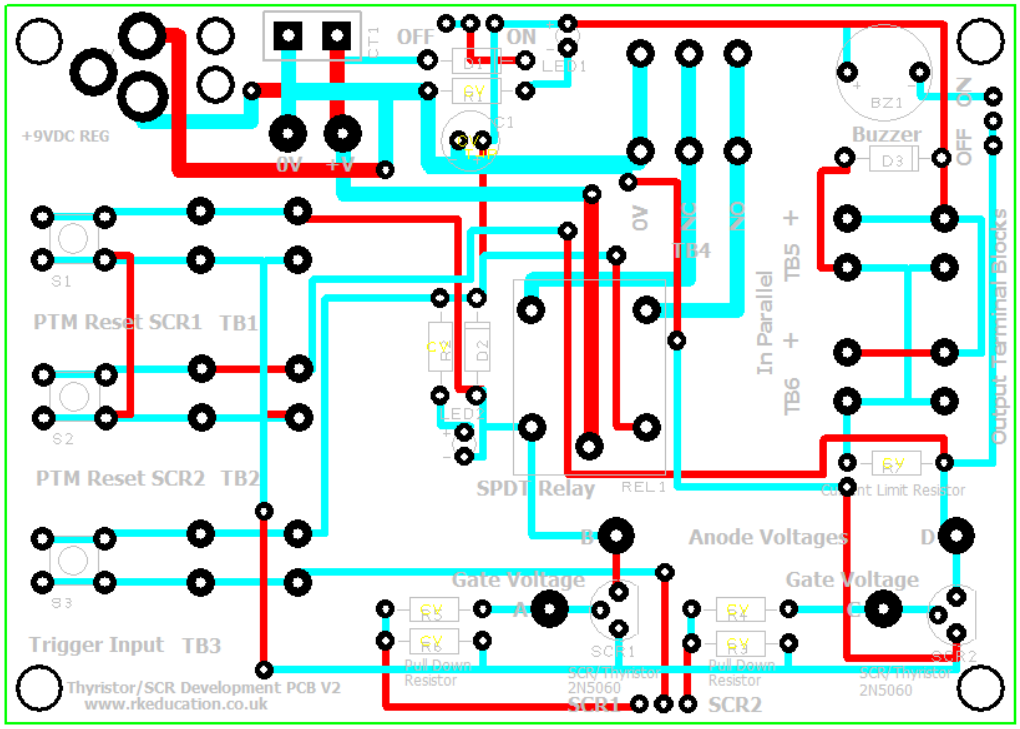
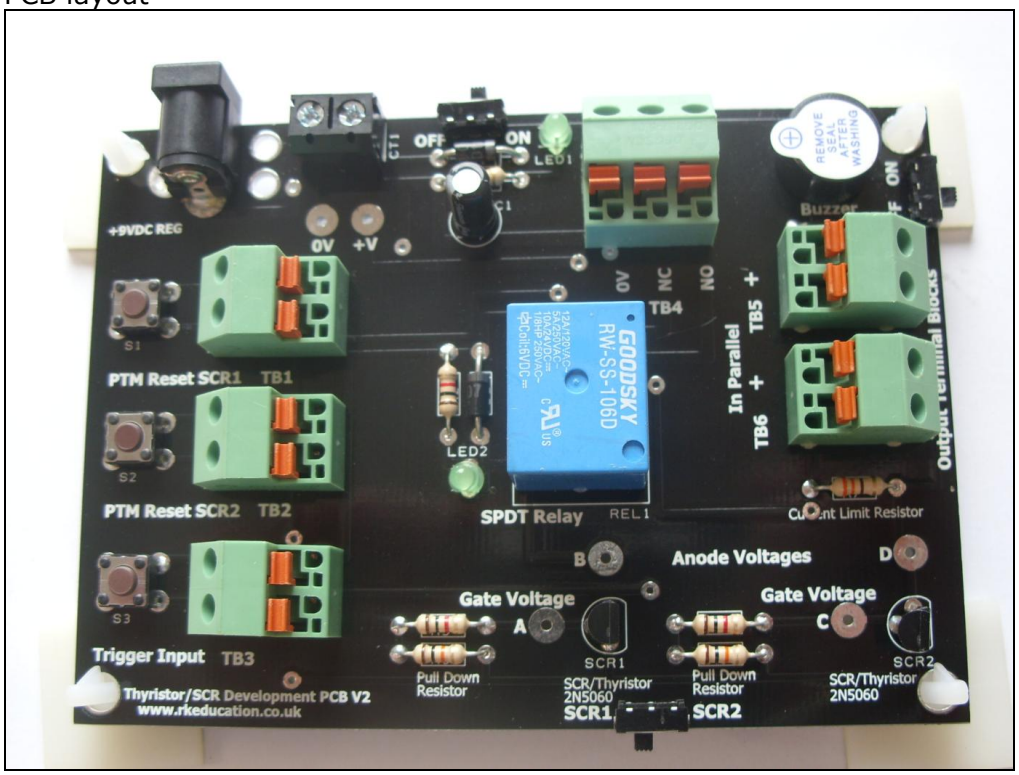
