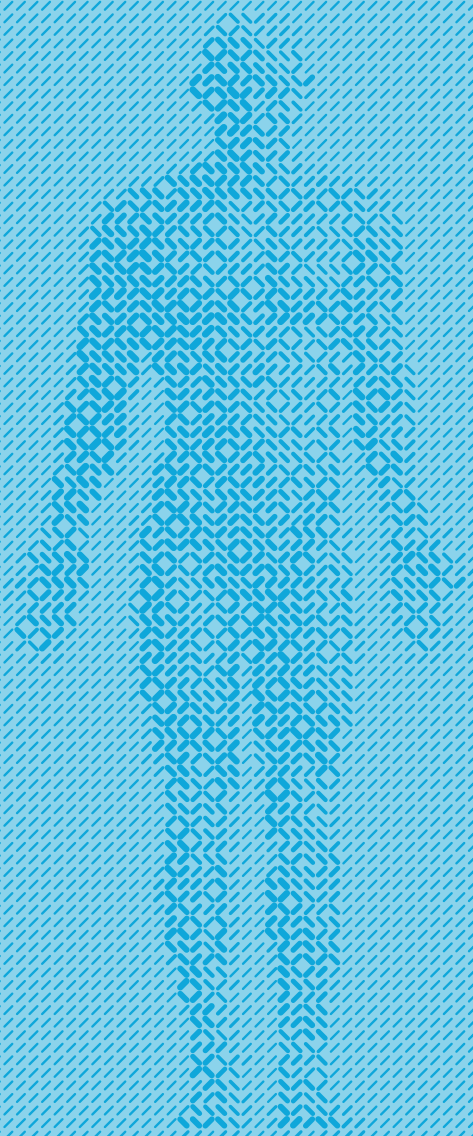


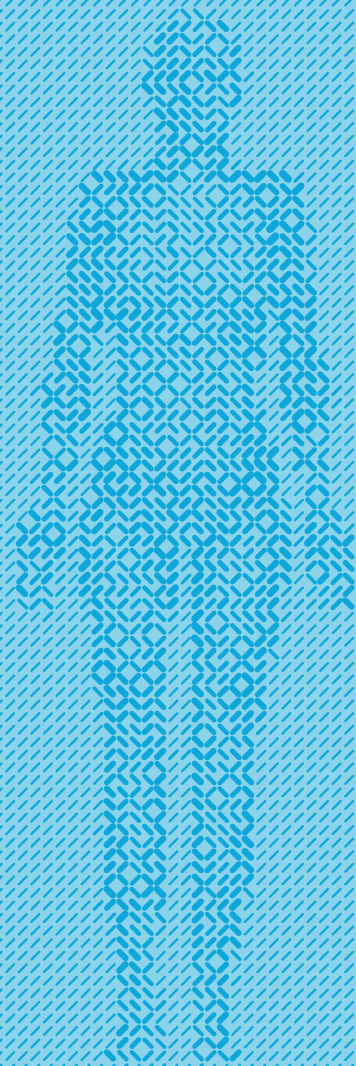


ORB-HM1TM

hub module









Orb™ Hub Module

Gas, Energy, Stretch.

Our Orb Hub Module is a central hub that connects to up to four Zoë™ Culture Modules. It provides a simple solution for installing and operating our system within the lab environment.

The sphere acts as a transformer by harvesting CO₂ and electricity from standard lab connections, and outputs the precise balance of air and energy required by our Zoë Culture Modules for optimum cell culture performance.

The Orb Hub Module also supplies the vacuum pump functionality required for automated control of the dynamic mechanical forces the Zoë Culture Modules require for Organ-Chips that require breathing motions or peristalsis – such as the lung or intestine.

Our work is directed towards a clear goal – to democratize Organs-on-Chips technology and create an easy-to-use research platform that emulates human biology for understanding how diseases, medicines, chemicals, and foods, affect human health.

This user guide contains important information to safely and effectively operate the Orb-HM1™ instrument. Please ensure that all users thoroughly read and understand this guide before operation.

This product is for research use only.

User Guide

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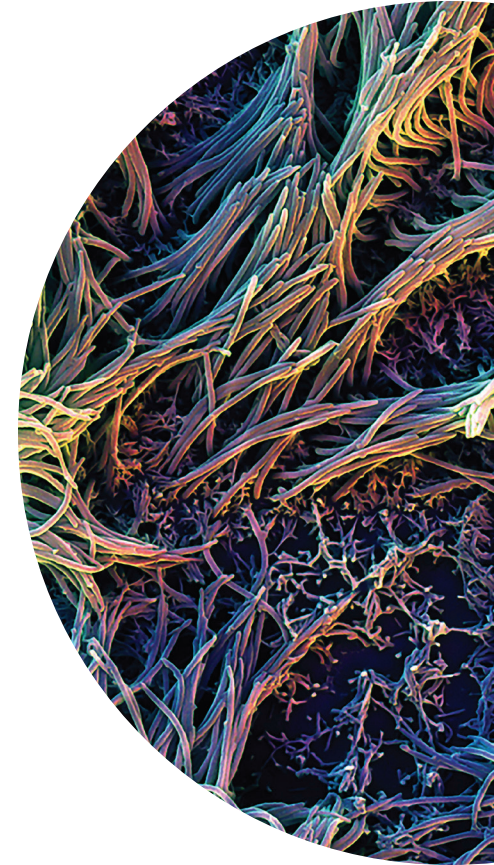
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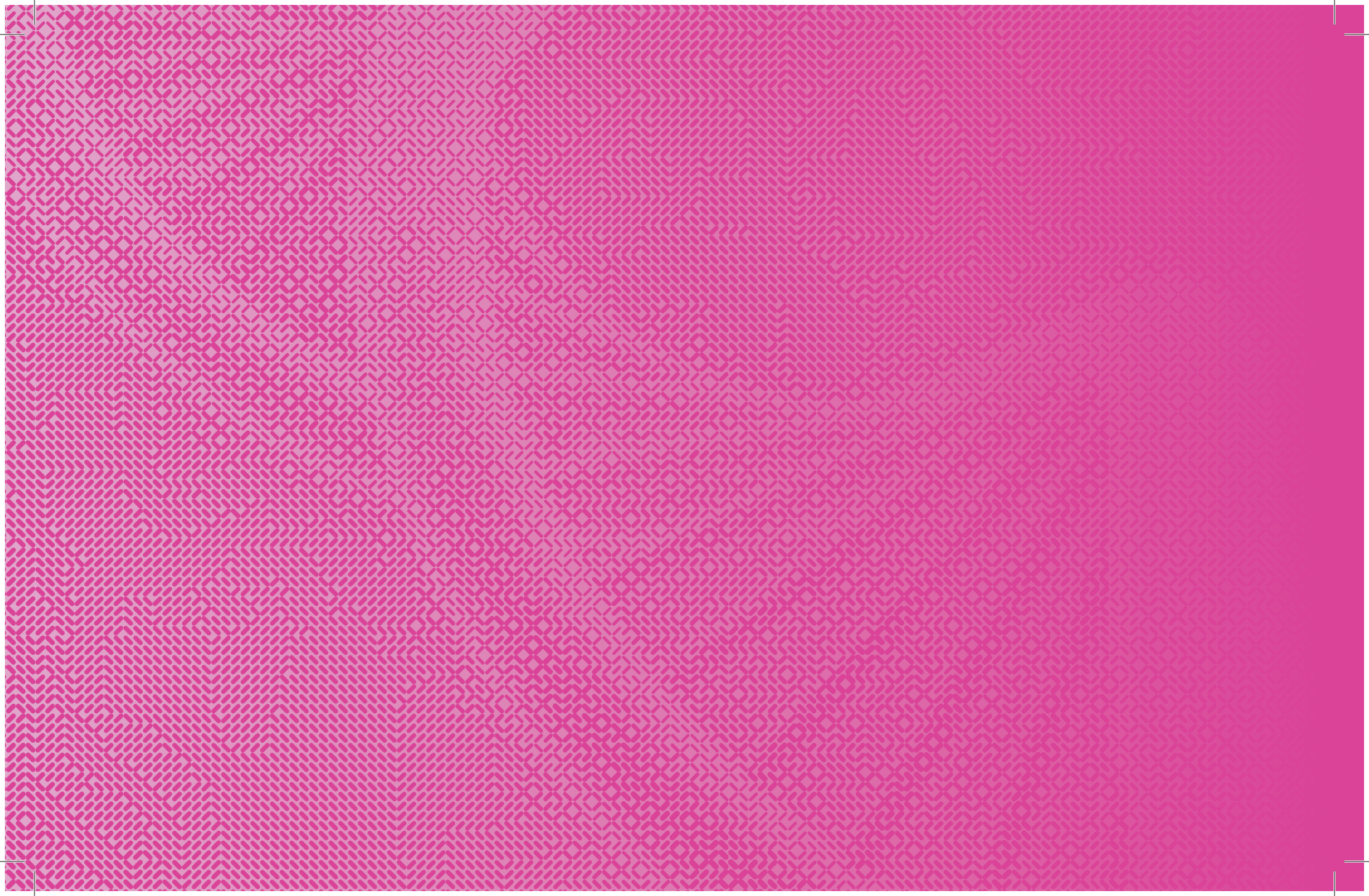
Care

