Leaving Certificate

Technology

Applied Control Technology

The Student Project Board

Soldering to a PCB: -

When soldering always make sure the soldering iron tip is hot and clean. To test if it is hot enough, try to melt a piece of solder on the tip. The solder should melt instantly. Then clean off the melted solder by wiping the tip on a damp sponge. Always make sure the tip has a thin coating of solder before you start. Use a flux to keep the tip clean.

Remember that solder will only 'stick' to hot surfaces. Therefore never melt the solder on the soldering iron tip and then try to 'drop' it onto the joint - this will not work as the joint will be cold and so the solder will not 'stick'.

To successfully solder you must hold the soldering iron in one hand and the solder in the other. Therefore make sure the PCB is held on the table so it will not move, use a bulldog clip or small vice.

Always: -

1. Clean the soldering iron tip on a damp sponge.
2. Press the soldering iron tip against the pad on the PCB <u>and</u> the leg of the component. Count to 3 to give the joint time to warm up.
3. Keep the soldering iron in position and touch the solder against the joint. Allow enough solder to melt to cover the joint.
4. Take the solder away first then the soldering iron.
5. Allow the solder to cool for about 5 seconds before trying to move the board.
6. After each joint is made make sure the solder does not 'bridge' across to other joints.

Tips: -

1. Always start with the smallest components like the resistors. Then move onto larger components like the IC socket and then finish with the tall components like capacitors and transistors. Do not try to put all the components in position at once, only solder one or two at a time.
2. Always make sure that the components lie flat on the board before they are soldered. When using components with long legs like resistors and LEDs make sure they are held firmly in position before soldering.
3. Make sure that the components that only work one way around (LEDs, diodes, transistors, capacitors) are correctly aligned before soldering, follow the makes on the PCB.
4. Try to remove any leg extensions from the back of the board as you solder.

Building the Student Project Board: -

The project board is manufactured with a 'solder resist' layer to make it simple to solder. This is the green 'lacquer' layer that covers the tracks so that the solder does not stick to these tracks. Each pad has also had a thin layer of solder applied to ease the soldering process. However for successful circuit operation the PCB must be carefully assembled and soldered.

Refer to no. 8. PICAXE 18 X Student Project Board for: -

1. Circuit diagram
2. Component list
3. PCB component layout

A variety of inputs, and outputs such as the LEDs and other output components can be soldered directly to the PCB or connected to wires when integrating with project work.

Steps: -

1. Start with the 10k resistors (brown black orange gold).
   Insert into positions R1, R4, R5, R7 and R8.
   Be careful of R6, it is not a 10k resistor!
   Make sure to cut away any leg extensions as you go.
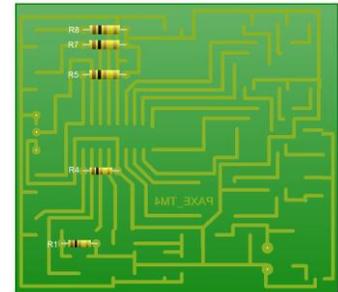
2. Next insert the 4k7 resistors (yellow violet red gold) into positons R3 & R6 and the 2K2 resistors (red red red gold) into positions R15 & R16
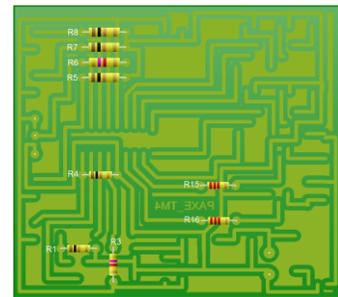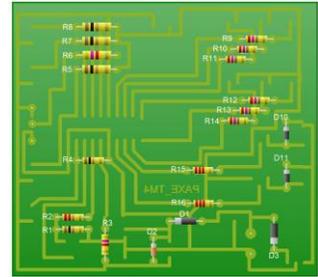
3. Place the 22k resistor (red red orange gold) R2 and Diode 1N4148, D2 in position and solder. Be careful to ensure the diode is correctly aligned.
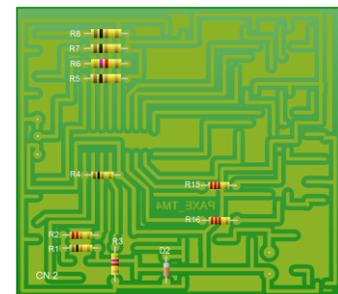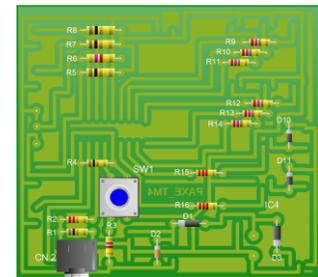
4. Now fit the 330 ohm resistors R9, R10, R11, R12, R13 & R14 and solder in position.
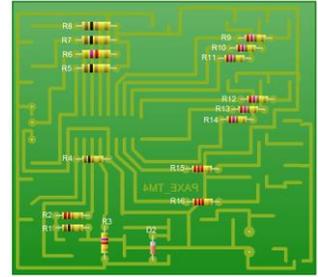

