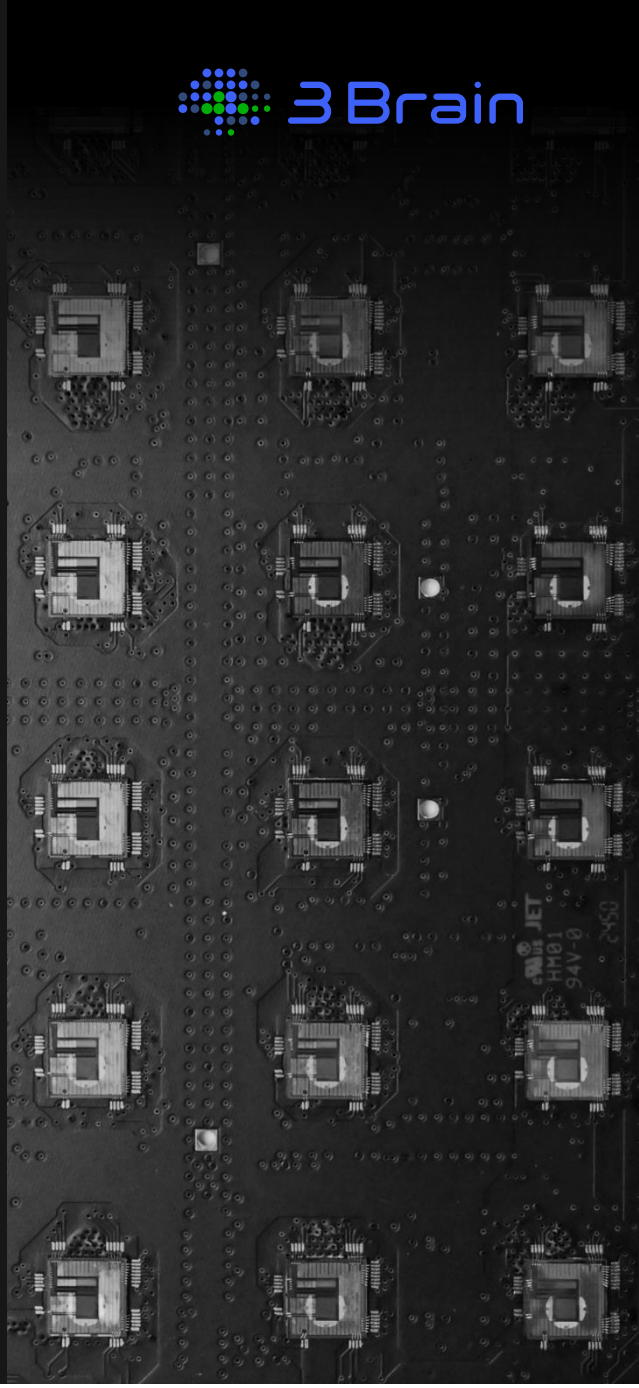
Technical Note



Recommended CorePlate™ 1W Perfusion System, Components and Set Up

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Introduction

Maintaining proper perfusion is essential for sustaining the viability and physiological function of certain tissues such as brain tissue slices during high-density microelectrode array (HD-MEA) recordings. Continuous perfusion ensures oxygenation and nutrient delivery to help preserve neuronal activity. This technical note outlines the recommended perfusion system, components and set up for the BioCAM DupleX & CorePlate™ 1W.

CorePlate™ 1W refers to the following:

- CorePlate™ 1W 27/42
- CorePlate™ 1W 27/42L
- CorePlate™ 1W 51/81
- CorePlate™ 1W 38/60
- CorePlate™ 1W-3D 38/60/90

Perfusion

Perfusion system

A suitable perfusion system includes a peristaltic pump with two or more lines (one for the inflow, one for the outflow) that can be controlled independently, a perfusion inlet and outlet system, and dependant on the experimental model, an in-line heater.

Perfusion inlet and outlet options

Perfusion may be performed with either:

Option 1: CorePlate™ 1W Lid with Membrane and Perfusion Interface.
Option 2: A traditional magnetic perfusion inlet and outlet system.

