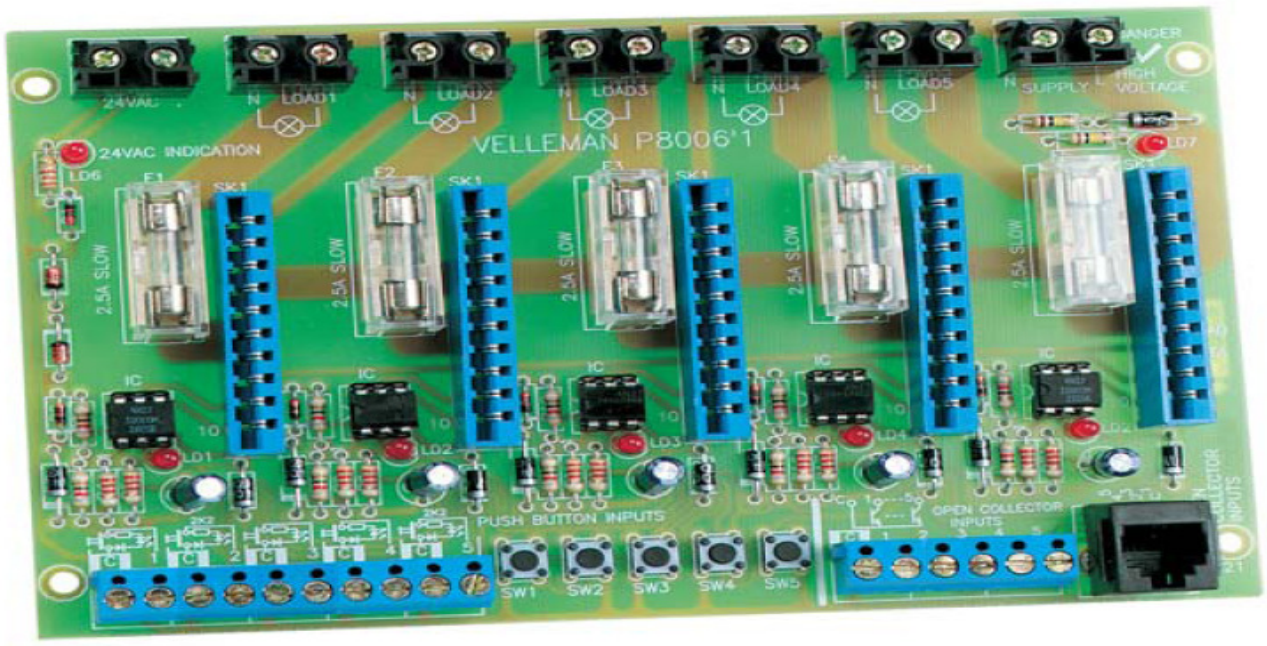
# Assembly Project (A)
# 'Modular Control unit'

**(Time 2 Hours)**




**Contents:**

This Assembly is a modular light control system operated by multifunction relay sub assemblies. The Project consists of the following documentation:

a) Construction instructions for 1 off A and 1 off B Units.

b) Circuit diagrams

c) Marking criteria

d) Testing instruction

**Introduction:**

- Perform the assembly in the order as set out in the detailed instructions.
- Position all components on the printed circuit boards as shown on the component layout diagram
- Where possible ensure that component values/identification marks can be read after assembly.

## Assembly: A---1 off

**Marking Criteria:**

| | | |
|---|---|---|
| A | **Assembly Project** | **Total---23 marks** |
| A1 | **Mechanical assembly** | 5 Marks |
| A2 | **Component placement** | 5 Marks |
| A3 | **Soldering Quality** | 5 Marks |
| A4 | **Testing A & B** | 8 Marks |

**Multifunction Relay Module -Assembly: B----1 off**

**Marking Criteria:**

| | | |
|---|---|---|
| B | **Assembling and test Project** | **Total--- marks = 7** |
| B1 | **Mechanical assembly** | 2 Marks |
| B2 | **Component placement** | 2 Marks |
| B3 | **Soldering Quality** | 3 Marks |
| | | |

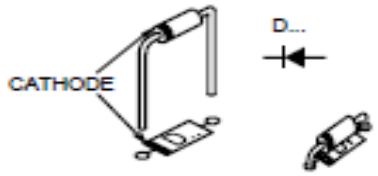
Note: a) one mark will be deducted for each missing component/s.

b) one mark will be deducted for component leads not trimmed to acceptable quality standard.

c) one mark will be deducted for damaged component not to acceptable quality standard.