5. Insert diodes (1N4001) D1, D3, D10 & D11 and solder. Again watch alignment!


6. Insert the stereo jack plug CN2 and the switch SW1. Bend the legs of the switch to hold in position and then solder.


7. Push the IC socket IC2 into position. Make sure the notch at one end points to the left. Fold the legs over to hold it in position and then solder in place. Next insert, one at a time, the digital thermometer IC3, the two cream capacitors C1 & C4 and the two transistors Q1 & Q2 and solder. Take care not to over heat the transistors!
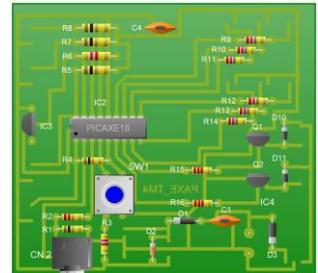

8. Insert and solder the LEDs D4, D5, D6, D7, D8 & D9. Follow the markings on the PCB to ensure the LEDs are aligned correctly and sitting flat to the board.
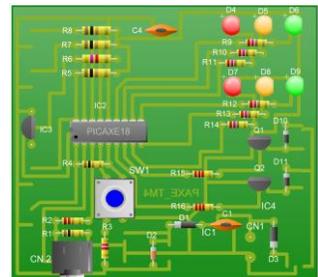
9. Fit and solder each of the 2 way terminal blocks TB1, TB2, TB4, TB5 & TB6. Push the DC power socket CN1 into position and solder.
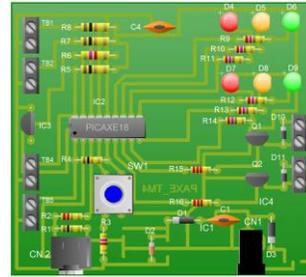

10. Follow the markings on the PCB to insert and solder the two capacitors C2 & C3 and the two voltage regulators IC1 & IC4. Remember the capacitors are polarised so check the '+' connections. The voltage regulators can be bent back to lie flat on the board as shown below.
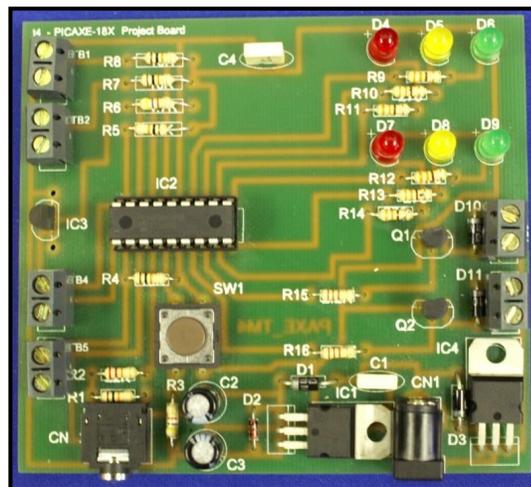
If your board looks like this, well done! You are now ready to start programming.

To identify the correct inputs when programming, follow the circuit diagram 8. Student Project Board. To select the correct outputs, identify the correct pin out track on the PCB board. The example shown is pin 13 or output 7 i.e. output 7 will turn on the green LED, D6.
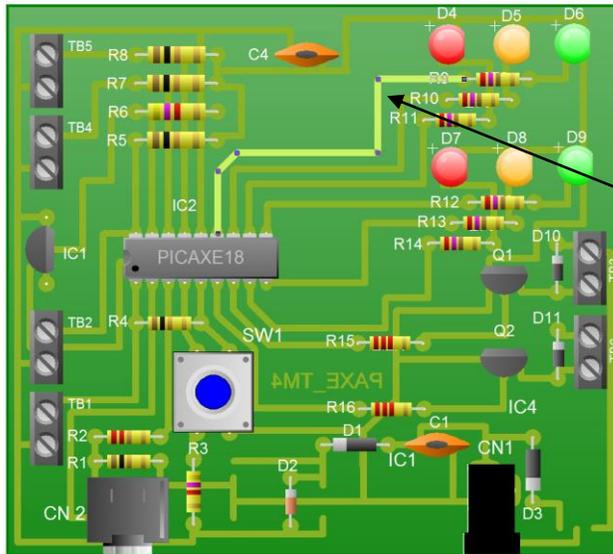
Project Board work sheet 1: -

