

M64-Px

PLANAR ELECTRODE ARRAYS PERFUSION SERIES



Perfusion-integrated *in vitro* microelectrode arrays for network electrophysiology:

- Acute, brain-slice electrophysiology
- Long-term continuous perfusion
- 64 low-noise microelectrodes
- Upright and inverted microscope compatible
- Water-tight, gas-permeable lid
- Gas-delivery capacity for extended experiments
- Automatic plate recognition in Axion Muse™ systems

Description

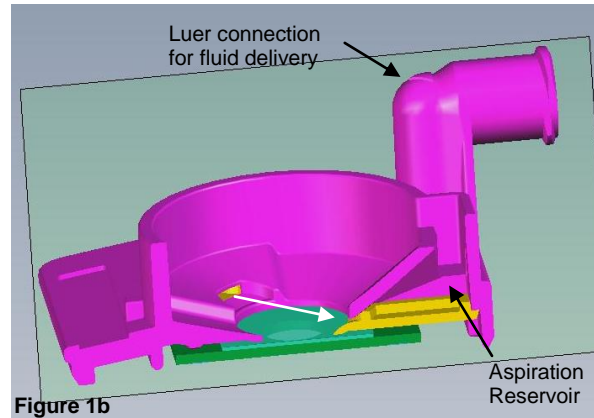
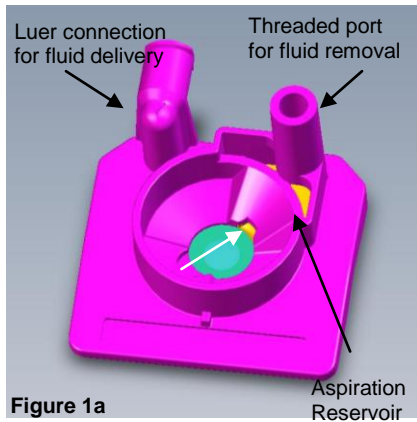
The perfusion MEA delivers fluid perfusion and simultaneous MEA recording capabilities for (1) acute brain slice electrophysiology and (2) long-term, fluidic control for recording dissociated cultures. The perfusion design has integrated ports for fluid delivery and removal. The removal, via a secondary reservoir, protects the main well from the effects of vacuum and turbulence associated with fluid removal. The inlet port to the main well opens with a slight elevation above the MEA surface to enhance the fluid flow over the brain slice surface in acute electrophysiology applications. The inlet and outlet ports are spaced 180° apart to distribute the flow across the center of the MEA electrode recording region.

Features

- Fluidic handling for acute and long-term perfusion-assisted electrophysiology.
- Flow rates from sub $\mu\text{l}/\text{min}$ to 4 ml/min (volume exchange rate 8x/min).
- Compatible with syringe pumps, peristaltic pumps, and gravity/vacuum fluid circulation.
- Water-tight, gas-permeable lid
- Gas-delivery-port for extended studies
- 300 μm glass substrate to facilitate inverted microscopy with small working distance objectives.
- Top-side microscopy capabilities (see specifications, page 3)
- Muse-integrated temperature regulation
- 64 microelectrodes in an 8x8 configuration
- 30 μm microelectrode diameter
- 200 μm electrode spacing (center-to-center)
- 4 GNDs (2 Stimulation & 2 Recording GNDs)
- Nano-porous Platinum or Gold microelectrodes
- SU-8 polymer or Oxide (SiO_2) insulation
- Ergonomic, clear polystyrene culture well
- Autoplate recognition in Axion Muse™ systems
- 25 K Ω average impedance at 1 khz for platinum black electrodes

Perfusion Well Features and Geometry

The M64-Px microelectrodes are packaged into an ergonomic polystyrene/polycarbonate well with a water-tight, gas-permeable lid, with the option of an integrated gas delivery port for extended time-period experiments outside of the incubator. A small well around the electrode array contains the fluid around the tissue, while expanding out into a larger conical structure to facilitate easy placement of the tissue.



The device is shown from an overhead and cut-away side view to show the outlay of the ports and fluid path. Figure 1(a): The fluid is delivered to the chamber via a luer lock connection, and flows across the MEA to the outlet port. The inlet and outlet ports are spaced 180° apart to distribute the flow across the center of the MEA electrode recording region (as indicated by the white arrow). The fluid flows from the main well into the aspiration reservoir for removal. Figure 1(b): The cross-section of the aspiration reservoir is shown in a cut-away view of the chamber. The inlet port to the main well opens with a slight elevation above the MEA surface for fluid flow over the brain slice surface in acute electrophysiology applications.

