

## CLIPPER COMPASS

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# CLIPPER COMPASS

## INTRODUCTION

The Clipper Compass is supplied complete with display unit, sensor unit, and mounting kit. It is designed to operate from the vessel's 12V battery supply.

## PRE-TEST OF INSTRUMENT

Before mounting the units, check that the instrument is complete and undamaged. Plug the sensor unit into the display unit and apply 12 volts. Confirm that a reading is shown on the display.

## INSTALLATION OF SENSOR

The sensor measures the direction of the Earth's weak magnetic field, and so is sensitive to other magnetic fields which can affect the unit's accuracy. It should therefore be positioned carefully. Select a position as far as possible away from large ferrous objects such as engines, and items such as DC motors or loudspeakers which have powerful permanent magnets in them. Check also for small ferrous objects close to the mounting location such as screws, nails, hinges etc. These can become magnetised and cause errors. When a likely location has been found, a check for reasonable accuracy can be made with a hand bearing compass to confirm its suitability.

The magnetic sensor itself is fully gimballed within the housing. To accommodate the maximum pitch and roll motions, mount the sensor as near to horizontal as possible. For best performance in rough weather conditions, it is also advisable to mount the sensor in a position (usually amidships) that minimises lateral accelerations due to pitch and roll. Avoid mounting the sensor high above the water line because doing so also increases pitch and roll acceleration.

Position the sensor so the two arrows on the top are pointing forward. It is important that the sensor is aligned within 30° of the vessel's axis before doing the final compass alignment in Engineering (see below). Mark and drill the pilot holes for the mounting screws. Now mount the sensor carefully in position and tighten its non-magnetic brass mounting screws.

## INSTALLING THE DISPLAY

Select a convenient position for the display on a panel or bulk-head. The site must be flat and the cavity behind the panel must remain dry at all times. (The cable entry is deliberately not sealed to ensure adequate ventilation. This prevents misting of the display).

Cut a hole in the panel 67mm high and 87mm wide. Bring the wiring through the hole in the panel and connect the black wire to negative and red to positive. (See Figure 1). It is wise to use a fused supply to provide protection should a fault occur. The current consumption is very small, so any supply with a ¼-Amp fuse is more than adequate.

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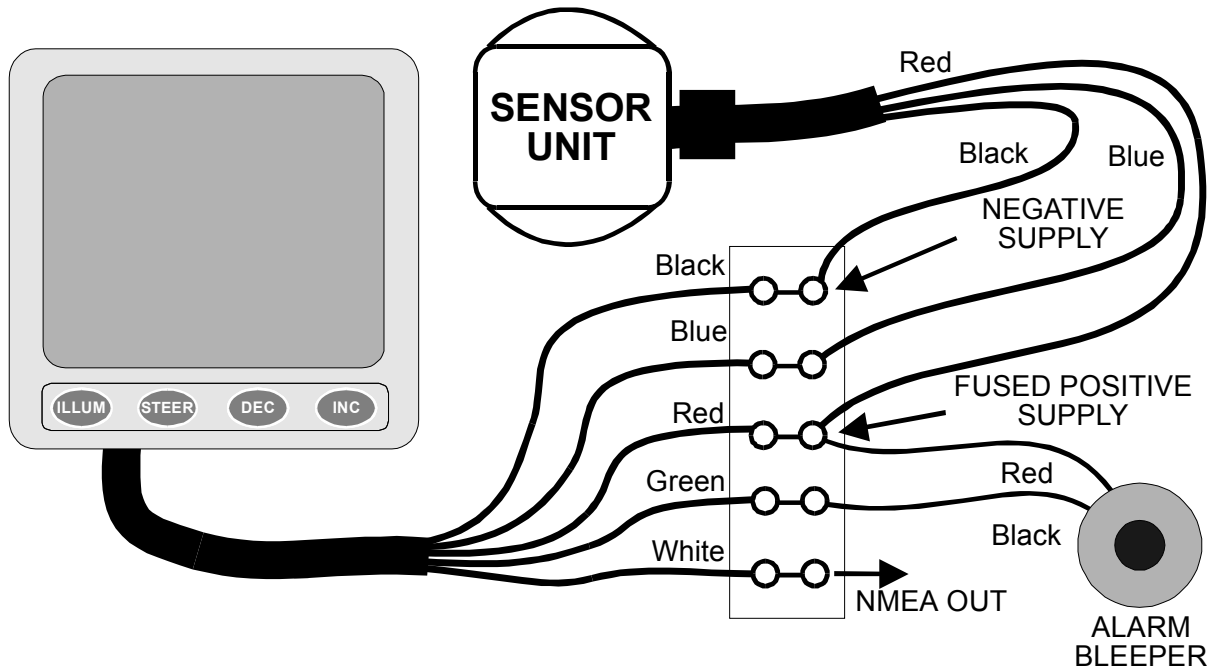