Inlet and outlet positioning (CorePlate™ 1W Lid with Membrane and Perfusion Interface)

If using the CorePlate™ 1W Lid with Membrane and Perfusion Interface, the inlet and outlet positions are fixed making it ready for immediate use. Simply place the cap on top of CorePlate™ 1W, ensuring that the inlet and outlet positions are located above the reference electrodes as shown in Fig. 1.

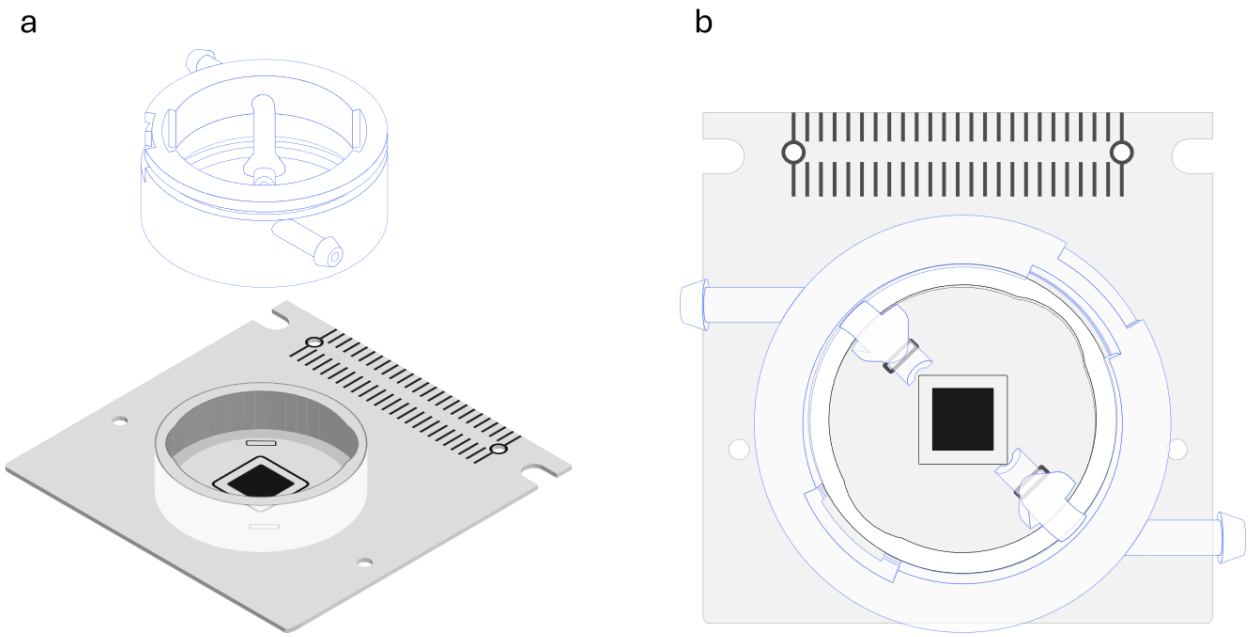

Figure 1. Diagram illustrating the correct placement of CorePlate™ 1W Lid with Membrane and Perfusion Interface. Separated units (a), assembled unit with inlet and outlet positioned above the reference electrodes (b).

Inlet and outlet positioning (magnetic perfusion inlet and outlet system)

After connecting each inflow and outflow line to the appropriate inlet and outlet on the traditional magnetic perfusion system, the inlet and outlet must be positioned correctly. The inlet should be positioned at the bottom of the CorePlate™ 1W reservoir. The outlet should be positioned slightly higher than the inlet, at the opposite side of the well (ensuring neither touch the bottom of the well, or the well wall) (Fig. 2).

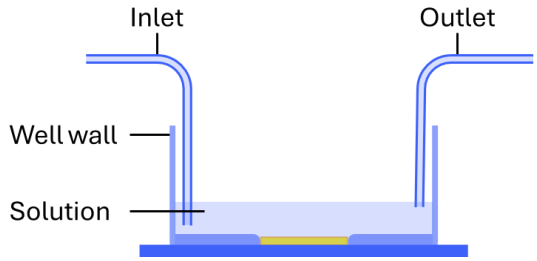

Figure 2. Diagram illustrating the correct placement of the inlet and outlet when using a magnetic perfusion system.

