

Calibration Advice: This is a general guideline. It needs to be checked against advice/manuals from the manufacturers of units.

At the dock:

- 1 Many units allow damping the output on the display. To start the damping of each unit should be set to low/very low level so that each display fluctuates every second or so but not faster.
- 2 Check that the setting of the autopilot is set correctly: the rudder must move freely between its max positions, maximum steering must not run the rudder against the chocks, the centre position of the rudder indicator must be aligned to the centre position of the rudder position.
- 3 Start with the GPS unit. This is important as the GPS may be the most accurate source and thus required to calibrate other devices. Though there is little to calibrate on today's GPS units, the GPS needs to be set to the correct chart datum, in most cases this is WGS84 as your chart will be, otherwise adjust to the chart datum you use. Older GPS units may allow for individual correction of the position. Check that the position displayed is set to true not magnetic.
- 4 It may be a good practice to calibrate the depth unit once tight to the dock by measuring depth with an object over-board as a reference. More precisely the vessel may be checked when the vessel is on the hard and leveled out to the water line, then the delta is measured between the transducer and the level of the keel base. It is important for crew members and users to know what actually has been corrected and what the depth figures on the display really mean in fact: depth below keel, depth below transducer or depth of water.

On the water:

- 5 Find an area free of current and with low traffic and set one crew member to supervise traffic around the boat, always be prepared to stop the operation.
- 6 Next calibrate the fluxgate compass unit. This is usually done by running the vessel through a number of turns at constant speed according to the recommendations of the manufacturer. Check the compass' or the system's documentation for exact details.
- 7 Setting the compass up to true North is more difficult as the methodology for doing so varies between makes and some times compass sensors may only be set to zero by the fluxgate unit's manufacturer's display. Other makes allow for adjustment/zero-ing by buttons on the unit itself. Zeroing may be done on the water or where available by swinging the vessel around a pole.
- 8 As state-of-the-art units operate at frequencies >5 the boat must be held to a proper course (determined by the GPS) or by measuring against a terrestrial object.
- 9 Next calibrate the speed unit. This is to be done while being on the water as well. It may be achieved by comparing the speed through water against speed over ground supplied by the GPS or by passing between two known marks in both directions to calculate the differences and define an off-set for the display.

- 10 Choose a medium speed as linearity of speed sensor units is not constant over the range of operation. Race boat/more sophisticated systems may allow to calibrate at different speeds but this is not common on cruising equipment.
- 11 If an automated routine is available this may be used by needs to be checked for accuracy afterwards.
- 12 Next calibrate the mast-head/wind unit. Calibration of wind speeds is usually unnecessary and difficult to arrange without a proper reference source. Set the unit to display wind speeds in m/sec or knots, not Beaufort. Mechanical systems, particularly when aged, may show significant non-linearity at low wind speeds due to resistance in the mechanics of the unit, so wind speeds of around 10 kn are probably best. Ultrasound devices probably show best linearity in the market.
- 13 As with the fluxgate unit it may be difficult to set the wind system to apparent wind angle/0° north, so this is best done tight to the dock or a pole which allows to swing the vessel around. Unfortunately, older wind units may require a dedicated display made by the same manufacturer like the mast-head unit to establish the off-set or worse a mechanic adjustment of the mast head unit has to be made. However in these cases software-based displays like on the ipad allow for correction in a much more easy fashion than dedicated wind displays. A mechanic correction may be tried at the time the mast is taken off the vessel for other reasons.
- 14 At the end: Note down all off-sets and set damping of all units to a level which does not appear to be a nuisance to the user.

Back at the dock

- 15 Note down all your offsets made
- 16 Be prepared to recheck settings as often as reasonably possible as settings of wind units and speed units may change over time
- 17 Be prepared to find differences of wind speeds between weather station reports and values obtained on board: forecasts report wind speeds at 10 m altitude, wind units of sail boats are mounted at varying heights thus introducing differences in double-digit % values at mast heights above 20 m