**Assembly Instructions: A**

**1. Diodes (check the polarity)**

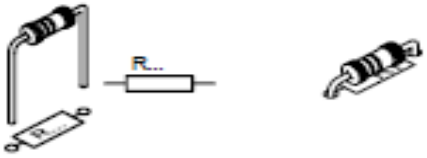



- ❑ D1 : 1N4148
- ❑ D2 : 1N4148
- ❑ D3 : 1N4148
- ❑ D4 : 1N4148
- ❑ D5 : 1N4148
- ❑ D6 : 1N4148
- ❑ D7 : 1N4007
- ❑ D8 : 1N4007
- ❑ D9 : 1N4007
- ❑ D10 : 1N4007
- ❑ D11 : 1N4007
- ❑ D12 : 1N4007
- ❑ D13 : 1N4007
- ❑ D14 : 1N4007
- ❑ D15 : 1N4007
- ❑ D16 : 1N4007
- ❑ D17 : 1N4007

**2. Zener diodes (check the polarity)**


- ❑ ZD1 : 47V / 1,3W
- ❑ ZD2 : 47V / 1,3W

**3. 1/4W Resistor.**



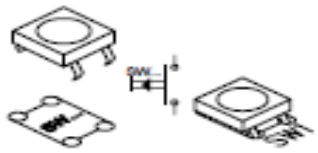

- ❑ R1 : 3K3 (3 - 3 - 2 - B)

**4. 1/2W Resistors.**


- ❑ R2 : 180 (1 - 8 - 1 - B - 9)
- ❑ R3 : 180 (1 - 8 - 1 - B - 9)
- ❑ R4 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R5 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R6 : 180 (1 - 8 - 1 - B - 9)
- ❑ R7 : 180 (1 - 8 - 1 - B - 9)
- ❑ R8 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R9 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R10 : 180 (1 - 8 - 1 - B - 9)
- ❑ R11 : 180 (1 - 8 - 1 - B - 9)
- ❑ R12 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R13 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R14 : 180 (1 - 8 - 1 - B - 9)
- ❑ R15 : 180 (1 - 8 - 1 - B - 9)
- ❑ R16 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R17 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R18 : 180 (1 - 8 - 1 - B - 9)
- ❑ R19 : 180 (1 - 8 - 1 - B - 9)
- ❑ R20 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R21 : 2K2 (2 - 2 - 2 - B - 9)
- ❑ R22 : 100K (1 - 0 - 4 - B - 9)
- ❑ R23 : 100K (1 - 0 - 4 - B - 9)

