Chip-R1 Handling Guidelines

Zoë Firmware Compatibility

CAUTION

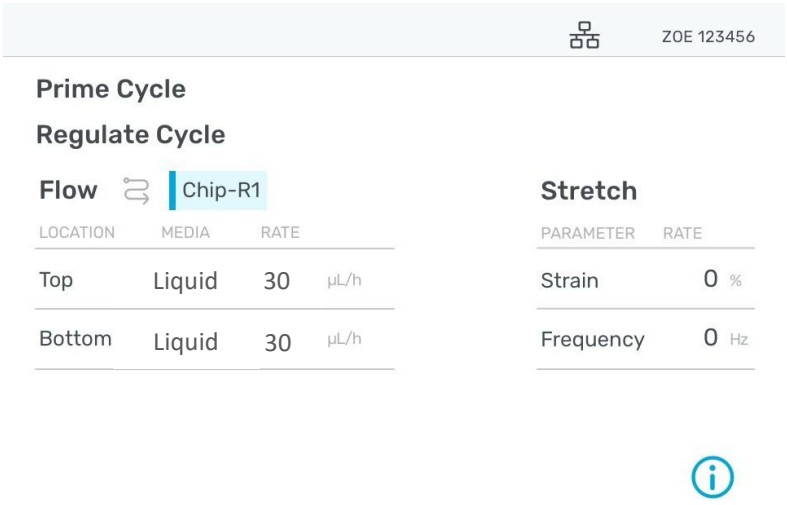
Extreme consideration must be taken when using the Emulate Chip with a Zoë. The consumable type must be configured on the UI screen according to the chip being used (Chip-S1 or Chip-R1). This setting impacts the Prime, Regulate, and Flow parameters for the chip. A mismatch between UI setting and the physical consumable can lead to incorrect flow and instrument failure.

Chip-R1 can only be used with Pod-2. Chip-S1 can only be used with Pod-1.

To use Chip-R1 on Zoë-CM1, ensure the firmware is on v1.2.4 or above
To use Chip-R1 on Zoë-CM2, ensure the firmware is on v1.4.5 or above*

Firmware updates can be performed through Utility Hub on the Emulate website.

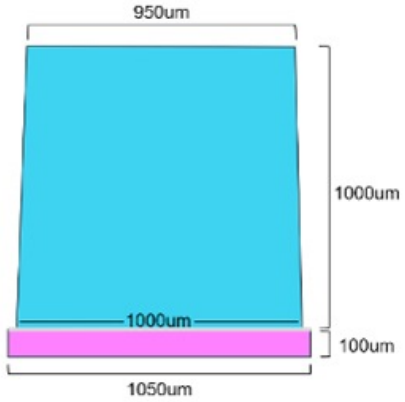
**If your Zoë-CM2 is on v1.3.0 or below, please contact Emulate Support.*



Step	Action
1	Use the Dial to highlight “Chip-S1” or “Chip-R1” on the display.
2	Press the Dial Button to select the displayed chip type.
3	Rotate the Dial to toggle to “Chip-R1.”
4	Press the Dial Button to select “Chip-R1.”

User Guide: EG-184 Rev A | Sep 2024

Specifications

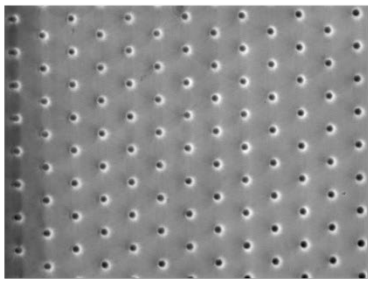
Top Channel	
Width x Height Dimensions	1000 µm x 1000 µm
Area	25.66 mm^2
Volume	24.52 µL
Imaging distance from the bottom of the chip to the top of the membrane	172 µm
	
Bottom Channel	
Width x Height Dimensions	1000 µm x 100 µm
Area	29.46 mm^2
Volume	2.97 µL
Membrane	
Pore diameter	3.0 µm
Pore spacing	Random distribution (Track-etched membrane)
Porosity	2.8 %
Thickness	22 µm
Co-Culture Region	
Area	16.56 mm^2

Chip Membrane

The Chip-R1 membrane is comprised of a different material than Chip-S1. To improve physiological relevance, Chip-R1 membrane thickness and pore size have been reduced, while the overall porosity has increased.

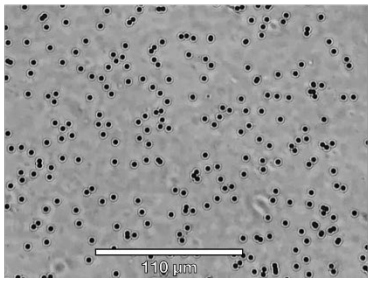
Membrane: Chip-R1 vs. Chip-S1

Chip-S1



Material: PDMS
Thickness: 50µm
Pore Size: 7µm
Porosity: 2.7%
Distribution: Spaced 40µm center to center

Chip-R1

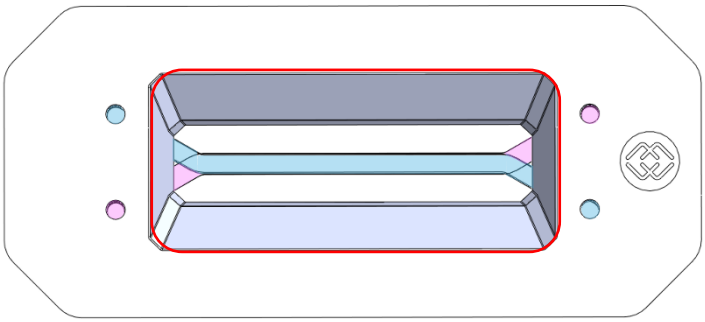


Material: Polycarbonate
Thickness: 22µm
Pore Size: 3µm
Porosity: 2.8%
Distribution: Randomized (no pores in monoculture region)

The Chip-R1 membrane is tissue culture treated through a chemical oxidation process. Therefore, chip activation is not required, and ER-1, ER-2, and the UV lamp are not utilized at any stage during chip preparation.

