

1) Illumination dimmer, 2) Ocular with rubber eyepiece, 3) Removable cover to change the light bulb, 4) Bracket for sextant fixing, 5) Light cable with connector, 6) Removable shade glass, 7) Adjustment screw, 8) Objective, 9) Light bulb

Use of the unit

The artificial bubble horizon attachment will enable the marine sextant to be used without reference to the sea or „natural“ horizon. In doing so, no correction for height of eye is necessary. Likewise, it may be used without regard to height above mean sea level (MSL). For use at typical airplane altitudes however, atmospheric refraction corrections may be different from those at sea level. Electrical power from the battery(s) in the sextant handle is required in order to see the bubble in the field of view. Ambient light alone is not sufficient for this purpose. The unit is installed on the sextant in place of the normal telescope. Use the shade glass for sun observation at daylight and remove it for nightly star observations. The telescope of the unit (3x magnification, 25 mm objective dia.) can be used for standard observations without shade glass and inactivated illumination.

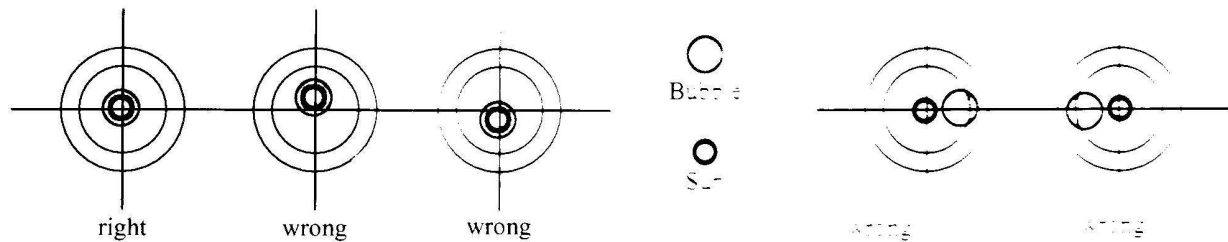
Examine the unit

The eyepiece is surrounded with a rubber guard for eye comfort. The eyepiece may be turned for focusing. A wire with a single prong plug emanates from the unit. The plug is for insertion in the receptacle in the sextant handle to provide electrical power. The tines of the plug may be spread with a sharp knife, to make the fit tighter as desired. The lighting of the bubble chamber is actuated by the button on the sextant handle, may be dimmed by a rheostat knob above the eyepiece. The objective lens is covered with an auxiliary sunshade. This should be removed by finger pressure from the lens in order to see normally through the unit. A small screw protrudes from beneath the objective lens, and is used to re-adjust the height of the bubble in the unit. A thread locking dab of paint may surround this screw, which may be turned by the allen wrench for mirror adjustment enclosed in the range of delivery of the sextant. Caution, turning this screw may necessitate reapplication of a thread locking paint to ensure its security.

Positioning of the bubble

When the bubble is viewed within the chamber, the sextant should be held so that the bubble is in the center of the viewing area. This takes some practice, and cannot always be achieved with accuracy. However, the inside the bubble chamber is machined in such a way that if the bubble is a little high or low, but not off to the side, no appreciable error will be introduced. If the bubble is allowed to drift to the side of the bubble chamber, it will tend to be

trapped there, and give very erroneous results.



Calibration of the unit

The unit is factory adjusted to provide accurate operation with a standard sextant. However, each sextant may have small variations from others which may slightly affect orientation of the unit with respect to the sextant frame. This difference must be either adjusted to zero, or accounted for as a correction to subsequent observations. It is suggested that the latter course of making corrections be used instead of making adjustments to the unit; at least until the user is experienced with use of the unit. Two methods may be used to determine corrections or to adjust the bubble: the natural horizon method, and the celestial method.

(a) Natural Horizon Method The index error should first be adjusted to zero using the normal method for marine sextants. Next, consult the Nautical Almanac for the normal height of eye correction (Dip, table A2). Move the micrometer drum to a reading off the arc by this amount. For example, if the dip correction is 3', set the drum to -3' (ie. from 0 back to 57' on the drum). The image of the horizon as reflected by the index mirror will now be above the real view of the horizon by this amount. To avoid confusion, the horizon sun shades may be moved to cover the real view. The remaining reflected image should now run exactly across the center of the bubble image. If not, reset the reflected image with the micrometer drum to achieve this alignment, and apply the difference as a correction to subsequent observations. Since estimation of the center of the bubble is subject to personal interpretation, observations with the top and bottom of the bubble may be averaged to achieve more accurate results.

(b) Celestial Method Where a natural horizon is not available, celestial observations from a known position may be conducted to ascertain errors which may be compensated for by equal and opposite corrections. A convenient method is to use the star Polaris, whose altitude changes very little with time, and is easy to compute from a known latitude. Most accurate results will be obtained with the sextant supported by a padded vise, and average readings taken against the top and bottom of the bubble.

In either of the above cases, the adjustment screw may be used to zero the bubble against the target, be it the horizon or a star. However, this should be delayed until after the user is competent in use of the bubble horizon.

Field use

The bubble horizon attachment will give very erroneous results if outside accelerations are allowed to act upon it. This means use on a boat (unless the sea is calm), or from an airplane whose course or speed is changing. At high aircraft speeds, coriolis may also affect the bubble position. If the IC of the sextant changes from zero, it too should be applied to bubble altitudes.

Replacement of illumination bulb

Remove the top cover of the unit. The bulb will appear Unscrew and replace it. Use bulbs of screw E5.5 and 3 V.