KANGA PRODUCTS

Kanga Barometer / Propagation Indicator

Some might dismiss this as the most boring kit they'll ever build — but if you're anything like me, you'll find yourself using it every single day. A simple barometer can reveal a surprising amount about the weather and radio conditions.

🌦️ Why Pressure Matters

- High pressure often signals settled weather. In winter, it can mean crisp, clear cold spells; in summer, it usually brings sunshine.
- Low pressure tends to bring cloud, rain, and unsettled conditions.
- Rapid pressure changes are especially telling:
- A sharp drop may indicate an approaching storm.
- A sudden rise often means a storm is subsiding.

📡 Relevance for Radio Hams

For us in the amateur radio world, knowing the pressure trend is more than just meteorology — it’s propagation intelligence. VHF (above 30 MHz) and higher frequencies are particularly sensitive to atmospheric pressure. You may have heard of a “lift” — a phenomenon where signals bend or refract over long distances due to high-pressure systems. These conditions can dramatically improve range and signal clarity.

In the analogue TV era, high pressure sometimes caused interference from continental stations bleeding into local frequencies — a mixed blessing depending on your interests!

🔧 Kit Overview

The Kanga Barometer kit features:

- LED barograph display from 985 mb to 1030 mb
- Over/under pressure indicators
- Reversible front panel: one side shows pressure, the other shows local propagation status
- Low power consumption: most current goes to the LEDs; the BMP280 sensor and ATmega328 controller draw only a few mA

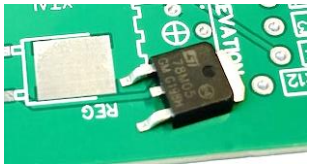
📦 Parts Checklist

Before you begin, confirm you have all the components:

- Metal case (split type)
- Front & rear panels
- 8 × 2 mm fixing screws
- PCB
- DC power socket
- 90 degree Pin Strip
- LED mounting PCB
- 5 × Red 3 mm LEDs
- 3 × Yellow/Orange 3 mm LEDs
- 4 × Green 3 mm LEDs
- 3 × 4.7 kΩ ¼W resistors (1st three bands Yellow, Voilet, Red)
- 6 × 10 kΩ ¼W resistors(1st three bands Brown, Black, Orange)
- 4 × 15 kΩ ¼W resistors(1st three bands Brown, Green, Orange)
- 10 kΩ trimmer resistor , Marked 103
- 5 V SMD voltage regulator
- 2 × 100 nF MLCC capacitors (marked “104”)
- 2 × 22 pF MLCC capacitors (marked “220”)
- 16 MHz crystal
- Push Button
- 1N4001 diode (or 1N4004/4007)
- 4-pin strip
- 28-pin DIP socket
- 3-way DIP switch
- ATmega328 pre-programmed controller
- BMP280 pressure sensor
- 4 x Stick on feet

Stage 1: Power Regulator Circuit

Step 1: Voltage Regulator (SMD)



Don't panic — this SMD part is unusually large and easy to handle.

1. Apply a small blob of solder to one of the regulator's small pad positions on the PCB.
2. Position the regulator so its leg sits on the solder blob.
3. Hold the body gently and apply the iron to the leg until the solder melts and bonds.
4. Check alignment — if it's not square or leaves no room to solder the top tab, reheat and adjust.
5. Once satisfied, solder the second leg and the large top tab.

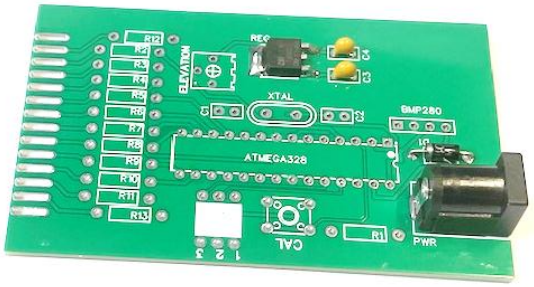
Step 2: DC Power Socket

- Fit the socket flush and square to the board edge.
- Trim the large tags underneath as flush as possible.

