Exaggeration factor x1   Exaggeration factor x50
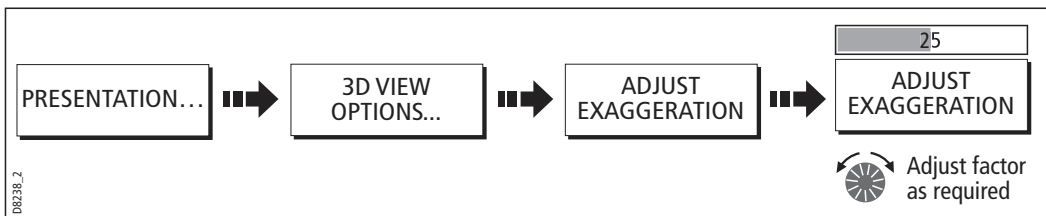
To adjust exaggeration:

Press **CANCEL** at any time during adjustment to return to the previous setting.

# Declutter

Navigating in an area that shows a lot of information on the chart, such as navigation marks, can be confusing. Depending on your chart view level it can make features or even your position difficult to see. Declutter helps you to reduce this confusion and make the chart clearer, by removing some objects from view.

Declutter OFF   Declutter ON
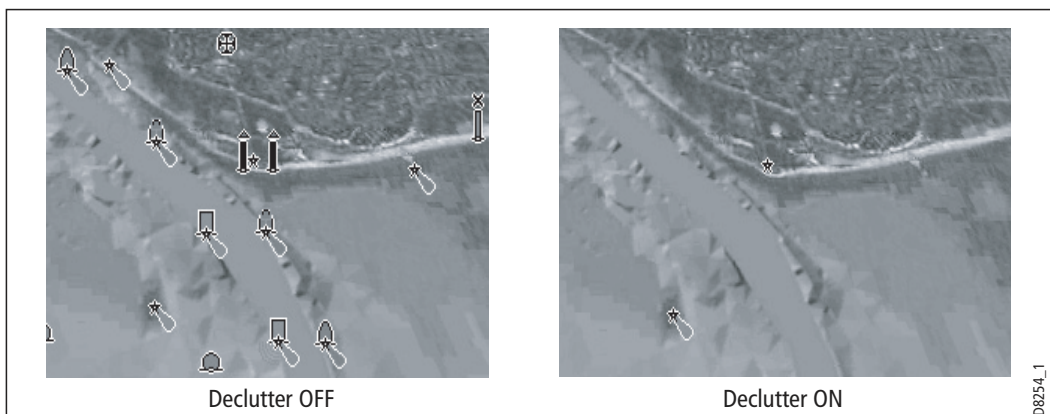
To declutter your 3D screen:
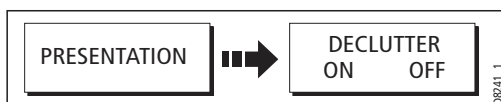
5.12 Using 2D and 3D charts together
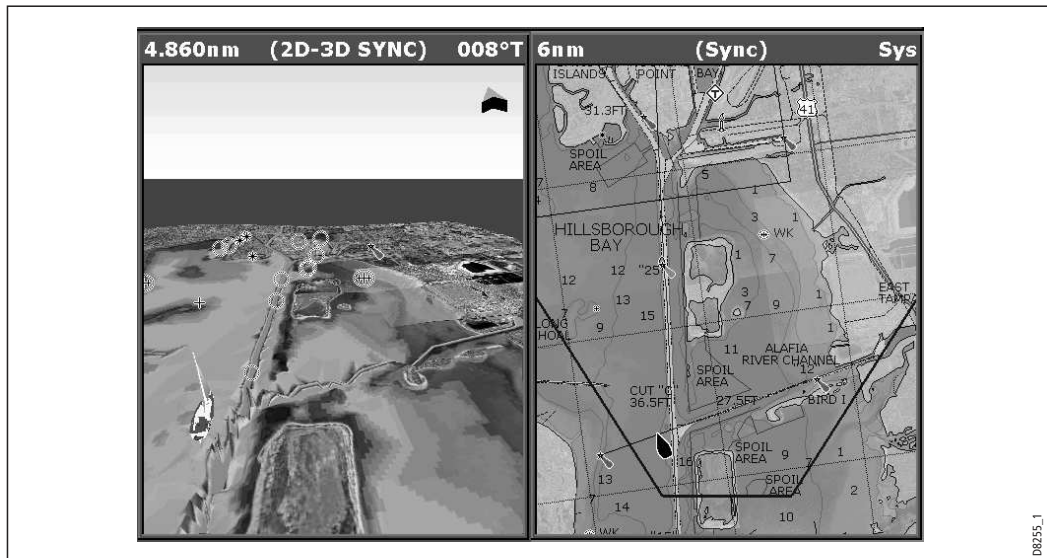
If the area in which you are navigating is unfamiliar, or visibility is poor, working with 2D and 3D chart applications on the screen side-by-side can give you extra confidence and help you find out what is around you. With the charts displayed side by side, a comprehensive view of the surrounding area is available. As with all multiple page sets, the active window is indicated by a red border. To make changes to an application it must be the active window.

