

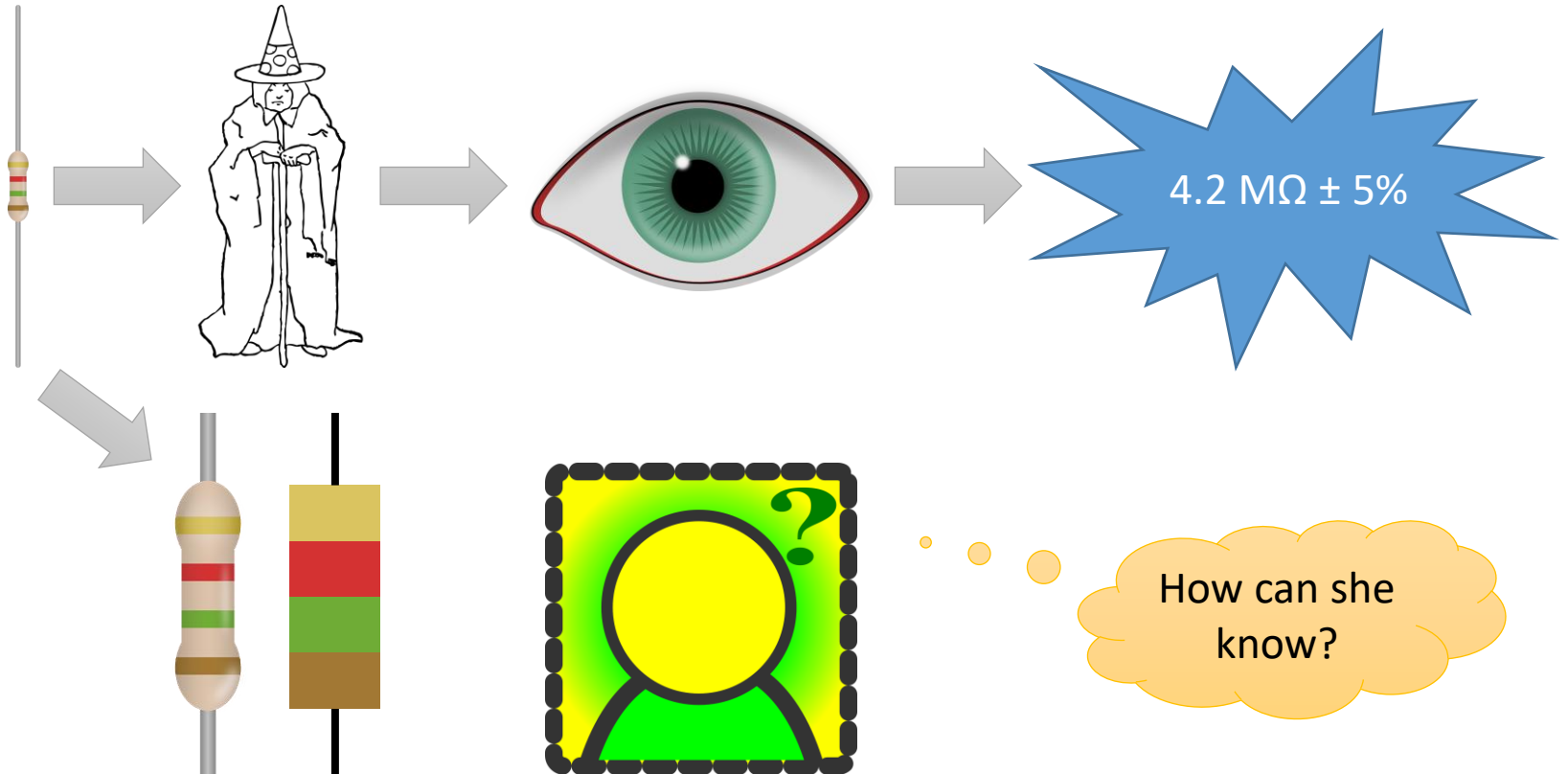
Color Codes and Marking

Electrical Engineering

Wolfgang Neff

Resistor Color Codes (1)