Step 3: Diode D1

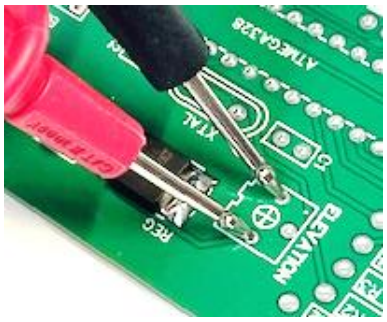
- Fit any 1A diode (e.g., 1N4001).
- Ensure correct orientation: the band on the diode must match the PCB's printed line.

Step 4: Capacitors



- Fit the two 100nF MLCC capacitors (marked "104") — these belong in this stage.
- Do not confuse them with the 22 pF capacitors (marked "220") — those are for the crystal stage later.

Step 5: Final Checks



- Inspect all joints and trim leads flush to the board.
- You may now perform a power test: (optional)
- Connect a 7–14 V DC supply.
- Measure voltage across the outer terminals of the trimmer position — you should see a steady 5 V.

🔧 Stage 2: IC Socket, Resistors & Trimmer

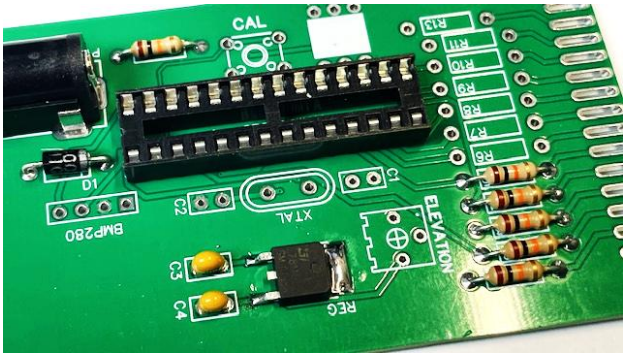
IC Socket

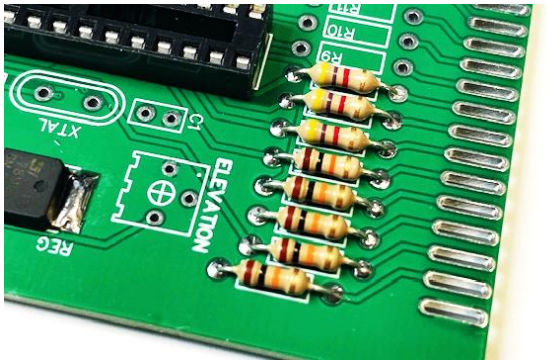
- Locate the 28-pin IC socket.
- One end has a small notch — align this notch with the corresponding notch printed on the PCB, which should be nearest to the DC power socket.

Resistors

This kit uses 3 different resistor values, making identification straightforward.

- Fit the following 10 kΩ resistors (colour bands: Brown, Black, Orange):
- R1 to R5 then R12

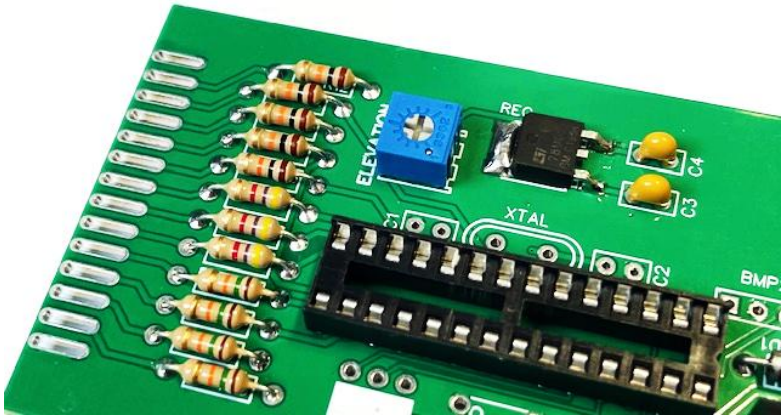




- Next fit the following 4.7 kΩ resistors (colour bands Yellow, Purple, Red):
- R6 to R8

- Fit the following 15 kΩ resistors (colour bands: Brown, Green, Orange):
- R9 to R11 & R13

These resistors control LED brightness. Green LEDs are most efficient, so they use higher-value resistors to balance intensity with the red and orange LEDs.