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Use





1 Introduction

This section contains an overview of the Orb™ Hub Module and its functions. The Orb Hub Module provides the power, gas mixture, and vacuum required for Organ-Chip cell culture. It can generate the appropriate gas mixture from an external 100% carbon dioxide supply, or from a portable carbon dioxide canister for increased flexibility. The Orb Hub Module can support up to four Zoë™ Culture Modules simultaneously, which equates to up to 48 Organ-Chips.

Orb-HM1™

System Components

The Orb™ Hub Module provides all the necessary elements to power and run up to four Zoë™ Culture Modules at once. These elements include mixed gas, vacuum, and power. The Orb Hub Module takes 100% carbon dioxide from one of two sources, mixes the CO₂ with air, and outputs a gas mixture that contains 5% CO₂. The CO₂ sources can be a direct line from an external 100% CO₂ source, such as one that provides CO₂ to incubators, or a portable CO₂ canister. The CO₂ canister is installed directly onto the Orb Hub Module in the center of the Control Panel. The Orb Hub Module generates the vacuum required to apply Organ-Chip stretching, and contains four individual power ports.

Important note: this user guide covers the basic operation of the Orb Hub Module. For specific protocols on using the Organ-Chips and Pod™ assemblies to culture cells, please refer to the appropriate Organ-Chip documentation.



1

Orb™ Hub Module (Front)

Provides the gas mixture, vacuum,
and power to run up to four Zoë™
Culture Modules.



2

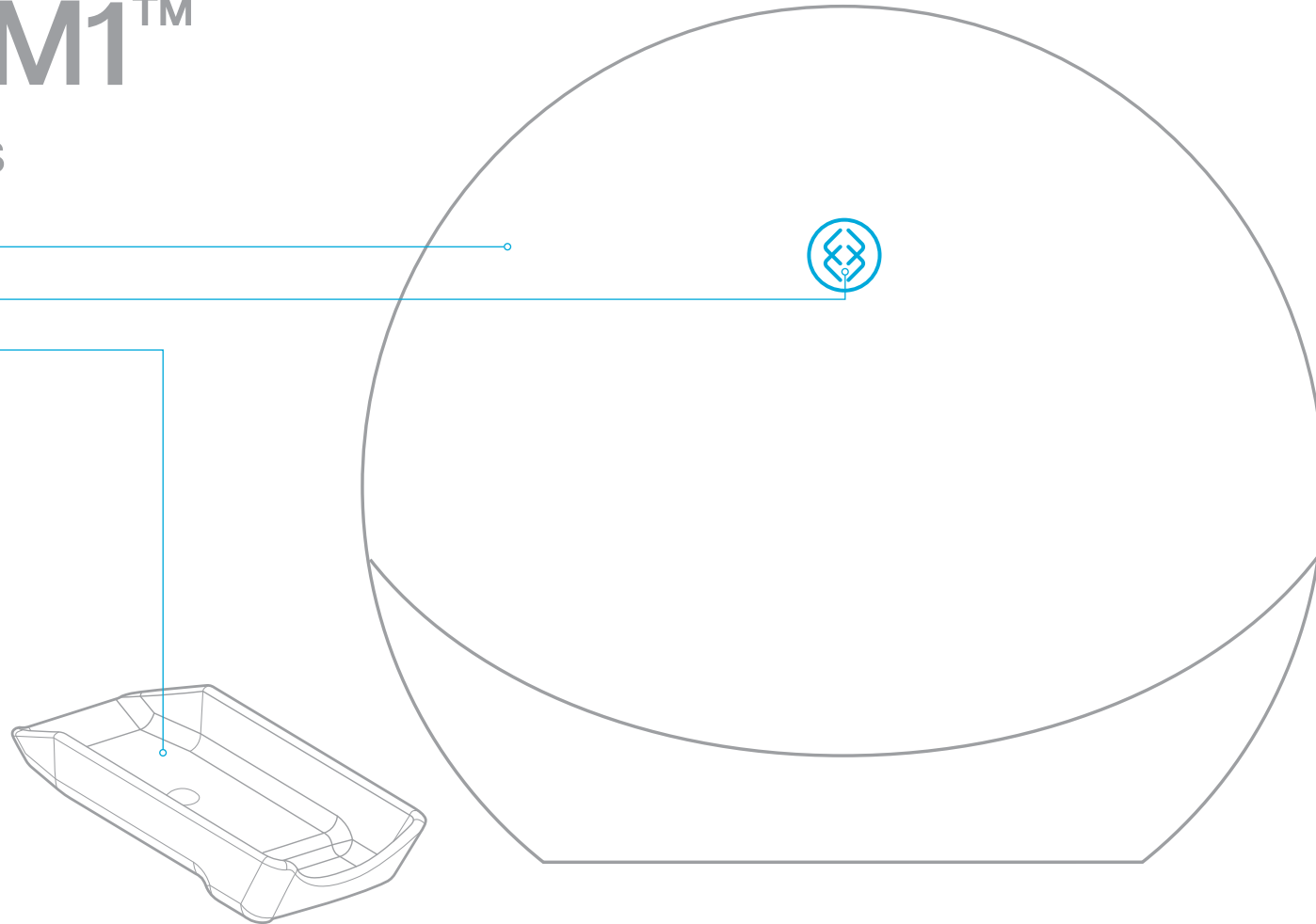
Control Panel (Rear)

All ports are located on the rear
Control Panel. The Orb Hub Module
can utilize an external CO₂ source or
a portable CO₂ canister.