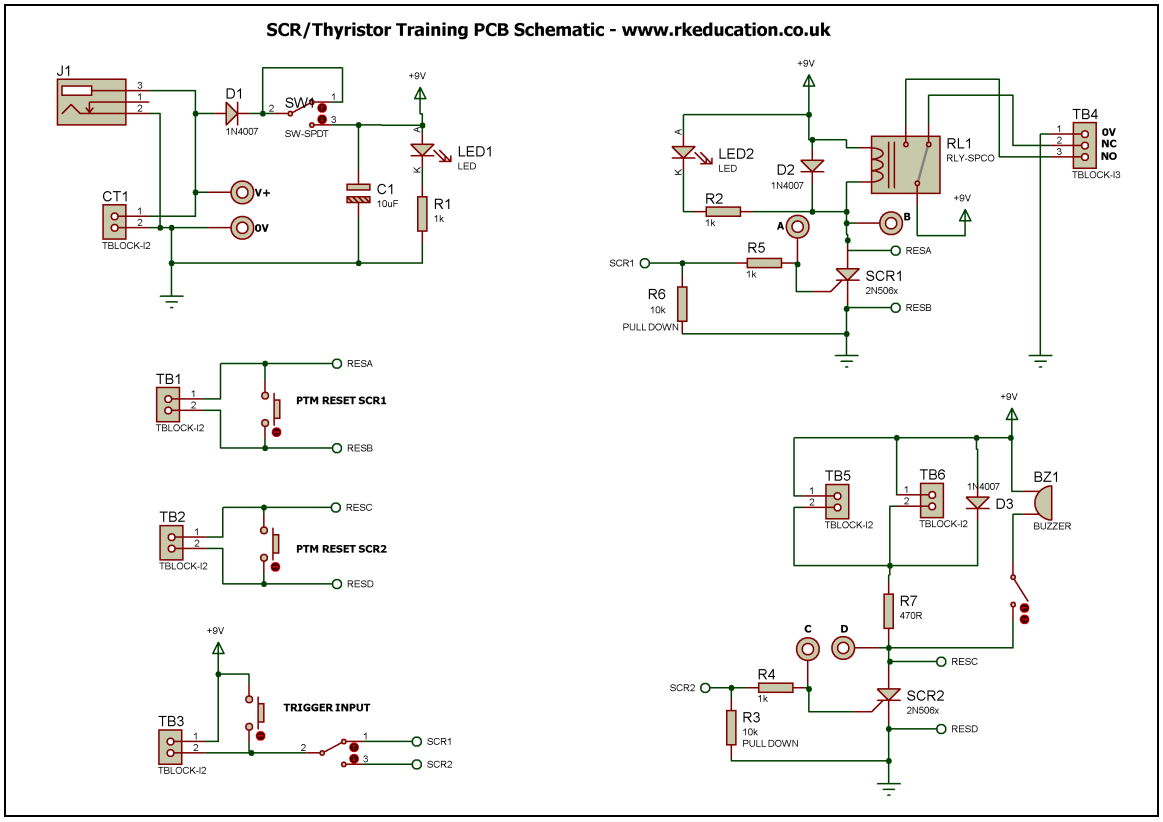
SCR/Thyristor Training PCB Component List and Instructions – Version 2