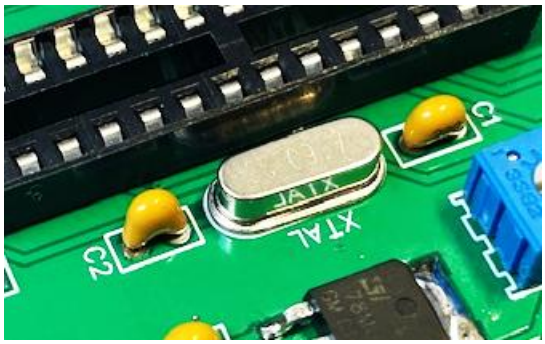
Trimmer Potentiometer

Fit the small blue trimmer in the position marked ‘ELEVATION’ on the PCB.

This will be used later during the calibration process to fine-tune altitude compensation.

🔧 Stage 3: Crystal & Capacitors

22 pF Capacitors



- Fit capacitors C1 and C2, marked “220” — this denotes 22 pF.

These are used in conjunction with the crystal oscillator. Trim leads neatly after soldering.

16 MHz Crystal

- Fit the crystal flush to the board.
- It is non-polarised, so it can be installed either way round.

🔧 Stage 4: CAL Push Switch & 3-Way DIP Switch

• Locate the 3-way DIP switch and insert it into the designated position on the PCB.

Ensure the ‘ON’ marking is closest to the edge of the board — this sets the correct orientation.

• Fit the CAL push button into its marked position.

Before soldering, double-check that all four pins are fully protruding through the PCB.

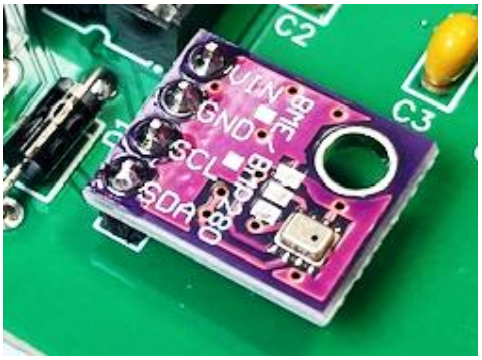
Stage 5: BMP280 Pressure Sensor

This kit uses the BMP280, a precision pressure sensor that also monitors ambient temperature.

It calculates true sea-level pressure by compensating for local elevation and temperature — essential for accurate barometric readings.

Steps:

- Locate the 4-pin header strip.
- Insert the strip so that the longer pins pass through the PCB and the shorter pins remain on top.
- Solder the header vertically, ensuring it sits flush and upright on the board. Trim the leads under the board when fully soldered.

- 

Carefully fit the BMP280 module onto the header. Keep it square to the main PCB.

- Important: The sensor must be oriented facing upwards — this ensures the data and power pins are correctly ordinated. (see Photo)

For now that completes the first part of the build.

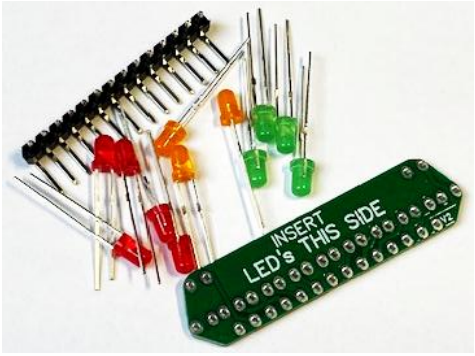
Now we move onto the LED front PCB.