Follow the copper tracks on the Project Board PCB to identify the Input and Output pin connections for: -

    (a) Green LED

    (b) Temperature sensor

Complete the connections on the diagram below.
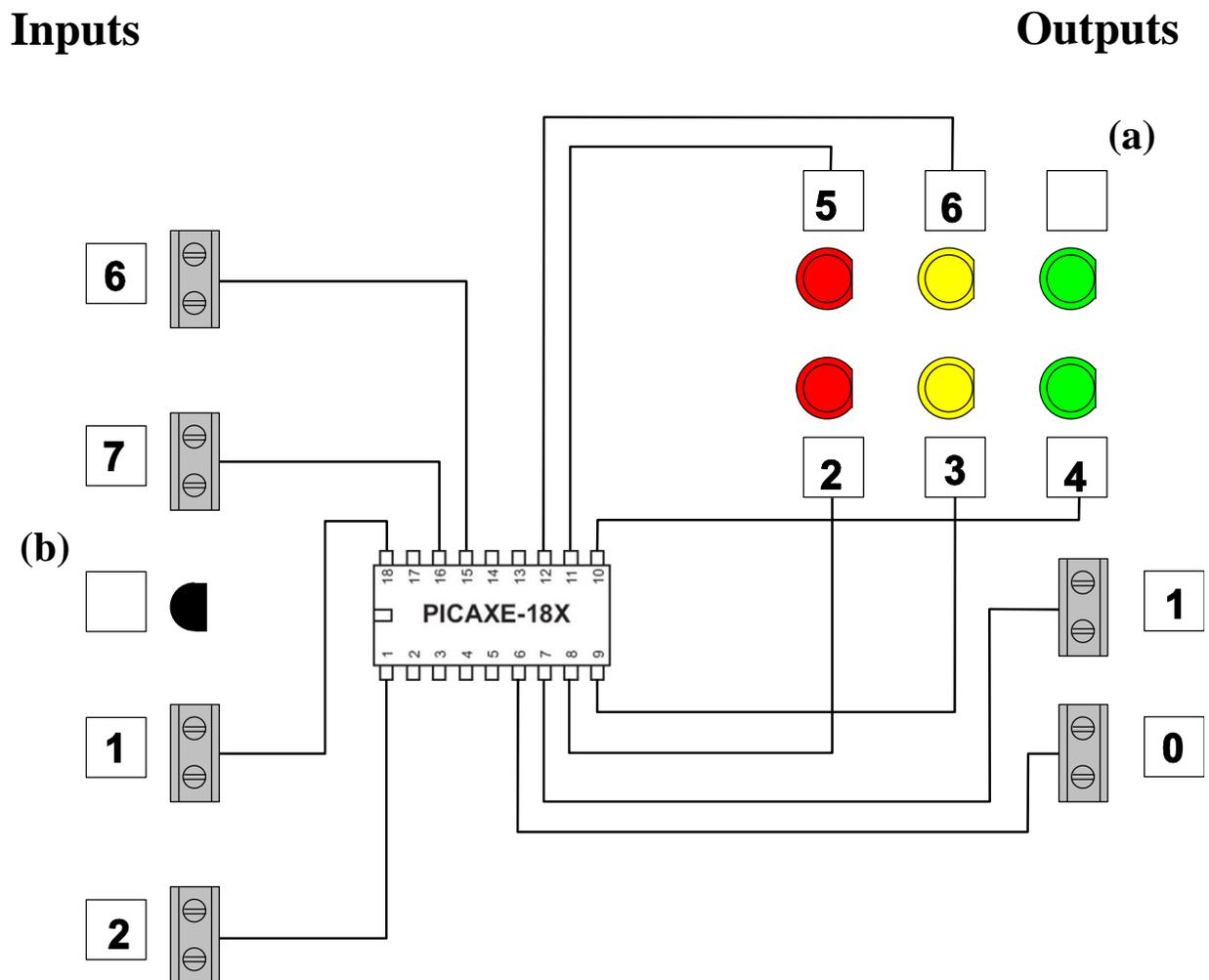
Inputs   Outputs

