

Blocked Area Calculation Report (Step-wise)

File: 1.2b 1hz 30um.csv

Pressure: 1.2 bar

Device: 30um

Date: 2026-01-02 16:50:38

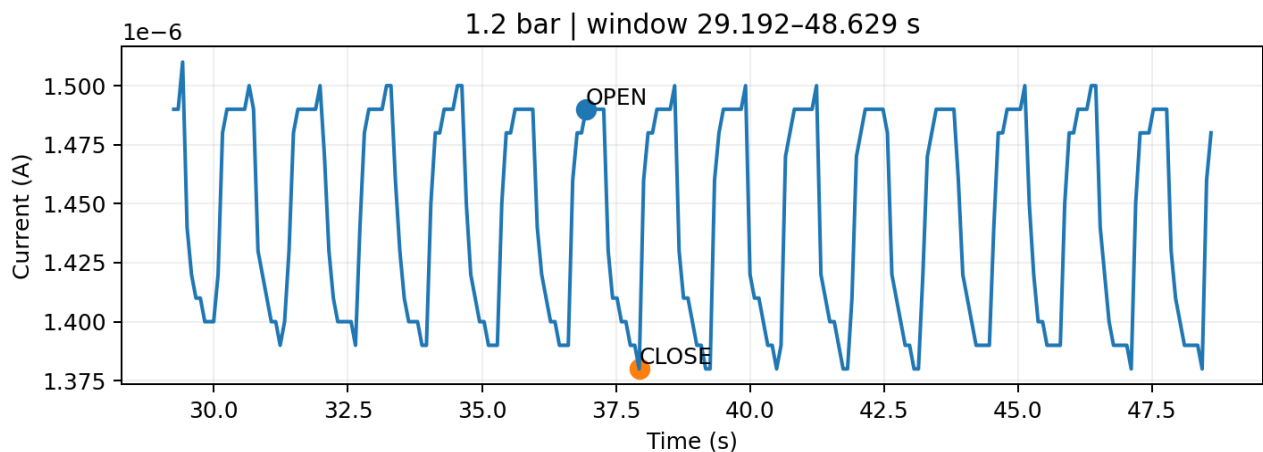
1) Selected window

Window start = 29.191934 s, Window end = 48.628510 s

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

Point	Snapped time (s)	Snapped current (A)
OPEN	36.942057	1.4900000000000e-06
CLOSE	37.934431	1.3800000000000e-06

3) Window plot with selected points



4) Experimental blocked area (exact order)

$V = 1.0 \text{ V}$
 $\rho = 0.0896 \text{ } \Omega \cdot \text{m}$, $l = 0.000145 \text{ m}$, $w = 0.0001 \text{ m}$, $d = 3\text{e-}05 \text{ m}$
 $A = wxd = 3\text{e-}09 \text{ m}^2$, $\rho l = \rho \times l = 1.2992\text{e-}05 \text{ } \Omega \cdot \text{m}^2$
 $G_{\text{open}} = |I_{\text{open}}/V| = |1.4900000000000\text{e-}06/1.0| = 1.4900000000000\text{e-}06 \text{ S}$
 $G_{\text{closed}} = |I_{\text{close}}/V| = |1.3800000000000\text{e-}06/1.0| = 1.3800000000000\text{e-}06 \text{ S}$
 $R_{\text{open}} = 1/G_{\text{open}} = 671141 \text{ } \Omega$
 $R_{\text{closed}} = 1/G_{\text{closed}} = 724638 \text{ } \Omega$
 $\Delta R = R_{\text{closed}} - R_{\text{open}} = 53496.7 \text{ } \Omega$
 $k = (\Delta R)/(\rho l) = 12.353$
 $A'/A = 1/(1+k) = 0.0748895$
 $\text{Blocked\%} = 100 \times (1 - A'/A) = 92.511 \text{ \%}$

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

[1] Input Parameters

Pressure (P) = 1.2 bar = 120000 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') = $E/(1-\nu) = 1.00\text{e+}07 \text{ Pa}$
Channel cross-section A = 3.00000e-05 cm^2

[2] Intermediate Calculations

```
Factor = (a × P × Cf) / (E' × t)
        = (0.00500 × 120000 × 2.67) / (1.00e+07 × 0.00015)
        = 1.06800
w = a × factor(1/3)
    = 0.00500 × (1.06800)(1/3)
    = 0.00511 cm = 51.11 μm
r = (a2 + w2) / (2w)
    = (5.00000e-03 + 2.61209e-05) / (2 × 0.00511)
    = 0.00500 cm
θ = 2 × arcsin(a / r)
    = 2 × arcsin(0.00500 / 0.00500)
    = 3.09774 rad
Triangle Area = a × (r - w)
               = 0.00500 × (0.00500 - 0.00511)
               = -5.48275e-07 cm2
Sector Area = 0.5 × r2 × θ
             = 0.5 × 0.005002 × 3.09774
             = 3.87403e-05 cm2
Arc (Blocked) Area = Sector - Triangle
                   = 3.87403e-05 - -5.48275e-07
                   = 3.92886e-05 cm2
```

[3] Final Result

```
Blocked Area (%) = (Arc Area / Channel Area) × 100
                  = (3.92886e-05 / 3.00000e-05) × 100
                  = 130.96 %
```