This is the most difficult part of the kit

In order to fit the 12 LEDs into such as small space we have a very close pin spacing of around 2mm. you will need a fine tip soldering iron and I would suggest some decent soldering skills.

The Board as two sides, one marked ‘Connector this side’ and the other side marked ‘Insert LED’s This Side’

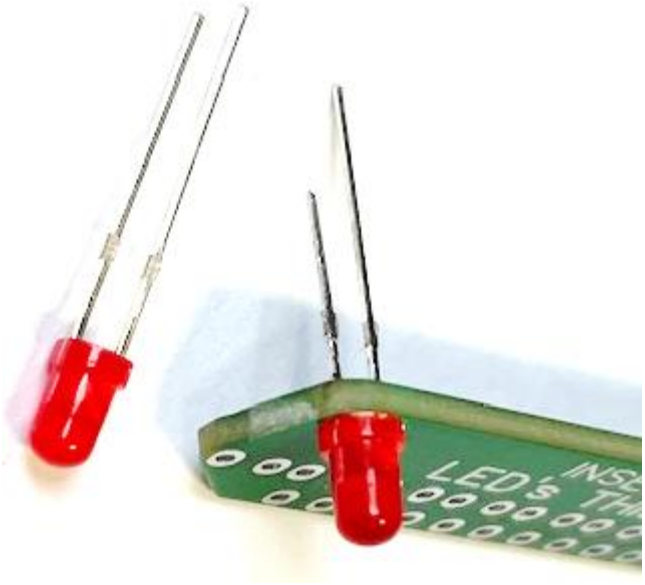
💡 Stage 6: Fitting the LEDs, Read all this Stage BEFORE doing any work!



Installing the LEDs requires precision and care — this is one of the more delicate steps in the build. Fully read this Stages instructions **BEFORE** starting work.

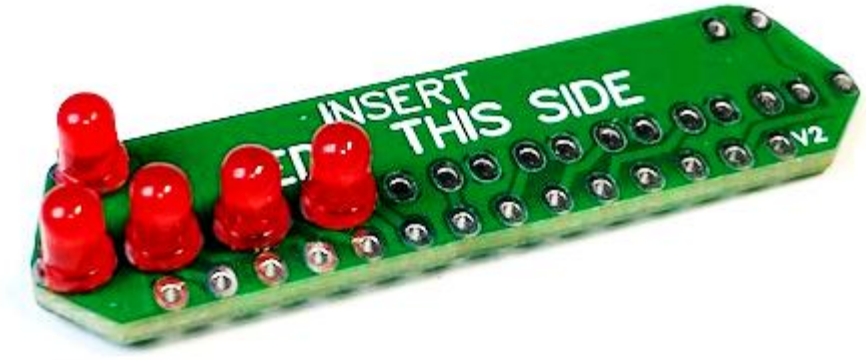
✒️ Fitting the LEDs – Orientation & Placement

Before fitting the LEDs, take a close look:



Each LED has one leg longer than the other. This indicates polarity. LEDs are polarised components and must be installed the correct way round.

- The longer leg is the anode (+) and should be positioned as shown in the reference photo.
- Insert the first LED (Red) into its designated position on the PCB, ensuring correct orientation. The shortest leg should be nearest to the edge of the board.
  VERY IMPORTANT be 100% sure you have put each LED in correctly. It will be VERY hard to correct any mistakes you make on this board.
- Carefully solder the LED in place, making sure it sits flush to the board.
- Repeat this process for each LED, one at a time. Making sure the LED's are correctly orientated as the first one. Make sure you use the correct row of holes for the LED's. the bottom row is for a connector we will fit later.



after fitted a few LED's try putting the front panel on top of the LEDs, if the LEDS are not square it will be hard to fit the front panel. At this stage it shouldn't be to hard to slightly reposition any led that is causing a problem, (do this check a number of times as you fit all the LEDs).
Once all Red LEDs are fitted move onto fitting the Orange and then the Green. Be 100% sure that these are fitted the same way as the Red ones. As you insert the LED the long leg should be on the right side as you look at the front of the board.

