ready to start your Stimulation.

- 1. Navigate to the Stimulation Studio tab on the left, and click the triangular 'Play' button. (fig. 33)
- 2. In the popup menu, choose whether you will apply stimulation while recording or stimulation without recording. (fig. 33)

Stimulation Studi	o	•	
Stim Lid Barcode:	MS22001000-2	ø	
Stim status: Ready			
Stimulation Cont	rols		
	C 0		
Data Analysis		Only	
Duta Analysis	Start Reco	rding c	and Stimulation

**Figure 33:** When starting a stimulation session, you can choose whether to start a concurrent recording session.

- 3. Clicking either option will immediately start the stimulation option (and the recording if applicable).
- 4. While stimulation is underway, you may switch to the Data Acquisition tab and turn on 'Live View' (see the Data Recording section on page 14 for more information).
- 5. The stimulation session will end when the longest assigned stimulation ends. Recording will continue until manually stopped.
- 6. You can end the stimulation at any time by hitting the red 'Stop' button. (fig. 34)

▲ Stopping the stimulation will not stop the recording. If you chose to apply stimulation and record at the same time, you must navigate to the 'Data Acquisition' tab and manually stop the recording in that tab. Choosing to stop the stimulation in the 'Stimulation Studio' tab will not stop the recording.



**Figure 34:** Press the 'Stop Stimulation' button to stop the stimulation. An accompanying recording session must be stopped separately from the 'Data Acquisition' tab.

Accessing N Data	Your	Curi Bio is committed to data accessibility. All recording data is stored locally on your computer for your convenience. Once a recording is complete, the data is automatically saved to the following <b>recordings</b> <b>path</b> :
		C:\Users\ <b>username</b> \AppData\Roaming\MantarrayController\recordings
		where <b>username</b> is the name of your computer's user account.
		Within the <b>recordings path</b> , each recording session is saved in its own folder. Upon successful completion of the session, the folder will contain 24 pairs of files — each pair corresponding to a single well in the 24-well plate. Each file pair includes:
		<ol> <li>Recording File: Contains the raw data used for downstream analysis and decision-making.</li> </ol>
		2. Calibration File: Ensures data accuracy and validity.
		All files end in '-XX.h5', when XX indicates the Mantarray Plate well that the file corresponds to. Furthermore, all files are stored in the .h5 format, designed for machine readability. <b>To convert these files into</b> <b>human-readable formats and process them, please read the 'Data</b> <b>Analysis' section below.</b>
		<b>A</b> Renaming Raw Data Files: Curi Bio strongly advises against renaming, moving, or deleting files or folders within the recordings directory. Altering these files may result in data inaccessibility or loss.

▲ Safe Data Storage: Curi Bio does not guarantee the safety or long-term storage of locally saved data. To ensure data security, users are responsible for implementing their own backup methods or storing data in secure repositories. You may also purchase access to Curi Bio's cloud platform, Pulse, for online data storage and processing, to maintain additional copies of your data. For more information about Pulse, please contact your Curi Bio representative or email us at contact@curibio.com.

#### Data Analysis

#### Analysis Methods

There are three methods available for analyzing data to assess the contractility of your engineered tissues. This manual will guide you through the first method in detail.

- 1. Local Export using the Mantarray Controller App: This method provides raw Force vs. Time data, which is stored locally on the Mantarray Laptop. The data is exported as an Excel-compatible .csv file for further analysis.
- Automatic Cloud Analysis on Pulse: Data is automatically uploaded and analyzed on the cloud. Simply log in to your user account on the Mantarray Controller software as described previously, and the data will be uploaded and analyzed automatically. The processed data can then be accessed by logging into the cloud platform.
   Mote: An active internet connection is required for this method.
- 3. **Manual Cloud Analysis on Pulse:** This method allows you to manually upload data for cloud analysis. Navigate to the Curi Bio Dashboard and create a user account if you do not already have one. Once logged in, upload your .5 files for processing and analysis.

#### Local Export

The Mantarray Controller App provides a quick and convenient way to convert raw data into a processable .csv format. Follow these steps to complete the export:

1. Open the Mantarray Controller and navigate to the 'Data Analysis' tab on the left side of the Controller window. (fig. 35).