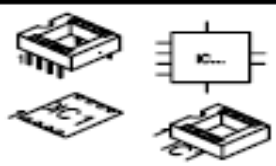
**5. Pushbuttons**

- ❑ SW1
- ❑ SW2
- ❑ SW3
- ❑ SW4
- ❑ SW5



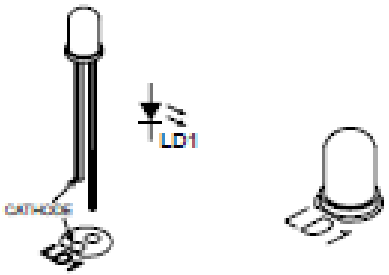
**6. IC sockets**

- ❑ IC1 : 6P
- ❑ IC2 : 6P
- ❑ IC3 : 6P
- ❑ IC4 : 6P
- ❑ IC5 : 6P



**Assembly Instructions: A Cont'd**

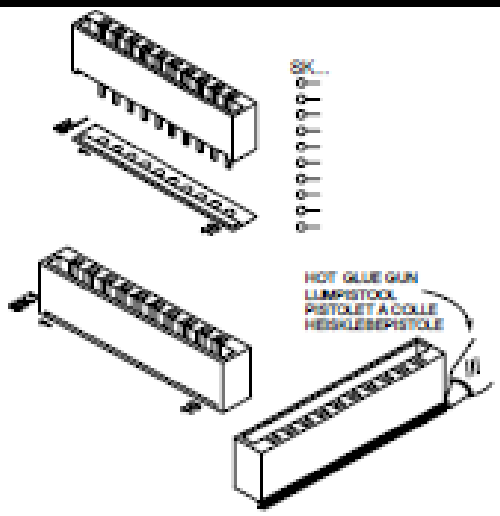
**7. LEDs. Watch the polarity!**




- ❑ LD1
- ❑ LD2
- ❑ LD3
- ❑ LD4
- ❑ LD5
- ❑ LD6
- ❑ LD7

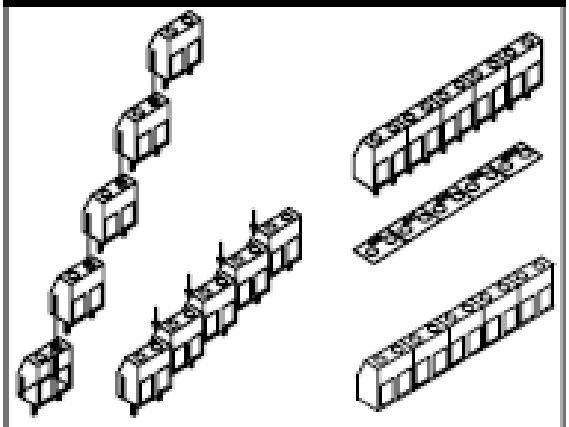
3mm RED

**8. PCB Edge Connectors (Watch the orientation!)**

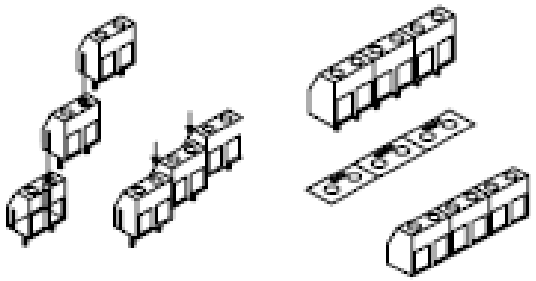



- ❑ SK1 : 10 POLE
- ❑ SK2 : 10 POLE
- ❑ SK3 : 10 POLE
- ❑ SK4 : 10 POLE
- ❑ SK5 : 10 POLE

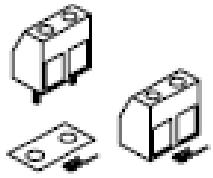
**9. PC Terminal blocks (Slide the terminal blocks, one into each other)**



- ❑ SK6 to SK10 : 2P+2P+2P+2P+2P



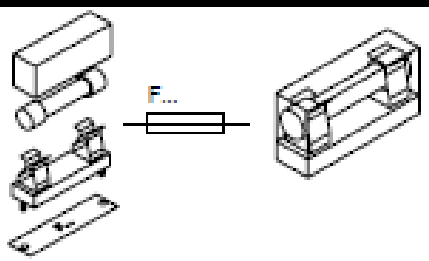
- ❑ SK11 to SK13 : 2P+2P+2P



- ❑ SK14: 2-POLE (wide)
- ❑ SK15: 2-POLE (wide)
- ❑ SK16: 2-POLE (wide)
- ❑ SK17: 2-POLE (wide)
- ❑ SK18: 2-POLE (wide)
- ❑ SK19: 2-POLE (wide)
- ❑ SK20: 2-POLE (wide)

**Assembly Instructions: A Cont'd**

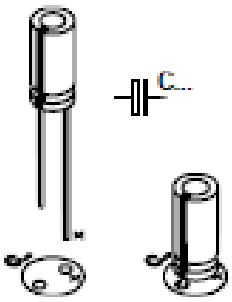
## 10. Fuse Holder + Fuse



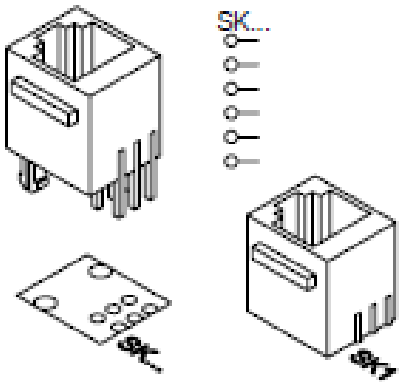

- ❑ F1 : 2,5A SLOW
- ❑ F2 : 2,5A SLOW
- ❑ F3 : 2,5A SLOW
- ❑ F4 : 2,5A SLOW
- ❑ F5 : 2,5A SLOW

## 11. Electrolytic capacitors. Check the polarity !

- ❑ C1 : 22µF/50V
- ❑ C2 : 22µF/50V
- ❑ C3 : 22µF/50V
- ❑ C4 : 22µF/50V
- ❑ C5 : 22µF/50V

