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Digital Barometer
G3YHV

Table of Contents

Change History

Version	Date	Details of Changes
1.0	April 2024	

Project Overview

This kit will enable you to construct a barometer which provides a digital readout of the current atmospheric pressure and the temperature (in Centigrade or Fahrenheit). The display alternates between the pressure and temperature under normal operation. If there is a rapid change in pressure the barometer will alert you using the 2 LED's.

The software is provided on a PIC chip which is pre-programmed. The software has been developed using Positron BASIC and the only way it can be changed is by re-programming the PIC chip.

At power up you can change a number of settings to change the operation of the barometer which are detailed later in this document.

The main component of the barometer is the Bosch BMP180 sensor. The BMP180 uses a piezo resistive element which produces an analogue output that represents air pressure and temperature. Each chip is individually calibrated during manufacture and the result is converted to a digital signal and output using the I2C communication protocol. This only uses two wires. The output consists a string of variables which have to be manipulated with some horrid arithmetic. Our pic chip does this using the Positron BASIC language.

The display chip is a TM1637. This is built into the four section seven segment display. Communication with the chip is a modified version of the SPI protocol. The Pic chip we are using is the PIC18F26K22-IP. This is the same chip that we used in the WSPR transmitter. The chip has a built in clock oscillator running at 64MHz, so no Clock crystal is required. This chip has 64k of program memory but our BASIC program is only using about 8k ! so we have plenty of room for more options or improvements. The chip can also store options in non-volatile memory which will be remembered when powered down.

The red and green LEDs are turned on by the two NPN transistors (BC547). If the air pressure is dropping rapidly the red LED will turn on for one hour - Bad weather is coming! The green LED will turn on when pressure is rising, the weather is improving. The detection setting is 2 Millibars change in one hour. Millibars are now called Hectopascals (hPa). Average pressure is about 1014 hPa. The lowest pressure record was 953.3 hPa (mb) in Plymouth during Storm Ciaran. The highest was a reading of 1050.5 hPa (mb) recorded at the Mumbles, in Swansea, making it the highest UK reading since January 1957. When the red warning LED comes on the circuit will send SOS in morse code using a piezo sounder. The green led will Play a "bing bong" sound !
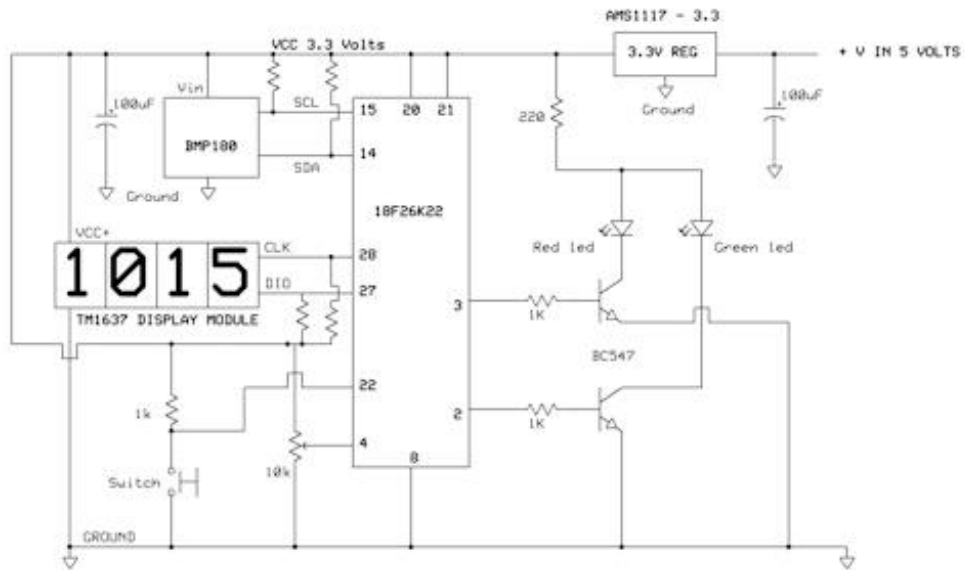

Front view   Back view

Circuit Diagram

Figure 1- Circuit Diagram

Components List

Supplied	Not Supplied
1 * PCB 1 * pre-programmed 18F26K22 PIC chip 1 * LED display module TM1637 (2 types) 2 * ultrabright LED's (1 red & 1 green) 1 * 3.3v regulator 2 * 8 pin header sockets to create the DIL Socket 8 pin header sockets (LED, Power, Sounder) 1 * 10k preset 2 * 100mFD 10v capacitor 2 * BC547 transistors 7 * 1k ohm resistor 1 * 220 ohm resistor 1 * Push Button tactile switch 1 * Piezo sounder 1 * Bosch BMP-180 Barometric/Temperature sensor	1 * Case 1 * Power Socket Hook up wire Power supply – up to 5v dc