Grounding the perfusion line

The BioCAM DupleX can typically operate on a lab bench without needing an anti-vibration table or a Faraday cage. Nevertheless, as for other recording systems, perfusion lines can introduce noise (typically 50Hz in Europe, 60Hz in US depending on the electrical grid). To remove this low frequency noise, it is necessary to ground the perfusion lines to the BioCAM DupleX. A simple solution is to introduce a metallic bypass to each line (e.g., a syringe needle with the tip cut off) that can be connected to the BioCAM DupleX grounding point as illustrated in Fig. 3 & 4).

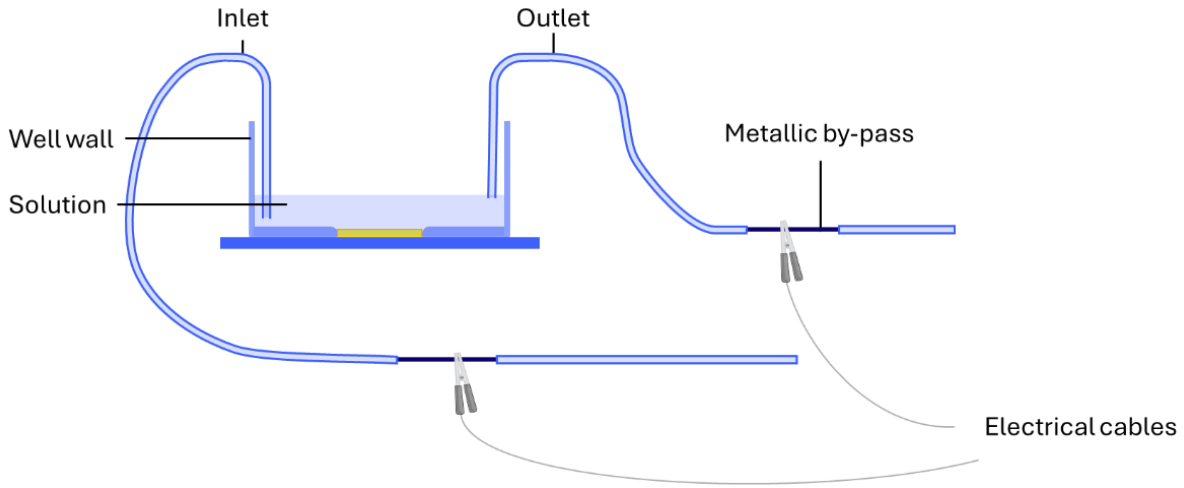

Figure 3. Diagram showing the metallic by-pass grounding points of the perfusion lines.

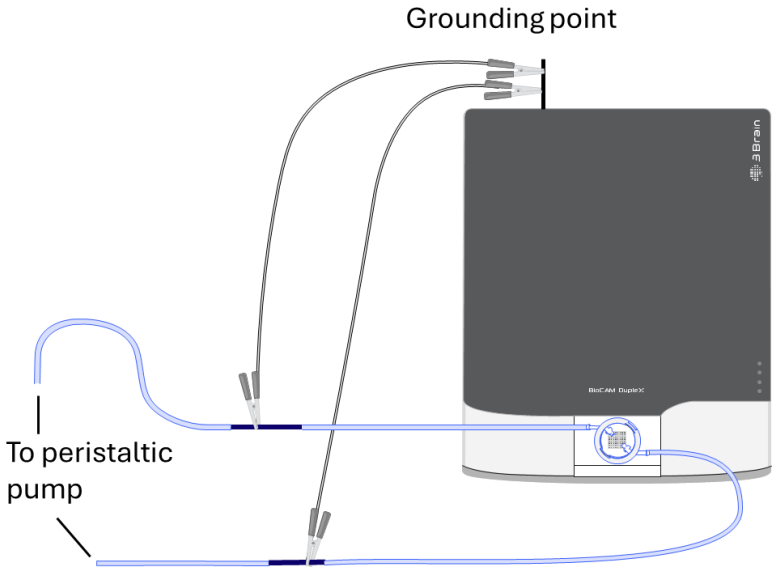

Figure 4. Diagram showing the grounding of the perfusion lines to the grounding point of the BioCAM Duplex.