- The oracle of resistors



Resistor Color Codes (2)

- How to read resistors

5-Band-Resistor



$$234 * 100k\Omega = 23.4M\Omega @ 0.25\%$$

| Color | Band 1 | Band 2 | Band 3 | Multiplic. | Tolerance |
|--------|--------|--------|--------|----------------------------|--------------|
| Black | 0 | 0 | 0 | 10^0 (1 Ω) | |
| Brown | 1 | 1 | 1 | 10^1 (10 Ω) | $\pm 1\%$ |
| Red | 2 | 2 | 2 | 10^2 (100 Ω) | $\pm 2\%$ |
| Orange | 3 | 3 | 3 | 10^3 (1k Ω) | |
| Yellow | 4 | 4 | 4 | 10^4 (10k Ω) | |
| Green | 5 | 5 | 5 | 10^5 (100k Ω) | $\pm 0.5\%$ |
| Blue | 6 | 6 | 6 | 10^6 (1M Ω) | $\pm 0.25\%$ |
| Purple | 7 | 7 | 7 | 10^7 (10M Ω) | $\pm 0.1\%$ |
| Gray | 8 | 8 | 8 | 10^8 (100M Ω) | $\pm 0.05\%$ |
| White | 9 | 9 | 9 | 10^9 (1G Ω) | |
| Gold | | | | 10^{-1} (100m Ω) | $\pm 5\%$ |
| Silver | | | | 10^{-2} (10m Ω) | $\pm 10\%$ |

4-Band-Resistor



$$23 * 10k\Omega = 230k\Omega @ 0.5\%$$

Resistor Color Codes (3)

- Mnemonic

- **0** light makes everything **black**



- My **1** cent coin is **brown**



- My girlfriend has **2** red lips



- **3** has learned nothing and must sell **oranges**

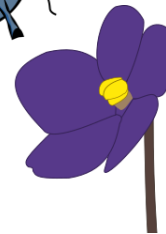
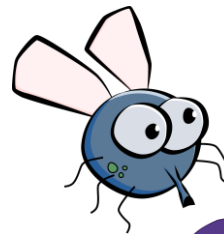


- The **yellow** cab has **4** wheels



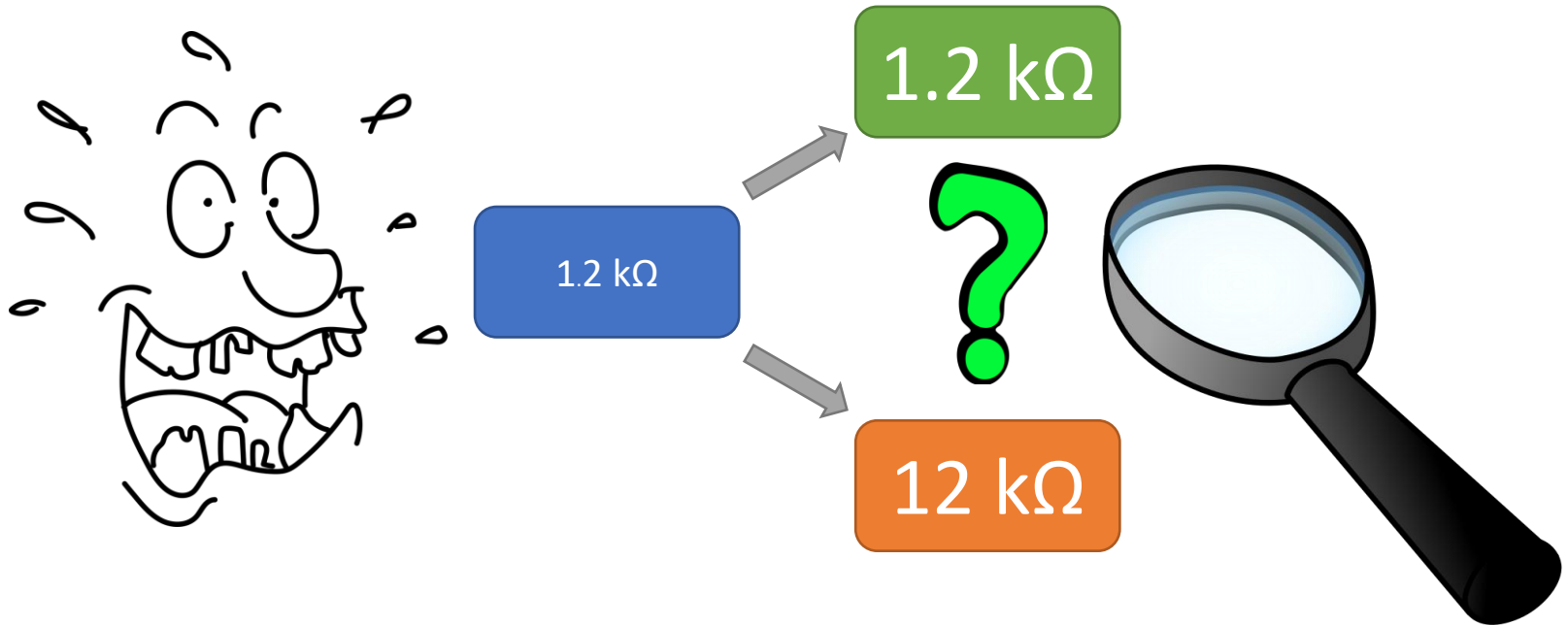
Resistor Color Codes (4)