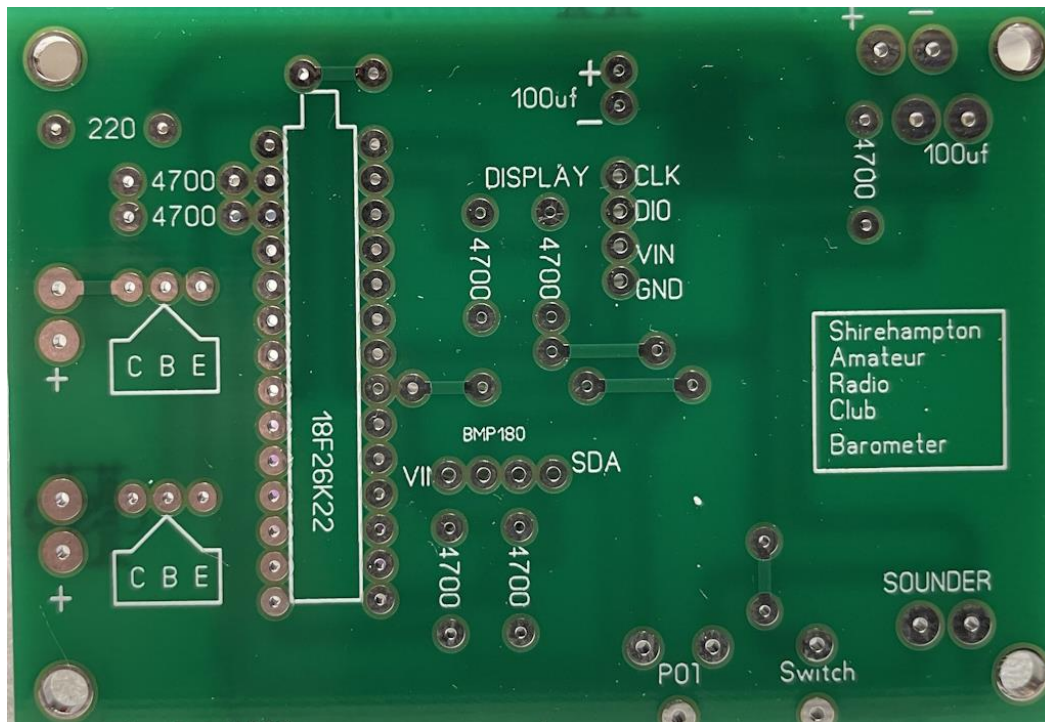*Figure 2- Component list*

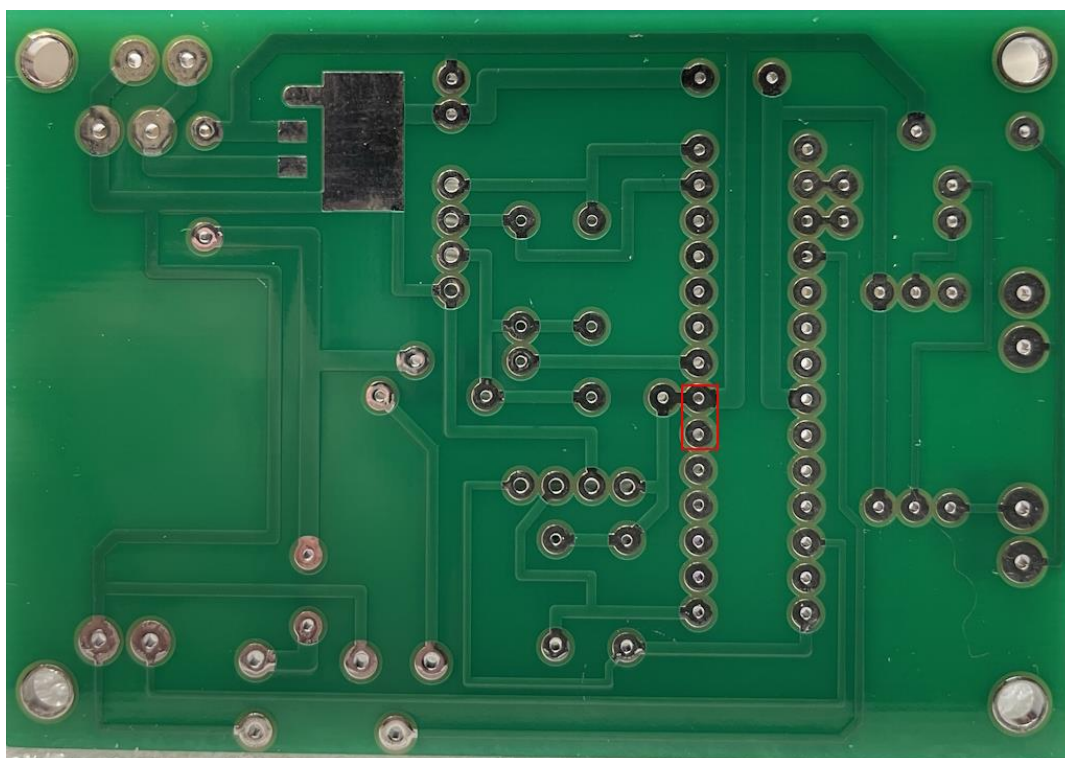# Circuit Board