Orb-HM1™

Components

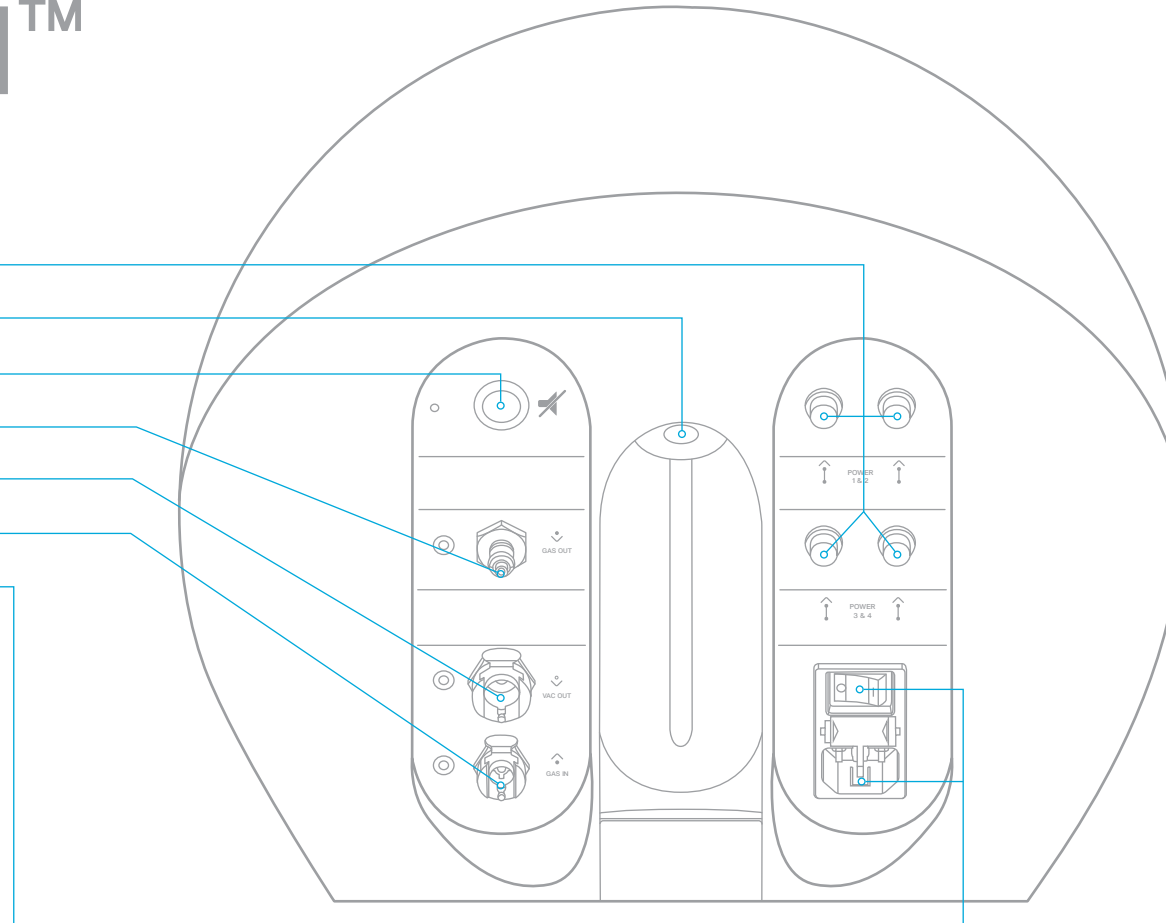
1. Orb™ Hub Module
2. Main Status Indicator
3. Drip Tray

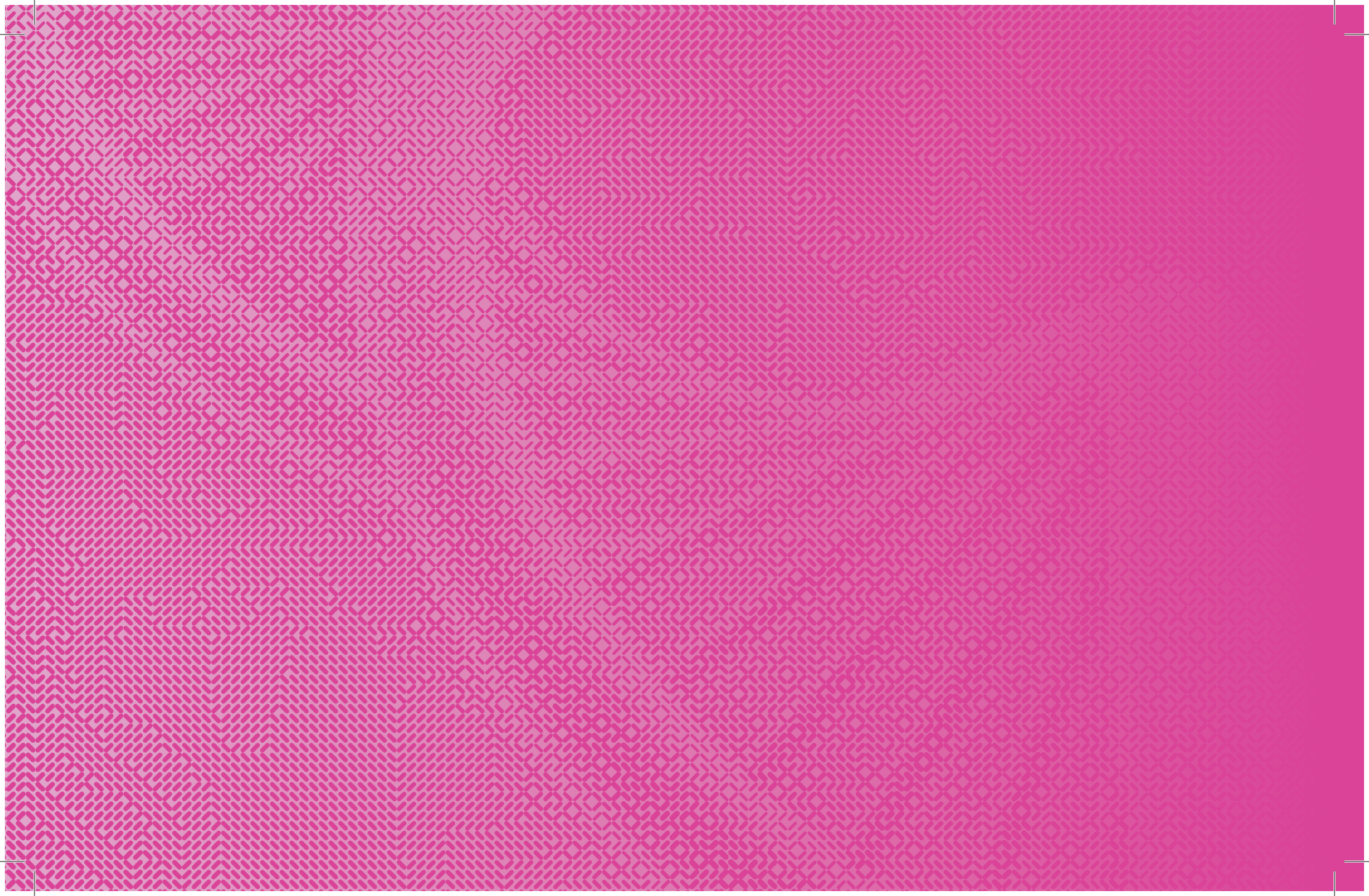


Orb-HM1™

Control Panel

1. Power Ports
2. CO₂ Canister Connection
3. Alarm Silence Button
4. Mixed CO₂ Out
5. Vacuum Out
6. 100% CO₂ In
7. Power Input & On / Off Switch





2 Specifications

This section includes specific technical information and operation requirements, such as system dimensions, temperature, and gas. Manufacturer and contact information is included here as well.

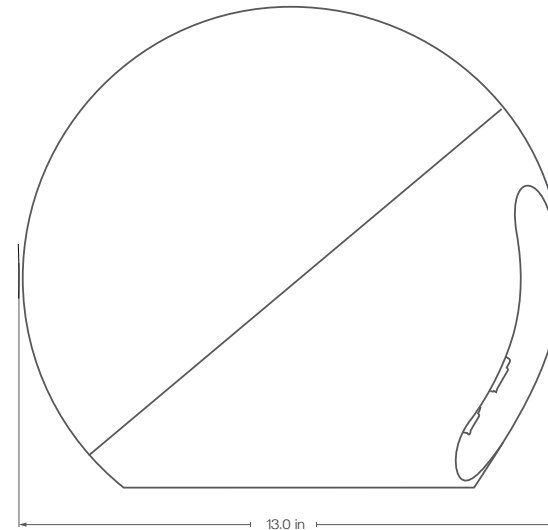
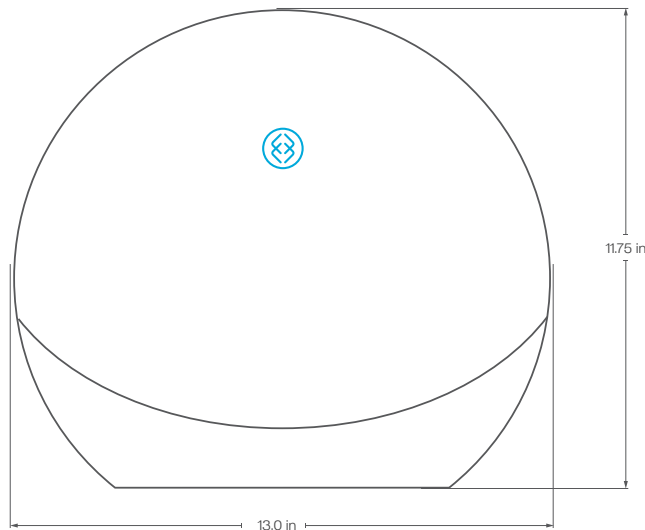
Orb-HM1™

Specifications

Manufacturer Emulate, Inc., 27 Drydock Avenue, Boston, MA 02210

Assistance For technical assistance, contact Emulate, Inc., support@emulatebio.com

Use The Orb™ Hub Module is for use with the Zoë-CM1™. The Orb Hub Module is for research use only.