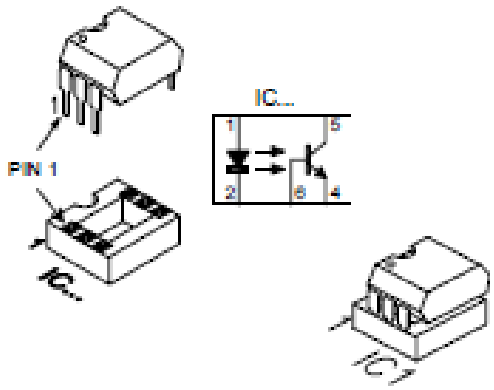



## 12. Modular Jack



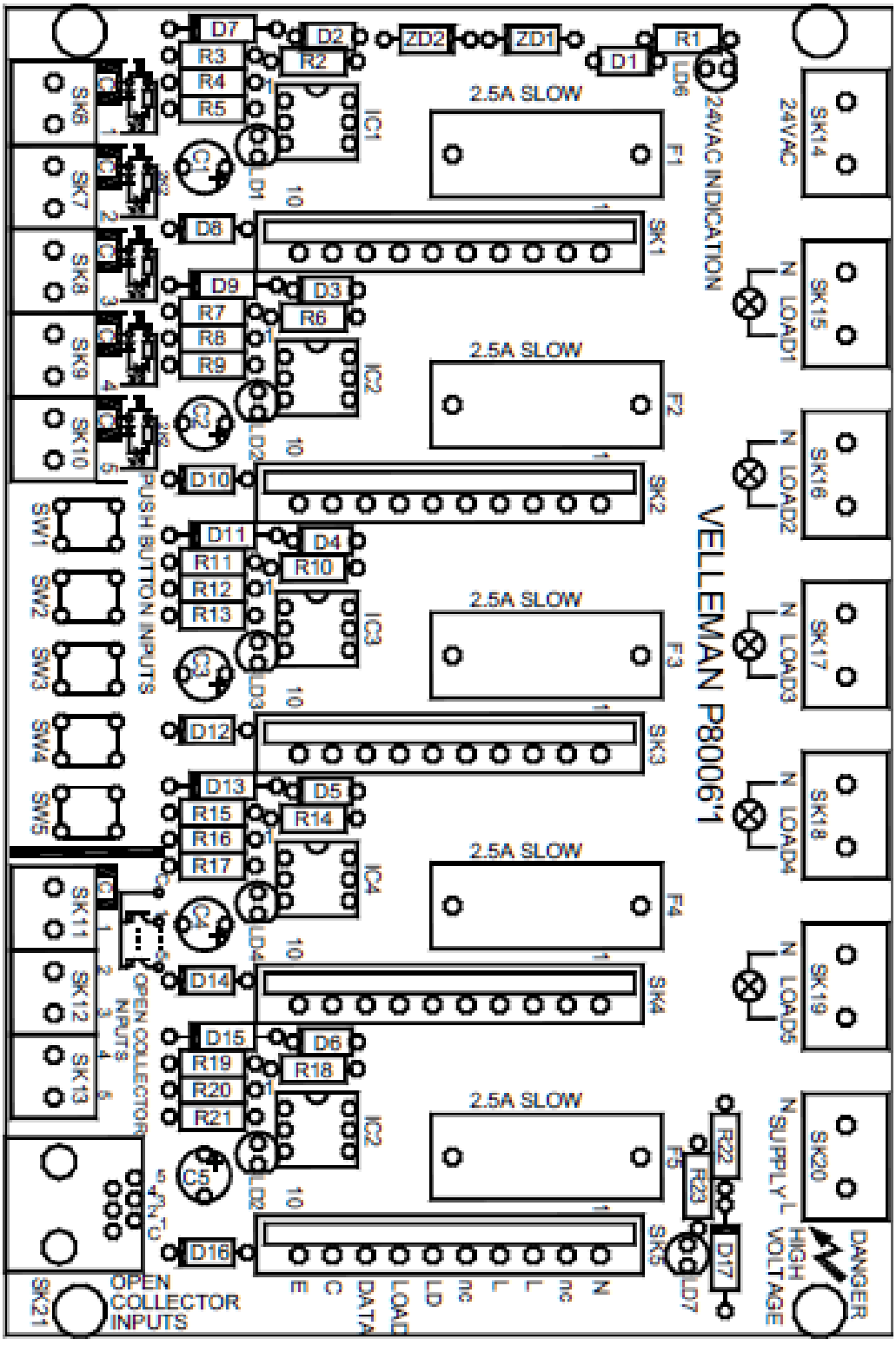

- ❑ SK21 : 6-POLE

## 13. Insert the OPTO Coupler into the socket (Watch the position of the notch!)