PCB layout



Constructed PCB



Schematic Diagram

Description

This system has been specifically designed to be used alongside the **SCR/Thyristor Project PCB, 70-6031**. For details of the **SCR/Thyristor Project** and other projects please visit – www.rkeducation.co.uk

- Simple, low cost and portable
- Powered from a DC power adapter or batteries
- Power switch and LED power indicator
- Curriculum-based
- Allows learners to visualise thyristor/SCR latching circuits
- Uses a trigger to switch on an output
- Uses 2 methods of resetting
- Multiple outputs – thyristor driven, buzzer and SPCO relay
- Allows students to test their designs prior to final construction
- Screwless terminal blocks allow students to easily insert different trigger and reset devices
- Professional double-sided, black PCB
- Clear silkscreen text has been used to aid learning
- Includes test points that are used with a digital multi meter – DMM – to measure important values
- Suitable for **Key Stages 2, 3 & 4** (ages 7 to 16)
- Perfect for **Steady Hand Game** projects

Component List

BZ1 – PCB mount buzzer
C1 – Smoothing cap, 10uF electrolytic or suitable alternative
CT1 – 2 way 5mm terminal block
DC power socket – 2.1mm
D1 – D3 ~ 1N400x
R1, R2, R4, R5 – 1k ~ BROWN, BLACK, RED
R3, R6 – 10k ~ BROWN, BLACK, ORANGE
R7 – 470R ~ YELLOW, VIOLET, BROWN
REL1 – SPCO relay 6VDC coil
LED1, LED2 – 3 or 5mm LED (green) for power indicators
S1 – S3 ~ Tactile switch
SCR1, SCR2 – 2N506x thyristor
2 way screwless terminal blocks x5
3 way screwless terminal block x1
PCB feet x4
Ultra miniature slide switch x3

When constructing always start with the components that have the lowest profile and work high, for example start with the resistors and end on the electrolytic capacitor. For this kit please solder the battery clip last (if used). The battery clip leads should be threaded thorough the 2 holes to the right of R1, it is advisable to twist the wires of the battery clip together.

Please only attempt to construct this unit if you are confident you are able to do this, if you are not confident please purchase a constructed unit. We will not accept responsibility for damaged and faulty units due to poor soldering.

Instructions

This system has been specifically designed to be used alongside the **SCR/Thyristor Project PCB,** please visit www.rkeducation.co.uk

There are 6 areas to familiarize yourself with.

1. Power
2. Pads for measuring values
3. Screwless terminal blocks
4. Trigger and resets
5. SCR/Thyristors
6. Outputs

Connecting Power

The first step is to power the PCB, use either a 9VDC power supply with a 2.1mm plug, it is also possible to use a bench DC power supply or 9V PP3 battery attached a battery clip and screwed into TB1, which ever method is used always check the polarity of the power supply. This unit is designed to work at 9VDC.

The system can now be turned on using the ultra-miniature slide switch at the top of the PCB, it is marked **ON** and **OFF.** The green power LED should light up, it is below

the power switch. If it does not light up it may indicate faulty batteries or power supply, check them carefully or a short circuit.

Pads for measuring values

There are several large pads around the PCB that are used to measure voltages so the user can observe what is happening. The pads located around **SCR1** and **SCR2** and are labelled **Anode Voltage** and **Gate Voltage – A, B, C, D** and there voltage reference pads near the ON/OFF switch that are labelled **0V** and **+V.** To measure a voltage simply put the black probes from a digital multi meter, DMM, on 0V and the red probe on either Anode Voltage or Gate Voltage depending on what is being measured.

Screwless terminal blocks

This PCB has been designed around screwless terminal blocks, these allow components to be quickly and easily inserted and changed. Screwless terminal blocks are located around the PCB where the user may want to change/vary components, for example changing an output. This innovative approach allows for flexible project outcomes as the student experiment with their designs prior to manufacture in order to achieve the desired practical outcome. To insert a component simply press the levers on the terminal block and insert the leads into the holes, care should be taken to ensure a good contact.

Trigger and Reset inputs

This is a latching circuit and is based around the 2N5060/2N5061 Thyristor/SCR. When a high enough voltage is applied to the GATE of the SCR the device will turn on and latch, that is it will remain on until it is reset. When the SCR turns on an output can be turned on, this could be an LED, buzzer, bulb or other suitable output transducer. The SCRs on this circuit will latch when the **Trigger Input** is short circuited by pressing the tactile switch or the terminal block is shorted. An ideal way to see this easily is to insert a piece of wire into each terminal, when the wires are touched together a voltage is applied to the GATE of the SCR and the circuit will latch. It will remain latched until reset, this is achieved by removing the power or by resetting the appropriate SCR, this is achieved by pressing the tactile switch.

