A short guide to altimeter setting

Most of us fly with an instrument that has an altimeter function, but many pilots are a bit hazy about correct altimeter settings. It is important to get to grips with these as they can be critical on XC flights, where you will inevitably encounter controlled airspace or other hazards (and for powered pilots when approaching or joining a circuit pattern at an airfield).

Many pilots taking the BHPA Pilot mock exam had difficulty with the question about altimeter settings (www.bhpa.co.uk/sport/bhpa/mock_exams.php). This article looks at the basics of settable pressure altimeters (flight instruments, not mobile phone or smart-watch apps which mostly rely on GPS data).

An altimeter can be pre-set to give the pilot three distinct pieces of information: height, altitude and Flight Level.

Height. This is the distance above some pre-determined point on the ground. This can be the take-off point, the approximate ground level you will be flying over, or a specific reference point such as your landing goal field or an aerodrome you may need to overfly.

The pressure setting to achieve a height reading is known as QFE (in general aviation it usually refers to an airfield). An incoming aircraft would check a map to find this out, or would make a radio call to the airfield. The mnemonic 'Field Elevation' is often used to remember QFE.

Your height is very useful to know when joining an airfield circuit or when flying XC. Some hazards are marked on air charts with their height above the surface; or extend upwards from surface level. For example the ATZ of an aerodrome extends to 2,000ft above aerodrome level (AAL), which is helpfully noted on the chart.

Many of the instruments used in our sport will automatically set the altimeter at zero when they are switched on, or shortly before launch, giving QFE above your take-off location..

Altitude. This is distance above mean sea level (AMSL). If you are launching from a point marked on the map as 920ft, you would set your altimeter to read 920ft before you take off. Altitude is also used to define the vertical dimensions of other hazards; how high cables on tow fields will reach, for example, or the vertical limit of Prohibited or Restricted areas. The setting to achieve a distance above mean sea level reading is known as QNH. The mnemonic 'Nautical Height' is often used to remember it.

Flight Level. A Flight Level is also a distance above sea level, but based on a set of criteria – the ICAO standard atmosphere – that assumes a sea level pressure atmospheric of 1013.25 hectopascals (hPa)* or Standard Pressure Setting. It is very important to have access to this reading, as much of the UK's controlled airspace has its vertical dimensions expressed as Flight Levels.

Photo: Colin Fargher

Clearly you need to know your own Flight Level to be able to know your position relative to this airspace.

On many flight instruments this setting is easily achieved by pressing the 'SPS' or '1013' button. If you don't have this facility you need to know the current sea level pressure and do some mental arithmetic. It is preferable to set one of your altimeter functions to the correct value before take-off.

Even a moderate cross-country distance will see the pilot having to refer to their height, altitude and their Flight Level in order to navigate hazards and avoid vertical infringements of controlled airspace.

You should be familiar with when each setting should be used, and with checking each of these on your instrument in flight.

It may be tempting to simply leave your altimeter on one setting, but this is a bad idea because the atmospheric pressure can vary significantly – in the last four days it has changed from 1019hPa to more than 1029hPa.

Atimeter readings are affected by changes in pressure, each hectopascal (hPa) equating to approximately 30ft. With the change in pressure noted above, any controlled airspace based on the Standard Pressure Setting (ie defined by a Flight Level) will have moved upwards by more than 300ft in the last few days, and relative to an altimeter set to QNH.

On a day with a sea level pressure of 1016hPa, a pilot might be flying below some Class D airspace with a base of FL45 (often thought of as 'about 4500ft'). With an altimeter set to QNH and reading 4,300ft they would be 300ft below the airspace boundary. A few days later, if the pressure had dropped by 13hPa to 1003hPa, the pilot flying in the same place with their altimeter set to the changed QNH and again reading 4300ft, would now be 100ft inside the controlled airspace (and making an illegal airspace infringement).

For this reason, anyone flying close to controlled airspace with its dimensions defined by a Flight Level, must be using an altimeter set to the Flight Level datum.

Equally, a pilot flying on a Flight Level setting will not know their position relative to lower-level airspace or other hazards based on a QNH or QFE datum, such as an ATZ or when overflying a town.

Key points

- A pressure change of one hectopascal means a change in the altimeter reading of approximately 30ft.
- As atmospheric pressure rises, airspace based on a Flight Level also rises further above the ground (and the opposite if the atmospheric pressure drops).
- Each aerodrome has its Altitude in feet marked on an aeronautical chart.
- The Transition Altitude (at which you switch to Flight Level) within the UK is 3,000ft, except in, or beneath, some specified airspace. For example, the transition altitude within or beneath the Doncaster/ Sheffield CTR/CTA, and the Manchester TMA, is 5,000ft. For the Belfast TMA and Scottish TMA it is 6,000ft. There are 23 exceptions to the default 3,000ft Transition Altitude; a full list is available on the NATS website (aurora.nats.co.uk).
- When flying at or below the transition altitude below a TMA, CTA, or Airway whose base levels are expressed as an Altitude, pilots should use the QNH of an adjacent aerodrome in order to avoid penetrating the base of the controlled airspace.
- Sometimes you may be flying over one hazard, with vertical dimensions expressed in QFE or QNH, but below other controlled airspace based on a Flight Level. To navigate through the sandwich, you need to know both readings. An instrument with at least two altimeters that you can toggle between is very useful.

This the basic information that anyone seeking a BHPA Pilot rating or wishing to fly XC needs to know.

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*** Hectopascal is the unit of atmospheric pressure used throughout Europe and in weather forecasts. One hPa has the same value as one millibar (mb), which you may be familiar with and is often used in older publications. In the USA atmospheric pressure is measured in inches of mercury. 1 inch of mercury (inHg) = 33.86 hPa**