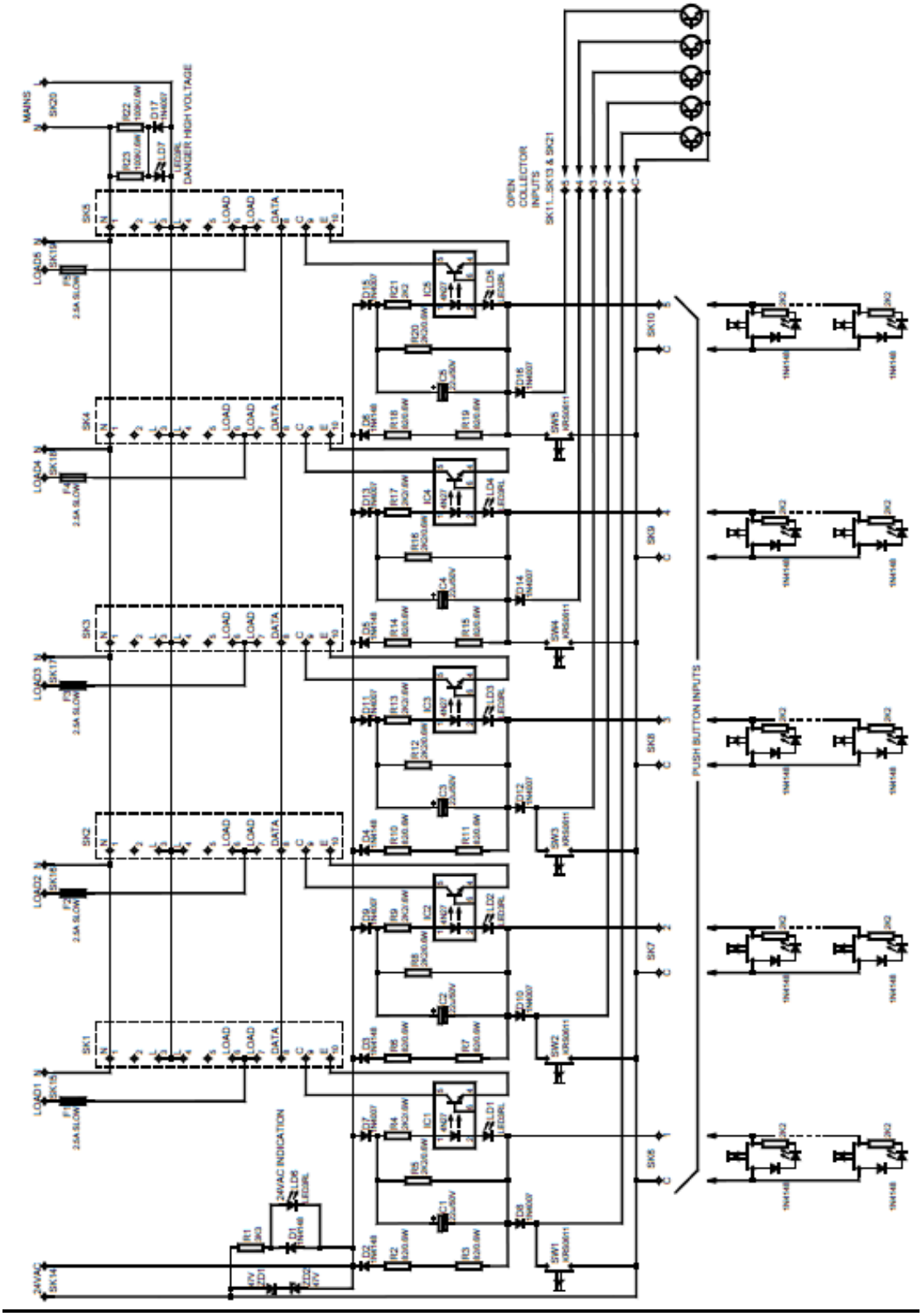



- ❑ IC1 : 4N27, TIL111 or eq.
- ❑ IC2 : 4N27, TIL111 or eq.
- ❑ IC3 : 4N27, TIL111 or eq.
- ❑ IC4 : 4N27, TIL111 or eq.
- ❑ IC5 : 4N27, TIL111 or eq.