Figure 1 - Wiring Installation

Unscrew and remove the two wing nuts from the rear of the instrument and remove the stainless steel clamping bracket. Fit the “O” ring seal into the groove in the panel mounting face of the instrument. Ensure that it is correctly lying in its groove before fitting the instrument to the panel, which provides the watertight seal for the display.

Fit the instrument into the panel, fit the stainless clamp over the studs, fit and tighten the two wing nuts finger tight only.

It is important that the O-ring rubber seal makes good contact with the panel to prevent water getting behind the unit and entering the cavity behind the panel.

It is good practice to run the cables vertically downwards from the unit, even if they later have to rise to connect to the vessel’s supplies. Doing so prevents any water that might get onto the cables from running back along the cables and into the unit. Plug the cable from the sensor into the back of the display unit. For the marine environment it is advisable to smear a small amount of light grease (ideally a silicon grease, but a petroleum jelly such as Vaseline will do) to protect the connection.

### **NORMAL OPERATION**

When power is applied to the Clipper Compass, it executes a comprehensive internal test routine, shown by the display On. It then displays the heading. A typical display is shown on Figure 2.

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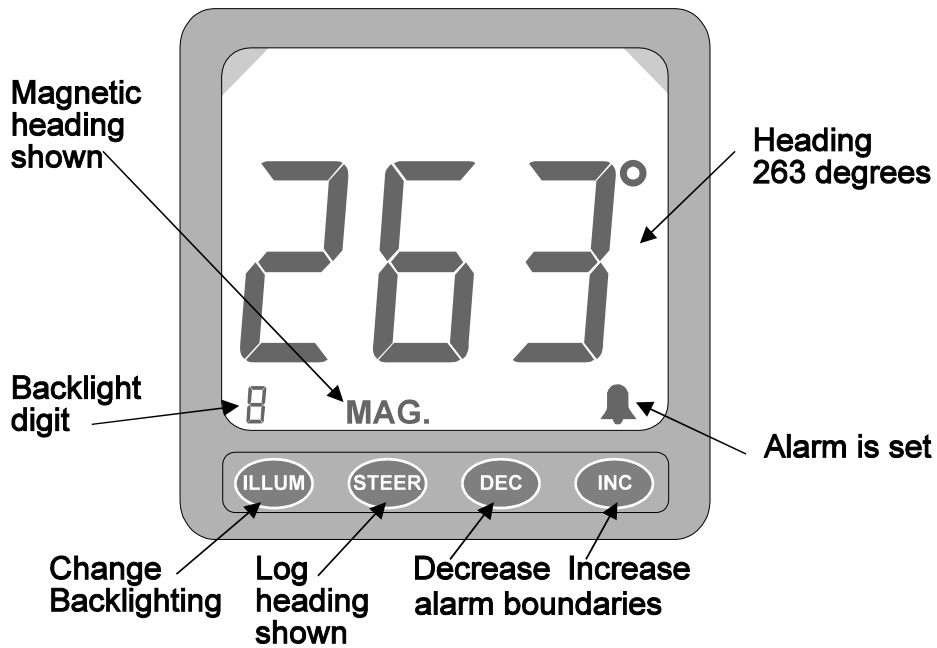


Figure 2 - Normal operation display.

### CHANGING THE BACKLIGHT SETTING

Backlighting is provided to allow the unit to be seen at night. The backlit area is restricted in the top corners of the display to concentrate the lighting in the areas of interest (see Figure 2). The brightness of the backlighting is adjusted by pressing the ILLUM button at any time during normal operation. Each press of the button increases the brightness by one in the range 0 to 9, shown by the backlight indicator in the bottom left of the display (see Figures).