For details of how to set up a page set to view the two applications together see *page 17.*

3D view locator

If required, you can show the 3D view locator on the 2D chart. This is a polygon outlined in blue and extending from the virtual eye point icon. This polygon indicates the boundaries of the area shown on the current 3D chart.

As you rotate, adjust pitch, pan or zoom, the 3D chart the view locator moves on the 2D chart and shows the area covered.

To display the 3D view locator when a chart window is active:

View locator   Eye point icon
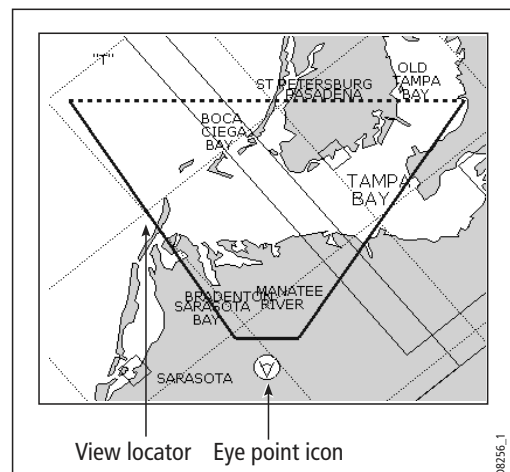
Note: *If the 3D view locator is switched on in a chart window that is set to system view, the locator will be displayed in all other system view chart windows.*

Chart synchronization

Chart synchronization enables you to synchronize the heading, range and position information on the 2D and 3D charts.

When chart synchronization is **ON**, please note the following:

- The 2D-3D synchronization is shown in the status bar of the applications.
- Soft key options that are not available with this feature are "grayed" out.
- Pressing FIND SHIP from any synchronized application, will return the 3D chart to the default active motion mode view and synchronize the 2D chart to the same view.
- Any changes made to the heading, range or position in **either** 2D **or** 3D charts will be displayed in both 2D and 3D windows.
- If the 2D chart view for the current window is set to SYSTEM and you have multiple windows on a page/more than one display, any changes made to a chart will be reflected in all windows in all displays.
- If the 2D chart view for the current window is set to LOCAL, no other windows will be affected.
- You can synchronize the 2D chart with the 3D chart **or** the radar but not both.
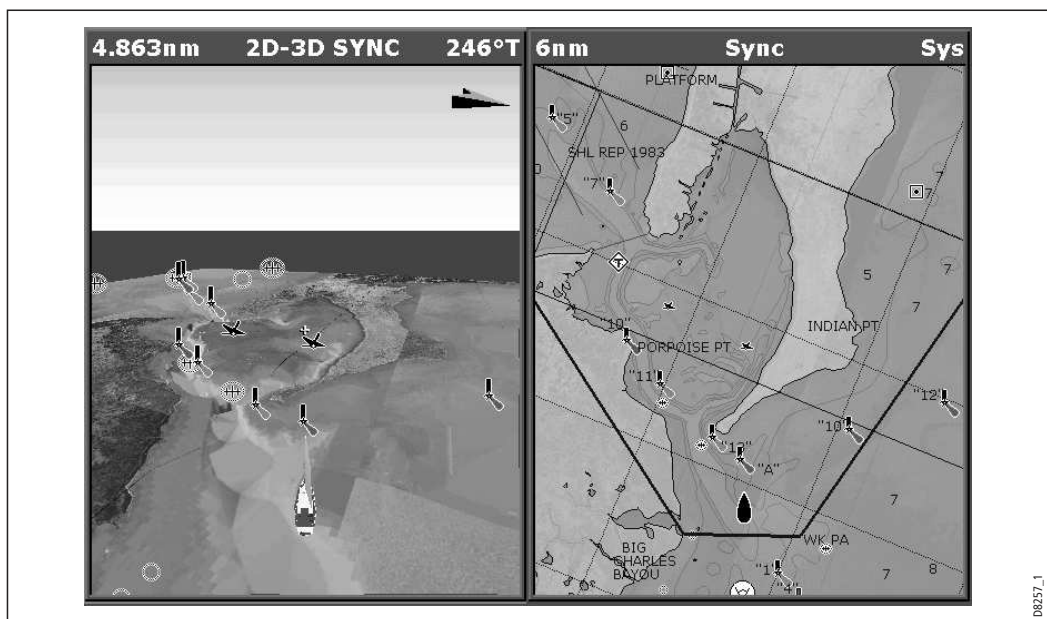
To synchronize the 2D and 3D charts:


Chart application active
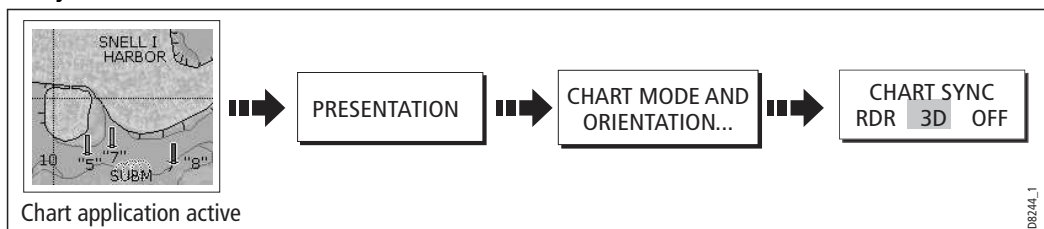
5.13 Using the 3D chart with a fishfinder

If you have a fishfinder in your system, you can display the transducer cone to indicate the area that it covers on the 3D chart. This is particularly useful when fishing as it enables you to compare the chart view with the information your fishfinder is showing you.

50 kHz   200 kHz

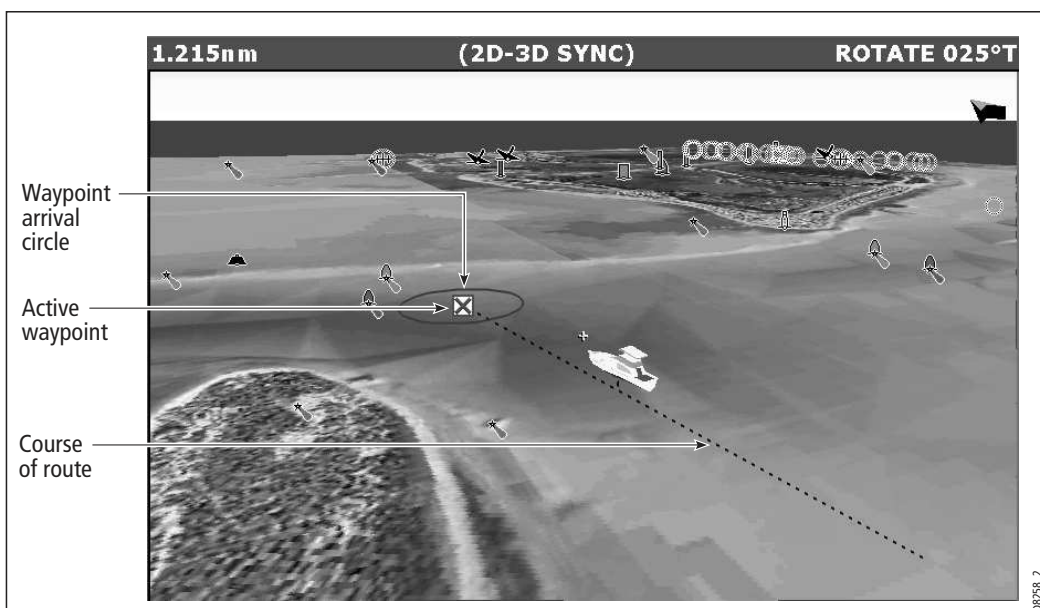To display the transducer cone:

PRESENTATION…   ➡   TRANS CONE
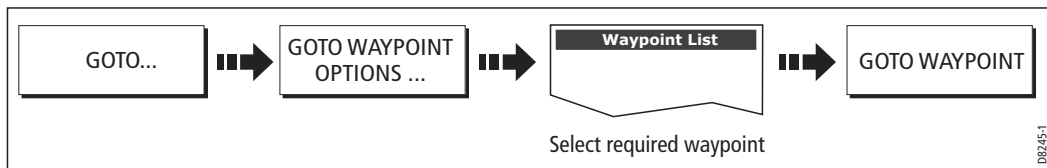   ON   OFF
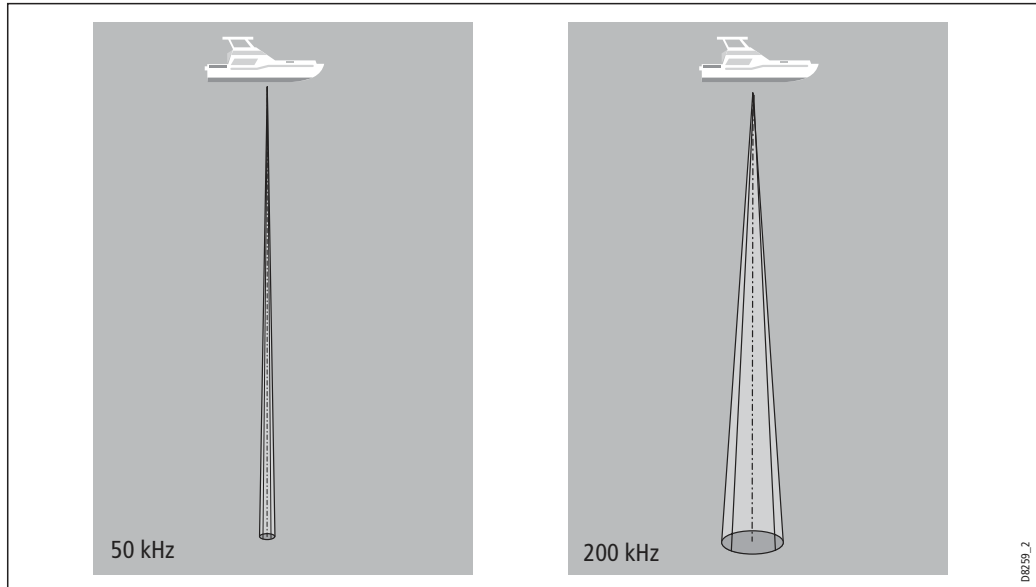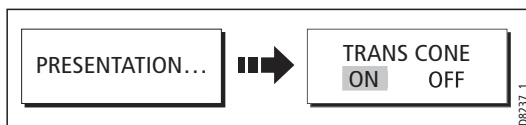
5.14 Navigating with 3D charts

You can access navigation options when a 3D chart is active. This includes following a route and selecting a waypoint from the waypoint list to start a GOTO.
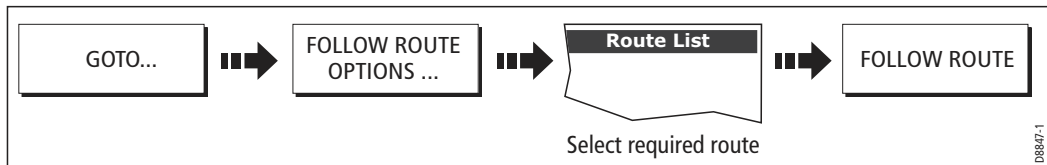

1.215nm   (2D-3D SYNC)   ROTATE 025°T

Waypoint
arrival
circle

Active
waypoint

Course
of route

... via the waypoint list

Select required waypoint

Note: *Please refer to "Navigating to a waypoint" on page 36, for full details.*

... using the follow route option

Select required route

Note: *Please refer to "Following a route" on page 72, for full details.*

REMEMBER: A route can only be edited using a 2D chart. Changes made on the 2D chart are also shown on the 3D chart.

5.15 Setting up the 3D Chart

The set up for your 3D chart can be changed from the standard configuration to suit your particular needs. Although you will probably only do this when you first use the chart, you may decide to make subsequent adjustments once you become more familiar with the system. Any settings that you change are retained at power off.

To select the 3D Chart Setup Menu:
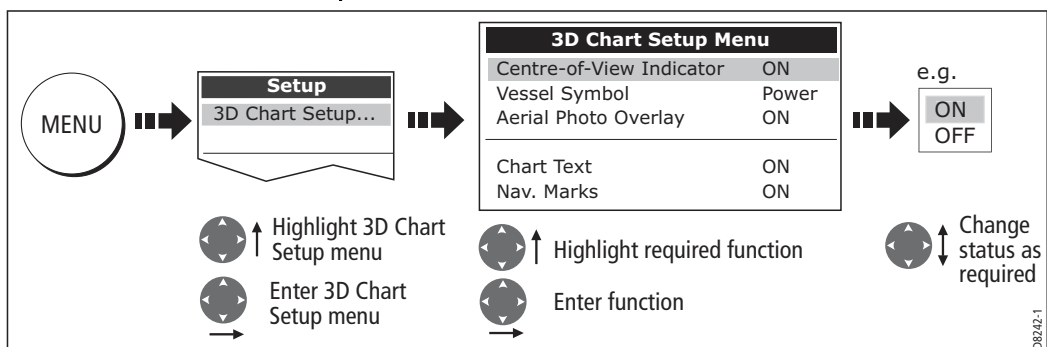
This menu lets you change:

FUNCTION Description	OPTIONS (Default in **bold**)
Centre-of-view indicator Centre-of-view indicator (marked with a white cross)	**ON** OFF
Vessel symbol Style of boat symbol displayed on-screen.	Sail **Power**

FUNCTION Description	OPTIONS (Default in **bold**)
Vessel size	Tiny Small **Medium** Large Huge
Aerial photo overlay Overlay an aerial photograph on the 3D chart	**ON** OFF
Chart text Text viewed on the 3D chart	**ON** OFF
Navigation marks Navigation marks viewed on the 3D chart.	**ON** OFF

Chapter 6: The Fishfinder

The fishfinder uses acoustic sounding to display fish, seabed structure, and underwater obstructions like wrecks.