SCR/Thyristor

The trigger input in this circuit is used to switch on or off the SCR/Thyristors – 2N506x – **SCR1** and **SCR2**. The 2N506x will switch on when a voltage is applied to the GATE (middle leg). Once turned on the SCR remains on until reset or the power is removed, this type of circuit is known as a latching circuit. There is a protection resistor (1k) that protects the gate from excessive currents. The anode of the SCRs are connected to the outputs. The **Anode voltage** and **Gate voltage** can be measured with a DMM in order to observe the SCR operating. This unit has 2 SCRs and which SCR that is to be used is selected by a slide switch located at the bottom of the PCB and is labelled **SCR1** and **SCR2**. SCR1 is connected the relay - **REL1** and SCR2 is connected to the **Output Terminal Blocks** and the PCB mounted **Buzzer**.

Outputs

The outputs are divided into 2 sections with each of the transistors controlling one of the sections. **SCR1** controls the relay output **REL1** and **SCR2** controls the **Output Terminal Blocks** and PCB mounted **Buzzer**.

The collector of the anode **SCR1** is connected to **REL1** and when **SCR1** is selected applying voltage from the trigger to the gate will turn on **SCR1** and thus energise the relay, the SCR will remain turned on until it is reset. The relay contacts take their power from the main supply so therefore the relay switches 9VDC. By connecting a transducer to the 3 way terminal block the transducer can be turned on and off depending on the state of the potential divider. As an example a motor can be connected to the 3 way terminal block which gives access to the relay contacts. There are 3 connections, **0V, NC –** normally connected and **NO** – normally open**.** It is assumed the motor will have flying leads soldered to the terminals and it is advisable to also solder a suppression capacitor to the motor terminals. Attach one flying lead into **0V** and the other to **NO,** when the relay is energised and the click is heard the contacts change over and the motor will turn on, when the relay turns off the motor will turn off. By swopping **NO** and **NC** this is reversed and the motor will be turned on when the relay is not energised and the motor will turn off when the relay is energised. The motor can be changed for other transducers such as light bulbs and buzzers.

The anode of **SCR2** is connected to 3 outputs, 2 of these are in parallel and are protected with a resistor (470R) and are intended for use with LEDs. The top output is connected to a **Buzzer** and this buzzer can be turned off with an ultra miniature slide switch near to the buzzer marked **OFF ON**. When **SCR2** is selected it will turn on when a voltage is applied to the gate of the thyristor and the outputs will turn on until the base voltage thyristor is reset or the power is removed. To add an LED simply insert it into one of the terminal blocks marked **Output Terminal Blocks** observing the fact that LEDs have polarity, the longer leg should be inserted above the shorter leg.

A good way to observe the thyristor turning the outputs on and off is to turn the ultra miniature slide switch to **SCR1** and trigger and reset the SCR, the relay should be heard clicking as it changes state. This can be repeated with **SCR2** by triggering the SCR to turn the buzzer or an LED on and off.

Using the PCB

The PCB has been designed to be simple to use. In order to become familiar with the unit it is advisable to do the following.

- Set the lower slide switch to **SCR2**
- Solder wires to 2 push to make – PTM – switches
- Insert the PTM switches into **Trigger Input TB3** and **PTM Reset SCR2 TB2**
- Insert an LED into an output terminal block, be sure to insert the longer leg above the shorter leg
- Press the **Trigger Input** PTM switch and it should trigger the SCR and the LED should light and remain lit
- Press the **PTM Reset** and the SCR should reset and the LED should turn off

- Repeat this but use **SCR1** with a transducer inserted into the 3 way terminal block
- Now do this but observe the voltages with a DMM by placing the probes between **0V** and **Anode Voltage** and **Gate Voltage**
- Now use the buzzer
- To use this as a steady hand game replace the **Trigger Input** with 2 pieces of wire, this replicates the steady hand game hand hoop and wire course

