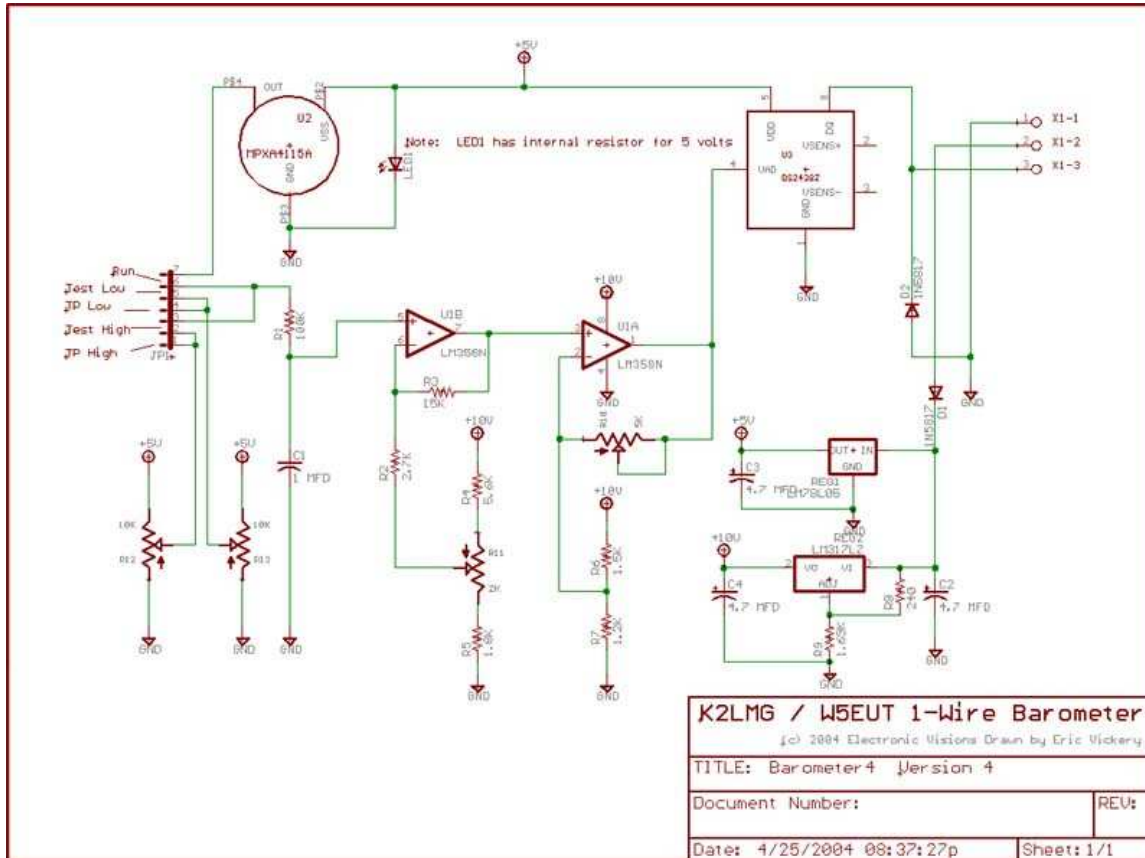


K2LMG/W5EUT 1-Wire Barometer – Version 4.0

This document describes details for constructing the 1-Wire Barometer which will work on a Dallas Semiconductor 1-Wire network. This design differs from Version 3.0 with the addition of a second calibration potentiometer.

As with 1-Wire Barometer Versions 1.1a, 2.0 and 3.0, this design uses a Motorola MPX4115 Silicon Pressure Sensor, a Dallas Semiconductor DS2438 Smart Battery Monitor (to perform 1-Wire analog to digital conversion), and an operational amplifier. It has two voltage regulators, two diodes, a LED, and several resistors and capacitors.

Circuit Schematic



Circuit Description

The circuit requires an additional power source other than that of the 1-Wire network. The MPX4115 requires about 7 ma of current. This is more than a 1-Wire network can provide without an elaborate circuit to store parasitic power from the 1-Wire network for short burst of current for pressure measurements. Two voltage regulators are used to provide both 5.0 and 10.0 voltages from a source of DC power ranging from 12 to 20 volts.