6.1 The fishfinder display

The fishfinder displays a scrolling image of the seabed, updating from the right as your vessel makes progress.
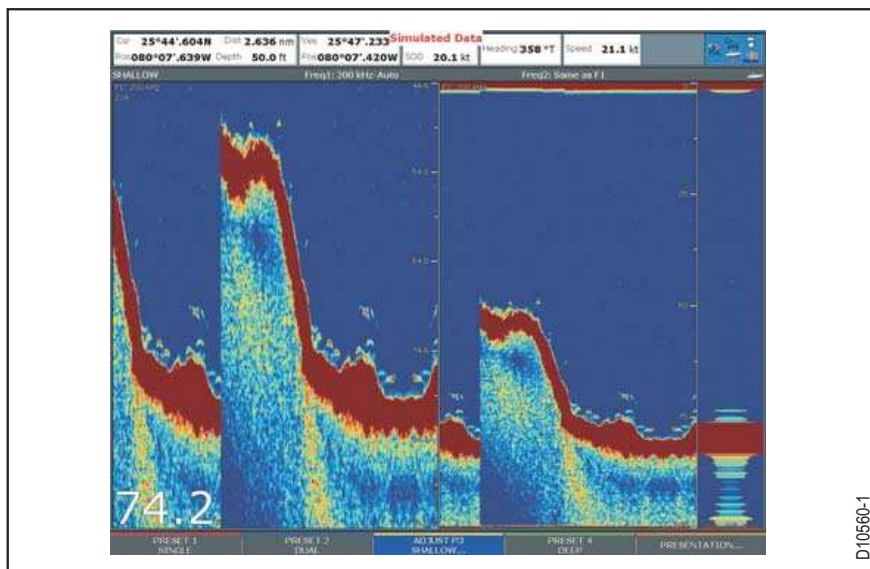
The fishfinder status icon is located in the top-right section of the monitor:

(animated icon)

Icon animated - connection to a DSM has been successful.
Icon static - the DSM is connected but not transmitting.
Icon greyed-out - no DSM is connected.

6.2 Background information

The fishfinder requires a Digital Sounder Module (DSM) to process acoustic signals and build up a detailed picture of the seabed.

A transducer on the bottom of the boat sends pulses of sound waves into the water and measures the time it takes for the sound wave to travel to the bottom and back. The returning echoes are affected by bottom structure and by any other objects in their path, for example reefs, wrecks, shoals or fish.

The strength of the echoes is indicated on the display by different colors. You can use this information to determine the shape and make-up of the seabed, or the size of shoals, or of other objects.

6.3 Operating the fishfinder

The fishfinder provides you with four preset configurations, available on the default toolbar. These are tailored to provide optimal operation in different circumstances - you should be able to find a preset that gives you excellent results in any situation.
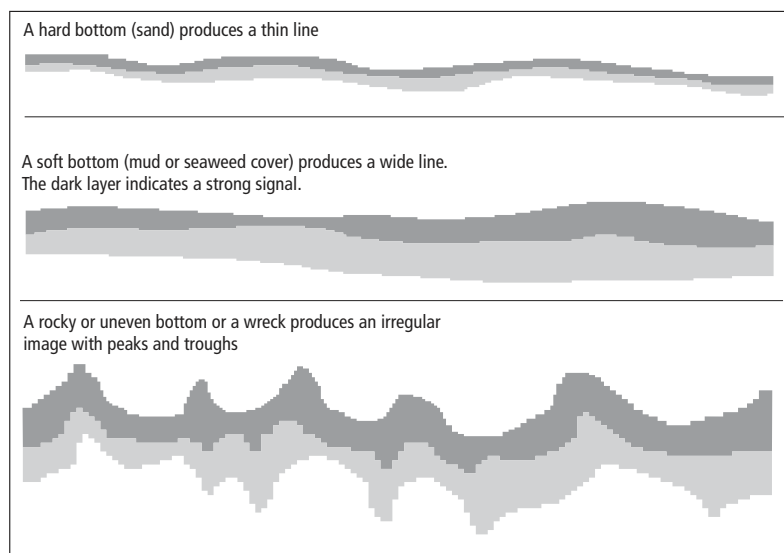
The presets are labelled single, dual, shallow and deep. When you make a fishfinder window active, the title bar shows you which preset is selected, along with its settings.

Each preset has been configured to provide the best operating parameters for the fishfinder. However, it is possible to adjust the presets if necessary.