- Mnemonic (continued)
 - **5 green** banknotes make me happy
 - 50 Stutz are **green**
 - 5 marks were **green**
 - The **blue** fly has **6** legs
 - **7 violets** for Snow White
 - When I am **80** I will have **grey** hair
 - When I am **90** I will have **white** hair



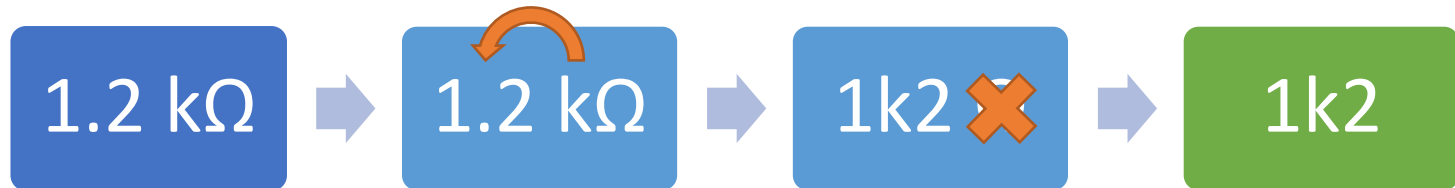
Marking of Components (1)

- Ever missed a decimal point?



Marking of Components (2)

- Let's make it more evident



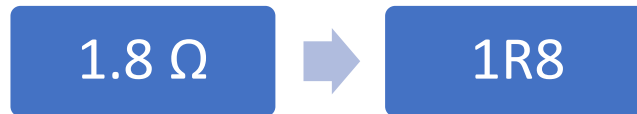
The decimal point gets replaced by the unit prefix