Data Analysis	•
Select Recordings	

Figure 35: The Data Analysis Tab

 Click 'Select Recordings...' and select the recordings you want to process in the window that pops up by clicking on their names. (fig. 36).

	Start analysis		
Please choose from the following recordings found at:			
C:\Users\ch	ris\AppData\Roaming\M ller\recordings	AantarrayContro	
Recording name:		Date created:	
ML22001000-22024	_03_08_212353	03-08-2024 21:23.54	
ML22001000-2_2024	_03_08_212434	03-08-2024 21:24.34	
ML22001000-2_2024	_03_15_162956	03-15-2024 16:29.57	
ML22001000-2_2024	_03_15_165728	03-15-2024 16:57.29	
ML22001000-22024	_04_07_202146	04-07-2024 20:21.46	
ML22001000-2_2024	_05_21_224441 - test	05-21-2024 22:44.42	
Cancel	Reset	Run	

Figure 36: Click 'Select Recordings' to open the above popup window.

3. Selected recordings will be highlighted in gray. Click on a highlighted recording to deselect it, or use the 'Reset' button to clear all selections. (fig. 37).

	Start analysis			
Please choo	ose from the following record	ings fo	ound at:	
C:\Users\ch	ris\AppData\Roaming\Man ller\recordings	ntarr	ayContro	
Recording name:			Date created:	
ML22001000-22024	4_03_08_212353	03-0	8-2024 21:23.54	
ML22001000-22024	4_03_08_212434	03-0	8-2024 21:24.34	
ML22001000-22024	4_03_15_162956	03-1	5-2024 16:29.57	
ML22001000-22024	4_03_15_165728	03-1	5-2024 16:57.29	
ML22001000-22024	4_04_07_202146	04-0	7-2024 20:21.46	
ML22001000-22024	4_05_21_224441 - test	05-2	1-2024 22:44.42	
Cancel	Reset		Run	

Figure 37: Selected recordings are highlighted in gray.

4. Once selections are finalized, click 'Run' to start processing.

5. The popup window will display that processing is underway, as shown below. Do not turn off the controller application until processing is complete. (fig. 38).



Figure 38: The spinning wheel indicates that processing is underway.

6. When processing is complete, the window will confirm success and display the path to the generated .csv files. Failed recordings, if any, will be listed below the confirmation message. (fig. 39).

Analysis Complete!	
1/2 recordings have been completed successfully.	
The data can be found at:	
C:\Users\chris\AppData\Roaming\Mantar rayController\time_force_data	
The following recordings failed to complete. Please try again.	
ML22001000-22024_03_08_212353	
Close	

Figure 39: The analysis is complete. Take note of any files that failed processing.

	All processed data is by default saved in the following path:
	C:\Users\ <b>username</b> \AppData\Roaming\MantarrayController\time_force_data
	where <b>username</b> is the name of your computer's user account.
	To open the .csv files, use any compatible software, such as Microsoft Excel. If you choose Microsoft Excel and you are prompted to apply data conversions, select 'Convert' to ensure the file is displayed correctly. You can now analyze, copy, or process your data as needed using your method of choice.
	▲ My export file is missing: Recordings that fail to process will not produce a .csv file. The popup window of the last processing step will list all recordings that failed processing.
	▲ <b>My processing failed:</b> Processing failures often result from poor calibration (refer to the associated calibration .h5 files on page 28). You might have to repeat your recording session, ensuring you follow all cautionary steps during the calibration steps. If failing analyses is a recurring issue, please contact Curi Bio for assistance.
	▲ I am not sure how to process my data: As different tissue types exhibit different contractile behaviors, each application might require different contractility metrics. We strongly advise you study your field's literature and identify the metrics of interest before defining your processing algorithm. You are also encourage to consider using the Curi Bio's Pulse platform, which automatically calculates the majority of metrics that can be extract from a single contraction.
Simulation Mode	Simulation mode is a distinct operational mode of the Mantarray Controller that enables you to perform core controller functions without requiring a connected instrument. It is ideal for creating and editing platemaps and stimulation protocols, analyzing data offline, and conducting training in the absence of an instrument.
	Accessing Simulation Mode
	Simulation mode is automatically activated when the Mantarray Controller is opened with no instrument connected to the computer:
	1. Ensure no instrument is connected to the computer.
	2. Open the Mantarray Controller application.
	<ol> <li>The Mantarray Controller will automatically search for connected instruments.</li> </ol>
	4. If no instrument is detected, Simulation Mode will load automatically.
	Confirming Simulation Mode
	To verify that Simulation Mode is active, check for the following indications:

- 1. Open the Data Acquisition tab and view the Contraction Trace plots. A "Simulation Mode" watermark should appear behind the plots. (fig. 40).
- 2. A bright red banner at the bottom left of the Controller window will indicate that Simulation Mode is active. (fig. 40).