Figure 3- Unpopulated Top of PCB

Figure 4- Unpopulated Bottom of PCB
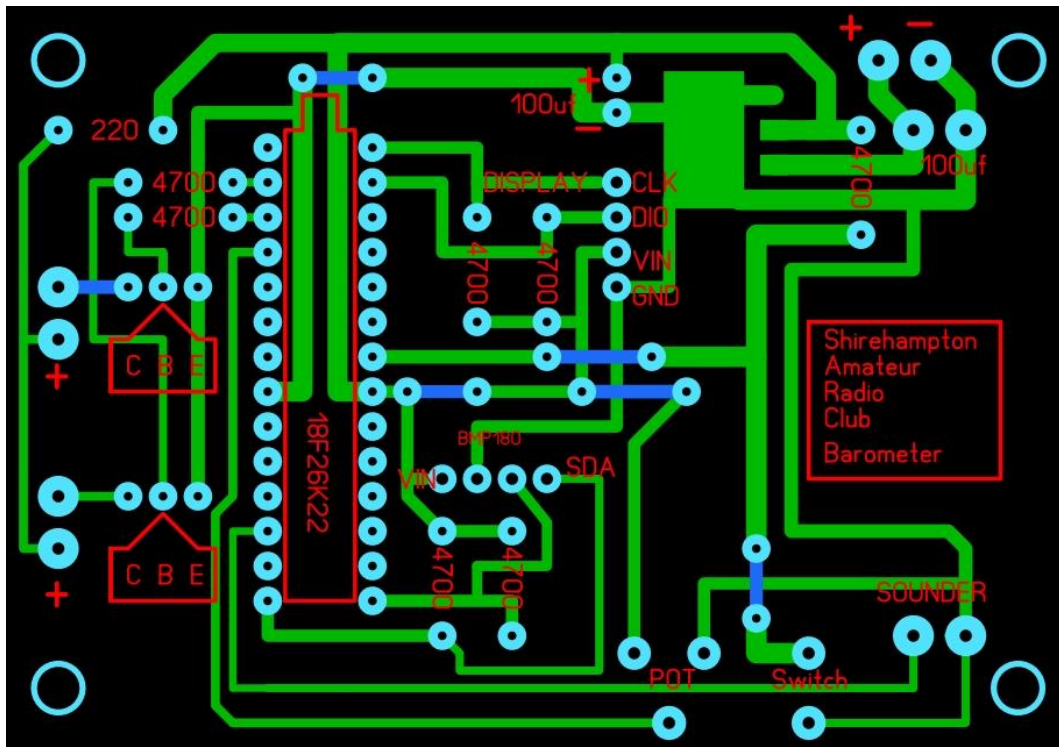
Approximate dimensions 7.5cm x 5.5cm