Advanced grounding configuration

In some cases, external pumps/environmental conditions may introduce a oscillating noise occurring on the electrodes below the recorded tissue. Such noise, that is not a 50 or 60Hz, can appear even after a few minutes from the moment in which the tissue is positioned on the chip and can start from a few adiacent electrodes spreading over a large area. To mitigate this, utilize the parts recommended in table 5.

In order to utilize the advanced grounding configuration method, connect the Micro HDMI port of the IO Connector box to the HDMI port of the BioCAM DupleX utilizing the provided Micro HDMI > HDMI cable (Fig. 5a & b). Following this, connect the Perfusion Ground Cable to the IO connector box at the STIM 2 OUT port (Fig. 5b & c), and ground the perfusion lines at the metallic by pass points as shown in Fig. 6.

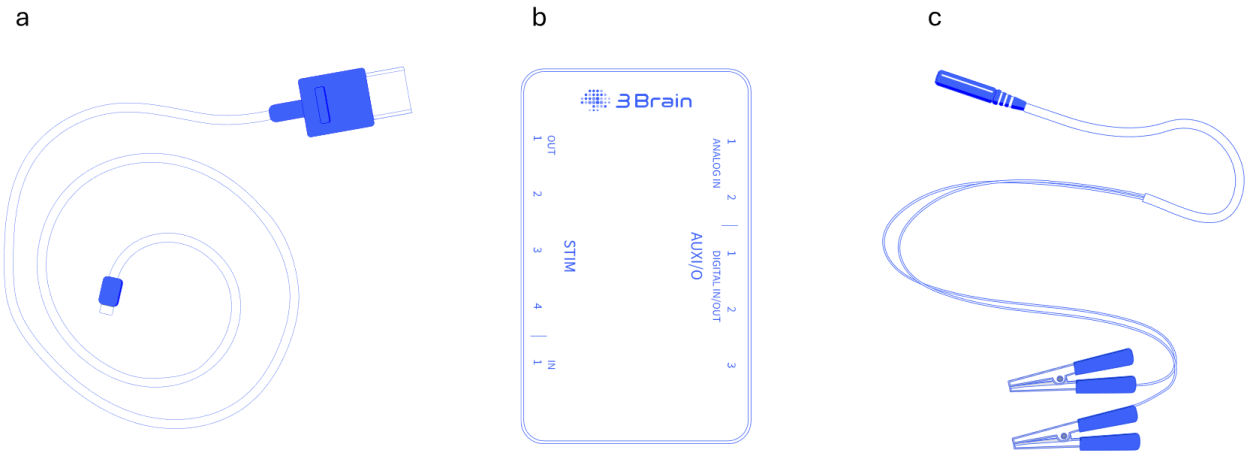

Figure 5. Illustration showing the advanced grounding configuration components. Micro HDMI > HDMI cable (a), IO Connector Box (b), Perfusion Ground Cable (c).

This grounding method may be used alongside the grounding method described in the “grounding the perfusion line” section. However, in this case, only the “advanced grounding configuration” should be connected to the metallic bypass of the inlet and outlet lines. All other grounding connections e.g. grounding the BioCAM Duplex to an Air Table should be connected to normal grounding point on the rear of the BioCAM DupleX (Fig. 6).

Ensure the firmware is fully up to date in order to perform this grounding procedure.

