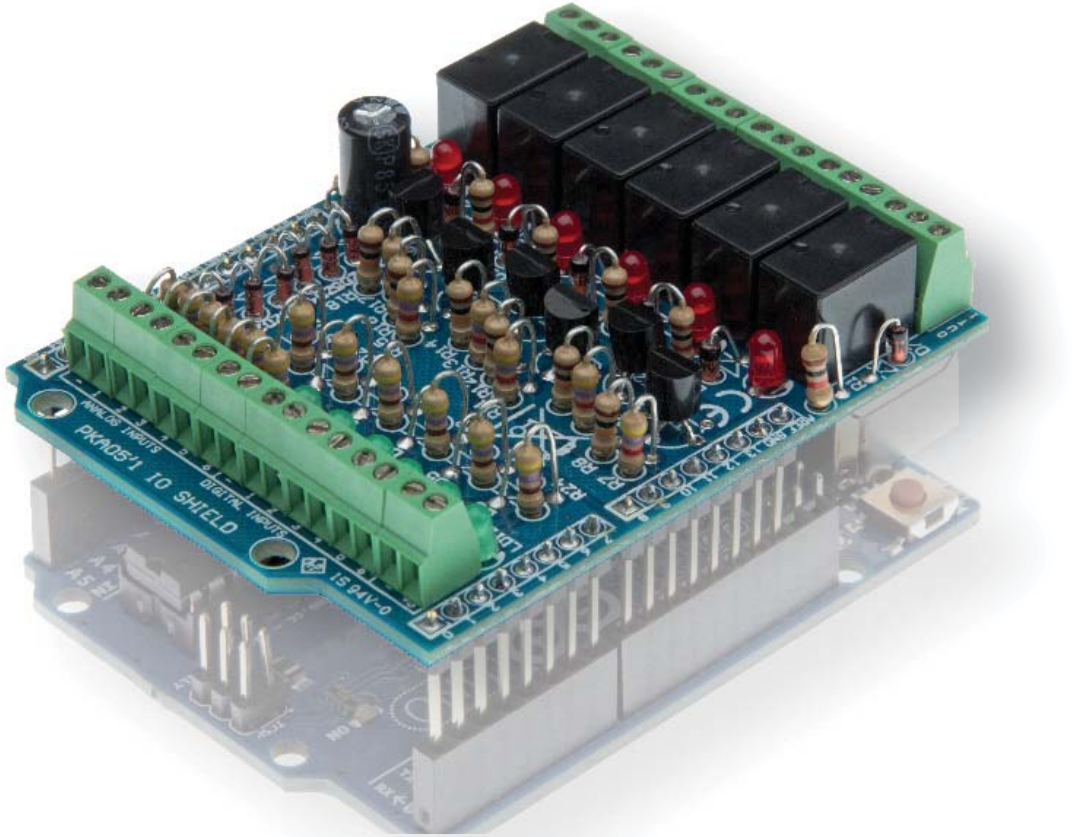
KA05

ILLUSTRATED ASSEMBLY MANUAL HKA05P'1

IN/OUT shield for Arduino®



General purpose INPUT - OUTPUT shield for Arduino®

Features

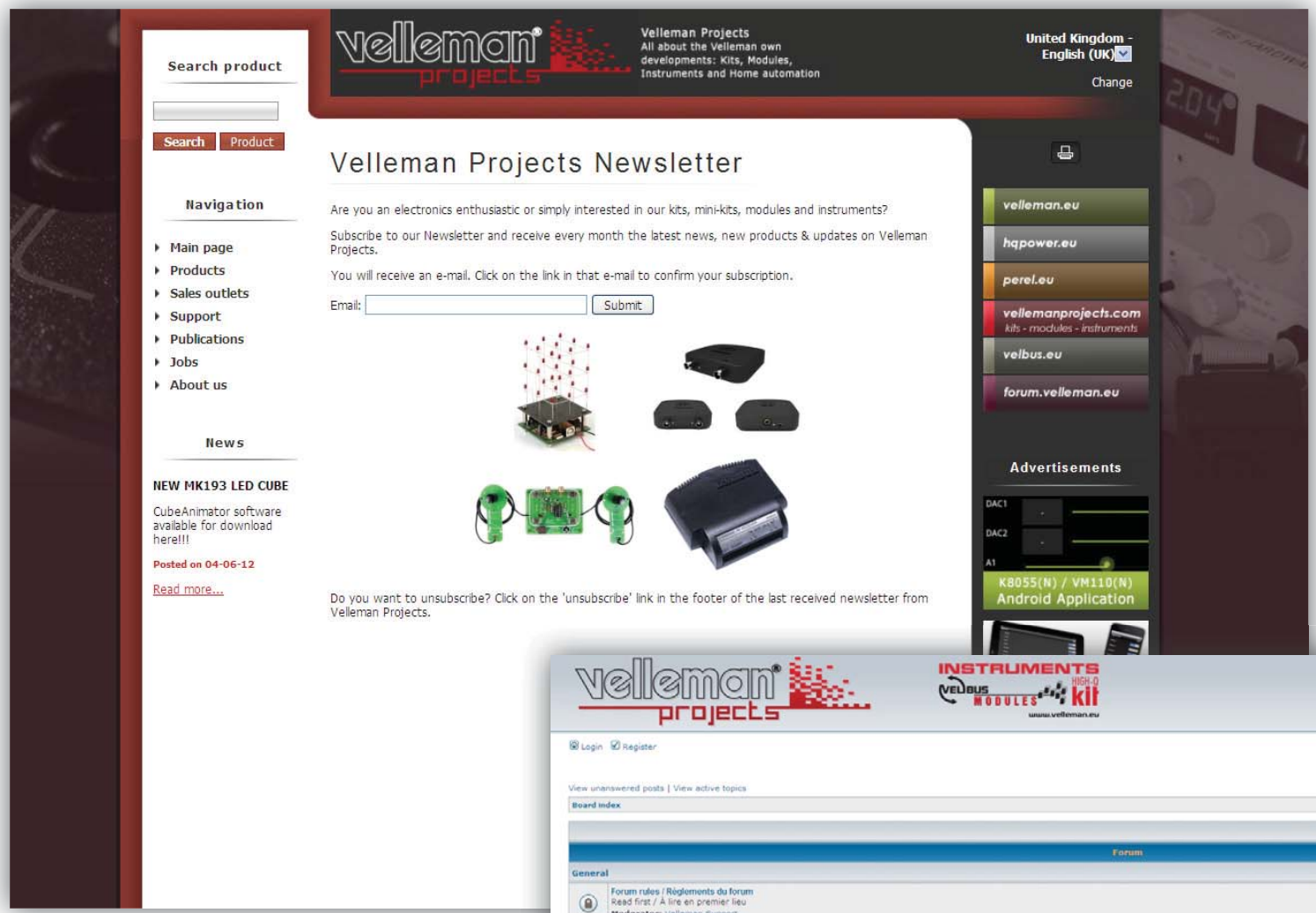
- For use with Arduino Due™, Arduino Uno™, Arduino Mega™
- 6 analog inputs
- 6 digital input
- 6 relay contact outputs
- Indicator leds for relay outputs and digital inputs