Figure 5- PCB layout from the computer viewpoint
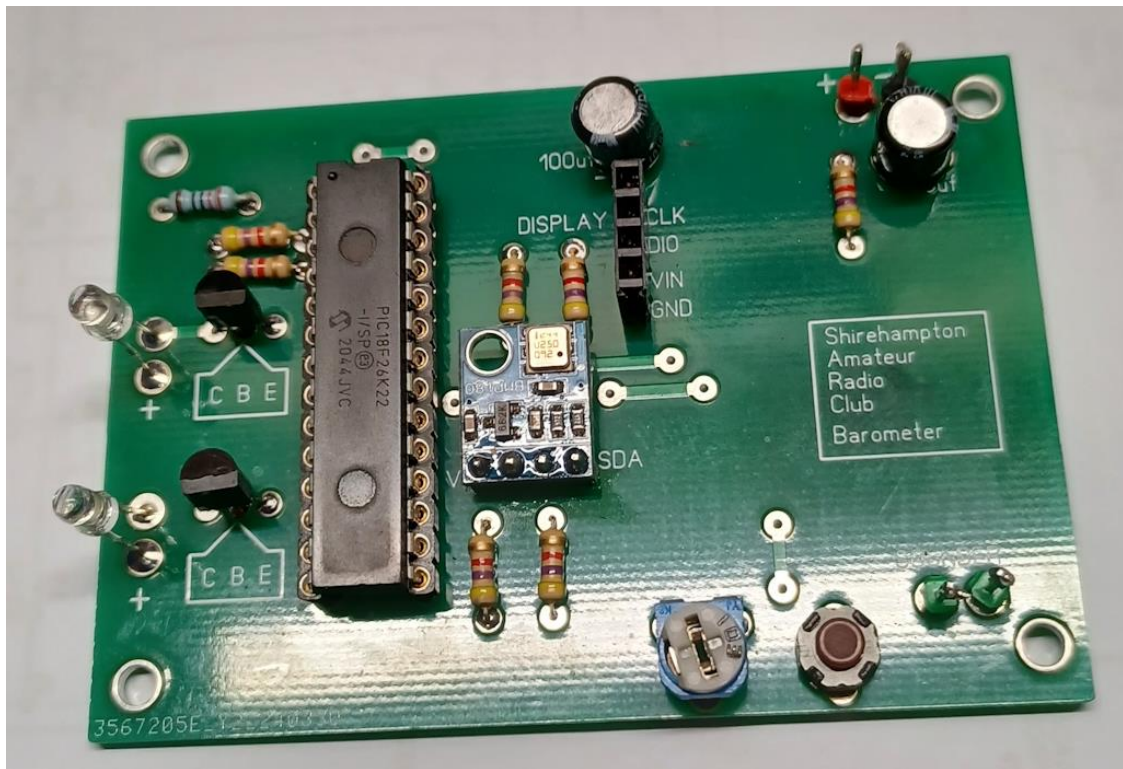
Construction

Figure 6- Completed board

There are only a handful of components to be soldered in and all are mounted on the board therefore the components are labelled rather than part numbers.

- The 2 pins on the base of the PCB must be linked/soldered due to a slight issue in the design. These are clearly marked in Figure 4.
- The tab on the regulator must **<u>NOT</u>** be soldered to the board, it should be removed.
- The red LED is located at bottom of the board, the green in the middle.

The LED display is supplied with pins attached which for initial testing is useful as the display can be plugged directly in the sockets on the board. Pin sockets have been provided to enable these connections to be made.

As the project box is not supplied this means there are multiple ways the display could be mounted along with the 2 LED's. The LED display could be connected using Dupont connectors or you may find it easier to remove the pins on the module and to wire to the boards directly.

The power supply to the board can be up to 5v DC. It will work up to 9v but the regulator will get hot so not a good idea with the BMP180 sensor being a thermometer. An old phone charger is ideal for this purpose but check the voltage ! Power consumption should be approximately 35mA.

Operating Instructions

On powering up the piezo sounder will emit 2 tones and the LED's flash.

Settings

There are currently 14 different settings that can be used to customise the barometer but this may increase!

The setting are accessed by pressing the small button at power on. If the unit is already powered on hold down the button for 7 seconds.

To select the different settings just turn the pot then press the button to store the it.

The options are as follows:

0. The barometer will return to its default settings.
1. Trim the pressure upwards by 1 mb
2. Trim the pressure upwards by 2 mb
3. Trim the pressure upwards by 3 mb
4. Trim the pressure downwards by -1 mb
5. Trim the pressure downwards by -2 mb
6. Trim the pressure downwards by -3 mb
7. Turn off all sounds
8. Turn on all sounds (Default)
9. Send Morse "SOS" at standard speed (Default)
10. Send Morse "SOS" at high speed
11. Temperature displayed in Fahrenheit
12. Temperature displayed in Centigrade (Default)
13. Reduce the brightness of the display module
14. Maximum brightness of the display module (Default)