A setting of zero switches the backlighting off, and a setting of 9 is maximum. In common with all the other settings in the unit, the backlight setting is stored even when the unit is off, so that it returns to the chosen setting whenever the unit is powered up again.

### CHANGING THE DAMPING

When the vessel is affected by rapid variations of heading in rough seas, a more heavily damped display can be selected instead of the normal lightly damped display. Press STEER and DEC together to switch between heavily and lightly damped modes. The backlight digit shows “L” (for Light damping), “A” (for Average damping) or “H” (for Heavy damping) for two seconds after the keys are released to indicate which mode has been selected. Successive presses of the two keys switches between the two damping settings.

### ASSISTED STEERING

Assisted steering means using the Clipper Compass to show errors from a chosen heading, and the direction to steer to bring the vessel back to the chosen heading, which is marked by the lubber line at all times.

When the vessel's heading is within the pre-set error limits, the dead-ahead indicator is lit to show that all is well (see Figure 3), and no steering adjustment is required.

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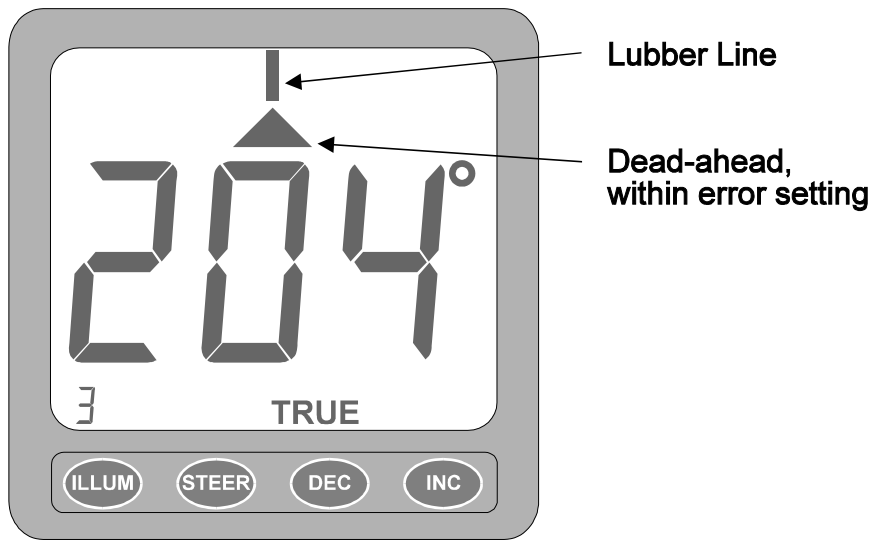


Figure 3 - Dead-ahead indication.

Steering chevrons light whenever the heading error is greater than a pre-set value (see Figures 4a and 4b). The factory default setting for the error value is 3°, but the setting can be adjusted when in Engineering mode (see below).

As the error builds up, more steering chevrons are lit to indicate the increasing strength of steering needed to correct the heading error. Three are shown on Figure 4a. If the error exceeds seven chevrons-worth, the central chevrons clear in sequence to indicate how far “Off the Scale” the steering correction is needed. Ten error chevrons-worth are shown on Figure 4b.

If the error increases beyond 180°, the error display reverses to show that the *shortest* route back to the desired heading is now using the opposite tiller.

