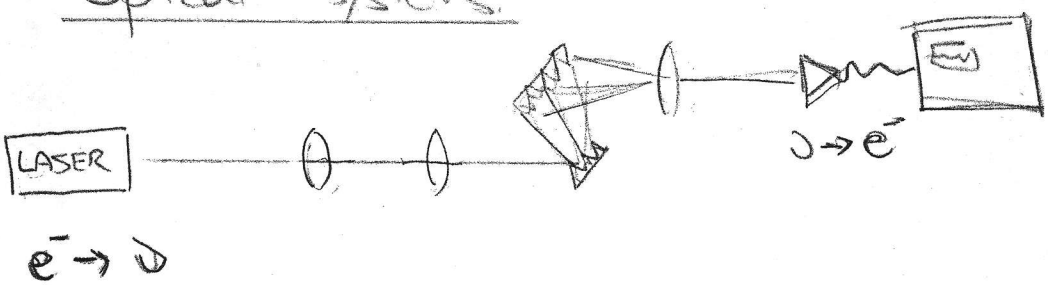
Optical systems:



Until now we discussed mostly the γ part of the set up. the rest of the course will be dedicated the to $\gamma \rightarrow e^-$ and e^- part of the system. Sources (i.e. $e^- \rightarrow \gamma$) part will not be discussed.

We will start with a review of basic (e^-) electronics building blocks. [A result of the previous course feedback]

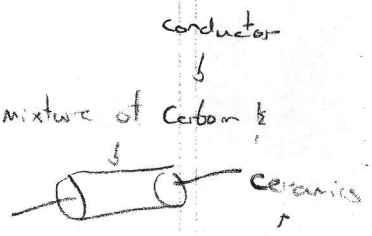
Horowitz & Hill "The art of electronics"

Resistors:

Ohm's law $\Rightarrow$ $V = IR$

highly linear $\Rightarrow$ $\Delta R < 10^{-7}$ / 1 Volt

two "standard" kinds:



Carbon composition: 2.7Ω $\leftrightarrow$ 22MΩ

up to 2W

Temp coeff: 10^{-3} / C° = $\frac{\Delta R}{R}$

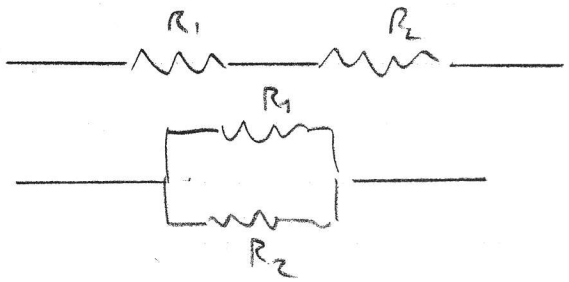
Tolerance: 10% ~ 1-2 NIS 5% ~ 5 NIS

Metal film: $10\,\Omega \leftrightarrow 200$ mW

up to 2W

Temp coeff: $\sim 5\times10^{-5}/C^\circ = \frac{\Delta R}{R}$

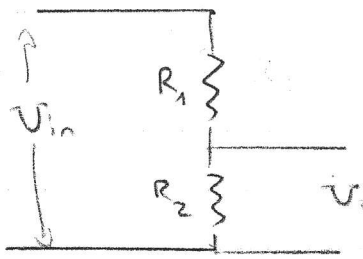
Tolerance : <1% 10-15 NIS



$R = R_1 + R_2$

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

Voltage devider:



$I = \frac{V_{in}}{R_1+R_2}$

$\Rightarrow V_{out} = IR_2 = \frac{R_2}{R_1+R_2} V_{in}$

Voltage source: maintains fixed voltage regardless of load.

for RF sources matched to load. $\Rightarrow$ transmission lines.

A "real life" voltage source: Max I $\Rightarrow$ small series resistance.

short circuit $\rightarrow$ 

a 9V Alkline battery: I_{max}: 3 Amp 3Ω series resistance.

Symbol: dc  ac 

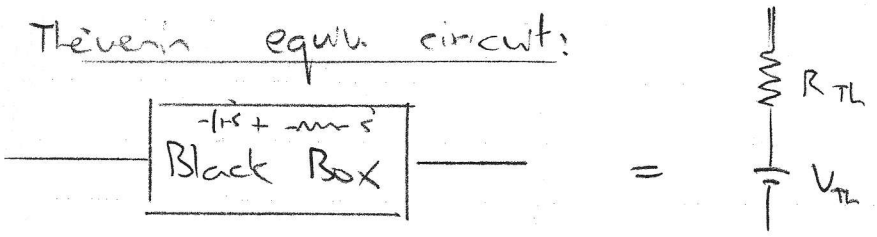
wants "open" circuit

Holes to be short circuited

Current source: Maintains a constant current regardless of load.

"real life" current sources have a max voltage they can supply.

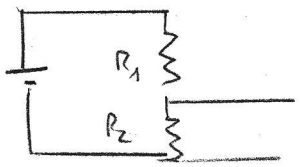
Thevenin equiv. circuit:



$V_{TL} = V(\text{open circuit})$

$$R_{TH} = \frac{V(\text{open circuit})}{I(\text{short circuit})}$$

Apply Thevenin to voltage divider:



$$V_{TH} = \frac{R_2}{R_1+R_2} V_{in}$$

$$R_{TH} = \frac{\frac{R_2}{R_1+R_2} V_{in}}{V_{in}/R_1} = \frac{R_1 R_2}{R_1+R_2}$$

$$\Rightarrow \frac{1}{R_{TH}} = \frac{1}{R_1} + \frac{1}{R_2} \quad \in \text{Parallel}$$

to make a voltage devider a good voltage source

$\Rightarrow R_{TH} \to 0 \Rightarrow R_1, R_2 \to 0$ large constant current