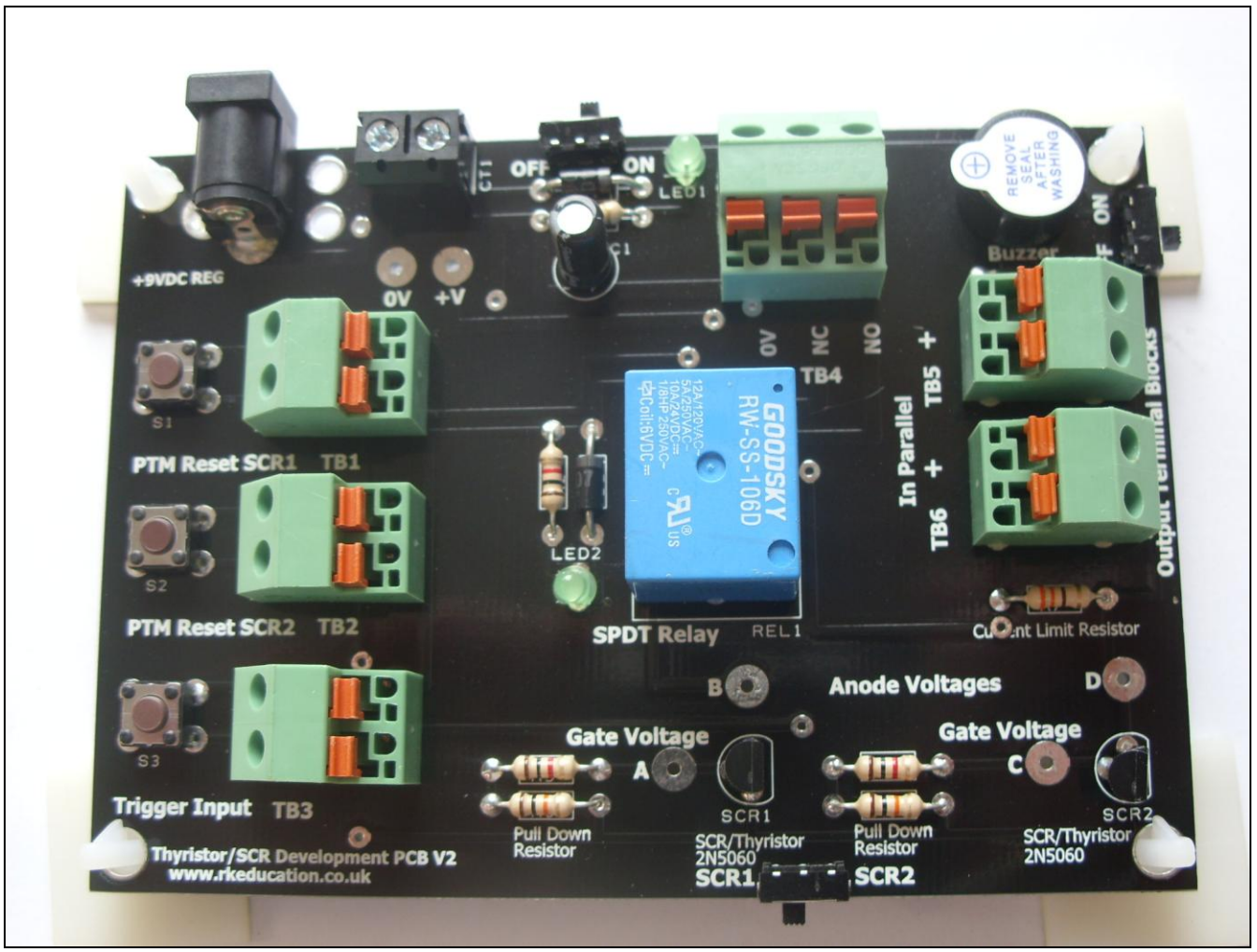
By using this system students can gain an understanding of the operation and application of the SCR latch circuit and this system also helps students make important decisions that will affect the final outcome of their project.

