Electronic Dice Board - “Pascal”

www.MaximumOctopus.com/electronics/pascal.htm

You’ll find the latest versions of the instructions and example code at the address above.

Thank you for purchasing the Pascal electronics kit! I hope you have lots of fun with it!

If you have any suggestions for future boards then please let me know. I’ll send you some free boards if I like your idea!

Kit Contents

This kit was put together by a team of highly skilled octopuses; it should contain the following items:

1) The main PCB
2) 2x 7-segment LED displays (either red or blue)
3) 1x PICAXE 08M2+ microcontroller
4) 2x push-buttons
5) 15x 330Ω resistors
6) 3x 10k resistors
7) 2x 16 pin DIP sockets
8) 1x 8 pin DIP socket
9) 3x 0.1µF capacitors
10) A 2 pin connector for power

The optional desktop kit contains:

1) 4x 18mm hex spacers and M3 screws
2) 8x washers
3) 1x battery clip
4) 1x 3xAA battery box
**Important Things to Remember**

This kit is designed to run from 5V. **Do not exceed 5V** or the ICs and LED components will be damaged. It will work fine from 4x 1.2V rechargeable batteries or 3x 1.5V alkaline batteries.

The LEDs and IC sockets (and corresponding ICs) must be placed on the board in the correct orientation or *pascal* will not work.

The two shift register and PICAXE ICs are sensitive to static shocks so handle them with care and avoid touching the legs (pins).

*Before* soldering any components check and then double-check that they are correctly oriented.

Don’t rush, and have lots of fun!

If you need a good tutorial on soldering then SparkFun Electronics has a good one ([https://www.sparkfun.com/tutorials/106](https://www.sparkfun.com/tutorials/106)) as does Adafruit Industries ([http://www.ladyada.net/learn/soldering/thm.html](http://www.ladyada.net/learn/soldering/thm.html)).
Building Instructions

You will need a soldering iron, solder, an octopus (or a set of handy helper things) and wire cutters. To keep some of the large components in place while soldering you might find Blue-Tac useful to stop them moving around or falling off, but be careful not to put it on anything that will get hot (resistor leads, LED leads etc.) or you’ll end up with a hot squidgy mess on your components.

Take your time and check the placement of every component before soldering them in place!

All of the components (except power connector) must be located on the top of the board, solder them on the underside.

STEP 1 – 330Ω Resistors (orange orange brown)
Solder each of the 15 330 ohm resistors on to the board first. These protect the LEDs from excessive current. It doesn’t matter which way around they go (but I like to make them all face the same way!).

They are labelled on the PCB as R1 to R14 (for the LED segments) and RDP (for the decimal points).

STEP 2 – 10kΩ Resistors (brown black orange)
Solder each of the 3 10K ohm resistors next. Two go in the bottom left corner, the third next to the 8 pin socket on the right. They are labelled R20, R21 and R22.

STEP 3 – 16 pin sockets
These sockets will eventually hold the two 74HC595 shift registers. Don’t put chips in until the end.

The socket on the left of the board has its “notch” facing down. The socket on the right has its “notch” facing up. Pin 1 can be identified by the square solder pad.

STEP 4 – 8 pin socket
This socket will eventually hold the PICAXE microcontroller. Place it so the notch faces the right. Pin 1 can be identified by the square solder pad.

STEP 6 – The Capacitors
There is one capacitor for each of the shift register ICs and they go in the spaces labelled C1 and C2. They are not polarised, they can go in anyway round. There is another capacitor, that is slightly larger, that goes in C3.

STEP 7 – Buttons
The two buttons go on the left-hand side of the board in the locations marked SELECT and ROLL. They should sit flat on the board.
**STEP 8 – Power Connector**

The 2-pin power connector can either go on the top or bottom side of the board. If you are planning on using hex spacers or fitting this in to a box then the underside will work best. If you solder it on the top then it’s best to have the screw terminals facing out, as in the picture above, if it’s going on the underside then have them facing inwards.