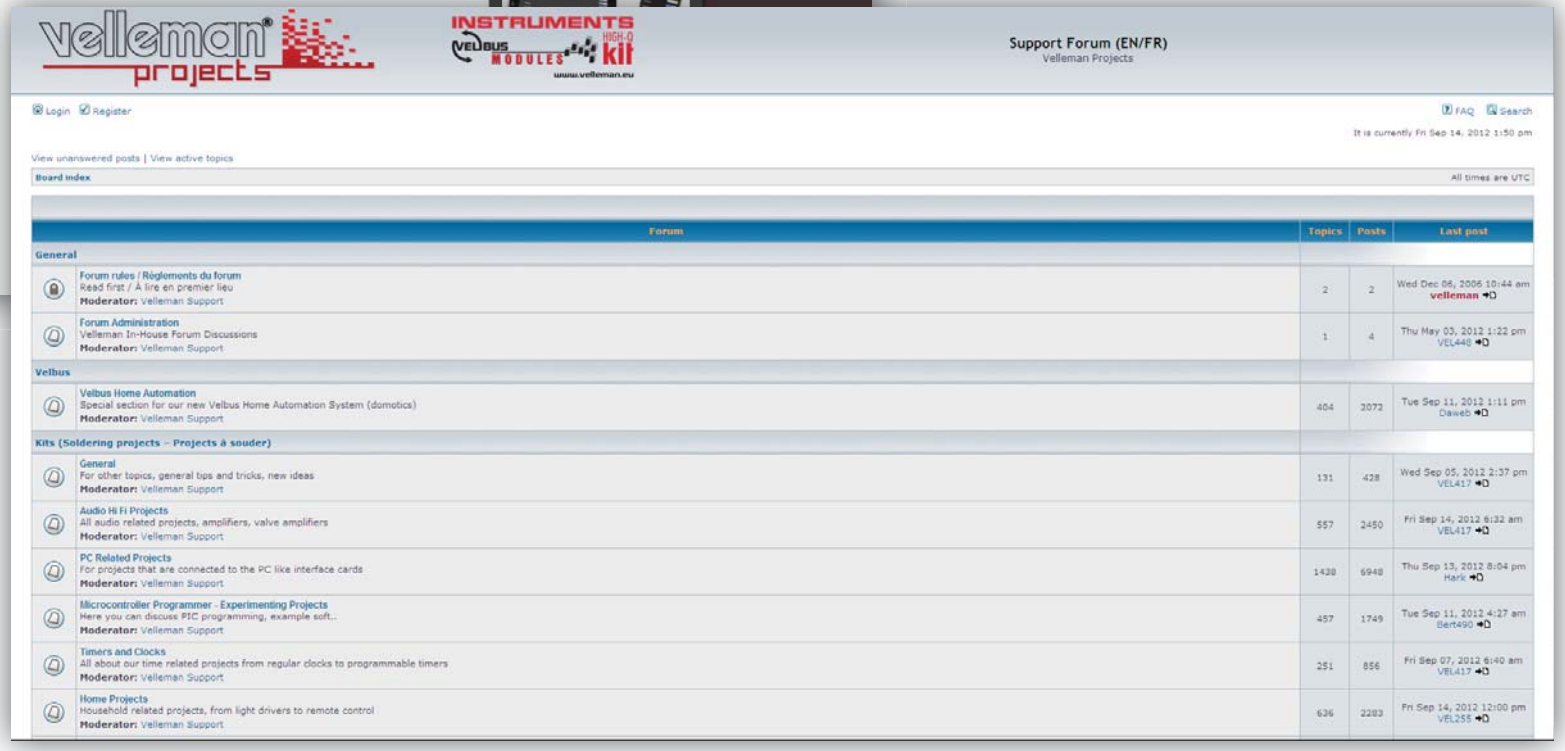
Specifications

- Analog inputs: 0..+5VDC
- Digital inputs: dry contact or open collector
- Relays: 12V
- Relay contacts: NO/NC 24VDC/1A max.
- Dimensions: 68 x 53mm / 2.67 x 2.08"

velleman® projects

Made for ARDUINO™





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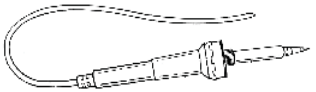
Velleman N.V.
Legen Heirweg 33
9890 Gavere
(België)

assembly hints

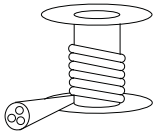
1. Assembly (Skipping this can lead to troubles !)