Chip Gasket

Because the Chip-R1 top channel is made of a rigid plastic, it is necessary to have a gasket layer on top of the chip stack. This gasket layer allows for a proper seal to be made with the pipette tip enabling users to access the channels with ease.



The Chip-R1 gasket contains a window cut-out (outlined in red). This window allows for increased gas exchange between the top channel and its local environment.

CAUTION

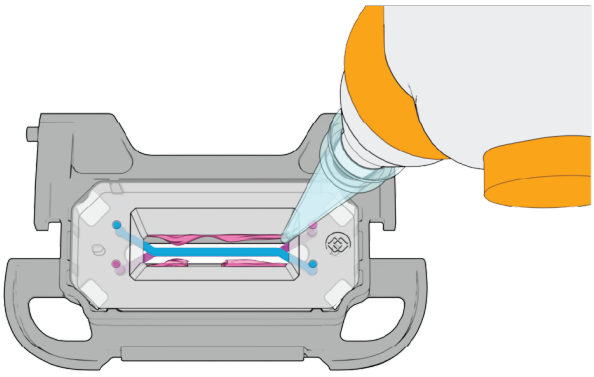
When aspirating from the gasket window, take precaution NOT to make contact with the channel feature itself. The top gas exchanger film can easily be punctured by a pipette tip.

There is additional resistance in the bottom channel of Chip-R1 compared to Chip-S1. Therefore, when pipetting into the bottom channel, depress the plunger fully and hold the pipette at the port for several seconds to allow the full volume to be pipetted through the bottom channel.

Note on Aspiration: Careful consideration must be given to aspiration steps during Chip-R1 seeding. Residual liquid over the outlet ports may be a contributing factor to the formation of cell distribution gradients when handling the chips post-seeding.

Suggestions for Aspiration and avoiding gradients:

1. Aspirate excessive volume from the outlets with a vacuum aspirator.
2. Do not work directly over the port as this may cause the cell medium to aspirate from the channel itself.
3. Do not drag the aspirator tip across the top of the chip as this can cause scratches on the top layer.

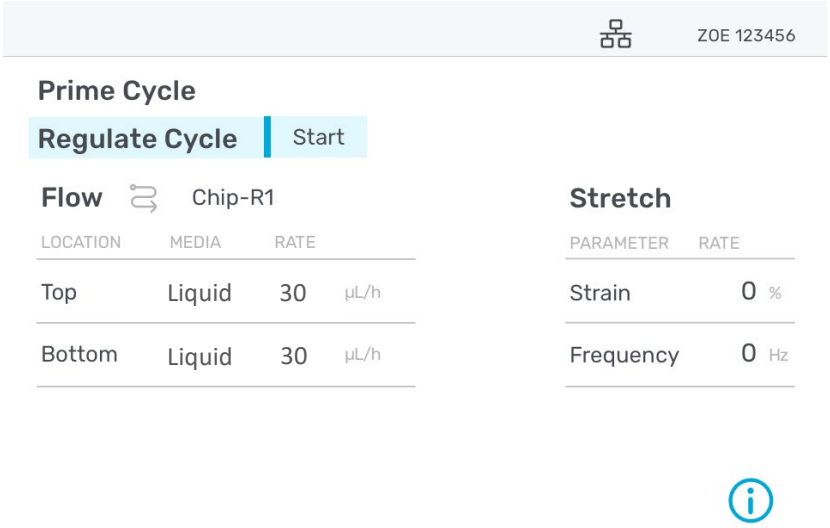


As shown in the image above, aspirate excess media by placing the aspirator tip against the corners of the chip gasket window and guiding it along the edges.

Regulate Cycle

To ensure minimal bubble formation during flow on the Chip-R1, two ***consecutive*** Regulate Cycles must be run with ***freshly replenished, warm, equilibrated media*** on the day of chip-to-Pod connection. Follow the steps below for preparation of the second Regulate Cycle ***which is different from the Chip-S1 protocol***:

1. Immediately upon completion of the first Regulate cycle, pause Zoë by pressing the silver “Activation” button located above the tray bays. This stops flow and releases the Pods.
2. Remove the Pod lids. Gently aspirate media from all four Pod reservoirs, ensuring that a thin liquid film still covers the reservoir Vias so that no air is introduced into them.
3. Refill the inlet and outlet reservoirs with channel-specific warm, equilibrated media at volumes of 3 mL and 300 µL respectively. Then, perform a Via wash by pipetting 200 µL of the medium in the reservoir directly over the top of the Via to dislodge any bubbles.
4. Place the Pod lids back on and return the trays to Zoë. Run the Regulate Cycle again. Once it is complete, Zoë will begin flow at the preset Organ-Chip culture conditions.



Ensure the Flow setting is configured to Chip-R1 before selecting “Start” for the Regulate Cycle, as shown in the UI above.