**STEP 9 – Seven-segment Displays**

These two devices fit on the board only one way around.

**STEP 8 – ICs in to the sockets**

Now all of the components have been soldered to the board it’s time to place the two 74HC595 chips and the PICAXE microcontroller in to their sockets. They should be socketed so the notch on the chip is on the same side as the notch on the socket (the left shift register faces down, the right one, up – this is very important!).

Before you try carefully slot the chips in to sockets you’ll notice that the legs are spread out too much to fit. They’ll need to be bent inwards before they’ll fit. DO NOT FORCE THEM.

The way I like to do this is by very carefully pressing each side of the chip on my desk until both sets of pins are parallel. Once the legs are parallel it will take a bit of force to push the chips in to the sockets, be gentle and patient.

That’s all the hard work finished, you should now have something that looks like the image below.
Pascal will turn on in “attract” mode with the word PASCAL scrolling across the display. Hold the ROLL button to start the dice. The ROLL button starts and stops the rolling.

The SELECT button puts pascal in selection mode. Press the SELECT button to toggle through all available dice modes, and ROLL to start rolling. Available dice modes are listed below:

- D4 (four-sided dice, will show: 01 – 04)
- D6 (six-sided dice, will show: 01 – 06)
- D8 (eight-sided dice, will show: 01 – 08)
- D10 (ten-sided dice, will show; 01 – 10)
- D11 (eleven-sided dice, will show; 01 – 11)
- D12 (a single twelve-sided dice, will show; 01 – 12)
- 2x D6 (two six-sided dice rolled together, will show; 02 – 12. The decimal point if two equal dice are rolled)
- 2x D6 (same as above, expect dice one is shown on the left display, dice two on the right)
- 3x D6 (three six-sided dice rolled together, will show; 03 – 18. The decimal point if three equal dice are rolled)
- D20 (twenty sided dice, will show; 01 – 20)
- 4x D6 (four six-sided dice rolled together, will show; 04 - 24. The decimal point if all equal dice are rolled)
- D49 (a forty nine-sided dice, will show; 01 – 49)
- D50 (a fifty-sided dice, will show; 01 – 50)
- D54 (a fifty four-sided dice, will show; 01 – 54)
- D100 (a one hundred sided dice; shows 01 – 00, where 00 is 100)
- D255 (255-sided dice, 00-FF, shows value in hexadecimal!)

Pressing SELECT will cycle through all possible dice modes, they will appear as the following on the display:

04, 06, 08, 10, 12, ‘12, .12, ’18, 20, 24, 49, 50, 00, FF

The PICAXE source code for this kit is available at the address at the top of this document.
Making the kit stand on your desk

**STEP 1 – Hex spacers**

For each of the four hex spacers, place a washer on one of the M3 screws then place it in one of the holes on the PCB, so the head of the screw is on the top of the board. Now place another washer on the screw, this should be on the bottom side, and screw the hex spacer on to the screw, but not too tight.

**STEP 2 – Battery box**

Using double sided sticky pads or similar, attach the battery box to the underside of the board, as far left as it will go. It’s important that the batteries are facing down (the sticky pads go on the bottom of the box) and the two connectors that the battery clip attaches to go on the right, closest to the power connector.

**STEP 3 – Battery clip**

Cut the clip to size and connect the wires to the battery connector, and the clip to the battery box. Check the polarity! Red wire to 5V, black wire to ground.
The source code for this project’s on-board PICAXE 08M2+ can be found here:

www.MaximumOctopus.com/electronics/pascal.htm

Please feel free to modify and publish the code as you see fit, but please let me know so that others can get the benefit from your code.

If you have any comments or suggestions for this kit then please let us know.

For more information, updates and details of new kits check out the following links:

- **Website**: www.MaximumOctopus.com
- **Twitter**: http://www.twitter.com/maximumoctopus
- **Blog**: http://maximumoctopus.wordpress.com
- **Online store**: http://store.MaximumOctopus.com
- **YouTube**: https://www.youtube.com/user/freshneyorg

This kit was designed and manufactured in the UK.