- Trim the leads flush to the board.
- Inspect each joint for clean soldering and confirm there are no solder bridges between adjacent pins,

Recommended Approach:

I tend to insert most components and slightly bend the legs apart before soldering to help hold the part in place. **DO NOT do this!** Keep the LED legs straight, bending the legs will make the chances of forming solder bridges much more likely.

1. Fit each LED one at a time with the correct orientation , carefully holding it in position.
2. Ensure the LED is fully seated and flush against the PCB before soldering.
   Each LED MUST be flush to the board or the front panel will not fit!
3. Solder each pin cleanly, avoiding excess solder.
4. Once satisfied with the alignment, trim the leads as flush as possible.
5. Inspect each joint closely to confirm there are no solder bridges between pins.

🔧 Final Assembly: LED Board and Pin Strip

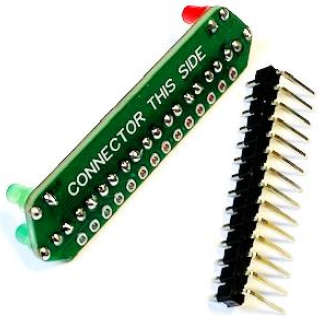
1. Inspect the LEDs

Once all LEDs are fitted, perform a final inspection of the solder joints. Ensure that:

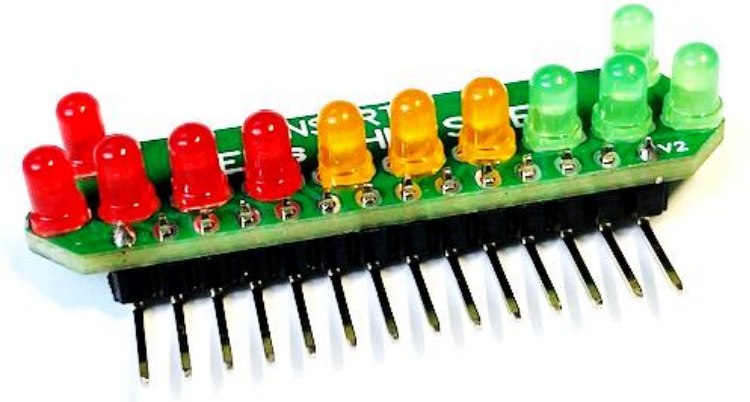
- All LEDs are seated flush against the PCB.
- Each solder joint is clean and free from bridges or cold joints.

2. Fit the Mounting Pin Strip

The pin strip has two lengths of pins: a short side and a long side.



- Insert the short pins through the designated holes in the LED board, as shown in the reference photo.
- Ensure the long pins are pointing downward, away from the PCB.



Begin by soldering the two outer pins to hold the strip in place.

- Check that the connector sits squarely and flush to the board.
- Once aligned, carefully solder the remaining pins, taking care to avoid solder bridges.

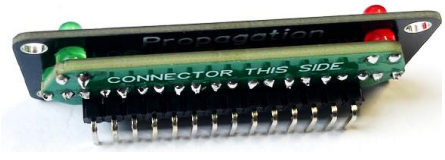
3. Final Check

After all pins are soldered:

- Inspect the board for any missed pins or solder bridges.
- Reflow any joints if necessary to ensure a reliable connection.

Now we can start putting things together.