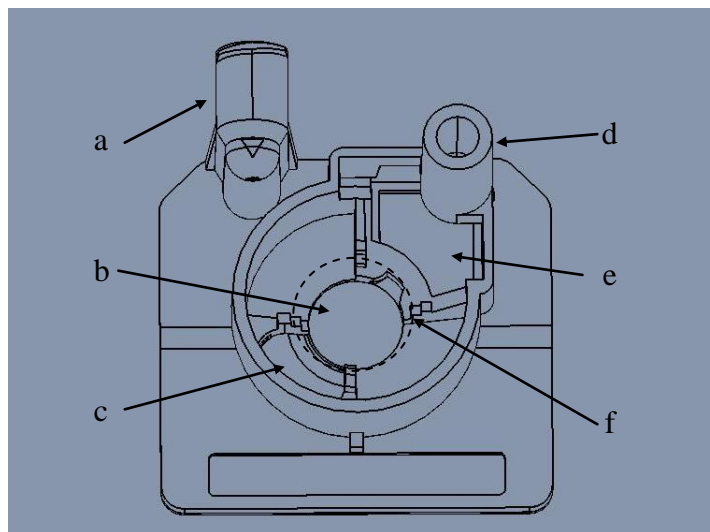


Figure 2: pMEA features:

- a) Luer-connection port for fluid inlet
- b) Electrode array and tissue chamber
- c) Inlet flow chamber
- d) Threaded port for fluid aspiration (10/32)
- e) Fluid aspiration chamber
- f) Rests to position glass cover slip (placement indicated via the dotted line)

Water-tight cap for gas delivery during extended recording periods

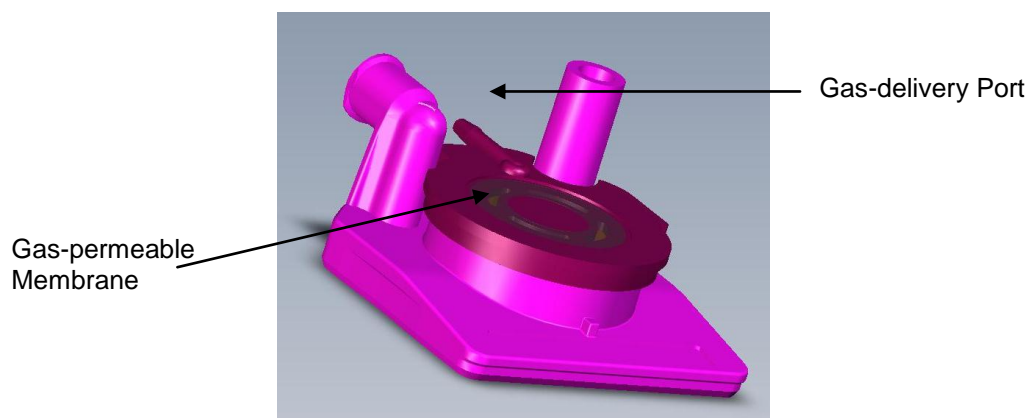


Figure 3: The water-tight caps are sealed with a recessed silicone gasket. To allow for air exchange, a ring of gas-permeable membrane is integrated into the top of the cap. The center of the cap remains clear to facilitate light transfer for inverted microscopy. The cap has a barbed fitting for gas delivery during extended experiments outside the incubator.

Specifications

pMEA Specifications	
Perfusion chamber diameter (bottom surface)	9 mm
Electrode array	2 mm square
Inlet flow fitting	Female luer
Outlet flow fitting	Female 10/32 threading
Recommended tubing (low flow, < 100 $\mu\text{l}/\text{min}$)	Small-bore PTFE, 1/16" OD (IDEX, Upchurch Scientific)
Recommended tubing (high flow > 100 $\mu\text{l}/\text{min}$)	Silicone rubber 1/16" ID, 1/8" OD (ColeParmer)
Height of slide rests from MEA surface	1.3 mm
Slice anchor	Stainless steel frame, PEEK mesh (71 μm thread, 218 μm opening)
Height of inlet flow from array surface	0.86 mm
Height of outlet flow from array surface	0.2 mm

Compatible Microscope Objective Series	
Nikon	CFI Achromat 4, 10, 20, 40, 60X
Olympus	ULPLFN 10XW, LUMPLFLN 40XW
Zeiss	N-Achroplan 10, 40X

Recommended fluid delivery and removal mechanisms	
Peristaltic pump	Boston Scientific, Mini-peristaltic Pump II
Syringe pump	KD Scientific, Infuse/Withdraw Dual Barrel
Vacuum (house-line or pump)	Approximate pressure range: \leq 100 kPA/ 15 psi