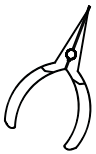
Ok, so we have your attention. These hints will help you to make this project successful. Read them carefully.

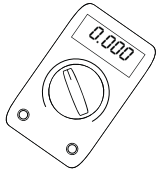


1.1 Make sure you have the right tools:

- A good quality soldering iron (25-40W) with a small tip.
- Wipe it often on a wet sponge or cloth, to keep it clean; then apply solder to the tip, to give it a wet look. This is called ‘thinning’ and will protect the tip, and enables you to make good connections. When solder rolls off the tip, it needs cleaning.
- Thin raisin-core solder. Do not use any flux or grease.
- A diagonal cutter to trim excess wires. To avoid injury when cutting excess leads, hold the lead so they cannot fly towards the eyes.
- Needle nose pliers, for bending leads, or to hold components in place.
- Small blade and Phillips screwdrivers. A basic range is fine.







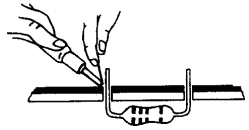
☝ For some projects, a basic multi-meter is required, or might be handy

1.2 Assembly Hints :

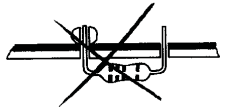
- Make sure the skill level matches your experience, to avoid disappointments.
- Follow the instructions carefully. Read and understand the entire step before you perform each operation.
- Perform the assembly in the correct order as stated in this manual
- Position all parts on the PCB (Printed Circuit Board) as shown on the drawings.
- Values on the circuit diagram are subject to changes, the values in this assembly guide are correct*
- Use the check-boxes to mark your progress.
- Please read the included information on safety and customer service

* Typographical inaccuracies excluded. Always look for possible last minute manual updates, indicated as ‘NOTE’ on a separate leaflet.

1.3 Soldering Hints :

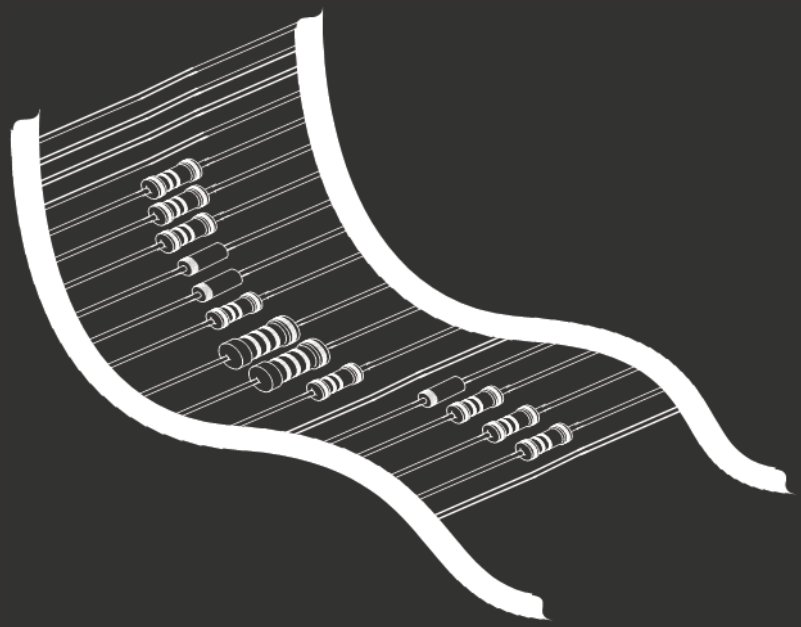


1. Mount the component against the PCB surface and carefully solder the leads



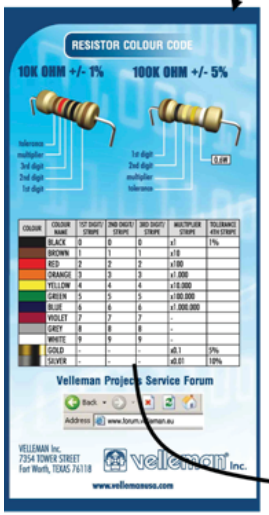
2. Make sure the solder joints are cone-shaped and shiny

3. Trim excess leads as close as possible to the solder joint

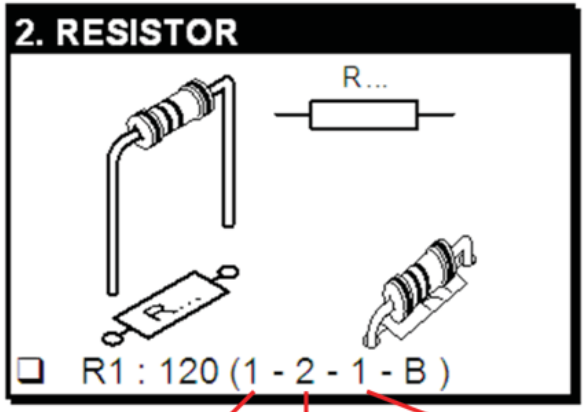


REMOVE THEM FROM THE TAPE ONE AT A TIME !