Select what side of the front panel you want to use, Pressure or Propagation and push the front panel onto the LEDs. It maybe tight so do it careful and be sure its square to all the LEDs

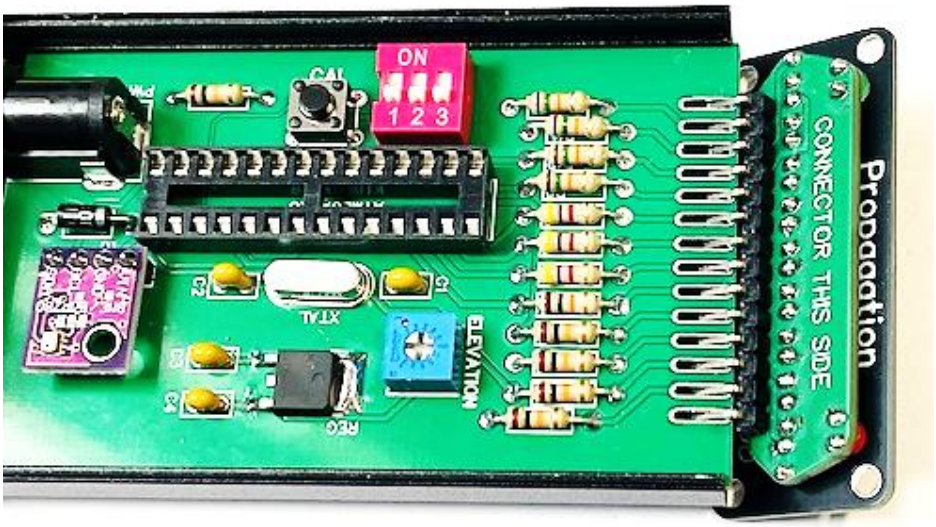


Barometer Assembly: Case and PCB Installation

🛠️ Prepare the Case

- Select one half of the enclosure to serve as the bottom section.
- Attach the rear panel to this bottom half using two screws. Ensure it's properly aligned and securely fastened.
- Carefully insert the main PCB into the bottom half of the case. Slide it into the grooves if the bottom half from the front of the case

Make sure it sits flat without forcing or bending any components.



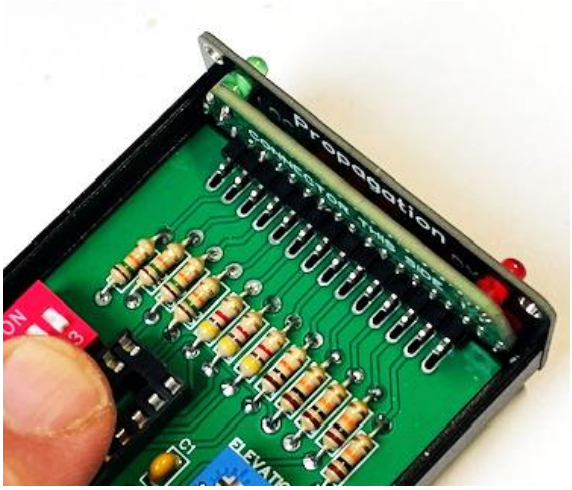
🧩 Fit the Front Panel

- Place the front panel onto the mainboard.

You'll notice the pins on the front panel are slightly too long — trim 2–3mm from each pin.

⚠️ Trim gradually and test fit often to avoid cutting too much.

- Once the front panel fits without fouling the bottom of the case, secure it to the bottom half using two screws.



🔧 Align and Tack the Display Connector

• The main board should now be able to slide back and forth slightly — the LED board slots allow this.

• Slide the board fully backward.

• While holding it in this position, tack solder the end pins of the display board connector to the main board.

This locks the alignment before full soldering.

🪛 Soldering Options

You now have two choices for completing the connector soldering:

- Option 1: Remove the assembly from the case and solder all connector pins from the underside of the board.
- Option 2: Continue soldering the remaining pins from the top side.

Either method is fine — but in both cases, you'll need to remove the assembly afterward to trim the excess leads on the underside.

🚫 Do Not Fit the Top Case Yet

Leave the top half of the enclosure off for now — we still need access to the board.

🧠 Fit the Processor Chip

- Locate the dot on the chip near one pin — this marks pin 1.
- Insert the chip with the dot facing the pressure sensor end of the board.

⚡ Power-Up and Self-Test

You can now perform a quick power-on test.

Note: The pressure readings will be uncalibrated and meaningless at this stage.