General

Model: HM1
Weight: 7.3 kg (16.0 lbs)
Power Consumption: 105W

**Operating
Requirements**

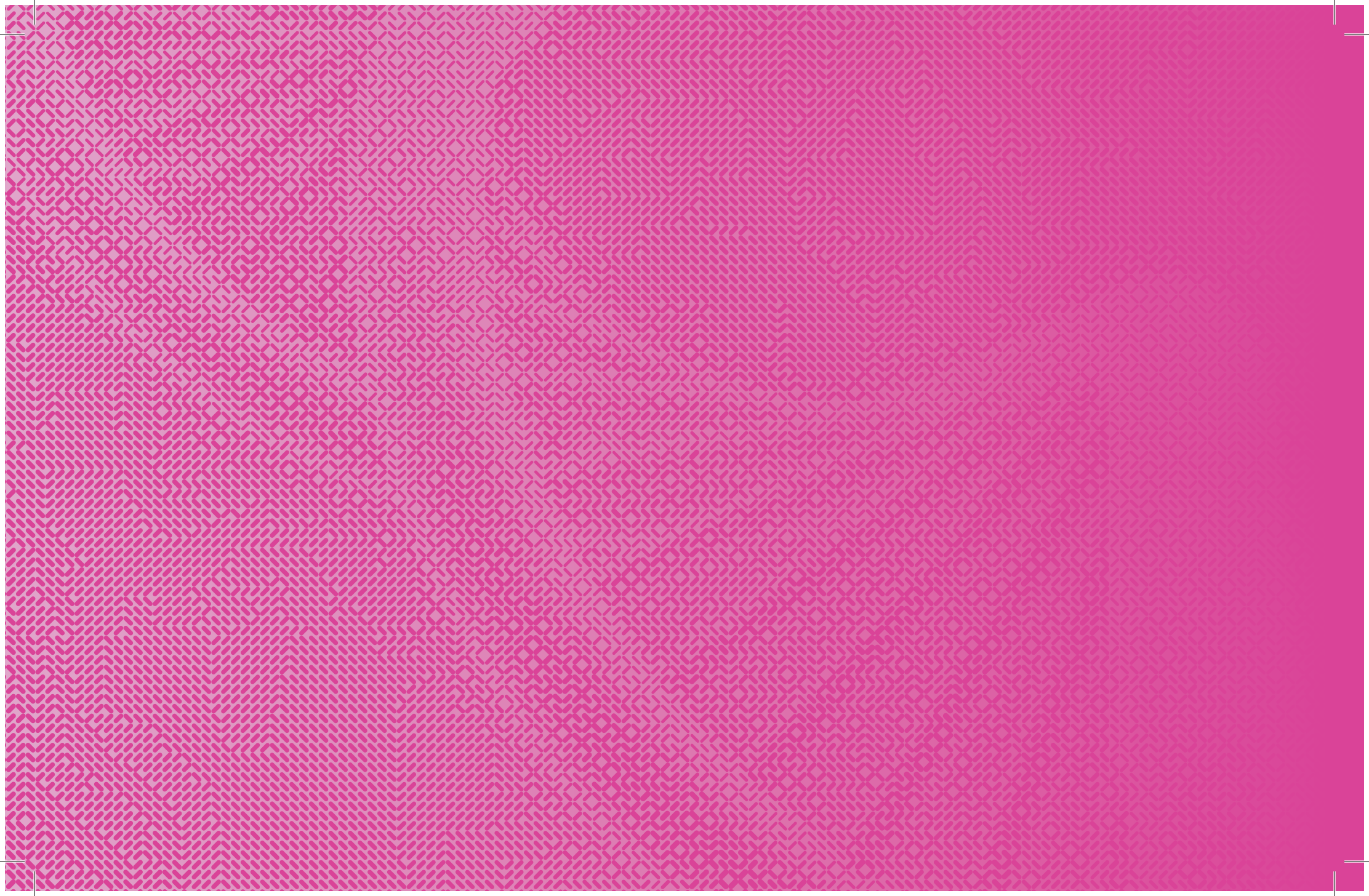
Electrical Power: 100–240VAC, 50–60Hz
Gas Input Pressure: 68.9–137.9 kPa from fixed source / 20,684.3 kPa from 68-gram gas canister
(10–20 psig from fixed source / 3,000 psig from 68-gram gas canister)
Gas Input Composition: 100% CO₂

Environmental

Operating Temperature: 10–35°C (50–95°F)
Relative Humidity: 30–80% RH
Max Altitude: 2,000 meters (6,562 feet)
Storage Temperature: -5–60°C
Storage Humidity: 30–90% RH, non-condensing
IP Rating: IP12B

Technical

Gas Output Composition: 5% CO₂, balance air
Gas Output Pressure: 275.8 kPa + / - 34.5 kPa (40 psig + / - 5 psig)
Max Mixed Gas Flowrate: 130 mL / minute
Vacuum Output: -70 kPa (-10.2 psig)
Electrical Output: Four 12VDC ports power up to four Zoë™ Culture Modules



3 Safety

This section includes precautions for handling and using the Orb™ Hub Module. The information here describes how users can minimize any chance of harming themselves or the Orb Hub Module during use. Additionally, regulatory compliance information is contained in this section.