Included in this kit



2. RESISTOR

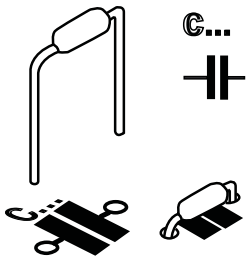


COLOUR	COLOUR NAME	1ST DIGIT/ STRIPE	2ND DIGIT/ STRIPE	3RD DIGIT/ STRIPE	MULTIPLIER STRIPE	TOLE 4TH
	BLACK	0	0	0	x1	1%
	BROWN	1	1	1	x10	
	RED	2	2	2	x100	
	ORANGE	3	3	3	x1.000	
	YELLOW	4	4	4	x10.000	
	GREEN	5	5	5	x100.000	
	BLUE	6	6	6	x1.000.000	

DO NOT BLINDLY FOLLOW THE ORDER OF THE COMPONENTS ONTO THE TAPE. ALWAYS CHECK THEIR VALUE ON THE PARTS LIST!

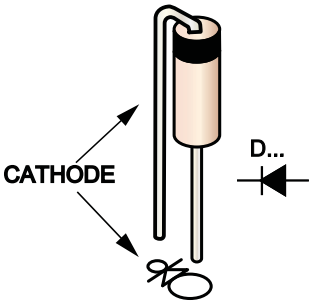
I CONSTRUCTION

1 Ceramic capacitor



- ❑ C2: 100nF (104)

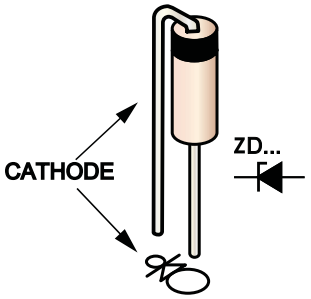
2 Diodes



Watch the polarity!

- ❑ D1 : 1N4148
- ❑ D2 : 1N4148
- ❑ D3 : 1N4148
- ❑ D4 : 1N4148
- ❑ D5 : 1N4148
- ❑ D6 : 1N4148
- ❑ D7 : 1N4148
- ❑ D8 : 1N4148
- ❑ D9 : 1N4148
- ❑ D10:1N4148
- ❑ D11:1N4148
- ❑ D12:1N4148

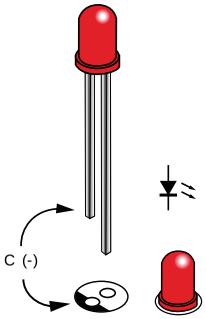
3 Zenerdiodes



- ❑ ZD1 : 5V1
- ❑ ZD2 : 5V1
- ❑ ZD3 : 5V1
- ❑ ZD4 : 5V1
- ❑ ZD5 : 5V1
- ❑ ZD6 : 5V1

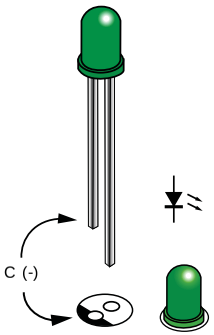
Watch the polarity!

4 LED



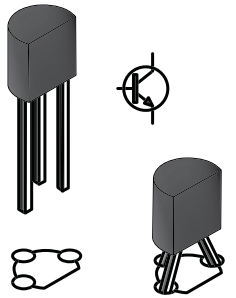
- ❑ LD1 : Red
- ❑ LD2 : Red
- ❑ LD3 : Red
- ❑ LD4 : Red
- ❑ LD5 : Red
- ❑ LD6 : Red

Watch the polarity!



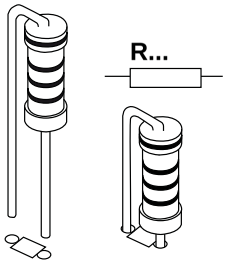
- ❑ LD7 : Green
- ❑ LD8 : Green
- ❑ LD9 : Green
- ❑ LD10 : Green
- ❑ LD11 : Green
- ❑ LD12 : Green

5 Transistors



- ❑ T1: BC547B
- ❑ T2: BC547B
- ❑ T3: BC547B
- ❑ T4: BC547B
- ❑ T5: BC547B
- ❑ T6: BC547B

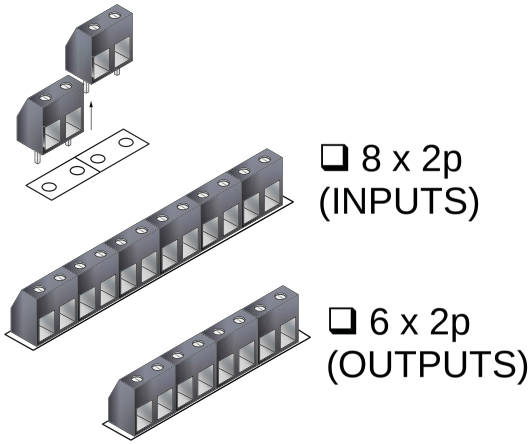
6 Resistors



- ❑ R1 : 1K (1 - 0 - 2 - B)
- ❑ R2 : 1K (1 - 0 - 2 - B)
- ❑ R3 : 1K (1 - 0 - 2 - B)
- ❑ R4 : 1K (1 - 0 - 2 - B)
- ❑ R5 : 1K (1 - 0 - 2 - B)
- ❑ R6 : 1K (1 - 0 - 2 - B)
- ❑ R7 : 4K7 (4 - 7 - 2 - B)
- ❑ R8 : 10K (1 - 0 - 3 - B)
- ❑ R9 : 4K7 (4 - 7 - 2 - B)
- ❑ R10: 10K (1 - 0 - 3 - B)
- ❑ R11: 4K7 (4 - 7 - 2 - B)
- ❑ R12: 10K (1 - 0 - 3 - B)