Figure 40: The watermark and red banner indicate that Simulation Mode is active.

#### **Exiting Simulation Mode**

To exit Simulation Mode, follow these steps:

- 1. Close the Mantarray Controller application.
- 2. Connect a powered-on Mantarray Instrument to the computer via the USB port.
- 3. Reopen the Mantarray Controller application.
- 4. If Simulation Mode persists, ensure the USB cable is securely connected to both the instrument and the computer. If the issue continues, contact Curi Bio support for assistance.

#### **Simulation Mode Functions**

While in Simulation Mode, you can still perform the following tasks outlined in previous sections of the manual:

- 1. **Platemaps:** Create, import, view, edit, and export platemaps for future use.
- 2. **Stimulation Protocols:** Create, import, view, edit, and export stimulation protocols for future use.
- 3. Data Analysis: Convert pre-recorded data into .csv files using the "Data Analysis" tab.
- 4. **Simulate Data Collection:** All controls for starting and stopping a data acquisition session are functional. Starting a session will display

"demo" cardiac contraction data. Upon ending the session, the controller will simulate saving the data. Note that the resulting files will be empty and will not contain usable or processable data.

5. **Simulate Stimulation Sessions:** All controls for starting and stopping a stimulation session will remain functional, but no stimulation will be generated. If a session is simulated with concurrent stimulation and recording, the "demo" data will not reflect the expected response to the selected stimulation protocol.

# Section 3: Associated Consumables

**Mantarray Plate** 



Figure 41: A Mantarray Mini Plate.

The Mantarray Plate and Mantarray Mini Plate are essential consumables for creating and maintaining 3D tissues. Specifically designed to be compatible with the Mantarray Instrument, these plates allow you to monitor the contractile behavior of your cast 3D tissues.

Please note that **the plates are sold separately from the Mantarray Instrument, as part of the Mantarray Plate Kit and the Mantarray Mini Plate Kit.** 

In the sections below, we provide details on the kit contents and the components of the Plates. For comprehensive instructions and protocols on using the plates to cast 3D tissues, please refer to the separate manuals available through your Curi Bio representative.

▲ Shelf Life: The shelf life for Mantarray Plate Kits is 6 months.

#### The Mantarray Plate Kit

The Mantarray Plates are provided as part of the Mantarray Plate Kit, which is packaged in a dedicated Curi Bio box. Each box contains four

individually sealed blister packages, each clearly labeled for easy identification. Below is an overview of the contents of each blister package, which together make up the complete Mantarray Mini Plate Kit.

**Package 1** contains a single Mantarray Lattice or a single Mantarray Mini Lattice, within a Culture Plate.



Figure 42: Package 1

**Package 2** contains a single Mantarray Casting Plate or a Mantarray Mini Casting Plate.



Figure 43: Package 2





Figure 44: Package 3 & Package 4

#### Understanding the Components of the Kit

Below you will find information about each component of the kit and their utility.

#### 1. The Mantarray Lattice



**Figure 45: Left:** A Mantarray Mini Lattice. **Right:** Magnified section of a Mantarray Mini Lattice, highlighting the posts and the embedded magnet.