- Apply 7–14V DC using a standard 2.1mm barrel jack (centre positive).
- Current draw is minimal (just a few milliamps, mostly for the LEDs).
- A small regulated plug-in PSU is ideal — aim for 9–10V if possible.

🔍 On Power-Up:

- If the pressure sensor fails, the top red (Storm) and top green (Extreme High) LEDs will flash alternately.
- If the sensor passes, all LEDs will light in an animated sequence — a visual confirmation.
- After a short pause, the default pressure value appears.

This will be replaced by the uncalibrated pressure reading after 2–3 seconds.

⚠️ Warning:

If two LEDs (3rd from the left and 3rd from the right) glow dimly, unplug the power immediately.

This means the processor chip is inserted backwards, which could cause damage.

That said, the chips are quite robust — I've done this myself during prototyping and never damaged one.

🍼 Calibration

To set accurate pressure readings, follow the calibration guide below.

Until calibration is complete, the displayed values will be random and unreliable.

🔗 Final Touches

- Fit the four stick-on feet to the bottom of the case.
- Once calibration is complete and everything is working, attach the top half of the enclosure.

🎉 Completion

I hope you've enjoyed building your Kanga Barometer and find it both useful and rewarding.

Calibration Guide

You'll need your elevation in **metres above sea level**.

DIP Switch Settings

DIP Switch Settings

Elevation Range	SW1	SW2	SW3
0–100 m	OFF	OFF	OFF
100–200 m	ON	OFF	OFF
200–300 m	OFF	ON	OFF
300–400 m	ON	ON	OFF
400–500 m	OFF	OFF	ON
500–600 m	ON	OFF	ON
600–700 m	OFF	ON	ON
700–800 m	ON	ON	ON

Calibration Steps

1. Set DIP switch to match your elevation range.
2. Apply power.
3. Press and hold CAL button.
4. Adjust CAL trimmer — each LED = 10 m.
5. Release CAL button — all LEDs flash 5× to confirm.
6. Done! Pressure is now corrected for your elevation.

Example: Wolverhampton is ~150 m ASL. Set SW1 to ON, SW2 & SW3 to OFF. Adjust CAL trimmer for 50 m (5 LEDs).

For quick setup in the UK if you don't know your height above Sea level (ASL), use 160m (average height ASL in UK) : SW1 ON, others OFF, CAL trimmer = 6 LEDs.

🌍 For elevations above 800 m ASL, contact me for a special firmware version.

What do the LEDs tell us?

There are two special LED's one by the Storm logo and one by the Sun. These have special meaning.

🌩️ **STORM LED Indicator**

The STORM LED serves as a warning for very low atmospheric pressure:

- If the LED is solidly lit, it indicates pressure between 975 mb and 985 mb — a range typically associated with storm conditions.
- If the LED begins to flash, it means the pressure has dropped below 975 mb — a rare and serious event that strongly suggests a major storm is imminent.

⚠️ Take note: readings below 975 mb are uncommon in the UK and should be treated as a significant weather alert

🌞 **SUN LED Indicator**

The SUN LED provides a visual cue for unusually high atmospheric pressure:

- When the pressure rises above 1035 mb, the SUN LED will light solidly — this is considered exceptionally high.
- If the pressure exceeds 1040 mb, the LED will begin to flash, indicating extremely high pressure.

Such conditions typically suggest:

- Dry, hot weather during the summer months
- Cold, clear spells in winter

🌤️ High pressure is generally associated with stable, settled weather — a welcome sign for outdoor activities and VHF propagation alike.

The Bottom Row of LED’s indicate the pressure between 985mb and 1030mb which is considered the normal range.

LED Indicators:

Pressure Range	LED Behaviour
< 975 mb	Storm LED flashes
975–985 mb	Storm LED solid
985–1030 mb	Bottom row LEDs light in 5 mb steps
1035 mb	Extreme High LED solid
≥ 1040 mb	Extreme High LED flashes