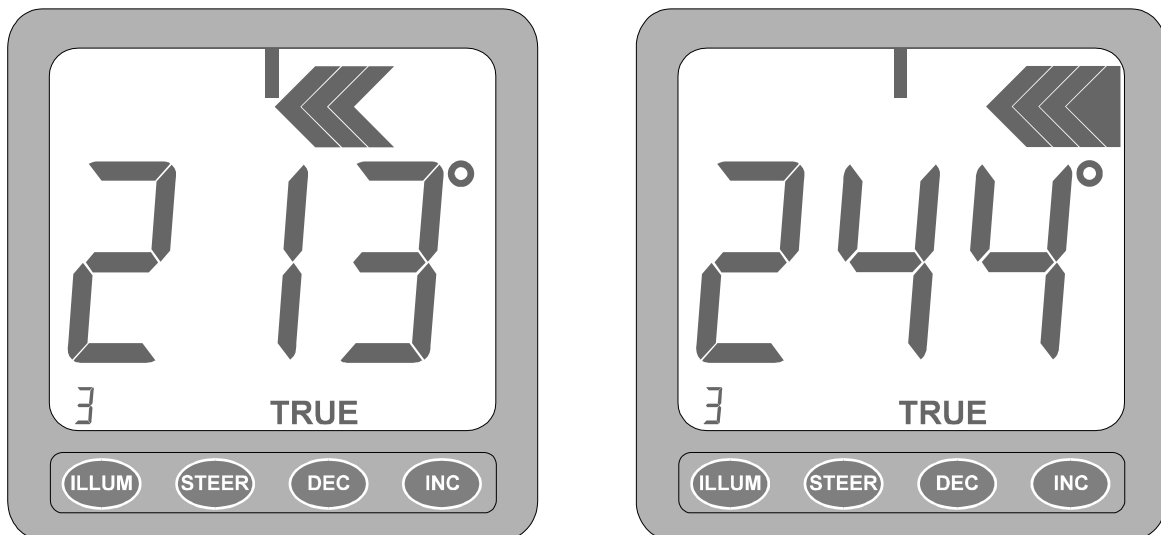


Figure 4a & b - Three and ten-chevron Steering indications

### SETTING THE DESIRED HEADING

Bring the Vessel to the desired heading, and press STEER to log that heading. The display changes as shown on Figure 5. The logged heading is the heading shown when the STEER button is FIRST pressed.

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The dead-ahead symbol indicates that the vessel's heading is within the error setting. The size of the error setting can be changed only in Engineering (see below).



FIGURE 5 - Vessel heading aligned with setting

### SWITCHING ASSISTED STEERING ON AND OFF

At any time while Assisted Steering is operating, pressing STEER switches it off. Pressing STEER again switches it back on again, but with the reference heading updated to the heading which is displayed when STEER is pressed. This facility is useful for resetting the desired heading when sailing on different legs of a route.

### HEADING ALARM

When Assisted Steering is in operation, an alarm can be set to sound whenever the heading exceeds a pre-set amount from a chosen heading. The chosen heading is the heading logged when assisted steering was selected by pressing STEER. Alarm operation is inhibited when Assisted Steering is off. The alarm, when set, sounds whenever the heading is at or outside the alarm setting to port or starboard.

The alarm setting is altered at any time during Assisted Steering operation by pressing INC to increase its value, or DEC to decrease it. The step size for the alarm setting is the same as the steering error chevron sensitivity. So, for example, if the default sensitivity of 3° is in place, the alarm settings will change from 3° to 6°, to 9°, etc., for each press of the INC key. It is not necessary to wait for the normal display to return before pressing a key again. The alarm boundaries are shown by the steering chevrons, as shown on Figure 6, for two seconds when the key is released, whereupon the display returns to the normal steering display.

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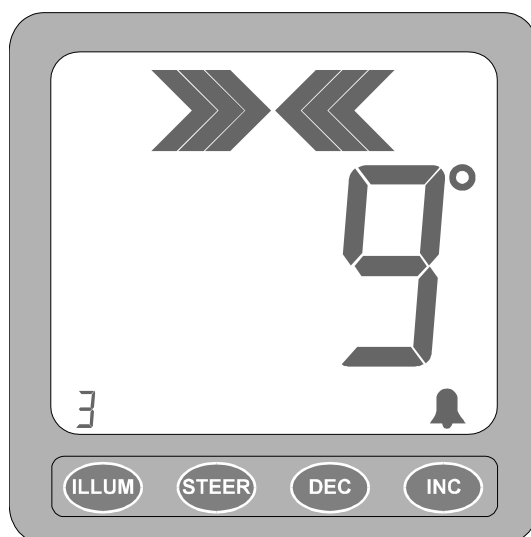


FIGURE 6 - Alarm Boundaries set at +/- 9°

The minimum alarm setting is 1 chevron at whatever steering sensitivity is set, and the maximum is 120° whatever the sensitivity setting. If the alarm setting is increased beyond seven chevrons, they change in the same way as the assisted steering indication up to a maximum of thirteen chevrons-worth.

### **SETTING OR STOPPING THE ALARM**

Press INC and DEC together to switch the alarm on or off. When the alarm is on, the bell symbol shows, as shown on Figure 5. The alarm is off when the bell symbol is off.