**Assembly Instructions: A----- PCB Component Layout Diagram**



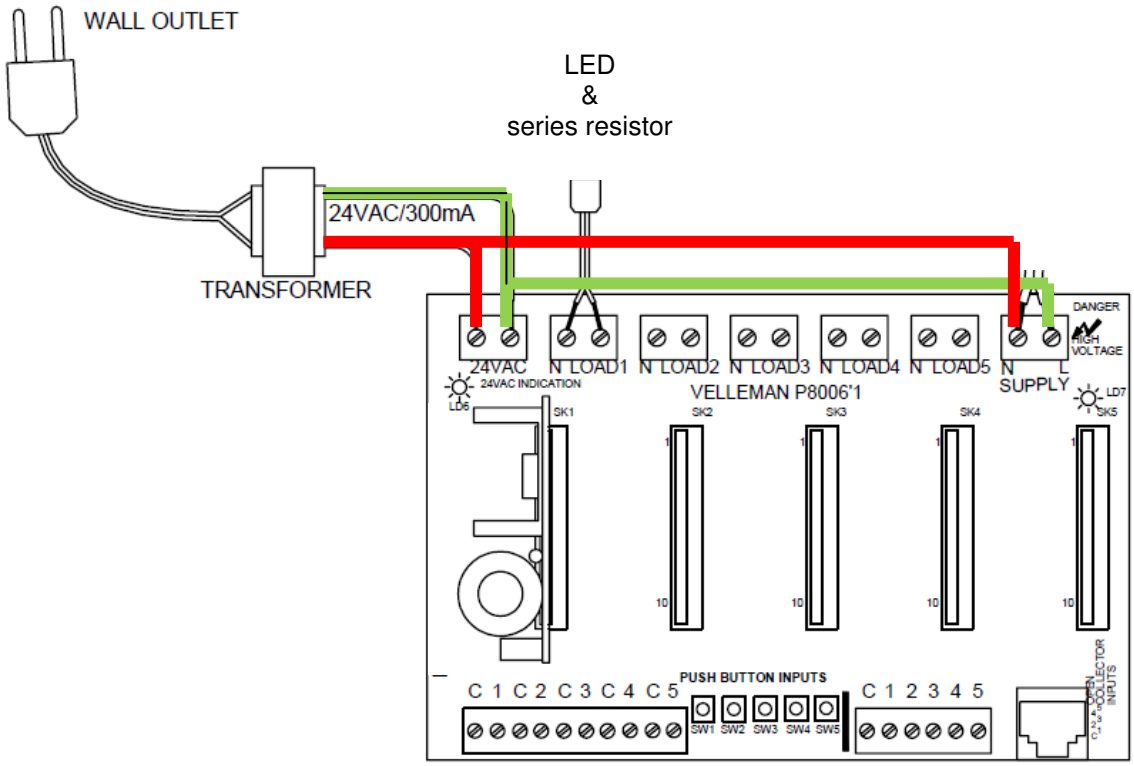
**Circuit Diagram: A----**



**Testing Instructions: Units A & B**

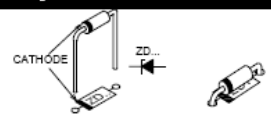
- Demonstrate the working unit to the judge.
- Connect the supplied LEDs and Resistors in series to each of the 'Load' sockets from Sk15 to Sk19.
- Connect the 24AC supply wires to Sk14, then switch on the 24v supply—Observe that LD6 is illuminated. Remove power.
- Wire Sk14 and Sk20 in parallel as shown in the wiring diagram and apply the 24vAC supply—Observe that LD6 and LD7 are illuminated. Remove power
- Insert a timer module into the first as shown. Apply power
- Press push button Sw1 to Sw5 in turn. The module 'B' will activate and the LEDs connected to 'Loads 1' to 'Load 5' should illuminate as each switch is pressed ( subject to module 'B' switch settings)
- This testing process should be performed within the construction time of the project

Wiring Diagram :



## Relay Unit B—Assembly Instructions

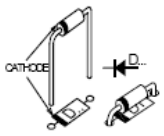
### 1. Zener diodes. Watch the polarity !



