Necessary parameters for the Four-state model

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| **Parameter [unit]** | **Definition** | **Value** |
| V [mV] | Holding potential | variable |
| 𝜀1 [ms-1] | Rate constant for C1→O1 transition | 0.8535 |
| 𝜀2 [ms-1] | Rate constant for C2→O2 transition | 0.14 |
| e12 [ms-1] | Rate constant for O1→O2 transition |  |
| e21 [ms-1] | Rate constant for O2→O1 transition |  |
| Gd1 [ms-1] | Rate constant for O1→C1 transition |  |
| Gd2 [ms-1] | Rate constant for C2→C2 transition | 0.05 |
| Gr [ms-1] | Rate constant for C2→C1 transition |  |
| λ [nm] | | Light wavelength | 470 |
| hc [kg m3/s2] | | Product of Planck’s constant and the speed of light | 1.986446 × 10-25 |
| Ephoton [J] | | Energy of photons |  |
| σret [m2] | | Retinal cross-section | 12 × 10-20 |
| wloss | | Scaling factor for loss of photons | 1.3 |
| F [ms-1] | Photon flux, number of photons per molecule per second |  |
| TChR2 [ms] | ChR2 activation time constant | 1.3 |
| gChR2 [mS/cm2] | Maximum conductance | 0.4 |
| EChR2 [mV] | | ChR2 reversal potential | 0.0 |
| p | ChR2 activation function | Equation X  Initial value: 0.0 |
| O1 | Fraction of molecules in O1 state | Equation X  Initial value: 0.0 |
| O2 | Fraction of molecules in O2 state | Equation X  Initial value: 0.0 |
| C1 | Fraction of molecules in C1 state | Equation X  Initial value: 1.0 |
| C2 | Fraction of molecules in C2 state | Equation X  Initial value: 0.0 |
| IChR2 | Induced photocurrent | Equation X |
| 𝛾 | Ratio of conductances of O2/O1 | 0.1 |
| SO(θ) | Light-dependent component of ChR2 activation function | Equation X |
| G(V) | Voltage-dependent rectification function | Equation X |
| i [mW/mm2] | irradiance | variable |