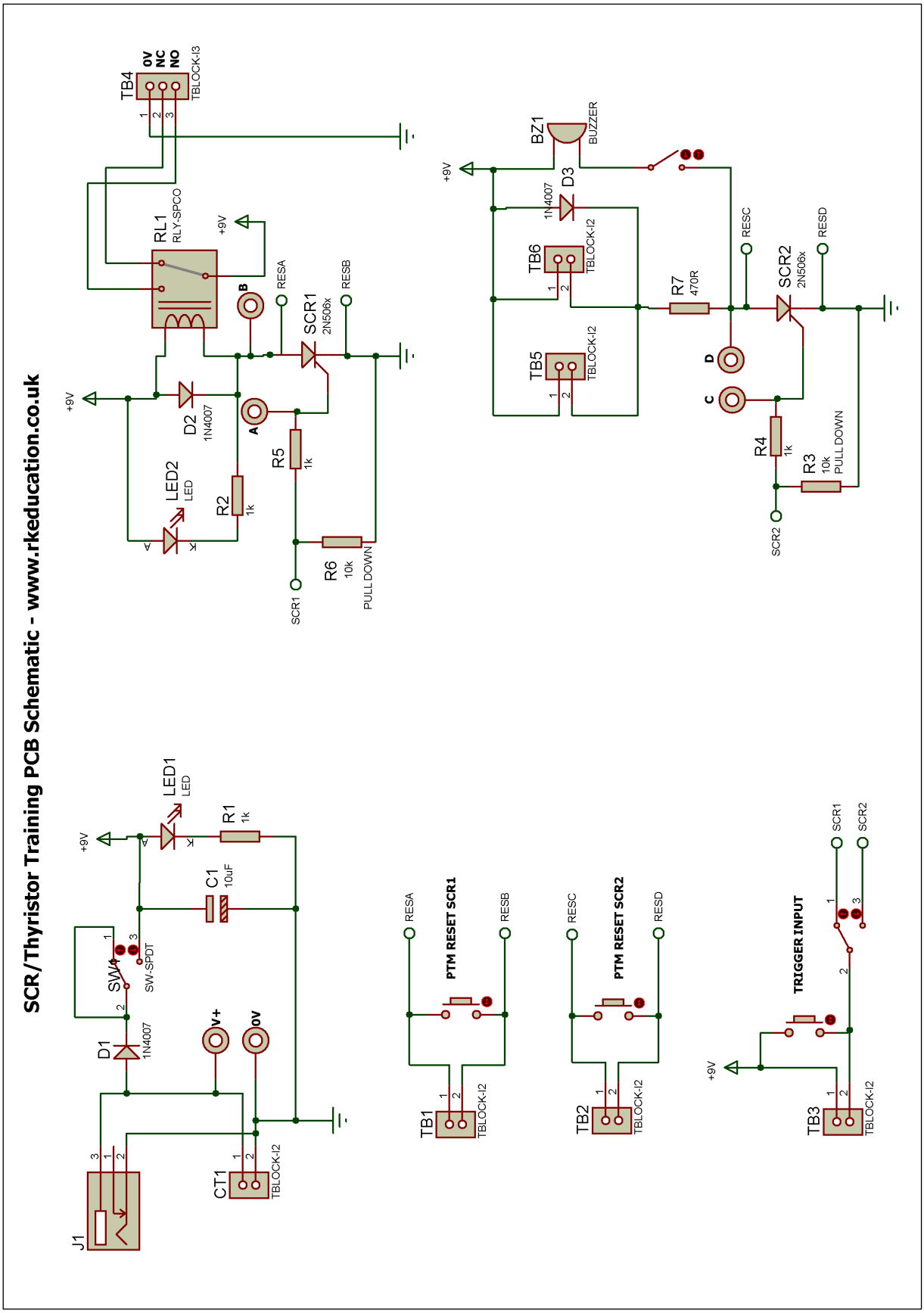
Please visit our website

www.rkeducation.co.uk

If you have any comments or queries please email us at

technical@rkeducation.co.uk




SCR/Thyristor Training PCB Schematic - www.rkeducation.co.uk
TB4
0V
NC
NO
TBLOCK-I3
RL1
RLY-SPCO
+9V
B
RESA
SCR1
2N506x
RESB
D2
1N4007
A
R5
1k
LED2
LED
R2
1k
SCR1
R6
10k
PULL DOWN
BZ1
BUZZER
D3
1N4007
TB6
TBLOCK-I2
TB5
TBLOCK-I2
R7
470R
RESC
SCR2
2N506x
RESD
D
C
R4
1k
R3
10k
PULL DOWN
SCR2
LED1
LED
R1
1k
C1
10uF
SW1
SW-SPDT
D1
1N4007
V+
0V
J1
CT1
TBLOCK-I2
RESA
PTM RESET SCR1
RESB
TB1
TBLOCK-I2
RESC
PTM RESET SCR2
RESD
TB2
TBLOCK-I2
TRIGGER INPUT
SCR1
SCR2
TB3
TBLOCK-I2