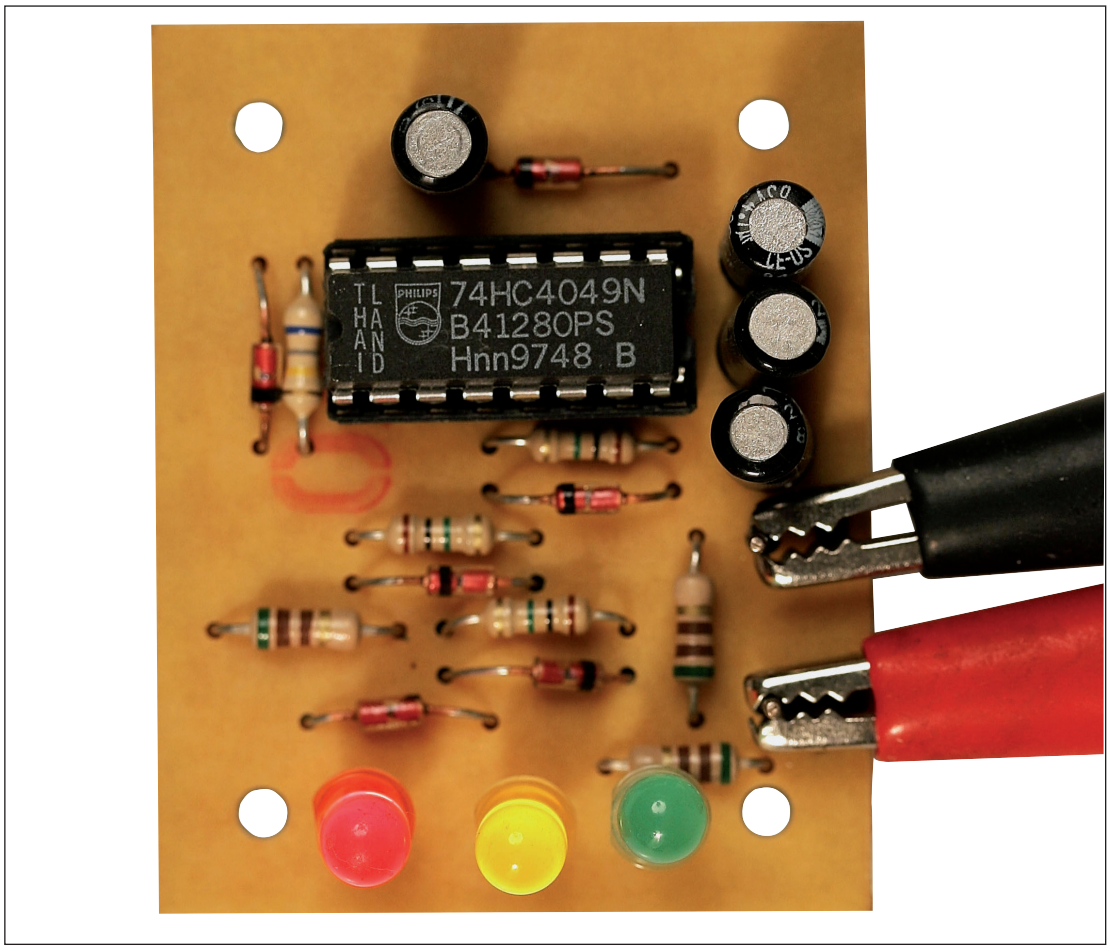
OPITEC

110.202
Traffic lights



Please Note

The OPITEC range of projects is not intended as play toys for young children.They are teaching aids for young people learning the skills of Craft, Design and Technolo- gy.These projects should only be undertaken and tested with the guidance of a fully qualified adult. The finished projects are not suitable to give to children under 3 years old. Some parts can be swallowed. Dan- ger of suffocation!

1. Product information:

Article: Electronic project;

Suitability: Key Stage 3/4 Age 12-16 years;

2. Material information: Electronic components and other parts:

Insulated wire: Multi strand insulated wire (0,14 mm^2);

Circuit board: Epoxy resin glass fibre board with copper tracks
The base on which the components are soldered;

LED: **L**ight **E**mitting **D**iode
Semi Conductor
Cathode (-) short leg, flat side.
Anode (+) longer leg.

IC: **I**ntegrated **C**ircuit
ICs are separate fully and functioning, they have many in built active (transistors) and passive (diodes, resistance, capacitors) components. The switching elements are fully enclosed. A single IC can carry out 2 to over 100,000 functions. Take care when you are inserting ICs !!!

Resistors: These guide the current (large resistance=low current small resistance=larger current flow)
Resistors are marked with coloured rings:
510 Ω: Green-brown -brown
680 kΩ: Blue-grey-yellow
1MΩ: Brown- black- green

Diode: Semi conductor
Cathode (-) this is identified by a black ring on the component.