Whenever the alarm is on, and the heading is outside the boundaries set at the desired heading, the alarm sounds, and the bell symbol flashes. It can be stopped only by correcting the heading error, or by pressing INC and DEC together (to switch it off), or by disengaging Assisted Steering by pressing STEER.

## ENGINEERING

Engineering settings means those adjustments which seldom need changing, but which affect how the unit operates. The settings (as are all those which can be selected in normal operation too) are stored even when the power is disconnected. There are four operating characteristics which can be set in Engineering: Magnetic Variation; Magnetic or True heading display; steering error chevron sensitivity; and Compass settings.

### SELECTING ENGINEERING MODE

Engineering mode is entered by the following procedure:

- (a) Turn off power;
- (b) Press and hold down the ILLUM key;
- (c) Turn on power;
- (d) Release the ILLUM key.

The Engineering mode displays “En” (for Engineering) for two seconds when the ILLUM key is released. When the two seconds is up, the Magnetic variation is shown in degrees. The present set-up is shown as “MAG.” (for magnetic readings) or “TRUE” (for true readings). Note that the magnetic variation affects only true readings, and need not be corrected as described below if magnetic bearing readings are required.

Magnetic Variation can be adjusted immediately when the “En” display clears, as described below.

Any of the following settings can be done when in Engineering. If more than one different setting is to be done, it is necessary only to return via the “En” display between different adjustments or settings, as described below.

### ADJUSTING MAGNETIC VARIATION

The Earth’s magnetic variation varies from year to year, and from place to place. The appropriate variation value can be found by reference to Almanacs, maps, or charts. The variation is quoted as the variation from true North. If Grid North of map or chart to be used is not correctly aligned with true North, allowance for the Grid offset (which is usually small) can be combined with the Magnetic variation if desired. If the Magnetic variation is quoted as West of true North, enter the variation as a negative number. If it is quoted as East of true North, enter a positive variation value.

Put the unit into the Engineering mode as described in SELECTING ENGINEERING MODE above. Then Figure 7 shows Magnetic operation, and a Westward variation of 6.5°.

Positive numbers represent Eastward variation, and negative numbers (as shown on Figure 7) represent Westward variations. Each press of INC or DEC alters the stored variation by 0.5°. The decimal value is always repeated in the backlight digit (as shown on Figure 7). If the total variation is greater than  $\pm 9.5^\circ$ , the decimal increments are shown only in the backlight digit. The maximum variation which can be set is  $\pm 51.5^\circ$ .



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FIGURE 7 - Magnetic Variation Display

Press INC or DEC to change the stored variation value to the correct value (found from charts, etc.) for the vessel's location and year of use. Note that changing the magnetic variation has no effect on the accuracy of the compass's compensation (see below).

If it is desired to end Engineering adjustments, press ILLUM to return to normal heading indication, using the revised magnetic variation value.

### **MAGNETIC OR TRUE READOUT**

Put the unit into the Engineering mode as described in SELECTING ENGINEERING MODE above. Then press STEER and INC together to switch between Magnetic and True display of the compass readings. When True is selected "TRUE" is displayed, and the variation on entering Engineering is used to correct the readings made by the sensor. When Magnetic is selected, "MAG." is displayed as shown on Figure 7. In Magnetic indication mode, the sensor readings are used as they are, and the variation value is ignored.

If it is desired to end Engineering adjustments, press ILLUM to return to normal heading indication.

### **SETTING THE STEERING SENSITIVITY**

During assisted steering in normal operation, the steering chevrons show the size of the heading error, and the direction to steer to remove the heading error. The sensitivity, which is the size of the steps between each chevron, is set in Engineering. The sensitivity step size represents the error required to light each successive chevron during assisted steering. The higher the sensitivity step size, the larger the error required to light all the chevrons, which fill up as the error increases.

To set the sensitivity, put the unit into the Engineering mode as described in SELECTING ENGINEERING MODE above. Then press STEER and DEC together. "MAG." and "TRUE" both disappear, and the first port and starboard error chevrons light to show that sensitivity is being set (see Figure 8 overleaf).

