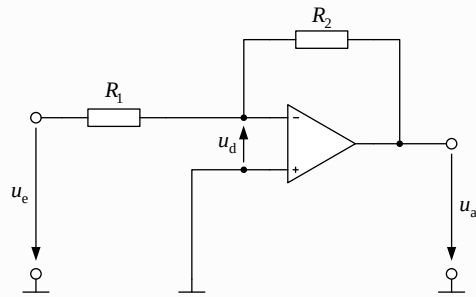


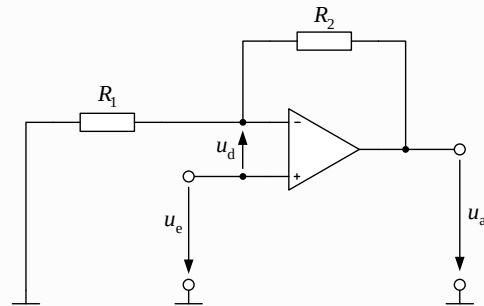
Schaltungen für Operationsverstärker

Invertierender Verstärker:



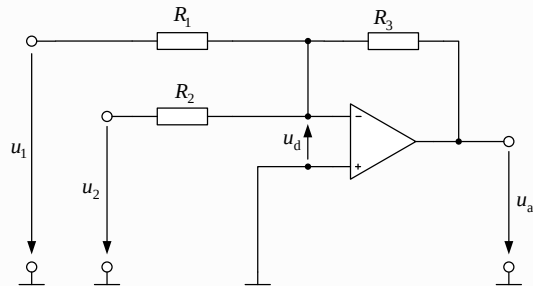
$$u_a = u_e \cdot \left(-\frac{R_2}{R_1} \right)$$

Nichtinvertierender Verstärker:



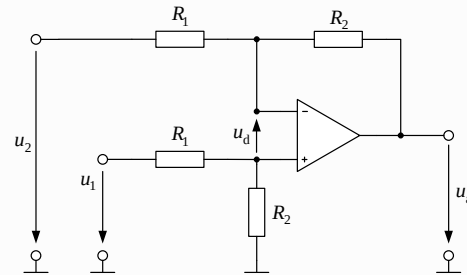
$$u_a = u_e \cdot \left(1 + \frac{R_2}{R_1} \right)$$

Invertierender Summierer:



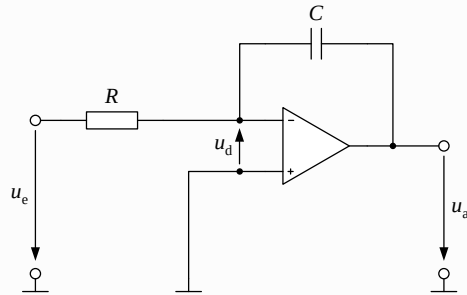
$$u_a = -R_3 \cdot \left(\frac{u_1}{R_1} + \frac{u_2}{R_2} \right)$$

Subtrahierer:



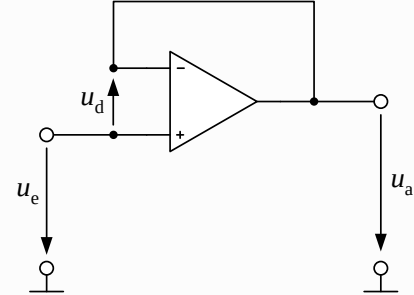
$$u_a = \frac{R_2}{R_1} \cdot (u_1 - u_2)$$

Integrierer:



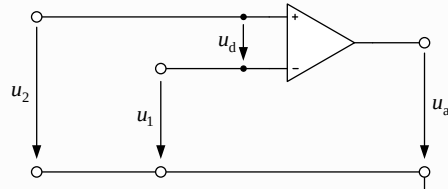
$$u_a(t) = -\frac{1}{R \cdot C} \cdot \int_0^t u_e(\tau) \cdot d\tau$$