The Mantarray Lattice and the Mantarray Mini Lattice serve as the core structure to which the tissues are attached. It consists of three components:

- 1. **Rigid Posts:** These black posts provide a fixed attachment point for your 3D engineered tissues. The distinct bent design of the rigid posts sets the Mantarray Mini Lattice apart from the Mantarray Lattice.
- 2. Flexible Posts: Made from a soft, deformable material, these posts are critical for:
  - a. **Contractile Shortening:** Flexible posts allow tissues to shorten upon contraction.
  - b. **Magnetic Contractility Output:** Each post contains a magnet, enabling force tracking via the Mantarray instrument.
  - c. **Optical Contractility Output:** The magnet also acts as a marker for optical tracking of tissue length.
  - d. **Modular Stiffness:** Post thickness can be adjusted to modulate the post stiffness, available in soft (1x stiffness) and stiff (12x stiffness).
- 3. **Barcode:** The tissues are attached to the same lattice throughout their culture period, hence a unique barcode number is associated with each lattice to serve as an identifier for the tissues. Each Mantarray Lattice features four barcode labels, each positioned on a different side of the lattice. During recordings, one of these barcodes is scanned by the Mantarray instrument, enabling automatic registration of your tissues in the recording metadata. All barcode labels adhere to the format MLYYDDDTXX-S:
  - a. **ML** signifies 'Mantarray Lattice,' distinguishing the lattice from other barcoded products like the stimulation lid.
  - b. **YY** represents the last two digits of the year the lattice was assembled. A lattice assembled in 2024 will feature 'YY' as 24.
  - c. **DDD** indicates the Julian day of the year the lattice was assembled, ranging from 001 to 365. For instance, a lattice assembled on February 14th would show 'DDD' as 044.



Figure 46: Standard Barcode Format

 d. T denotes the type of lattice, where '3' might represent a Mantarray Mini 1X lattice, and '4' a Mantarray Mini 12X lattice. Below is a detailed table of lattice types:

Value of Identifier T	Lattice Type
0	Mantarray - 1x Stiffness
1	Mantarray - 12x Stiffness
2	Mantarray - Variable Stiffness
3	Mantarray Mini – 1x Stiffness
4	Mantarray Mini – 12x Stiffness
5-9	Invalid



- e. XX marks the assembly sequence of the lattice, ranging from 00 to 99.
- f. S denotes the side of the Mantarray lattice where the specific barcode label is located, aiding in orientation identification. The image explains the label position and the S identifier value.
   Please note the beveled corner of the lattice that is used to identify the orientation of the lattice.





**Reporting Errors:** We strongly encourage you to report the complete barcode number (MLYYDDDTXX-S) when querying about a specific lattice or associated tissues to ensure precise identification and support. If the barcode number on a lattice appears incorrect, please do not hesitate to contact your Curi Bio representative for assistance.

#### 2. The Mantarray Casting Plate

This specialized plate is designed for casting 3D engineered tissues. Each large well features a smaller casting well at the bottom, tailored to accommodate the flexible and rigid posts of the Mantarray Mini Lattice, as show in the figure below. When a tissue is cast in the casting well, the specialized material of the well repels the hydrogel, maximizing tissue adhesion to the posts.



**Figure 48: Left:** The Mantarray Mini Casting Plate. **Right:** Magnified section of a casting plate featuring a Mantarray Mini Lattice.

#### 3. The Mantarray Culture Plate

It retains all the essential features of a standard Greiner 24-well culture plate. While the kit includes three culture plates, additional culture plates will be required.



Figure 49: A Mantarray Culture Plate.

#### Using the Mantarray Plate Kit

For comprehensive instructions and protocols on using the plates to cast 3D tissues, please refer to the separate manuals available through your Curi Bio representative.

#### **Stimulation Lid**



Figure 50: Stimulation Lid.

The Stimulation Lid (Stim Lid) is an essential consumable designed to enable stimulation of your cultures. It is sold separately from the Mantarray Instrument, and it is specifically designed to connect to your Mantarray Instrument and to fit in your Mantarray and Mantarray Mini Plates.

Although reusable, **the Stim Lid has a limited lifespan** and requires careful handling to prevent damage and to avoid cross-contamination between experimental conditions. Please review the guidelines and protocols below to maximize the performance and longevity of your Stim Lid.

#### **Summarized Guidelines**

Follow the guidelines below to ensure proper usage:

- 1. Avoid using the same Stim Lid for multiple experimental conditions.
- 2. Discard a Stim Lid after 3 months of use, or after 15 use cycles.
- 3. Inspect your Stim Lid before each use.
- 4. Clean and autoclave the Stim Lid after every use. See the "Cleaning & Sterilization" section for more information.
- 5. Be gentle when handling the Stim Lid, as the graphite electrodes can break.