Safety



REFER TO
INSTRUCTIONS

The Instructions Symbol

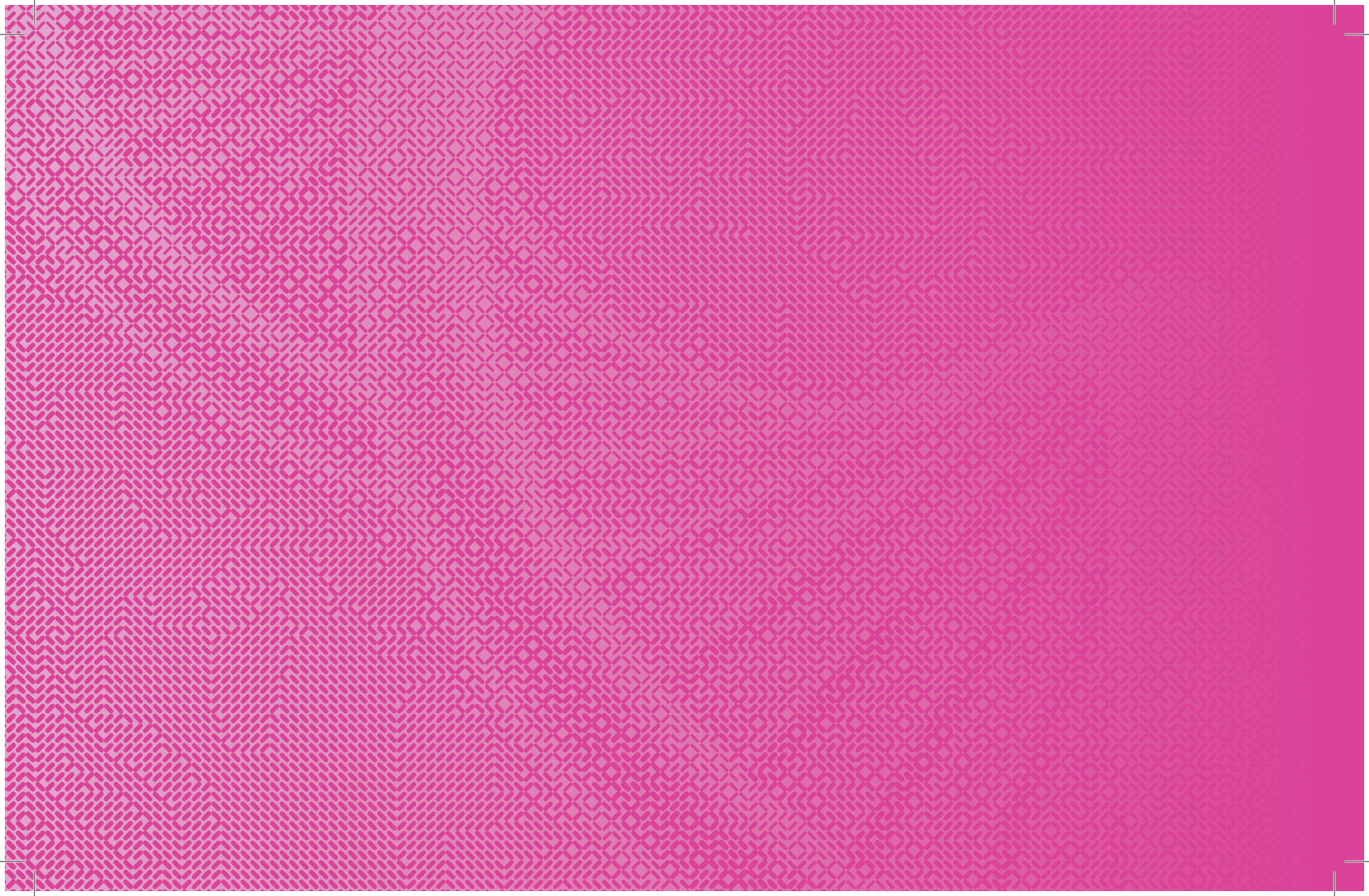
The product is marked with this warning symbol where it is necessary for the user to refer to the instructions in the user guide.

Regulatory Compliance and Testing

This product has been tested to the requirements of:

61010-1 (IEC, EN, CSA) Safety Requirements for Electrical Equipment for Laboratory Use
EMC Directive 2014 / 30 / EU, LVD Directive 2014 / 35 / EU
EN 61326-1 Electro-Magnetic Compliance (EMC)

CAUTION	Always connect the Power Cord to a grounded, three-prong outlet.
CAUTION	Never attempt to maintain or sanitize the Orb™ Hub Module without first disconnecting from power outlet.
CAUTION	Exercise care when moving and placing Hub Module into position.
CAUTION	Never insert fingers or foreign objects into CO ₂ connection or ports.
CAUTION	Always follow in-house safety protocols before handling compressed gas.
CAUTION	Ensure the supply pressure is within specified range before use.
CAUTION	Never attempt to disassemble or repair the Hub Module. Never attempt to replace any fuses.
CAUTION	Service and maintenance should only be completed by Emulate-certified personnel.
CAUTION	Remove the Power Cord from the Hub Module and / or from the wall power outlet to completely disconnect the module from AC power in the event of an emergency.
NOTE	If the Hub Module is used outside of its intended use, the protection provided by the equipment may be impaired.



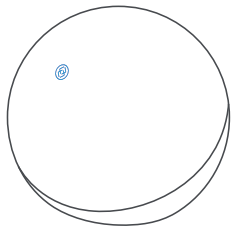
4 Installation

This section describes the items included with the Orb™ Hub Module and the steps involved in its installation. The accessories included are the Vacuum and Gas Hubs, Vacuum and Gas Connector Lines, Power Cord, and Power Cables. The Orb Hub Module requires a CO₂ source, which can be an external supply or an on-board canister. The CO₂ canister is available from Emulate separately, and requires periodic replacement based on usage. The installation process is described in seven simple steps.

This operation should only be performed by Emulate-certified personnel.

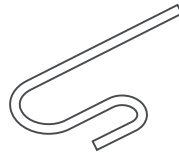
Equipment

Provided by Emulate



1

Orb™ Hub Module



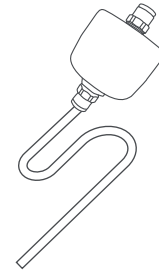
2

CO₂ Input Line



3

Vacuum
Connector Line
(Incl. Filter)



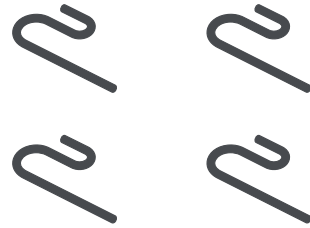
4

Mixed Gas
Connector Line
(Incl. Filter)



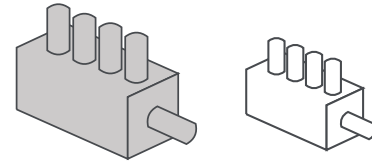
5

Power Cord



6

Power Cables (4)
(for Zoë™ Culture Modules)



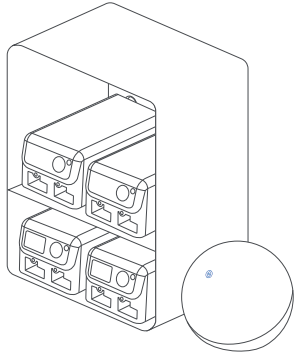
7

Vacuum & Gas
Hubs



8

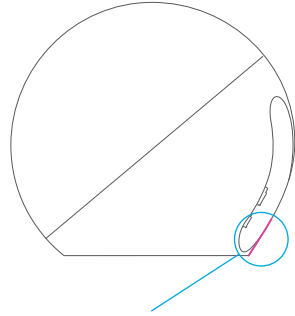
CO₂ Canister
(Not included)



1

Place

Place the Orb™ Hub Module next to the incubator that contains Zoë™ Culture Module(s). It should be oriented so that the Main Status Indicator is visible and On / Off Switch is accessible.

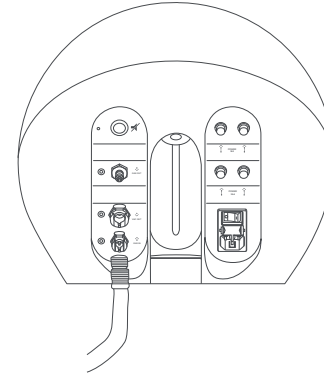


Drip Tray is flush with Orb exterior

2

Check

Check that the Orb Drip Tray is inserted completely. Drip Tray slides into the Orb Hub Modules until flush with the exterior.

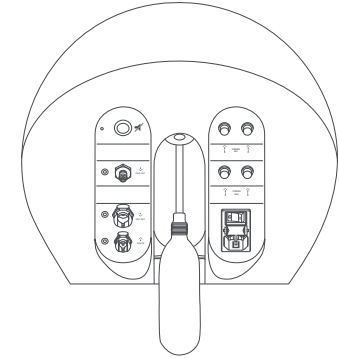


3A

Connect CO₂
Line

Connect 100% CO₂ from external source to the back of the Orb Hub Module. Pressure of CO₂ must be 10-20 psig.