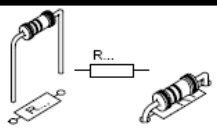

- ZD1 : 5V1 - 500mW
- ZD2 : 24V - 1,3W

### 2. Diodes. Watch the polarity !

- D1 : **1N4148**
- D2 : 1N4007
- D3 : 1N4007
- D4 : 1N4007
- D5 : 1N4007

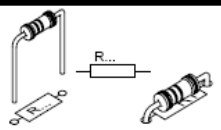



### 3. 1/4W Resistors



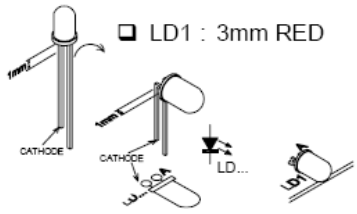

- R1 : 3K9 (3 - 9 - 2 - B)
- R2 : 47K (4 - 7 - 3 - B)
- R3 : 47K (4 - 7 - 3 - B)
- R4 : 120K (1 - 2 - 4 - B)
- R5 : 10K (1 - 0 - 3 - B)

### 4. Metal film resistors




- R6 : 220 (2 - 2 - 1 - B - 9)
- R7 : 220 (2 - 2 - 1 - B - 9)
- R8 : 220 (2 - 2 - 1 - B - 9)
- R9 : 330K (3 - 3 - 4 - B - 9)
- R10 : 330K (3 - 3 - 4 - B - 9)

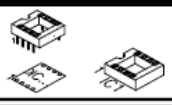
### 5. LED. Watch the polarity!




- LD1 : 3mm RED

### 6. IC socket. Watch the position of the notch!

- IC1 : 8p

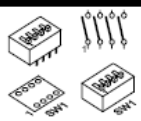


### 7. Capacitor

- C1 : 100nF (104)

### 8. Dip Switch. (Watch the orientation)

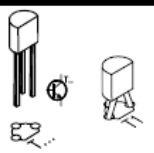
- SW1 : DS-4



**Note: Replace R9 and R10 with link wires –this is to for lower operation voltage**

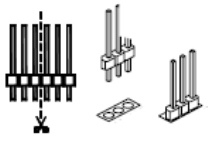
### 9. Transistor.

- T1 : BC547B



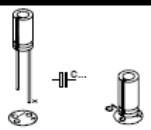
### 10. Pin header

- SK1 : 3p

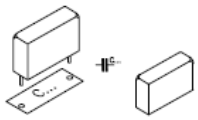


### 11. Electrolytic Capacitors. Watch the polarity !

- C2 : 100µF
- C3 : 100µF



### 12. Capacitor



- C5 : 100nF / 250V

***Choose operating voltage :***

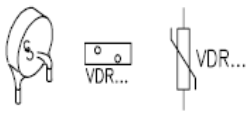
For 220-245VAC :

- C4 : 470nF/400VAC

For 110-125VAC :

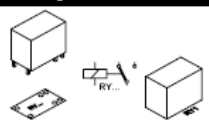
- C4 : 1µF/250VAC

### 13. VDR




- VDR1 : VDR 300 VAC

### 14. Relay

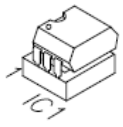



- RY1 : VR10V241C or eq.

### 15. IC. Watch the position of the notch!

- IC1 : VK8008

Programmed PIC12CE518

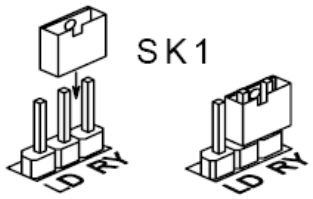


## Relay Unit B—Assembly Instructions Cont'd

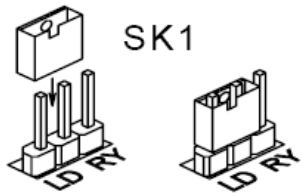
### 16. Shunt for transient suppressor.

The unit is equipped with a transient suppressor to reduce sparking. Normally, this suppressor is put over the relay contacts. In some cases it might be necessary to put it on the load (eg. with very small loads).