To select a preset mode
1. Press the appropriate softkey.

6.4 Explaining the readout

A hard bottom (sand) produces a thin line

A soft bottom (mud or seaweed cover) produces a wide line.
The dark layer indicates a strong signal.

A rocky or uneven bottom or a wreck produces an irregular image with peaks and troughs

D6855-2

The dark layers indicate a good echo; the lighter areas weaker echoes. This could mean that the upper layer is soft and therefore allowing sound waves to pass to the more solid layer below.

It is also possible that the sound waves are making two complete trips – hitting the bottom, bouncing off the boat, then reflecting off the bottom again. This can happen if the water is shallow, the bottom is hard, or gain is set too high.

6.5 Factors influencing the readout

The quality and accuracy of the display can be influenced by a number of factors including boat speed, depth, object size, background noise and transducer frequency.

Boat speed

The fishfinder's reading of the bottom changes as your speed changes. Slower speeds return flatter, more horizontal marks; as your speed increases, the image will tend to thicken and arch, until at high speeds the bottom resembles a double line on the fishfinder display.

Depth

As sea depth increases, signal strength decreases, resulting in a lighter on-screen image of the bottom.

Object size

The larger an object is, the stronger its return on the fishfinder display will be. However, the strength of return from fish depends upon the species' swim bladder, rather than the body size.

Background noise

The fishfinder readout can be affected by weak echoes from floating or submerged debris, air bubbles, or by your boat's movements.

This background noise is also known as clutter, and the E-Series system automatically adjusts sensitivity to it based on sea depth and water conditions. You can, however, set the sensitivity manually by using the gain modes (gain, color gain and TVG).

Transducer frequency

- **Lower frequencies** scan a wide area and penetrate water well. Use these settings if you want a large coverage beneath your boat or if you are in deep water.
- **Higher frequencies** (200 Khz) scan a narrow area but produce more detail, especially at high boat speed. They are most useful in shallower waters (up to 1000 feet).

Various frequencies may be available on your system, depending on the transducers fitted to your vessel.

Viewing single or dual frequencies

If the preset you are using includes two frequencies, you can use one fishfinder window to view both frequencies or just one. You can then send the second frequency to a fishfinder window on a second monitor, enabling you to view both frequencies at full screen.

6.6 Display mode settings

When a fishfinder preset is selected, its softkey label changes to **ADJUST**. Pressing this key allows you to configure the display mode settings to suit your requirements. (Changes to the display mode are saved with the preset at power-off.)

For each preset (and for each frequency within the preset), you can change the following display mode settings:

* Zoom
* Bottom Lock
* A-Scope

To change the settings for a preset

1. Press the **ADJUST <preset name>** softkey.
2. Select **F1** or **F2**.
3. Select the mode you want to adjust.
4. Make changes using the trackpad or rotary controller.
5. Press **OK** when complete.

Zoom

If necessary you can zoom in on the bottom to display more detail.

This zoom option lets you:

* Replace the standard fishfinder image with the zoomed image, or display the zoomed image alongside the standard fishfinder image.
* Set the zoom factor to a pre-defined level, or adjust it manually.
* Reposition the zoomed portion of the image to a different point in the display.

When the range increases, the area shown in the zoom window also increases.

Full or split screen

You can either replace the standard fishfinder image with the zoomed image or split the screen and display the zoomed image alongside the standard fishfinder image (ZOOM SPLIT). The zoomed section is indicated on the standard fishfinder screen by a zoom box (see illustration below).
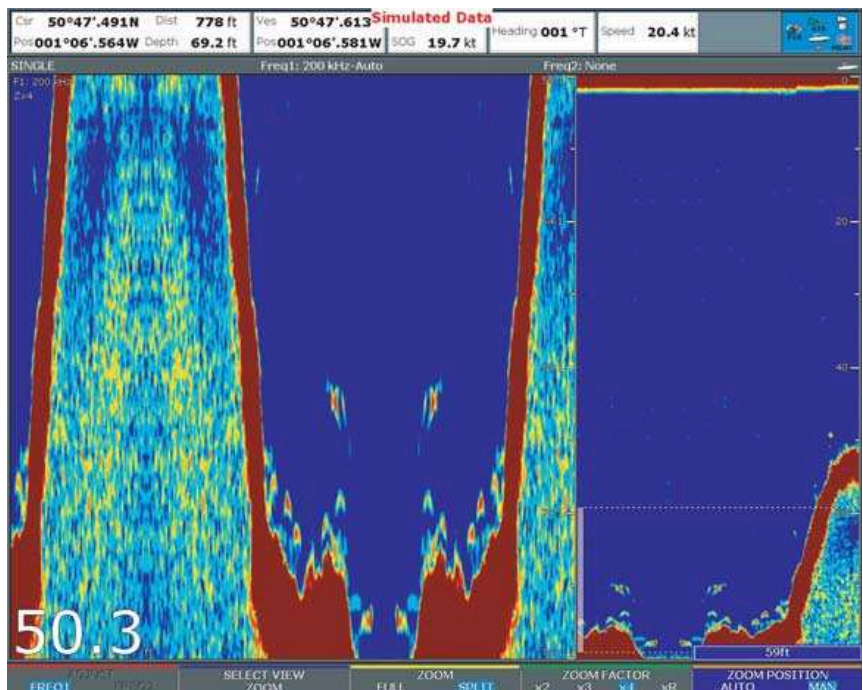
To select split-screen or full-screen