The unit itself gets dropped

Special Cases



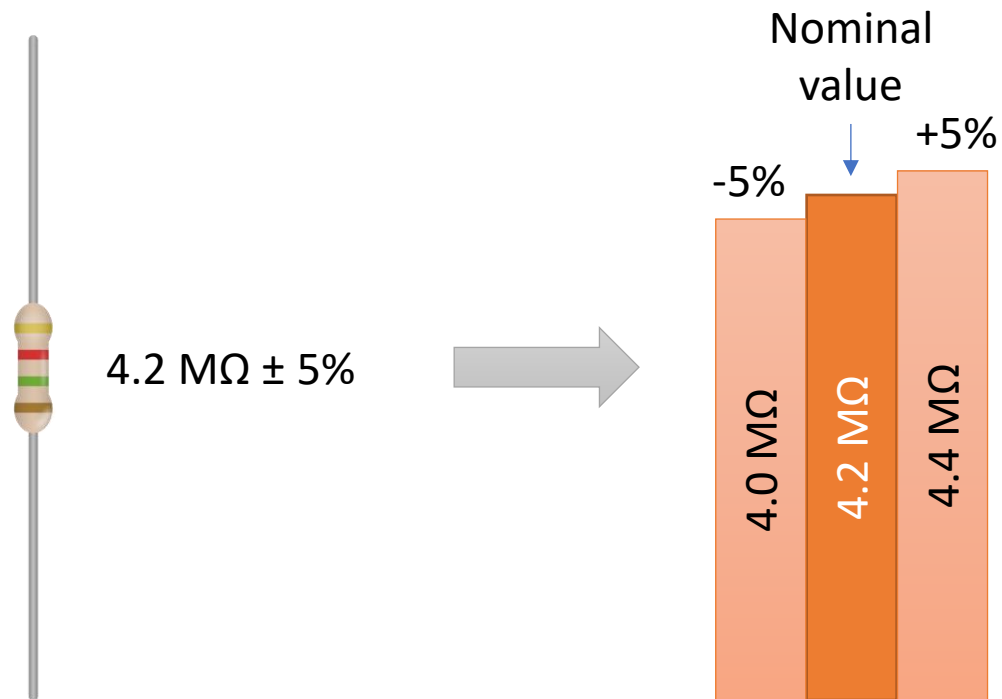
There are no trailing zeros



The symbol is used if there is no prefix

Preferred Values (1)

- Resistors have tolerances

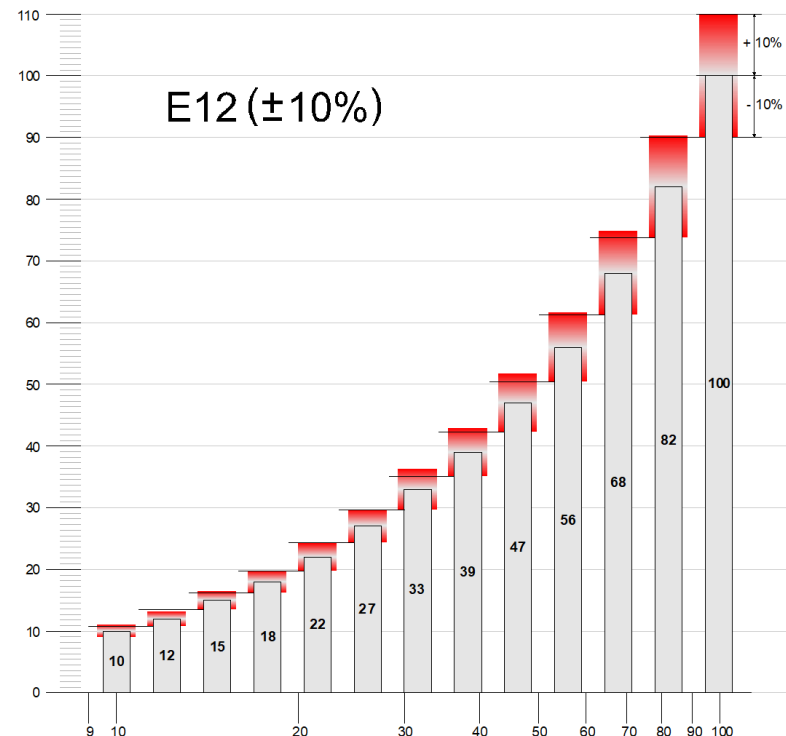
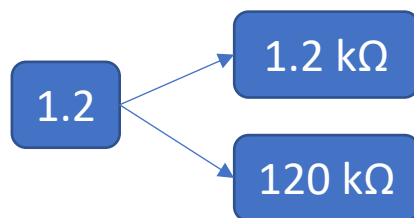


Preferred Values (2)

- Thanks to tolerance only certain values are needed

| E12 Series | | |
|------------|-----|-----|
| 1.0 | 1.2 | 1.5 |
| 1.8 | 2.2 | 2.7 |
| 3.3 | 3.9 | 4.7 |
| 5.6 | 6.8 | 8.2 |

These values are decades



Source: Wikimedia Commons – E12 series 10% tolerance