Project board 'Input' and 'Output' identification sheet: -
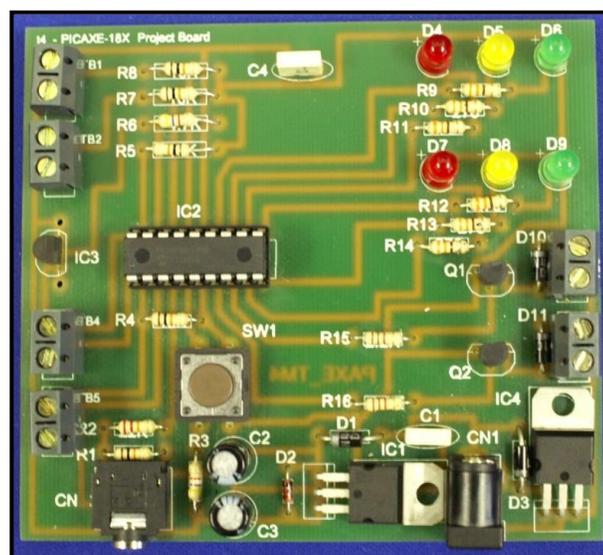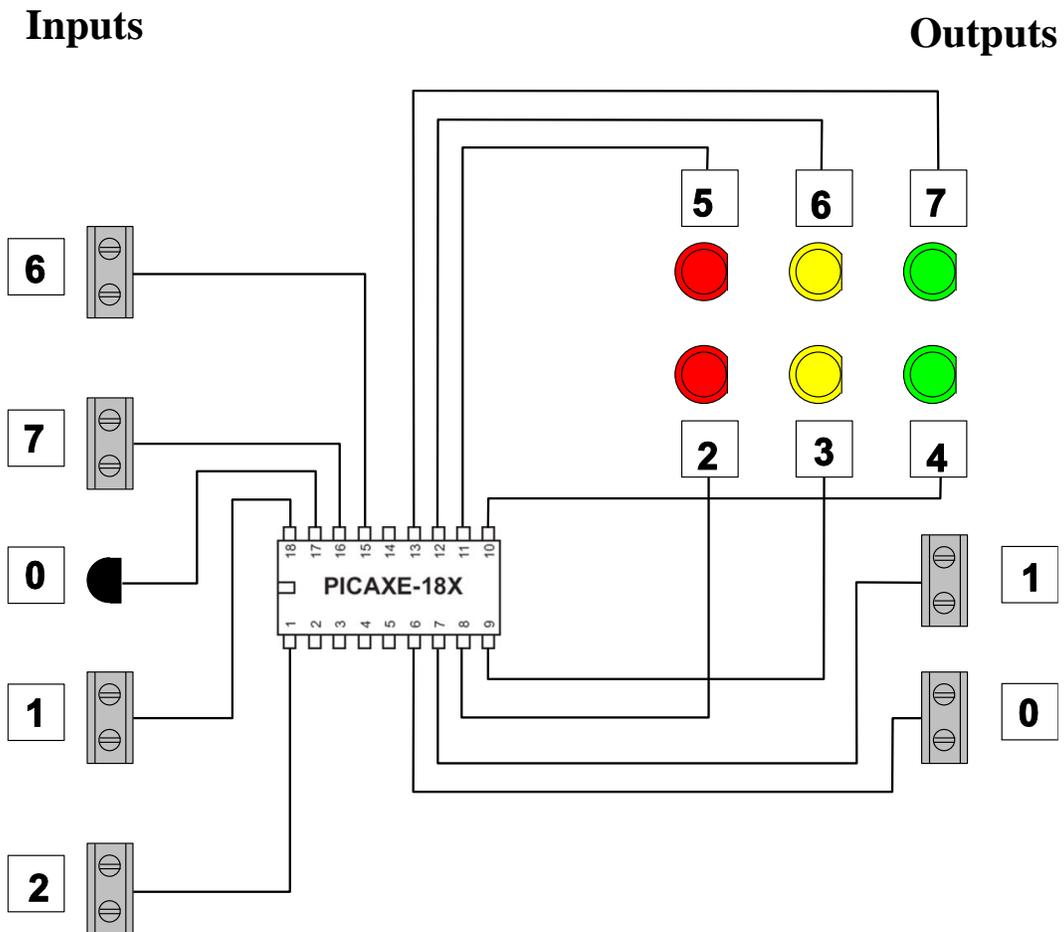
Inputs   **Outputs**

Project Board

Generic Board 'Input' and 'Output' connections: -

Inputs   **Outputs**

PICAXE assignments

Study each of the assignments below. Write up a flow chart and download to your PIXAXE board for testing.