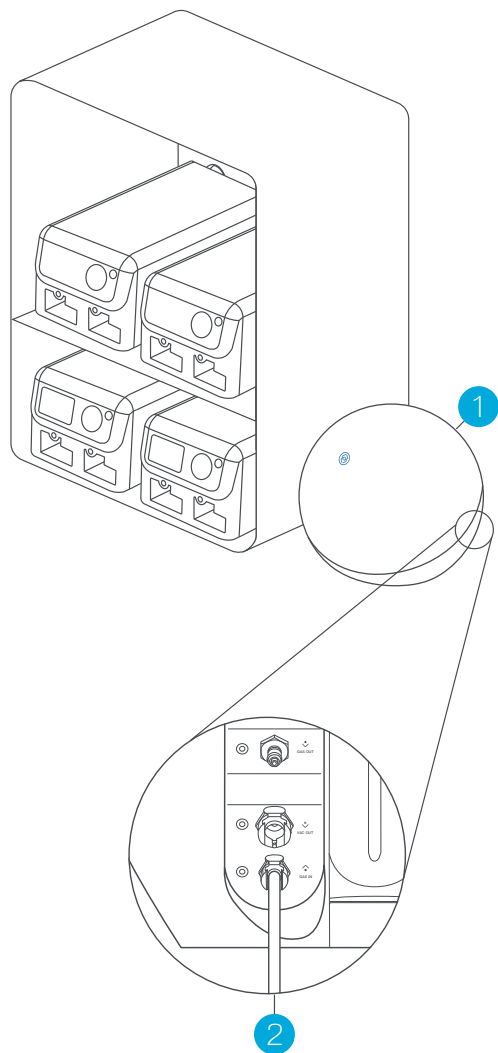
OR



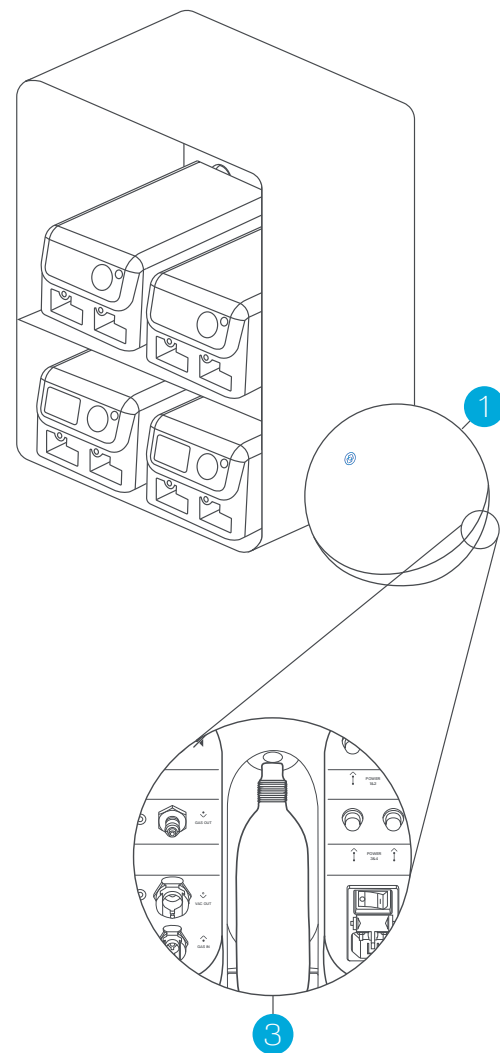
3B

Connect CO₂
Canister

Connect CO₂ canister to the Orb Hub Module. Completely thread the canister into the canister connection on the Orb Control Panel.



OR



TIP:

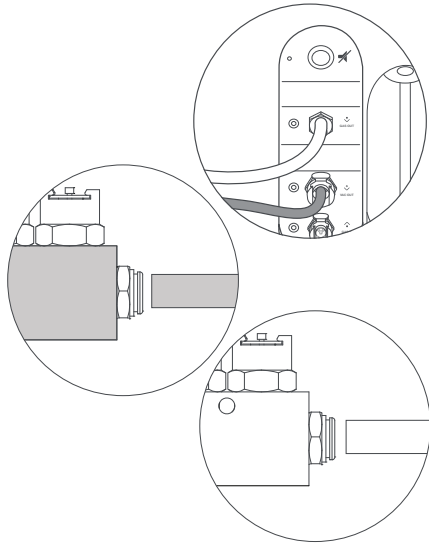
The Orb™ Hub Module can be connected to both CO₂ sources simultaneously. If pressure from external CO₂ source drops below 10 psig, it will automatically switch to canister as CO₂ source.

TIP:

To remove the CO₂ canister, slowly unscrew the canister from the Orb Hub Module. If hissing sound is heard, stop unscrewing the canister until the hissing sound stops. Then completely unscrew and discard the empty canister.

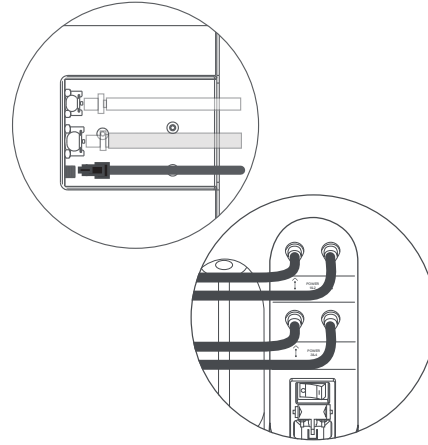
CAUTION:

Canister should not be removed from Orb Hub Module unless empty. Any hissing sound heard during canister removal indicates the canister is not empty.



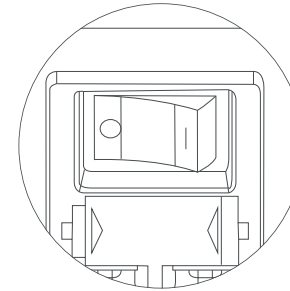
4

Connect Hubs



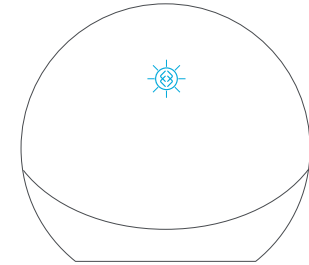
5

Connect Zoë™ Culture Modules



6

Power



7

Verify

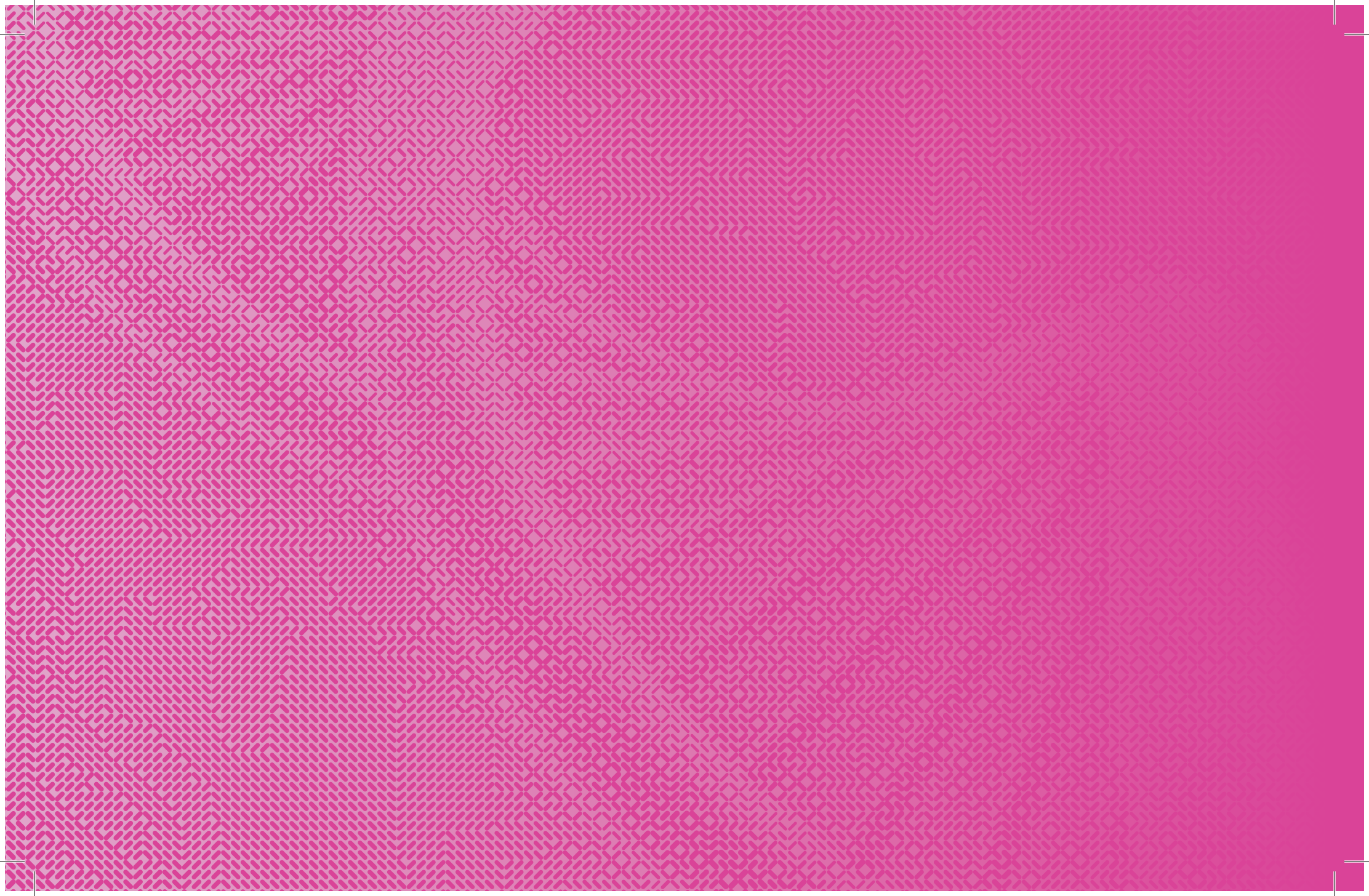
Connect Vacuum and Gas Connector Lines to the Orb™ Hub Module. Connect other ends of Vacuum and Gas Connector Lines to the Vacuum and Gas Hubs.