Capacitor: Electrolytic type
Stores electrons. ***Watch the polarity!*** (minus pole is clearly marked)

Soldering pins: silver plated pins to mount components;

Working: Components are mounted on the top of the board and soldered underneath. The protruding component legs can be cut off with snips.;

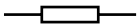
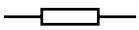
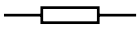
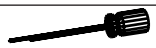
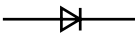
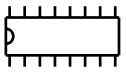
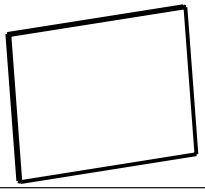
Note! Components can be overheated and damaged (excess heat can be diverted by holding the components with pliers when soldering)

Finish: The circuit board does not need any further treatment;

3. Tools:

Soldering: To solder the components to the board a 15-30W soldering iron is necessary. When working on the board hold it in a vice or use a "helping hands tool" so that both hands can be kept free.;

4. Parts list:

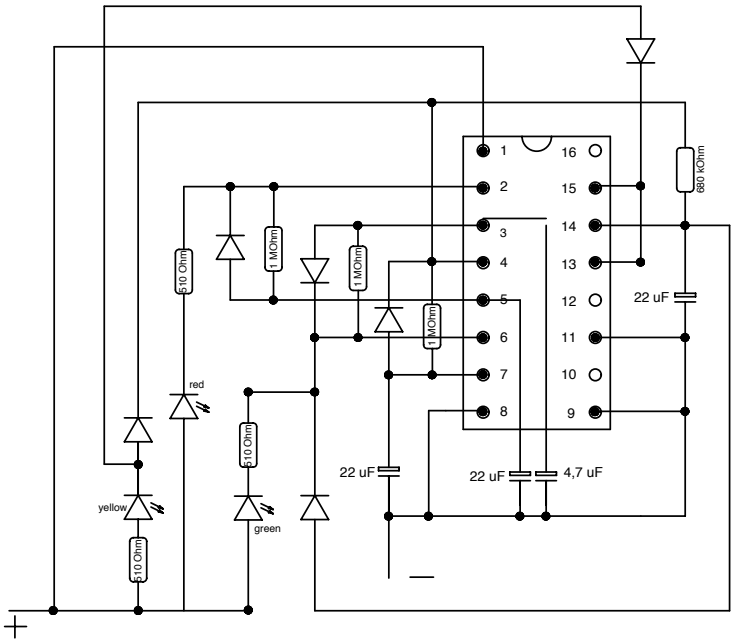
Component	Value/mesure	Quant.	Drawing / part N°	Symbol
LED	red, ø 5mm	1		
LED	yellow, ø 5mm	1		
LED	green, ø 5mm	1		
Resistor	510 Ω	3		
Resistor	680 kΩ	1		
Resistor	1 MΩ	3		
Capacitor	4,7 μF	1		
Capacitor	22 μF	3		
Diode	1N4148	6		
IC Holder	16 pole	1		
IC C-MOS (High speed)	74HC4049	1		
Insulated wire	0,5 m	1		
Soldering pins		2		
Circuit board		1		

International resistor colour code

To identify the correct value of the resistors

Colour ring	1st ring	2nd ring	3rd ring/ multiplier	4th ring/ tolerance
Black	0	0	1	Colour:
Brown,	1	1	10	Brown 1%
Red,	2	2	100	Red 2%
Orange,	3	3	1000	Gold 5%
Yellow,	4	4	10000	Silver 10%
Green,	5	5	100000	None 20%
Blue,	6	6	1000000	
Violet,	7	7		
Grey,	8	8		
White,	9	9		
Gold	-	-	0,1	
Silver	-	-	0,01	

5. Circuit diagram:



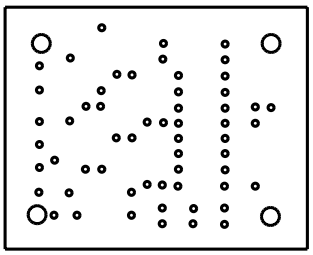
6. Circuit Description:

Connect the circuit to a 4.5 volt power source (Take care with the polarity)

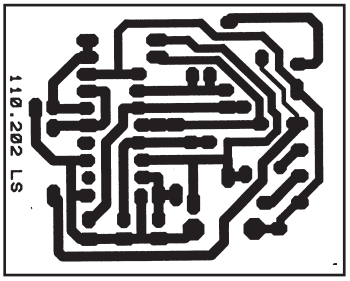
The traffic lights operate on the German operational sequence eg Green, amber, red and amber then green again, wherby the red and green phases are somewhat longer. If you leave out the diodes marked X on the circuit diagram the traffic lights will miss the red/amber phase as is normal in France.
The circuit is ideal for incorporating into models where the LEDs can put on extended wires.

The switching acts like a sequential light system with exception that a RC chain is inbuilt so that differing length of light phases are possible. The switching is by three inverters (74HC4049) which slow down the processs between each step. The odd number of inverters ensure that there is not a pause between the light sequence which repeats itself.
The red / amber phase is made possible by a parallel, somewhat smaller RC chain, that for a short time, before turning off the red, turns the amber on.

Circuit board plan



Layout (from underneath)



Circuit component layout