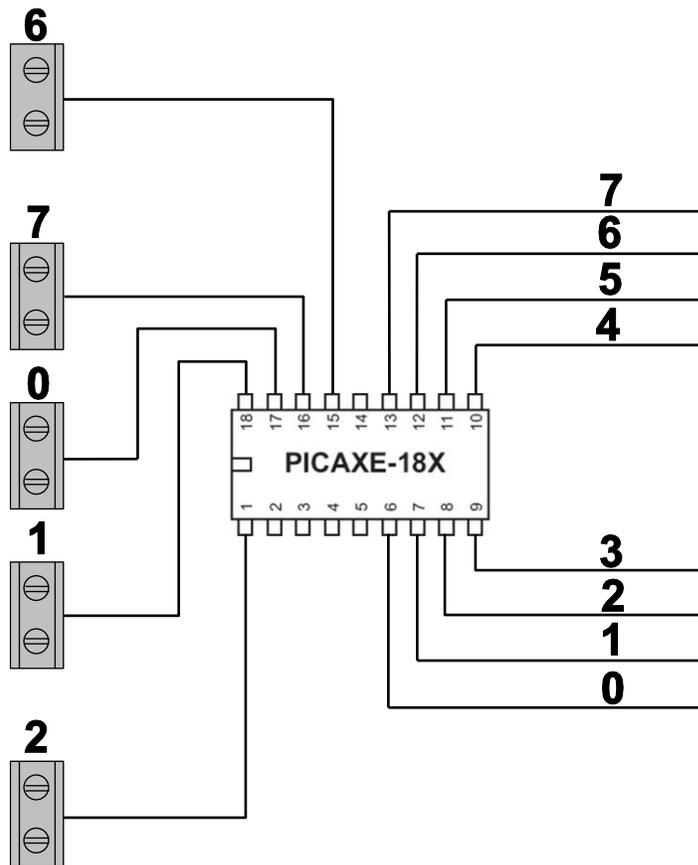1. A company logo is to be stamped onto boxes using a single printing plate. To prevent accidents, the machine will only work when the operator has both hands on the start buttons. If either button is released, the machine will stop. A buzzer and a light are used to indicate the machine is running.
   Design a system which will solve this problem. (Training or Project board)

2. Part of a production line involves a quality check. If goods are seen to be faulty then they are pushed off the conveyor by a motor. Two people are used to make sure that no faulty goods leave the factory. They each have a push button to operate the motor.
   Design a system which allows operator A **or** operator B turn on the motor. (Training or Project board)

3. Design a system for a light meter which will display the level of light available in your Technology room. (Training board)

4. You have been requested to design an alarm system which will sound a buzzer when a burglar steps on a pressure pad or opens window. A push to break switch is used to indicate when the window is open.
   What about adding a latch and a reset button? (Project board)

5. Design a system which will monitor the temperature in a room and switch on a fan when the temperature reaches a fixed level. When the temperature falls below the set level the fan should switch off. (Training board)

6. Your younger sister has asked if you can design a system which will play a tune when she hugs her toy rabbit. Can you help? Remember the tune must stop <u>immediately</u> when your sister stops hugging her toy. (Training board)

7. Design a pedestrian crossing with traffic signaling. A push button is used as an input for the pedestrian. Sound signaling must be incorporated for the visually impaired. (Project board)

More sample task for the Student Project Board

➢ Single set of traffic lights

➢ Pelican crossing

➢ Double set of traffic lights

➢ Timer countdown 6 seconds

➢ Reaction timer

➢ Chess timer

➢ Electronic dice

➢ Chaser for shop display / Halloween window display

➢ Random disco lights

➢ Motor/Fan control

➢ Solenoid for lock system

➢ Piezo sounder – Lorry or tractor reversing

➢ Switch on light bulbs

➢ Anti tilt device – tractor on a steep hill

➢ Train detector- 3km from station 1.5km from station etc

➢ Chevlon bike indicators

➢ Combination lock

➢ LDR Sensor / Home security

➢ PTM/PTB Configuration for house security

➢ Float switch – oil in tank

➢ Table tennis ball launcher – every 5 seconds

➢ Debating society

➢ Bleep test – fitness in gym

➢ Count press-ups – every 10th time switch is pressed switch on an LED i.e. 60 press-ups

➢ Score in a soccer match

➢ Drive an LCD Counter Display

➢ Mars bar simulation

➢ Using TB1 and TB2 drive a geared motor between two positions

➢ Hand dryer

➢ Display stand / Rotary table/ Revolving stage with light display

➢ Machine guard simulation

➢ Temperature control / Green house