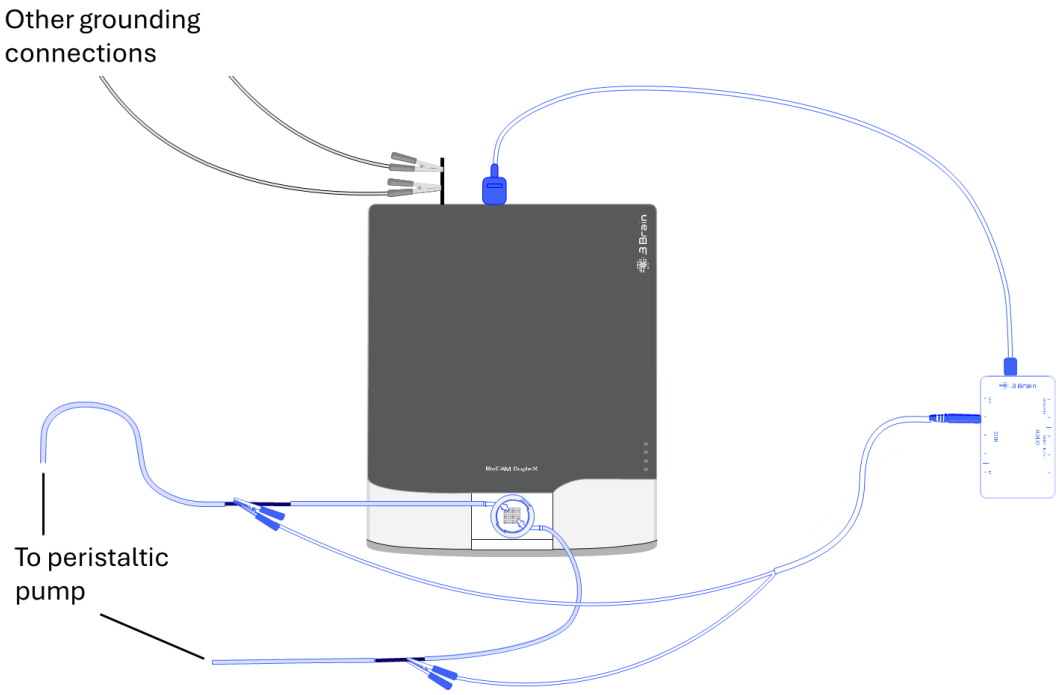

Figure 6. Illustration showing the setup of the advanced grounding method.

Recommended perfusion system

Although there are many suppliers of perfusion systems, we recommend using the components detailed in the following tables.

Disclaimer: The recommended perfusion system components of third party-suppliers indicated in the tables are provided solely for informational purposes. 3Brain does not manufacture, sell, or provide technical support for these products.

Table 1. Recommended peristaltic pump.

Item Name	Supplier	Description
(PPS2) MCS Peristaltic Pump Perfusion System	Warner Instruments	Peristaltic perfusion system with low pulsation.
MINIPULS® 3 Peristaltic Pump with Two Channel Pump Head	Gilson	Low-pulse, peristaltic pump with interchangeable pump heads.

Only one of peristaltic pumps is required from table 1, not both.

Table 2. Recommended Perfusion inlet and outlet option 1

Item Name	Supplier	Description
CorePlate™ 1W Lid with Membrane and Perfusion Interface	3Brain	Cap for CorePlate™ 1W with FEP membrane and perfusion inlet & outlet.

Table 3. Recommended Perfusion inlet and outlet option 2 (traditional magnetic perfusion inlet and outlet system)

Item Name	Supplier	Description
Perfusion manifold on magnetic holder, MTH-P-8	Bioscience Tools	**For inlet**. PTFE perfusion manifold TPM mounted on a magnetic base MTH1. Can be used for switching different solutions during perfusion. Adjustable base can be tilted at an angle and fixed using thumb screws. The manifold can be reduced down to 1-channel by closing inputs with provided plastic plugs.
Magnetic holder with Suction Tubing, MEH-S	Bioscience Tools	**For outlet**. Magnetic base with stainless steel suction tubing. Two thumb screws adjust tubing height (tilt) and length. The suction tubing can be replaced with any custom tubing up to 4mm diameter.
2 x TILTPORT	ALA Scientific	TILTPORT is a Tilt-a-Port™ perfusion port holder with a height-adjustable bent

	stainless steel cannula and grounding lug.

Only the Bioscience Tools or the ALA scientific tools are required from table 3, not both.

Table 4. Recommended In-line heater / cooler:

Item Name	Supplier	Description
(SC-20) Inline Heater/Cooler	Warner Instruments	In-line heater / cooler for maintaining the temperature of perfusion solutions.

Table 5. Advanced grounding configuration:

Item Name	Supplier	Description
Micro HDMI > HDMI Cable	3Brain	For connecting the IO Connector Box to the BioCAM DupleX.
IO Connector Box	3Brain	External IO Connector Box featuring 4 output stimulation channels, 1 input stimulation channel, 3 digital In / Out lines & 2 analogue input lines.
Perfusion Ground Cable	3Brain	Cable to ground the inlet and outlet lines to the BioCAM DupleX through the IO Connector Box.