1. Select **FULL** or **SPLIT** with the **ZOOM** softkey.

When the zoom function is active (ZOOM FULL or ZOOM SPLIT), you can either select a predefined zoom factor or adjust it manually.

To select the zoom factor

1. Press the **ZOOM** softkey.

2. On the **ZOOM FACTOR** key, toggle between pre-defined settings or select xR to set a factor manually. For manual settings, adjust the zoom factor with the rotary controller.

3. Press **OK** to accept your setting.

Adjusting the position of the zoomed area

When the zoom function is selected, the system automatically selects the zoom position so that the bottom details are always in the lower half of the display. If required you can reposition the portion of the image to be zoomed so that an alternative area is displayed.

To set the zoom position

1. Press the **ZOOM** softkey.

2. Select **MAN** with the **ZOOM POSITION** softkey.

3. Reposition the zoomed image using the rotary controller.

4. Press **OK.**

Bottom lock and bottom shift

The Bottom Lock function applies a filter to flatten the image of the seabed and make any objects on or just above it easier to discern.

This feature is particularly useful for finding fish that feed close to the bottom.

Bottom Lock is selected for individual fishfinder windows and can replace or appear alongside the standard fishfinder image.

Adjusting the range of the bottom lock image allows you to view more bottom details. You can also reposition the image on screen to anywhere between the bottom of the window (0%) and the middle of the window (50%) by using the Bottom Shift control.
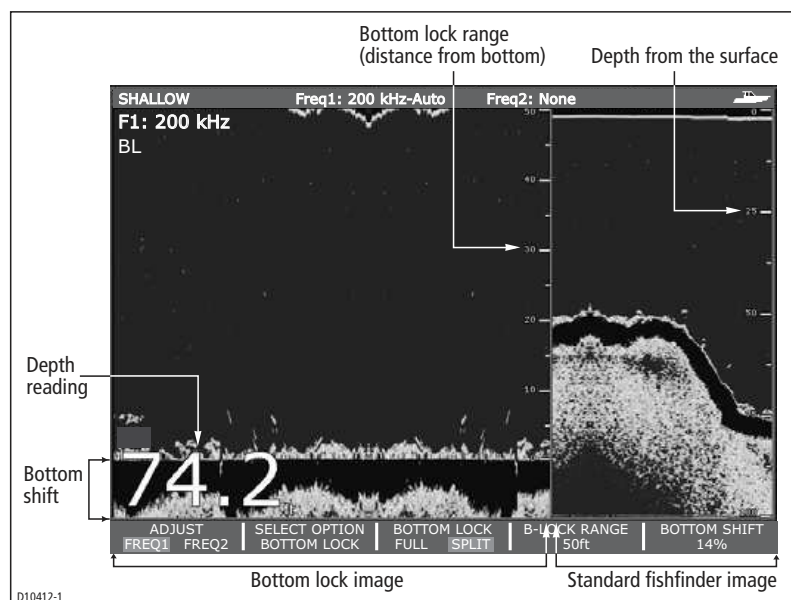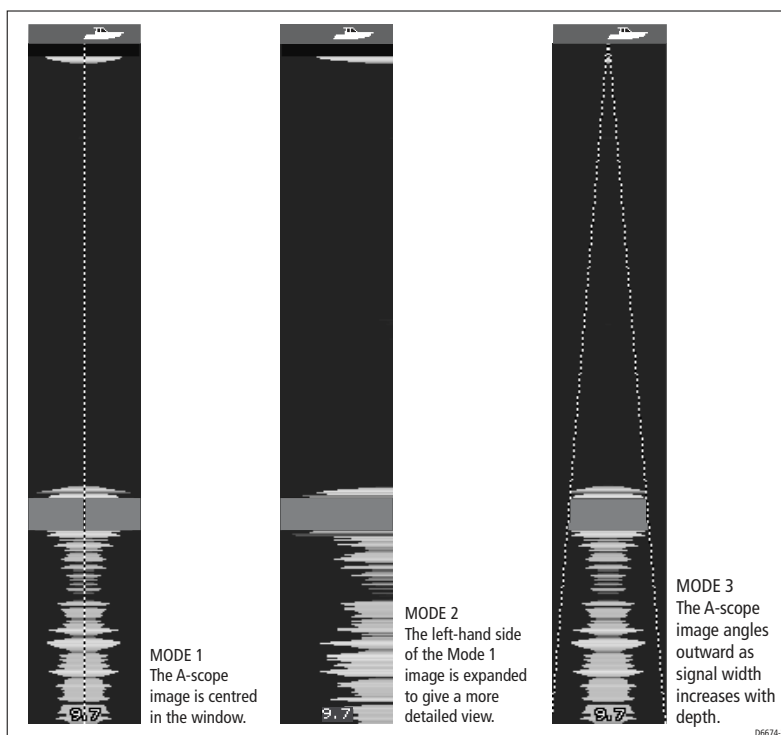