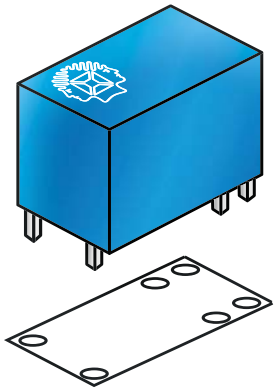
- ❑ R13: 4K7 (4 - 7 - 2 - B)
- ❑ R14: 10K (1 - 0 - 3 - B)
- ❑ R15: 4K7 (4 - 7 - 2 - B)
- ❑ R16: 10K (1 - 0 - 3 - B)
- ❑ R17: 4K7 (4 - 7 - 2 - B)
- ❑ R18: 10K (1 - 0 - 3 - B)
- ❑ R19: 470 (4 - 7 - 1 - B)
- ❑ R20: 470 (4 - 7 - 1 - B)
- ❑ R21: 470 (4 - 7 - 1 - B)
- ❑ R22: 470 (4 - 7 - 1 - B)
- ❑ R23: 470 (4 - 7 - 1 - B)
- ❑ R24: 470 (4 - 7 - 1 - B)
- ❑ R25: 4K7 (4 - 7 - 2 - B)
- ❑ R26: 4K7 (4 - 7 - 2 - B)
- ❑ R27: 4K7 (4 - 7 - 2 - B)
- ❑ R28: 4K7 (4 - 7 - 2 - B)
- ❑ R29: 4K7 (4 - 7 - 2 - B)
- ❑ R30: 4K7 (4 - 7 - 2 - B)

7 Terminal blocks



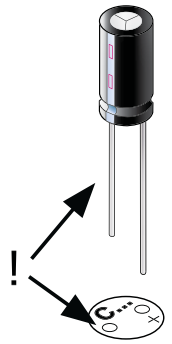
- ❑ 8 x 2p (INPUTS)
- ❑ 6 x 2p (OUTPUTS)

8 Relays

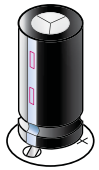


- ❑ RY1
- ❑ RY2
- ❑ RY3
- ❑ RY4
- ❑ RY5
- ❑ RY6

9 Electrolytic capacitors

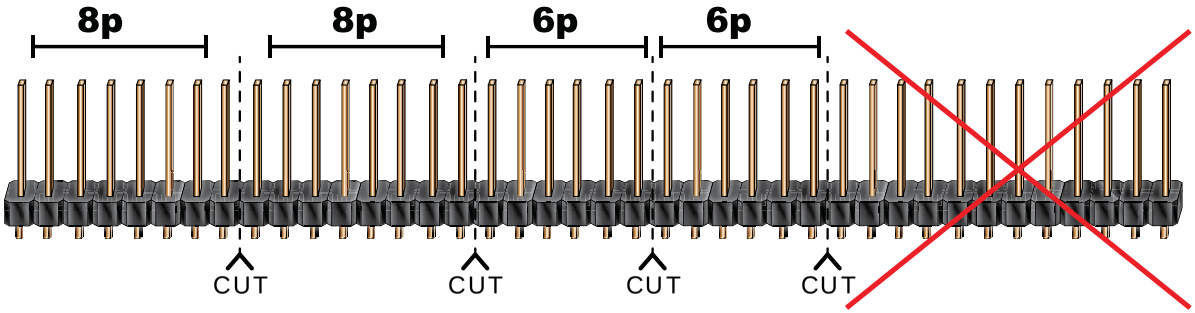


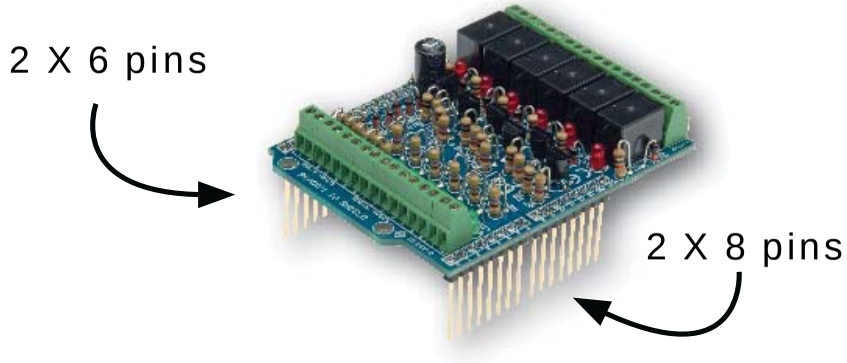
Watch the polarity!



