

Blocked Area Calculation Report (Step-wise)

File: 1.8b 1hz 30um.csv

Pressure: 1.8 bar

Device: 30um

Date: 2026-01-02 16:51:06

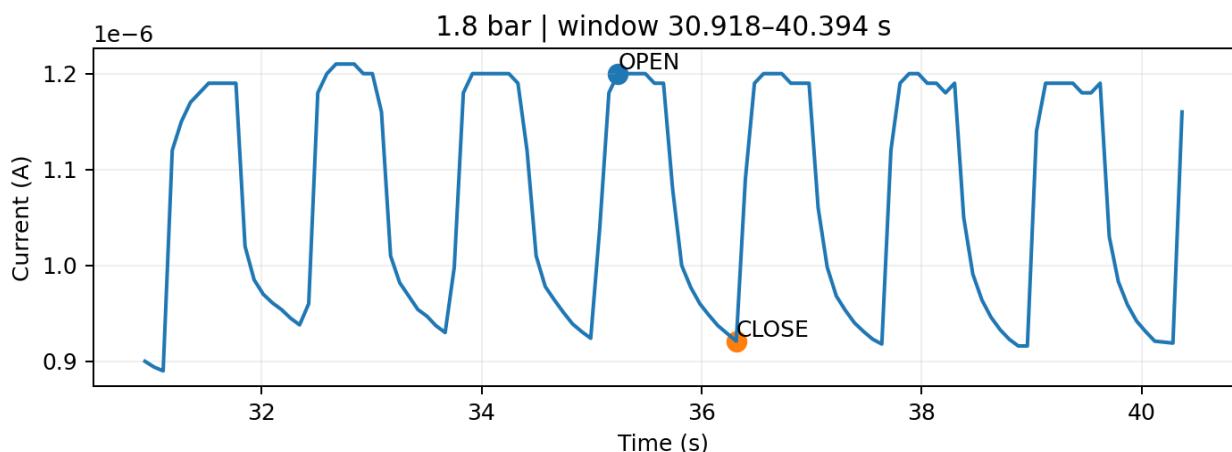
1) Selected window

Window start = 30.917539 s, Window end = 40.394446 s

2) Picked points (NO averaging; single raw datapoint)

| Point | Snapped time (s) | Snapped current (A) |
|-------|------------------|---------------------|
| OPEN | 35.240945 | 1.200000000000e-06 |
| CLOSE | 36.316136 | 9.210000000000e-07 |

3) Window plot with selected points



4) Experimental blocked area (exact order)

```
V = 1.0 V
ρ = 0.0896 Ω·m, l = 0.000145 m, w = 0.0001 m, d = 3e-05 m
A = w×d = 3e-09 m², p₁ = ρ×l = 1.2992e-05 Ω·m²
G_open = |I_open/V| = |1.200000000000e-06/1.0| = 1.200000000000e-06 S
G_closed = |I_close/V| = |9.210000000000e-07/1.0| = 9.210000000000e-07 S
R_open = 1/G_open = 833333 Ω
R_closed = 1/G_closed = 1.08578e+06 Ω
ΔR = R_closed - R_open = 252443 Ω
k = (A×ΔR)/(p₁) = 58.2919
A'/A = 1/(1+k) = 0.0168657
Blocked% = 100×(1 - A'/A) = 98.3134 %
```

5) Theoretical blocked area (PDF-style: sector – triangle)

[1] Input Parameters

Pressure (P) = 1.8 bar = 180000 Pa
Membrane radius (a) = 50.00 μm = 0.00500 cm
Membrane thickness (t) = 1.50 μm = 0.00015 cm
Young's modulus (E) = 7.00e+06 Pa
Poisson's ratio (ν) = 0.3
Constant (C_f) = 2.67
Effective modulus (E') = E/(1-ν) = 1.00e+07 Pa
Channel cross-section A = 3.00000e-05 cm²

[2] Intermediate Calculations

```
Factor = (a × P × C_f) / (E' × t)
       = (0.00500 × 180000 × 2.67) / (1.00e+07 × 0.00015)
       = 1.60200
w = a × factor^(1/3)
   = 0.00500 × (1.60200)^(1/3)
   = 0.00585 cm = 58.50 µm
r = (a² + w²) / (2w)
   = (5.00000e-03 + 3.42280e-05) / (2 × 0.00585)
   = 0.00506 cm
θ = 2 × arcsin(a / r)
   = 2 × arcsin(0.00500 / 0.00506)
   = 2.82871 rad
Triangle Area = a × (r - w)
               = 0.00500 × (0.00506 - 0.00585)
               = -3.94328e-06 cm²
Sector Area = 0.5 × r² × θ
               = 0.5 × 0.00506² × 2.82871
               = 3.62385e-05 cm²
Arc (Blocked) Area = Sector - Triangle
                     = 3.62385e-05 - -3.94328e-06
                     = 4.01818e-05 cm²
```

[3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                  = (4.01818e-05 / 3.00000e-05) × 100
                  = 133.94 %
```