- 6. Consider replacing the Stim Lid if there is visible electrode damage (see example below). Even if small graphite pieces break off the edge of the electrodes, the modified electrode surface may affect the injected current's profile.
- 7. Avoid rubbing the electrodes to avoid shedding graphite off the electrode.
- 8. Never sonicate the electrodes.
- 9. Avoid getting the circuit board wet. When cleaning the Stim Lid, wet only the electrodes. If the circuit board needs to be cleaned, carefully use a Q-tip or a scientific grade wipe.
- 10. If you see brown discolorations on an electrode or at its junction with the circuit board, consider replacing the Stim Lid (see examples below).

#### Inspecting a Stim Lid

The images below illustrate a Stim Lid that is safe to use compared to two Stim Lids that should be discarded.



Figure 51: Stim Lid 1 - Safe to use

**Stim Lid 1** shows typical signs of wear: the graphite electrodes exhibit slight greying/whitening at the edges, while the dark color remains intact near the junction with the board. The board has minor marks from condensation, which may develop over time with repeated use. These observations —colorless or white marks— may suggest that the lid is close to its expiration of 15 use cycles. However, these observations on their own should not impact the Stim Lid's performance. You should discard this Stim Lid once you are past its expiration (3 months since first use or 15 use cycles).

In contrast, **Stim Lid 2** displays significant color changes. The electrodes have a noticeable brown tint, condensation marks on the board might also be brown. Small particles are visible on the surface of the board,



Figure 52: Stim Lid 2 - Discard

and small amounts of residue might have accumulated at the junction of the electrodes and the board (not visible in the photo). The electrode discoloration suggests either surface modification has taken place, or foreign particles are present on or in the electrodes. Either case could contaminate tissue cultures with undesirable molecules or interfere with current injection during stimulation. This Stim Lid should be discarded immediately.



Figure 53: Stim Lid 3 - Discard

Finally, **Stim Lid 3** appears relatively new compared to Stim Lid 1 and shows none of the concerning signs seen in Stim Lid 2. However, some electrodes display physical damage, such as chipped or uneven edges. Please handle your Stim Lids carefully, as the electrodes are fragile and may break upon impact. If electrodes are damaged, avoid collecting data from affected wells, or consider discarding the Stim Lid.

#### **Stimulation Lid Use**

▲ Multiple Plates: Consider carefully the use of a single Stimulation Lid across multiple plates to prevent transfer of small molecules. It is advised to clean and sterilize the Stimulation lid before transferring to a new culture plate to avoid cross-contamination. Please consult the "Cleaning & Sterilization" section below.

▲ Wait 30 minutes: When introducing the Stim Lid to your tissue culture, the temperature of the culture will temporarily decrease. We recommend you leave the culture plate with the Stim Lid in the incubator for 30 minutes prior to starting your experiment, to ensure temperature equilibrium is restored.

Follow the steps below to introduce a Stim Lid into your culture plate and to connect it to your Mantarray or Stingray instrument.

1. In a biosafety cabinet, remove the Stimulation Lid from its sterile packaging.

▲ **Sterile Handling:** When handling the unpacked Stimulation Lid, apply standard sterile techniques. Hold the Stim Lid from the circumference of the metal frame and avoid touching the electrodes.

2. Before attempting to place the Stimulation Lid in your culture plate, take note of the alignment marks on the Stimulation Lid and rotate as needed.

▲ **Misalignment:** The Stimulation Lid must be aligned to the culture plate. Attempting to insert a misaligned Stim Lid can damage the Stim Lid and/or the culture plate.

3. In the biosafety cabinet, remove the plate lid from your culture plate and insert the stimulation lid in the plate.

▲ **Misalignment:** If you meet resistance when sliding the electrodes through the tissue lattice, please evaluate if your Stimulation Lid is misaligned.

- 4. Place the plate lid on the Stimulation Lid. The plate lid should align and fit tightly around the alignment pattern of the Stim Lid to ensure a sterile enclosure.
- 5. Transfer the culture plate at the location where the stimulation will be performed (e.g. the incubator)
- 6. Plug one end of the ribbon cable into the Mantarray or Stingray instrument that will deliver the stimulation. Apply a sufficient amount of pressure to ensure proper connection.
- 7. Plug the second end of the ribbon cable into the Stim Lid. To securely connect the cable, you will need to apply sufficient pressure, as poor connection will lead to inability to deliver stimulation.