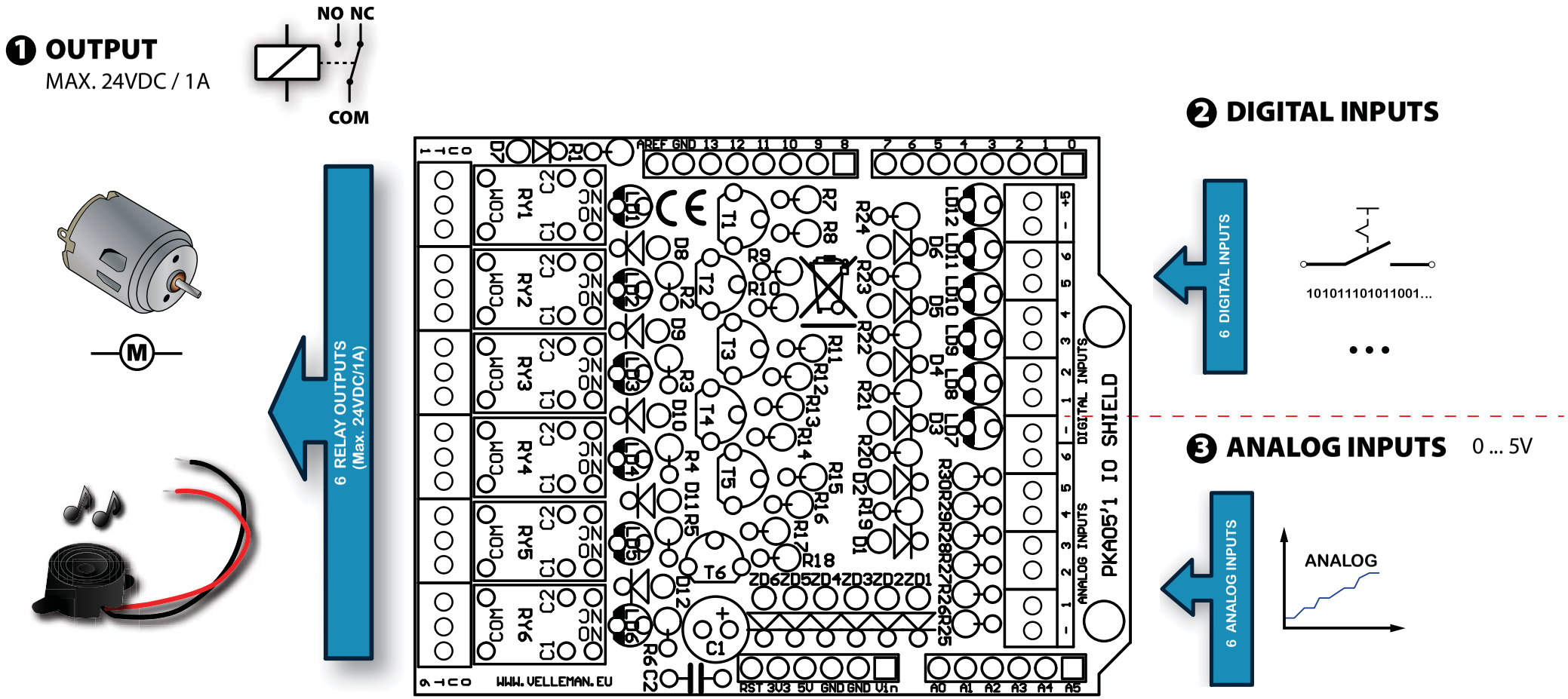
- ❑ C1 : 100µF

10 Male header

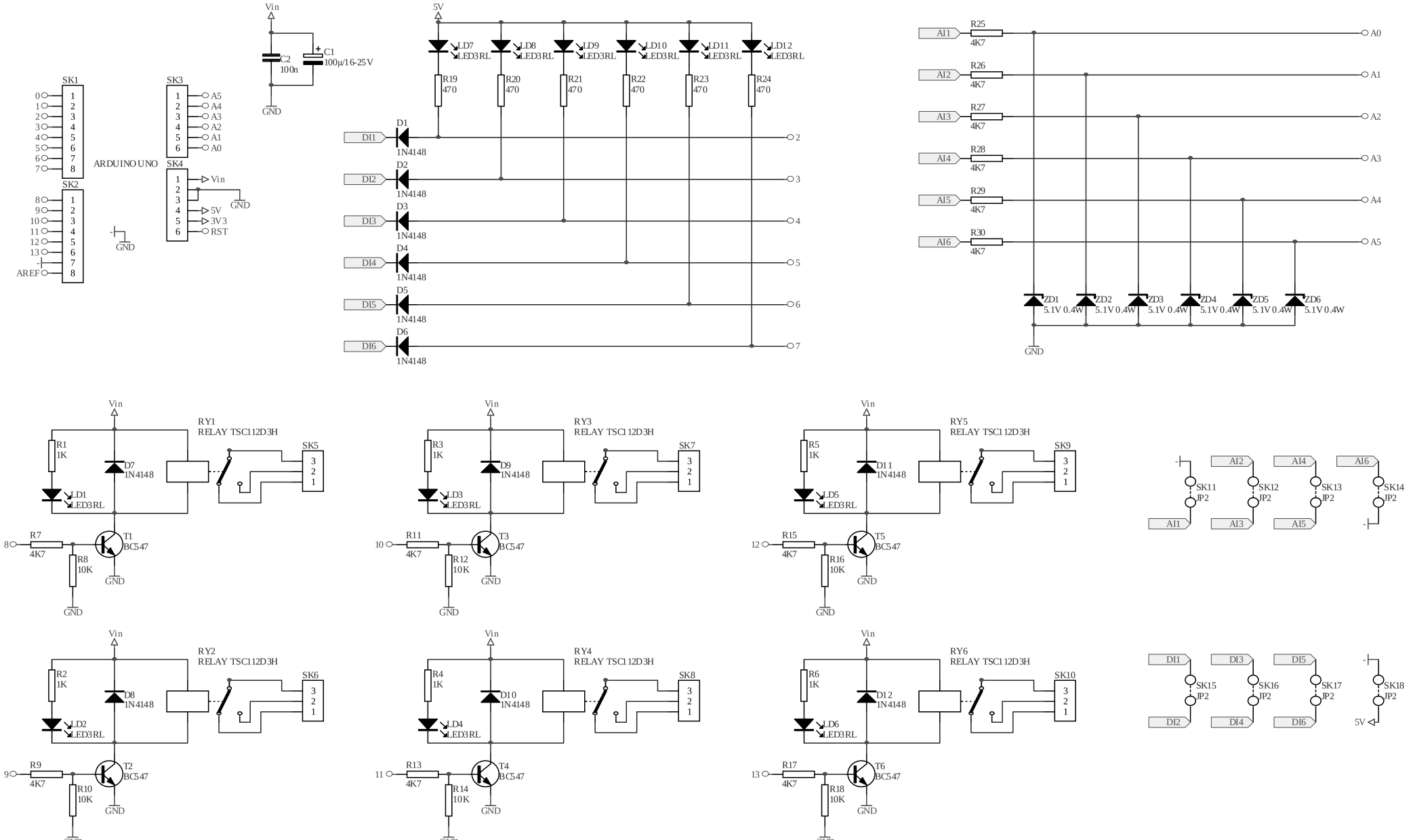


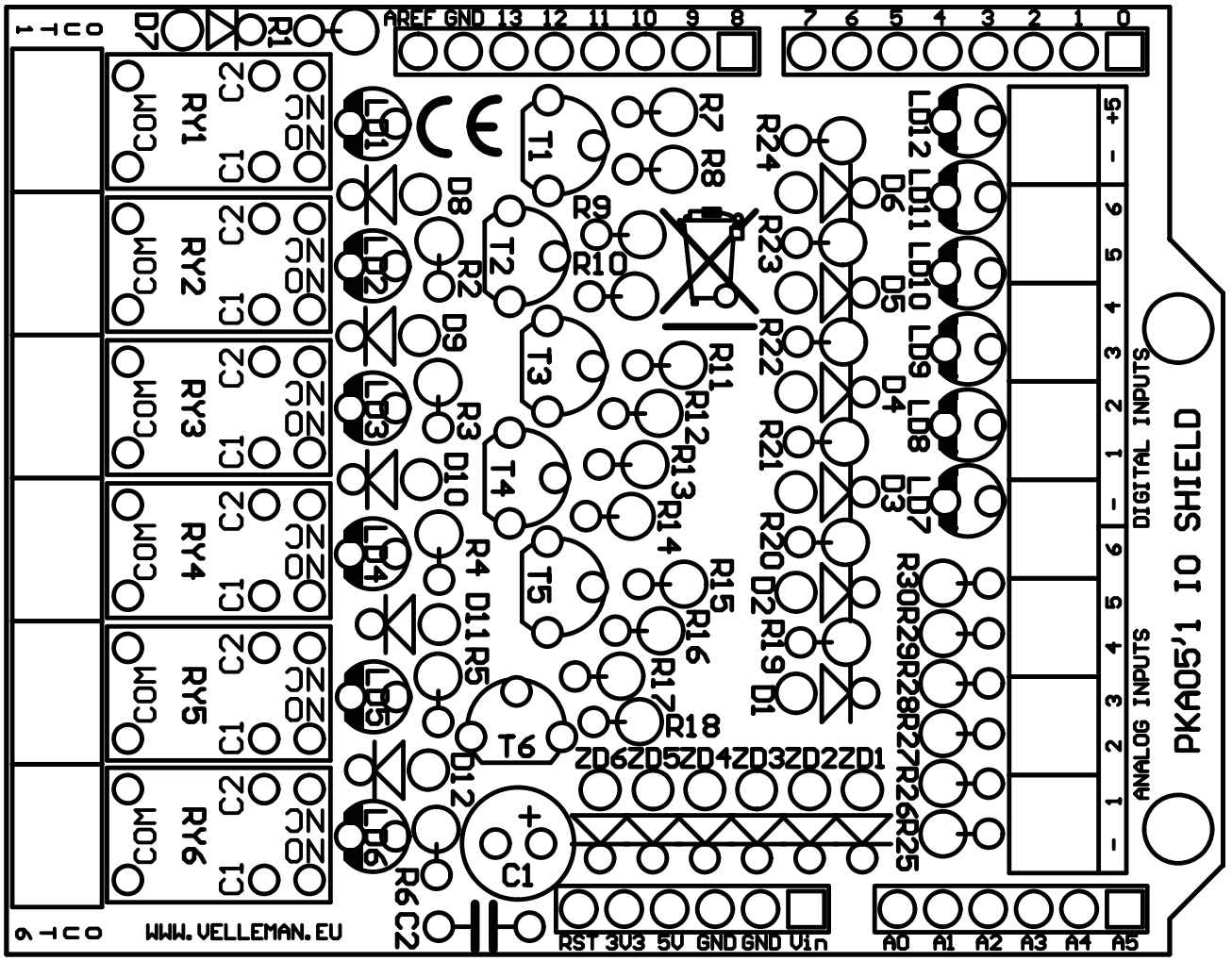


II CONNECTION DIAGRAM

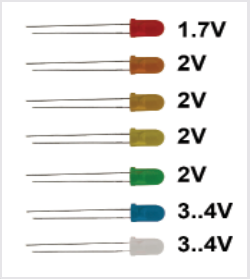


DOWNLOAD SAMPLE CODE FROM KA05 PAGE ON WWW.VELLEMAN.BE

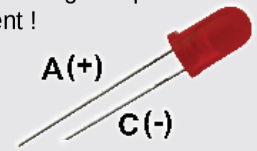

SK1
SK2
SK3
SK4
ARDUINO UNO
AREF
GND
Vin
5V
3V3
RST
A5
A4
A3
A2
A1
A0
C1
100µ/16-25V
C2
100n
LD7 LED3RL
LD8 LED3RL
LD9 LED3RL
LD10 LED3RL
LD11 LED3RL
LD12 LED3RL
R19 470
R20 470
R21 470
R22 470
R23 470
R24 470
D1 1N4148
D2 1N4148
D3 1N4148
D4 1N4148
D5 1N4148
D6 1N4148
DI1
DI2
DI3
DI4
DI5
DI6
R25 4K7
R26 4K7
R27 4K7
R28 4K7