The resolution of the barometric pressure is about 0.00417 inHg (0.0139 kPa) for a pressure range of 28.0 to 31.0 inHg (95.0 to 105.0 kPa, or 950 to 1050 mb). Better resolutions are possible with a more restricted pressure range. For barometric pressures the MPX4115 output voltage ranges from about 4.25 to 3.79 volts at sea level, and about 2.77 to 2.45 volts at 10,000 feet. Most of this range is above the active voltage range of a 5 volt opamp circuit. In effect the sensor voltage is referenced to the power supply, not ground as desired. Fortunately the DS2438 Smart Battery Monitor accepts inputs as high as 10 volts. Thus by powering an opamp from 10 volts the output of the MPX4115 is well in the opamp and DS2438 range.

The MPX4115 output is fed through an RC filter to opamp stage, U1B, which has a fixed gain of approximately 4. This stage has an adjustable voltage input which is added to the barometric sensor output within the opamp, thereby allowing the adjustment of the output voltage offset to the A/D converter. This in turn is fed to opamp stage, U1A with an adjustable gain. It is capable of a gain range of 1/1 to about 4.14/1. The two 10-turn potentiometers (pots) control the gain and offset. R10 controls the gain of U1A and R11 controls the offset of the output voltage to the 1-Wire DS2438 A/D converter.

The MPX4115 feeds R1 through jumper JP1. This allows easy change of the input voltage from the MPX4115 to R12 and R13 for calibration.

Construction and Calibration

It is assumed that you already have 1-Wire hardware and software working on a computer. If not you must obtain information on both at: <http://www.ibutton.com/software/tmex/index.html>.

NOTE: Baro30Cal.exe will use the IDs R3 and R4 but on the version 4.0 board these parts have the IDs R10 and R11.

1. Download Baro30Cal.exe.
2. Run Baro30Cal.exe. Note: You will need the VB 6.0 runtime files on your computer. If you do not have these files a search of "visual basic V6.0 runtime" on Google.com will find many free sources for them.
3. Enter your altitude and desired low and high barometric pressures. Note: To convert kPa to inHg divide kPa value by 3.3863 (or millibars by 33.863).
4. Set R10(R3) and R11(R4) to the values obtained from Baro30Cal.exe. Note: You should subtract 1,800 (the value of R5) from the value specified for R11(R4).
5. Finish constructing your barometer.
6. Connect the barometer to your 1-Wire interface on your PC and run the iButton viewer.
7. Apply power to your barometer.
8. Connect the shunt to the Test Low position of JP1 (across pins 5 and 6) to supply LoVin directly to opamp U1B from the calibration pot R13.
9. Set R13 to LoVin using pin 4 of JP1 as the test point.
10. Connect the shunt to the Test High position of JP1 (across pins 2 and 3) to supply HiVin directly to opamp U1B from the calibration pot R12.
11. Set R12 to HiVin using pin 1 of JP1 as the test point.
12. Move the shunt back to Test Low position of JP1 (across pins 5 and 6).

13. Adjust R11 to make it be equal to LoVolt using the iButton viewer.
14. Move the shunt to Test High position of JP1 (across pins 2 and 3).
15. Adjust R10 to make it be equal to HiVolt using the iButton viewer.
16. Repeat steps 11 through 14 until no more adjustment is needed.
17. Remove power from your barometer and set the jumper to the Run position.
18. Connect your barometer to your 1-Wire network and run your weather station software.
19. Finish the calibration by setting the barometric pressure reading to that of a nearby airport barometric pressure.

Suggestions on Final Calibration

Once you have constructed your barometer and done the initial calibration, it is recommended that you do a final calibration after the barometer has been operated for several days. Getting your barometer accuracy calibrated will take adjustment over several cycles of barometric pressure change. The initial calibration will not be accurate unless your MPX4115 has the same output vs. pressure slope as the typical sensor. Our recommendation is that you do not attempt to adjust the potentiometers of your barometer until you create a spreadsheet of local airport pressure vs. your readings, and do this for a significant number of readings over a range of pressures.

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