The step size is shown in degrees. The factory default is 3°. Press INC to increase the setting in 1° steps, and DEC to decrease the setting in 1° steps. The minimum setting is 1°, and the maximum is 10°. If 1° is set, the maximum indication of heading error which can be displayed is when 13° (and beyond) is reached to Port or Starboard. Likewise, when 10° is chosen, the maximum indication of

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heading error which can be displayed is when 130° (and beyond) is reached to Port or Starboard. The maximum displayable error is always 13 times the step size shown.

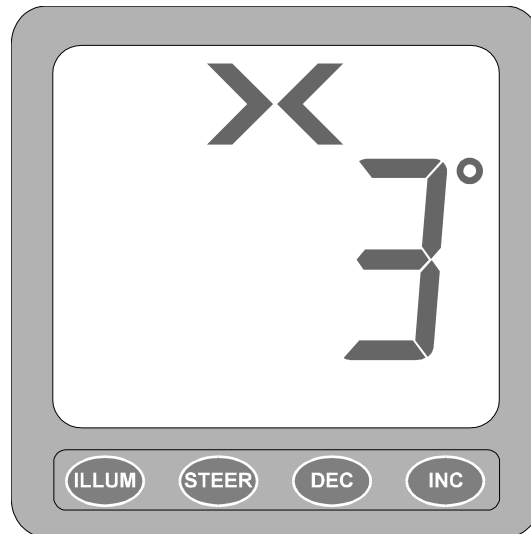


FIGURE 8 - Sensitivity Setting Display

Press STEER to return to Engineering (“En” displayed for two seconds) again. If it is desired to end Engineering adjustments, press ILLUM to return to normal heading indication.

### COMPASS ERROR CORRECTIONS

In common with all magnetic compasses, the presence of magnetic objects in the vessel distorts the earth’s magnetic field nearby, and can affect the accuracy of the detection of magnetic North, and the accuracy of readings at other points of the compass. The errors are known as compass deviations.

These errors can be compensated automatically in the Clipper compass if the vessel can be pointed accurately in particular directions by reference to known geographical features. However, compensation at these other points of the compass is seldom necessary if a good position for the sensor head has been chosen which has no field distortion by external magnetic objects. Compensation is done by logging the actual readings when the vessel is correctly aligned at the principal directions 45° (North-East), 90° (East), 135° (South-East), and so on. The logging is done automatically, with the compensations calculated and permanently stored in the unit’s memory. In normal operation of the compass, corrections at intermediate angles are in proportion to the compensation values logged at the eight principal directions.

### SETTING THE COMPASS COMPENSATION VALUES

It is important to decide before setting the compass compensation how the alignment of the vessel is to be achieved. If a hand bearing reference compass is to be used, set the unit to display Magnetic. If maps or chart references are to be used, set the unit to display True, and ensure that the magnetic variation is correctly set (see above). It is important that the correct magnetic variation is set *before* doing the compass setting, because the magnetic variation is always allowed for before the true heading is displayed.

Compass errors can be compensated as follows:

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1. Put the unit into the Engineering mode as described in SELECTING ENGINEERING MODE above. Then put the unit into compensation mode by pressing INC and DEC together. The display will show 0° to indicate North bearing. Bring the vessel to North bearing and wait for at least ten seconds for the sensor value to settle. Press STEER to log the bearing. "At" is displayed to indicate that the value is logged.
2. Press INC to move the indicated bearing to 45°. Bring the vessel to 45° bearing and wait at least 10 seconds for the sensor value to settle. Press STEER to log the bearing. "At" is displayed to indicate that the value is logged.
3. Press INC again to move the indicated bearing to the next bearing, and repeat the process at each 45° step until the 315° bearing has been logged. Calibration is completed by pressing ILLUM to exit Engineering and to return the unit to normal operation.

As a final test, the vessel can be swung to confirm that the compass is operating satisfactorily with all errors correctly compensated.

Note that it is not necessary to do all the settings as described. If the error at a particular angle is known to be negligible, there is no need to align the vessel and log the compensation at that position.

### **REMOTE REPEATER FACILITY**

An intelligent repeating display unit is available for use with the Clipper Compass, offering most of the main unit's facilities with independent controls. The repeater cable is plugged into the rear of the master instrument. The repeater socket is exposed by pulling off the round cover on the rear of the instrument. If no repeater is to be connected, leave the cover in place.