R29 4K7
R30 4K7
AI1
AI2
AI3
AI4
AI5
AI6
ZD1 5.1V 0.4W
ZD2 5.1V 0.4W
ZD3 5.1V 0.4W
ZD4 5.1V 0.4W
ZD5 5.1V 0.4W
ZD6 5.1V 0.4W
RY1 RELAY TSC112D3H
RY2 RELAY TSC112D3H
RY3 RELAY TSC112D3H
RY4 RELAY TSC112D3H
RY5 RELAY TSC112D3H
RY6 RELAY TSC112D3H
R1 1K
R2 1K
R3 1K
R4 1K
R5 1K
R6 1K
D7 1N4148
D8 1N4148
D9 1N4148
D10 1N4148
D11 1N4148
D12 1N4148
LD1 LED3RL
LD2 LED3RL
LD3 LED3RL
LD4 LED3RL
LD5 LED3RL
LD6 LED3RL
R7 4K7
R8 10K
R9 4K7
R10 10K
R11 4K7
R12 10K
R13 4K7
R14 10K
R15 4K7
R16 10K
R17 4K7
R18 10K
T1 BC547
T2 BC547
T3 BC547
T4 BC547
T5 BC547
T6 BC547
SK5
SK6
SK7
SK8
SK9
SK10
SK11 JP2
SK12 JP2
SK13 JP2
SK14 JP2
SK15 JP2
SK16 JP2
SK17 JP2
SK18 JP2