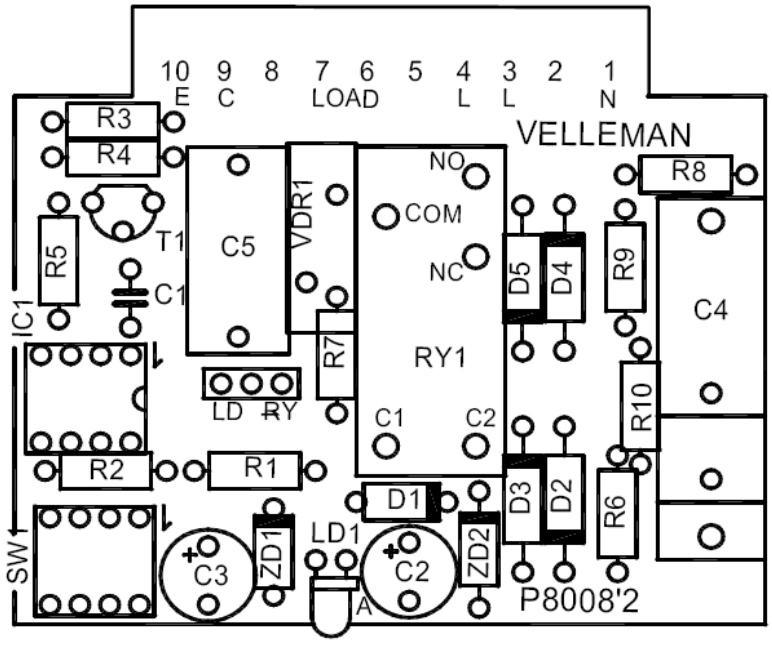
- Transient suppressor over the relay contacts



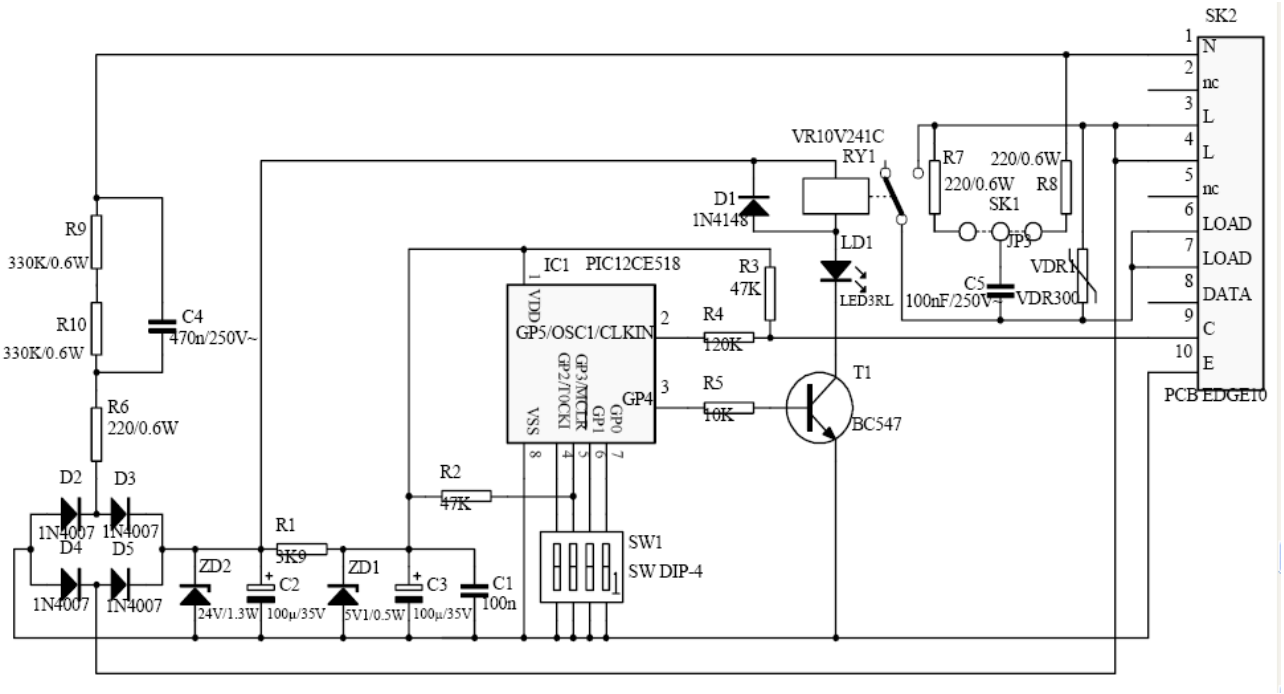

- Transient suppressor over the load



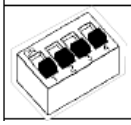

## Relay Assembly Instructions: 'B'----- PCB Component Layout Diagram



## Relay Circuit Diagram B ( Short circuit R9 and R10 for 24Volt AC Working




**Operation Mode:** **Note ----Momentary mode only will be use for test purposes.**

| SW1 | OPERATION MODE | DESCRIPTION |
|---|---|---|
|  | Momentary mode | The load will be switched on as long as the pushbutton is pressed.<br>**Applications :** doorbell, … |