 $\wedge$  **Counterpressure:** As you press, please ensure to apply the right amount of counterpressure to avoid dislodging the Stimulation Lid from the plate.

- 8. If stimulation is conducted in the incubator, you may now close the incubator.
- 9. Proceed to define the stimulation settings and perform your stimulation experiment following the "Stimulation" section above.

#### **Running Stimulation**

For more information on how to define and apply stimulation using the Mantarray Instrument and the Mantarray Controller Application, please refer to the respective section on page 17.

#### After Running Stimulation

Follow the steps below to remove a Stim Lid from your culture plate.

1. Once your stimulation protocol is complete, remove the ribbon cable from the Stimulation Lid. Press firmly on one of the tabs on the sides of the connector to lower the tab. Once the tab has been lowered, lower the second tab. Lowering both tabs should release the ribbon cable.

▲ **Counterpressure:** Ensure to apply a sufficient amount of counterpressure throughout to avoid dislodging the stimulation lid.

- 2. Move the plate to the biological safety cabinet.
- 3. In the cabinet, hold the tissue lattice and culture plate down and lift the Stim Lid. The Stimulation Lid should slide out of the plate.
- 4. Remove the plate lid from the Stim Lid and place it back on your culture plate.
- 5. If you need to place the Stim Lid down, ensure you do not invert it, so media does not drip towards the circuit board. We advise placing the Stim Lid on a thick stack of scientific grade wipes.
- 6. Store or discard your culture plate.
- 7. Returning to your instrument, you may leave the ribbon cable connected to the instrument. If you are concerned about sterility, you may apply 70% ethanol or isopropanol on a wipe and gently wipe the ribbon cable. Stay clear of the electrical ports of the connectors.
- 8. Clean and sterilize your Stim Lid according to the next section.

▲ **Clean Immediately:** We advise you do not leave the Stim Lid uncleaned for an extended amount of time, to minimize the accumulation of residues on the electrodes.

#### **Cleaning & Sterilization**

The Stimulation Lid features carbon electrodes that will absorb byproducts from your tissue culture wells. It is recommended to clean them at least every 24-48 hours of continuous use.

▲ **Cleaning Step Duration:** The steps below assume a very prolonged use of the Stim Lid. Adjust the cleaning time matching your use time. For example, a 30 minute use of the Stim Lid can be follow by a 1h long cleaning step. An overnight Stim Lid protocol can be followed by a 24h cleaning step.

▲ **Cleaning vs Rinsing:** Resorting to a plain rinse under running water will remove excess media on electrodes, but might not be sufficient to remove small molecules such as drug, fluorescent dyes, or viral particles. It is strongly recommended you follow the cleaning protocol below.

▲ **Before Autoclaving:** Always clean the Stimulation Lid before autoclaving.

1. Fill a clean, waterproof container only with deionized water. Add a stir bar and an empty Mantarray Lattice in the container and place the container on a stir plate.

**No Detergents:** Do NOT add detergents in the water.

- 2. Place the Stimulation Lid in the Mantarray Lattice, ensuring that ONLY the carbon electrodes are submerged. The water level should remain below the electrode socket by several millimeters. The stir bar should be either below the electrodes or adjacent to the electrodes, ensuring it can never directly touch with the electrodes while spinning.
- 3. Set the stir plate to a low rotation setting and begin stirring.
- 4. Wash for the appropriate amount of time, up to 48 hours. The water should be changed at least every 24 hours. More frequent water changes (every 12 hours) are recommended.

▲ **Clear Water:** At the end of this washing step, the water should be clear and no residual dyes (e.g. phenol red) should be observed in the water. If the water is not clear, repeat the washing step in increments of 24 hours until clear.

▲ **Remove Residues:** After multiple use cycles of the Stimulation Lid, residue might accumulate at the top of the electrodes, close to the socket with the circuit board. To remove this residue, dip a Q-tip in DI water and gently rub the electrodes. Rinse the Q-tip and repeat until the residue is sufficiently removed. Ensure to minimize the exposure of the main board to water.

5. Allow the electrodes to dry over an absorbent surface, such as a lab-grade wipe. Avoid rubbing the electrodes dry.
A Keep the Board Dry: Place the Stim Lid on an absorbent surface with the electrodes facing down to prevent water from dripping toward the main board.