Impedanzwandler:



$$u_a = u_e$$

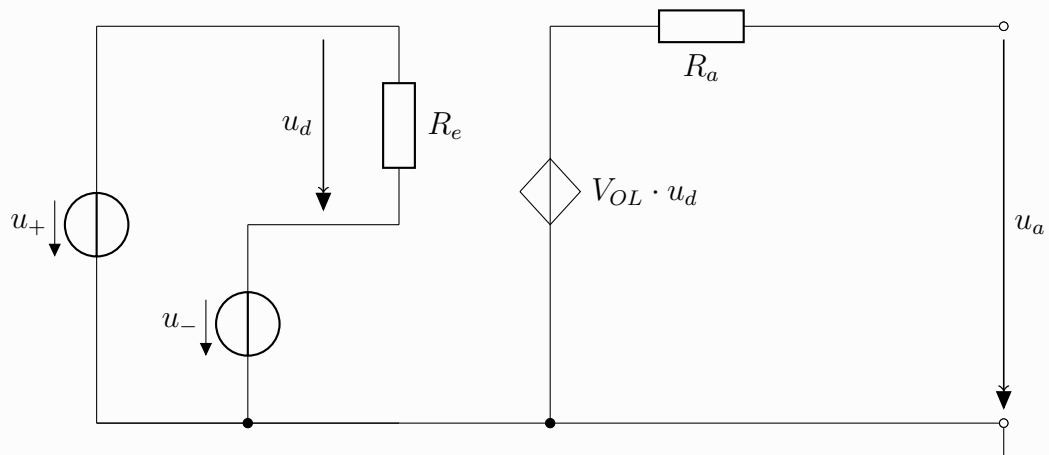
Komparator:



$$u_a = V_{OL} \cdot (u_2 - u_1)$$

$$u_a = \begin{cases} U_{a,\max} & \text{für } u_1 < u_2 \\ 0 \text{ V} & \text{für } u_1 = u_2 \\ U_{a,\min} & \text{für } u_1 > u_2 \end{cases}$$

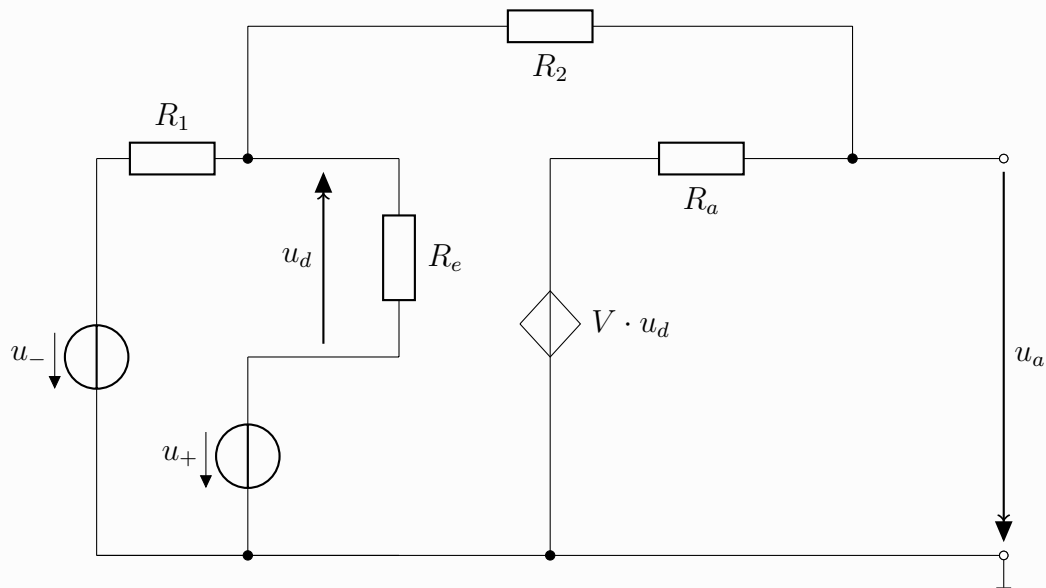
Ersatzschaltbild OpenLoop



Idealer Operationsverstärker

- $R_e = \infty$
- $R_a = 0$
- $V = \infty$

Ersatzschaltbild mit Rückkopplung



Idealer Operationsverstärker

- $R_e = \infty$
- $R_a = 0$
- $V \rightarrow \infty \rightsquigarrow u_d = 0 \rightsquigarrow u_+ = u_- \rightsquigarrow$ keine Eingangsströme