16x 5mm LED Display Board - “Freeman”

www.MaximumOctopus.com/electronics/freeman.htm

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

Thank you for purchasing the Freeman board! 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!

This kit can be powered by many microprocessors and development boards. I have been using it with the Arduino PICAXE, and Raspberry Pi systems.
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) 16 x 5mm LEDs  
3) 16 x 330Ω resistors  
4) 1 x 1N4001 diode  
5) 2 x 16 pin DIP sockets  
6) 2 x 74HC595 shift registers  
7) 2 x 0.1µF capacitors  
8) A 5 pin header

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 4 x 1.2V rechargeable batteries or 3 x 1.5V alkaline batteries.

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

The two shift register 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) as does Adafruit Industries (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 sit on the top of the board, solder them to the underside.

**STEP 1 – Resistors**

Solder each of the 16 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 R16.

**STEP 2 – DIP sockets**

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

Place them on the board so that the “notch” is on the right hand side (facing the octopus).

**STEP 3 – The diode**

The 1N4001 diode sits on the 5v line and protects the circuit from reverse polarity – that is, it will stop the sensitive components on the board from being damaged if the GND and 5v connections are connected the wrong way around.

The diode MUST be placed so that the end with the white marking is facing away from the octopus.

**STEP 4 – Headers**

These will be used to connect power and data to the board.

Split the 5-pin header in to a 3-pin and 2-pin header. The 3-pin header goes in the space marked “Control” on the board. The 2-pin header goes above it, in the space marked “Power”. Place them so the pins are pointing outwards.

The control pins are labelled:

- DS Data (serial data input)
- ST_CP Latch (storage register clock input)
- SH_CP Clock (shift register clock input)
**STEP 5 – The LEDs**

These are placed at the top of the board; the LEDs have a flattened edge (the cathode) that goes at the top of the board. Each LED has another identifying feature which is one lead slightly longer than the other; the longer lead is the anode and goes at the bottom.

**STEP 6 – The 0.1μF Capacitors**

These are soldered on the underside of the board to pins 13 and 16 of the shift registers. It’s probably worth bending them slightly so their leads don’t touch any of the vias (the small silver circles that connect the top to the bottom).

Notice that pin one has a square solder pad.

**STEP 7 – 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 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 – facing to the right.

Before you try to 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 this:

Connect the board up to your microcontroller of choice and start having fun! Start off by downloading the examples from the address at the top of this page and experiment.
LED Colour Suggestions

All red

All yellow

All orange

All blue

All green

Temperature or sensor

Binary clock; hours, minutes and seconds
Output Format

The pseudo-code for lighting up the LEDs on one board follows:

```plaintext
// send 16 bits, the first 8 go to the leftmost shift register
// the second 8 go to the rightmost shift register
Set the ST_CP (latch) low
Do this section 16 times, once for each bit:
{
  Set the DS pin (Data) to low or high (depending on data).
  Set the CLOCK to low.
  Set the CLOCK to high.
}
Set the ST_CP (latch) high
```

Byte 1       Byte 2
87654321 87654321

Byte 2 sets LEDs 1–8, byte 1 sets LEDs 9-16. A “1” turns an LED on, a “0” turns it off.

It’s important to send the bits from LEFT to RIGHT. The MSB of byte 1 first; the LSB of byte 2 last.

Have a look at the example programs for more information on how to talk to the shift registers.
Example source code for the following platforms can be found here:
www.MaximumOctopus.com/electronics/freeman.htm

  Arduino (and compatible boards) (arduino.cc)
  Espruino (and compatible boards) (espruino.com)
  PICAXE microcontrollers (picaxe.com)
  Raspberry Pi (all models) (raspberrypi.org)

If you would like some example code for a different platform then please get in touch.

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.

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