- 6. Place the dry Stimulation Lid in a autoclave pouch.
- 7. Autoclave the Stimulation Lid. We recommend using a steam ("Gravity") cycle with 20 minutes of sterilization at 120°C/248°F. If your autoclave has a cooldown ("Dry") cycle setting, we recommend 15 minutes of cooldown.
- 8. Store the autoclaved Stimulation Lid at room temperature and humidity until next use.

 $\land$  Hot Stim Lid: Remove the stimulation lid from the autoclave with caution. The stimulation lid will be hot.

### Section 4: Warranty and Technical Specifications

#### Warranty

The Curi Bio Mantarray is sold with a one year warranty, effective from the date of purchase, for any defects or failures in parts or workmanship. Additional warranty coverage may be purchased on a per-year basis by contacting sales@curibio.com. If the Mantarray fails or breaks within one year of purchase, Curi Bio will repair it at no charge to the customer. The customer is responsible for the cost of shipping the Mantarray to Curi Bio's headquarters in Seattle, WA, USA. Curi Bio will pay for the return shipment of the repaired equipment. All warranty returns must be accompanied by an RMA number. For any questions, please contact us at support@curibio.com or +1 (800) 913-4403.

This warranty does not cover cosmetic damage or wear. Damage due to mishandling, abuse, misuse, or through failure to adhere to the guidelines in this manual will not be covered.



### Specifications

Figure 54: Instrument Dimensions

#### Instrument Physical Specifications

- Length: 315.8 mm (12.43 in)
- Width: 200 mm (7.87 in)
- Height: 85.0 mm (3.35 in) including feet 91.5 mm (3.60 in)
- Instrument Weight: 4.8 kg (10.5 lbs)
- Color: Black
- Enclosure Material: Anodized aluminum

#### **Power Brick Physical Specification**

- Length: 189.6 mm (7.46 in)
- Width: 124.5 mm (4.90 in)
- Height: 47.5 mm (1.87 in) including feet 51.6 mm (2.03 in)
- Weight: 1.2 kg (2.54 lbs)
- Color: Black
- Enclosure Material: Anodized aluminum

#### **Cooling Unit Physical Specifications**

- Length: 60 mm (2.36 in)
- Width: 200 mm (7.87 in)
- Height: 207 mm (8.15 in)
- Weight: 1.7 kg (3.75 lbs)
- Color: Black
- Enclosure Material: Anodized aluminum

#### Connectivity

- Ports: USB-3 (cable included)
- **Storage:** Onboard memory for saved protocols, external computer for data.

#### Power

- Input Voltage: 100-240 VAC ±10%, single phase, 50-60 Hz, <6 Amp. Power Adapter (Power Brick) included.
- **Outlet type:** Plug type can be customized for different regions (e.g, North America, Europe, Asia, Australia)
- **Recommendation:** Use of a surge protector (<u>not</u> included) is strongly recommended.

#### Software Requirements

- **Operating System:** Windows 10 and Windows 11. The designated laptop sold with the instrument includes Windows 11 Pro.
- **Controller Application:** Included in the designated laptop sold with the instrument.

#### **Environmental Conditions**

The instrument can operate at room conditions and standard incubator conditions.

- **Temperature:** 20-40°C
- CO2 Level: 0-5%
- Humidity: 0-95% RH
- Altitude: up to 1000 m
- Pollution Degree: up to 2

Power Connection & Surge Protection Guidelines	The Mantarray instrument relies on sensitive electronic components to provide high-quality magnetic-based data. These components are vulnerable to power disturbances, which can occur unexpectedly and may impact functionality.
	To safeguard your Mantarray instrument, <b>Curi Bio strongly recommends</b> using a CE-marked surge protector between the instrument's power cable and your facility's power outlet. Ensure that the surge protector is connected directly to the outlet, without connecting multiple cords in series (daisy-chaining). If you surge protector features multiple outlets, connect only the Mantarray instrument to the surge protector. Avoid connecting other instruments to the same protector as they might introduce power transients that can impact your Mantarray's performance and functionality.
	Failure to meet these guidelines might lead to data distortion and critical failure of your instrument.
	For selecting an appropriate surge protector, consult your facilities management to ensure compatibility with your local power grid. For further assistance, contact support@curibio.com.
Safety & Warnings	This section outlines critical precautions to ensure the proper and safe use of the Mantarray Instrument and its components. Failure to follow these warnings may result in injury, equipment damage, or compromised performance.
	General Safety Warnings
	1. User Hazards:
	<ul> <li>Carry the instrument with care to avoid injuries. Its weight may cause significant harm if dropped.</li> <li>Avoid touching exposed electrical contacts with bare hands if the instrument is powered and moisture is present, as this may result in electrical shock.</li> </ul>
	<ul> <li>Do not use the instrument if any electrical cables are damaged or exposed.</li> </ul>