Connect Zoë Power Cables to the Orb Hub Module and to Zoë Culture Module. Note: Power Cables can only be connected to Zoë Culture Modules.

Connect the Power Cord to the Orb Hub Module and plug into wall outlet. Power on using the On / Off Switch and the it will begin running immediately.

Verify that the Main Status Indicator is pulsing blue and there is no audible alarm within approximately two minutes of powering on.





5 Use

This section describes how to interact with the Orb™ Hub Module. The Main Status Indicator reflects the real-time status of the Orb Hub Module. There are additional indicators on the rear Control Panel.

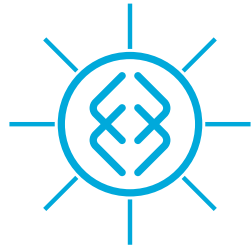
Interface & Control Panel

Main Status & Control Panel Indicators

The Main Status Indicator will display one of the following three statuses: pulsing blue, solid red, or pulsing red with audible alarm.

Each status represents the current state of the Orb™ Hub Module. Pulsing blue is normal, while both solid red and pulsing red with alarm indicate a warning or an error, respectively.

The rear Control Panel contains additional indicators and the Alarm Silence Button. The Control Panel Indicators provide more detail in the event of a warning or error. When the cause of a warning or error is resolved, the Main Status Indicator will automatically revert to pulsing blue.



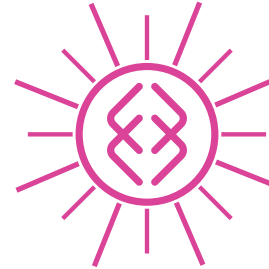
1

Pulsing Blue



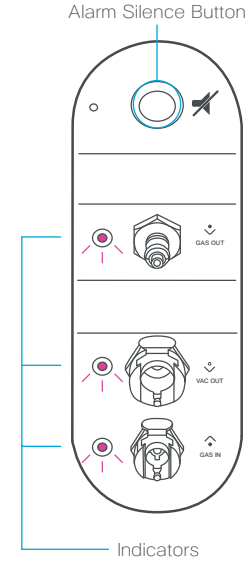
2

Solid Red



3

Pulsing Red
& Alarm



4

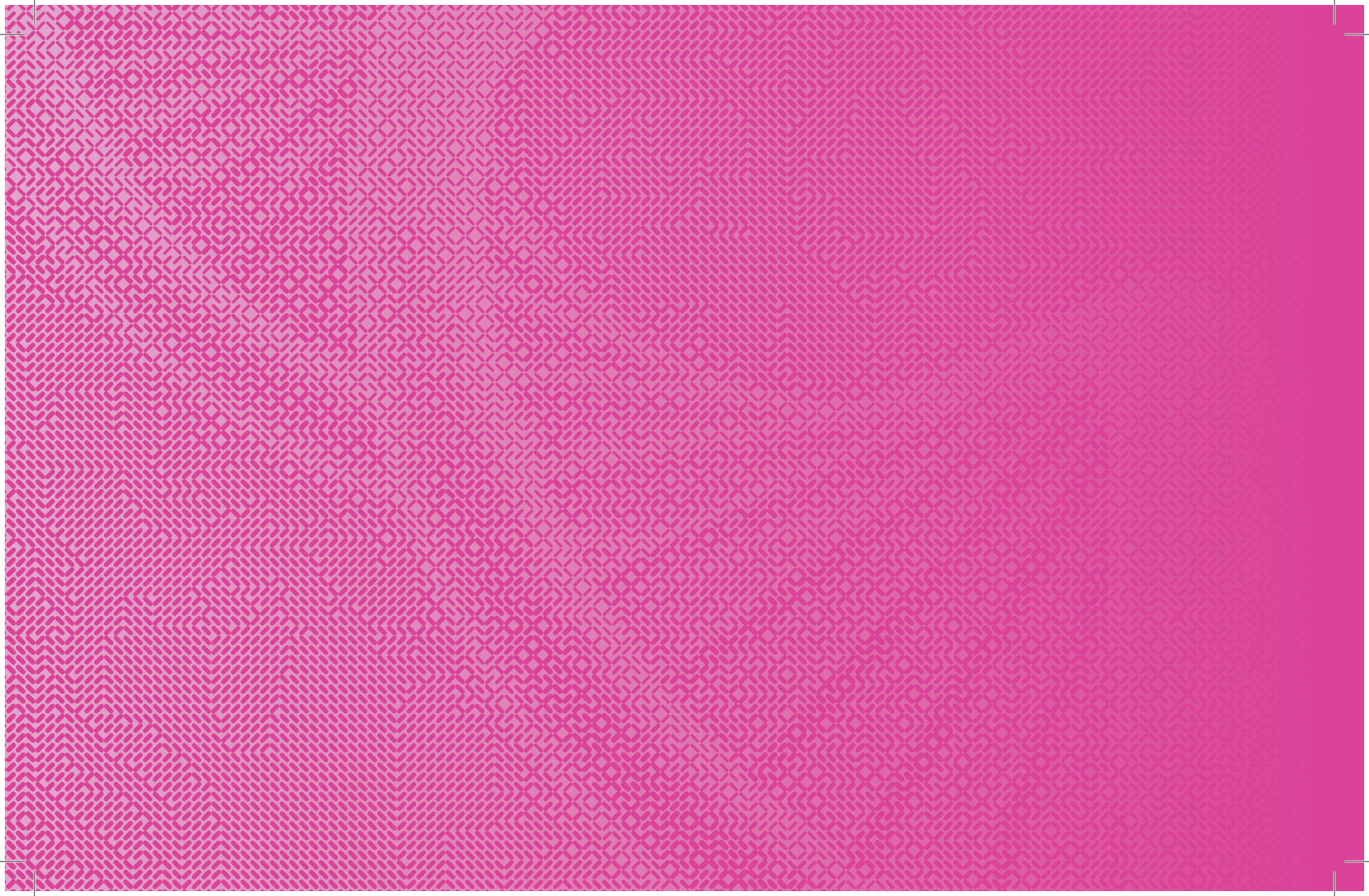
Control Panel

Pulsing blue indicates the Orb™ Hub Module is functioning properly.

Solid red indicates the CO₂ canister is low, and needs replacement.