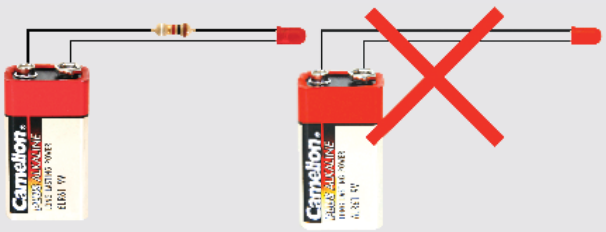

PKA05'1 IO SHIELD
WWW.VELLEMAN.EU
DIGITAL INPUTS
ANALOG INPUTS
AREF GND 13 12 11 10 9 8
7 6 5 4 3 2 1 0
RST 3V3 5V GND GND Vin
A0 A1 A2 A3 A4 A5
RY1
RY2
RY3
RY4
RY5
RY6
ZD6ZD5ZD4ZD3ZD2ZD1

Leds and how to use them

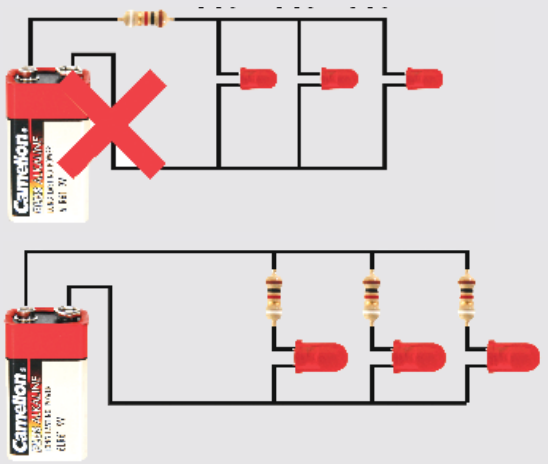


Leds feature a specific voltage drop, depending on type and colour. Check the datasheet for exact voltage drop and rated current !





Never connect leds in parallel



How to Calculate the series resistor:

Example: operate a red led (1.7V) on a 9Vdc source.
Required led current for full brightness: 5mA (this can be found in the datasheet of the led)

$$\frac{\text{Supply voltage (V) - led voltage (V)}}{\text{required current (A)}} = \text{series resistance (ohms)}$$

$$\rightarrow \quad \frac{9V - 1.7V}{0.005A} = 1460 \text{ ohm}$$

closest value :
use a 1k5 resistor

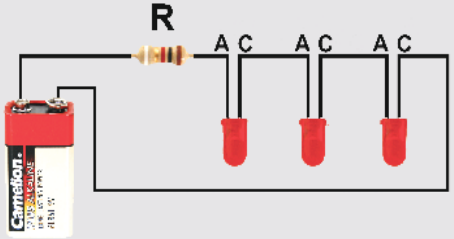
Required resistor power handling=
voltage over resistor x current passed trough resistor

$$\rightarrow \quad (9V - 1.7V) \times 0.005A = 0.036W$$

a standard 1/4W resistor will do the job

LEDs in series:

Example: 3 x red led (1.7V) on 9V battery
Required led current for full brightness: 5mA
(this can be found in the datasheet of the led)



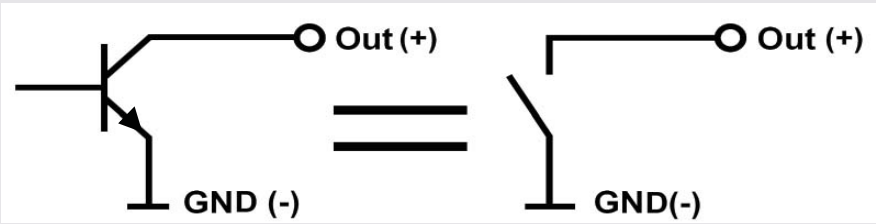
$$\frac{\text{Supply voltage (V) - (number of leds x led voltage (V))}}{\text{required current (A)}} = \text{series resistance (ohms)}$$

$$\rightarrow \quad \frac{9V - (3 \times 1.7V)}{0.005A} = 780 \text{ ohm}$$

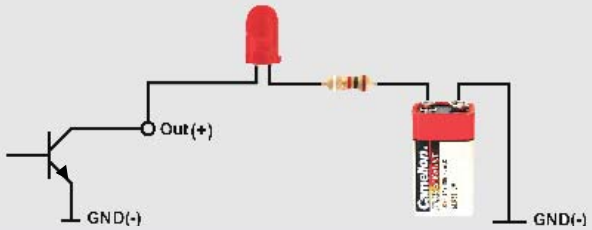
use an
820 ohm resistor

open collector outputs

An open collector output can be compared to a switch which switches to ground when operated



Example: How to switch an LED by means of an open collector output



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