#### 2. Fire and Explosion Risks:

- Operate the instrument only under the specified environmental conditions, away from flammable materials.
- When sterilizing the instrument with materials such as ethanol, ensure all excess liquid is wiped off to minimize fire risk.

#### 3. Environmental Conditions:

• Do not expose the instrument to water or conductive materials. Adhere to the specified humidity range to prevent damage to the internal electrical components.

#### **Operational Warnings**

#### 1. Correct Usage:

- Follow all protocols outlined in this manual to avoid damage or malfunction.
- Use only water and detergent-based water cleaners when filling the cooling unit. Do not use bleach-based cleaners or other incompatible substances, as they may irreparably damage the cooling unit, the Mantarray Instrument, or connecting tubing.
- Do not place any additional objects on the Mantarray Instrument or cooling unit. The instrument is designed to support only the combined weight of a Mantarray Plate and a Stim Lid or Lasarray Lid.

#### **Product-Specific Warnings**

#### 1. Recording Quality:

- Do not place multiple Mantarray Plates on the instrument as they might impact the recording quality.
- Do not introduce additional electrical devices into the incubator where the Mantarray Instrument is located, as this may introduce noise into the measurements and render recordings unusable.
- Refrain from opening or shaking the incubator while a recording is underway.
- Avoid the use of devices generating magnetic fluctuation (e.g. magnetic stirrers) in close vicinity to the instrument and the housing incubator.

#### 2. Safe Stimulation:

- Avoid physical contact with the instrument during an active stimulation protocol to prevent electrical shocks.
- Never touch an exposed stimulation lid while stimulation is underway.
- Do not look directly at the illumination sources of a Lasarray Lid during active stimulation.

#### **Environmental & Disposal Warnings**

- 1. Environmental Risks:
  - Contact Curi Bio for guidance before disposing of the instrument. Curi Bio might be able to provide assistance with proper disposal or recycling.

#### Legal and Regulatory Warnings

#### 1. Compliance:

- The Mantarray Instrument complies with CE marking requirements. Please contact Curi Bio to acquire the related Declaration of Conformity.
- The Mantarray Instrument complies with the following Safety Standards.
  - EN 61326-1:2013 | EN 61326-2-3:2013
  - IEC 61326-1:2013 | IEC 61326-2-3:2013

	FAQs
How is your Mantarray plate oriented in the instrument?	The Mantarray plate should be oriented such that well A1 is adjacent to the green triangle mark next to the plate loading area.
Am I able to electrically stimulate my tissues in culture?	Yes you can. The Mantarray has a built in stimulation system that allows for parallel electrical stimulation of 24 wells in an individually addressible manner.
Am I able to optically stimulate my tissues in culture?	Yes you can. The Mantarray has a built in circuitry and a specialized "Lasarray" consumable that allows for parallel optical stimulation of 24 wells in an individually addressible manner.
Do I need to use a Curi Bio Stimulation Lid to stimulate my tissues?	Yes, you must use the Curi Bio Stimulation Lid with the Mantarray plate and instrument.
How can I analyze my data?	Mantarray users can use both the desktop and the Pulse3D cloud analysis options.
Do I need to use the Pulse 3D cloud services to operate the instrument?	No, you do not need to use Curi Bio's cloud services, however it is highly recommended.
What types of cells can I use in my tissues? What cell types are suggested?	We have extensive experience with in-house and commercial lines for both cardiac and skeletal muscle applications, and we are always interested in expanding to new applications. Please contact our support team for suggestions specific to your cell line of interest.
More Questions?	If you have additional questions or concerns, please contact support@curibio.com for assistance.