Pulsing red with alarm indicates an error. Press Alarm Silence Button on the Control Panel to turn off the audible alarm.

The Control Panel Indicators identify the source of the error.



6 Care

This section details steps to ensure the Orb™ Hub Module is functioning as intended. Care includes periodic cleaning, emptying the Drip Tray, and checking indicators. Regular checks and record keeping provide helpful information should any troubleshooting be required.

Care

Cleaning & Maintenance

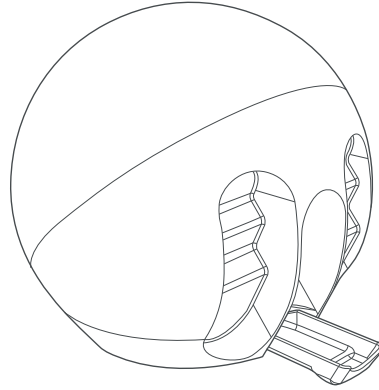
The Orb™ Hub Module does not require significant maintenance. The outer surface should be cleaned periodically with 70% ethanol. The Drip Tray collects any condensation that may accumulate as a result of regular Orb Hub Module use – this is normal. The Drip Tray should be checked every week and emptied as needed. All maintenance activities should be recorded in a lab notebook, or equivalent.



1

Clean

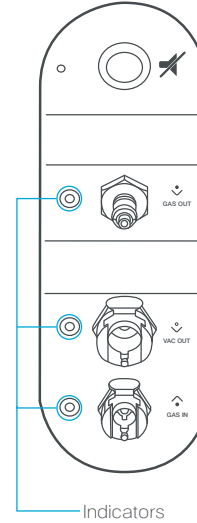
To clean the Orb™ Hub Module, spray with 70% ethanol and wipe thoroughly with a lint-free cloth.



2

Drip Tray

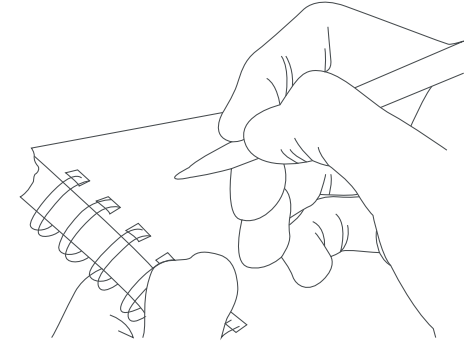
Every week check the Drip Tray. Empty as needed and clean with 70% ethanol after emptying.



3

Indicators

Check the Control Panel Indicators daily for any errors.



4

Record

Keep a record of all maintenance and cleaning activities, including the replacement of the Orb CO₂ canister, if applicable.

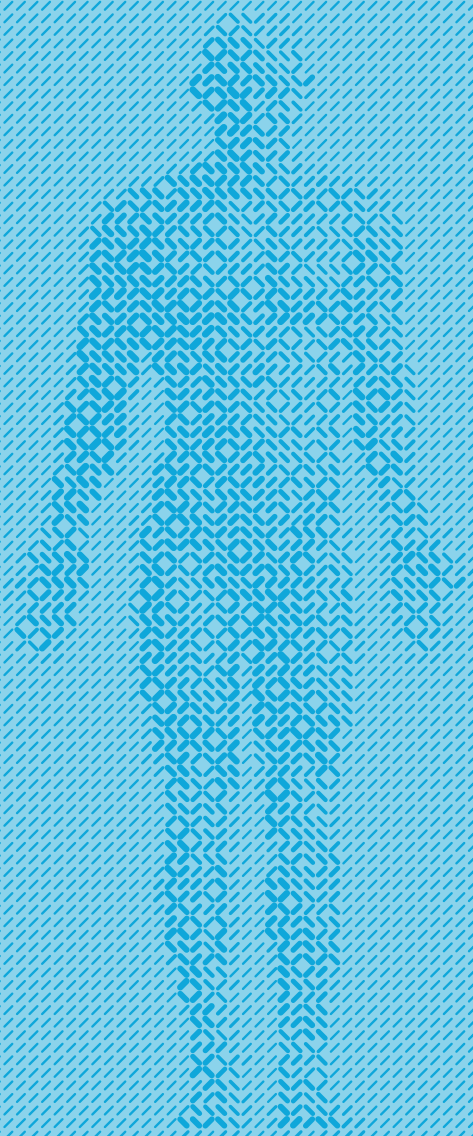
Care

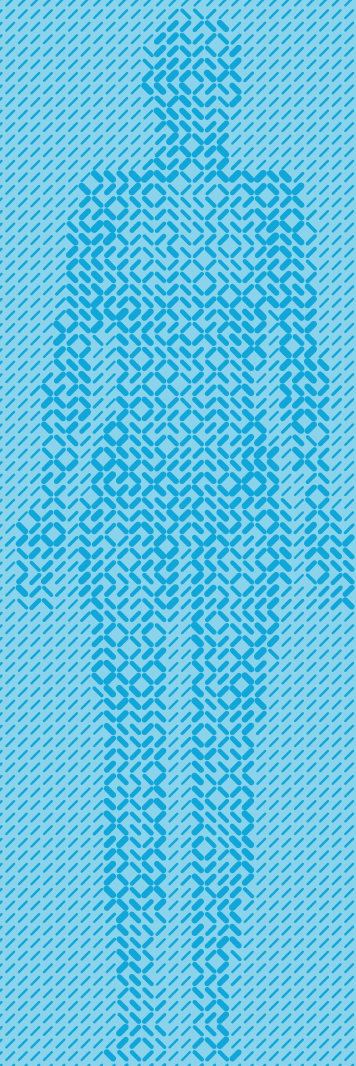
Troubleshooting

The Main Status and Control Panel Indicators make troubleshooting simple. The Main Status Indicator turns red when there is a warning, and pulses red and emits an alarm when there is a problem. The Control Panel Indicators identify the source of a problem. Refer to the troubleshooting table for potential causes of and solutions to problems.

Problem	Cause	Solution
The Orb™ Hub Module is plugged in but will not power on	The On / Off Switch on the rear Control Panel is in the off position	Switch the Orb Hub Module on
	The Power Cord is not connected to the wall outlet or connected incompletely	Connect the Power Cord securely to wall outlet and Orb power input
	A power rating, such as voltage, does not meet the specified electrical requirements	Check the power rating, voltage, and frequency of the wall outlet with the input range specified in this guide and on the Orb label
	The fuse in the system is blown	Contact Emulate for troubleshooting

Problem			Cause	Solution
Main Status Indicator shows an error	Main	Back Panel		
	Solid Red	None	CO ₂ canister volume is low	Replace CO ₂ canister or connect to external CO ₂ source
	Pulsing Red & Audible Alarm	None	Ambient conditions exceeded	Only operate the Orb Hub Module within the environmental specifications outlined herein
			System Error	Contact Emulate for troubleshooting
		Gas In	CO ₂ source disconnected	Connect CO ₂ source to Gas In port
			CO ₂ source pressure above or below specification	Adjust CO ₂ source pressure to within 10–20 psig range
		Gas Out	Gas Out port is connected, but open to atmosphere	Connect Gas Out Connector Line to Zoë Culture Module or Gas Hub or disconnect from Hub
			Gas Out port is connected to more than four Zoë Culture Modules	Disconnect extra Zoë Culture Modules so that only four are connected to a single Orb Hub Module
			System Error	Contact Emulate for troubleshooting
	Vacuum	Vacuum port is connected, but open to atmosphere	Connect Vacuum Connector Line to Zoë culture module or Vacuum Hub or disconnect from Hub	
Zoë™ Culture Module is connected to the Orb™ Hub Module but is not receiving power			The power connector is not connected or is connected incompletely	Connect the Power Cord securely to both the Zoë culture module and Orb Hub Module
			The Power Cord is damaged	Replace Power Cord; contact Emulate for replacement
			The output power fuse is blown	Connect to a different Zoë Power Port; contact Emulate for further troubleshooting







emulate™

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