To adjust bottom lock

1. Toggle to **FULL** or **SPLIT**.

2. Use the appropriate softkeys and rotary controller to set the range and bottom-shift values.

Using A-Scope to view a live image

The standard fishfinder display shows a historical record of fishfinder echoes. If required, you can display a live image of the bottom structure and the fish directly below the transducer by using the A-Scope feature. The width of the bottom area covered by the A-Scope is indicated by the number at the bottom of the window.

The A-SCOPE softkey

When A-Scope is on you can select one of three display modes:

MODE 1
The A-scope image is centred in the window.

MODE 2
The left-hand side of the Mode 1 image is expanded to give a more detailed view.

MODE 3
The A-scope image angles outward as signal width increases with depth.

D6674-3

To display the A-Scope image

1. Select A-Scope on the **SELECT VIEW** softkey.

2. Choose your mode on the **A-SCOPE MODE** softkey.

Changing the range

You can change the range for each displayed frequency from the Range Adjust toolbar, which gives you control over the range and range-shift settings.

The DSM automatically adjusts the display to show the shallowest required range. Alternatively, you can range in or out on the image, up to the maximum depth displayed on the scrolling bottom and A-Scope images. Changes to the range affect all fishfinder windows.

To open the Range Adjust toolbar

1. Press the **RANGE** button on the E-Series keyboard.

To select manual or auto range mode

1. Open the **Range Adjust** toolbar.

2. Toggle to **AUTO** or **MAN** on the RANGE softkey.

3. Press **OK**.

Range shift

The DSM automatically adjusts the display to keep the bottom in the lower half of the display window. Alternatively, you can shift the image within the current range. Changes to the range shift are reflected in all Fishfinder windows.

To shift the range image

1. Open the **Range Adjust** toolbar.

2. Press the **RANGE SHIFT** softkey.

3. Select your desired setting using the rotary controller or trackpad.

4. Press **OK**.

To return to the standard fishfinder image

1. Toggle to **AUTO** on the **RANGE** softkey.

2. Press **OK**.

6.7 Presentation toolbar

The PRESENTATION softkey gives you access to VRM features (for measuring depth and distance), frequency view selection and a scroll control. These settings affect the monitor you are working on.

6.8 Adjusting gain and power

Changing the preset gain settings alters the way the fishfinder processes background noise (also called clutter), and can improve the readout on the monitor. You can adjust:

- Gain mode (choose from three auto-settings or manual control)

- Color gain

- TVG

- Color threshold

If you change settings for any of these modes (except auto gain), the fishfinder applies them to all transducer frequencies.

For optimum performance, use the auto settings.

Auto gain settings

The gain, or sensitivity, of the display adjusts background noise by varying the echo strength for display. The value of the GAIN control determines the strength above which echoes are displayed. There are three AUTO GAIN modes, which are saved with the preset if power is removed from the system:

- **Low** (the default setting) is ideal for viewing fishfinder images with a minimum of background noise while you cruise to your fishing spot. Only the strongest echoes are displayed.

- **Medium** is a slightly higher gain setting that displays more detail.

- **High** provides the most detail, but also displays the most background noise and surface clutter.

To select an auto gain setting

1. Press the **GAIN MODE** softkey.

2. Select the auto setting from the pop-up list.

3. Press **OK**.

Manually-set gain levels

If necessary you can set gain levels manually. Manually-set gain levels are applied to the active window and any other fishfinder windows displaying that frequency.

To set the gain level manually

1. Press the **GAIN MODE** softkey.

2. Toggle the setting to **MAN**.

3. Use the slider to set your required gain value.

4. Press **OK**.

Gain should be set high enough to see fish and bottom detail but without too much background noise. Generally, high gain is better in deep or clear water; low gain is better for shallow or murky water. The default setting for manual gain is 75%.

Color Gain

This sets the lower limit for the strongest echo color. All echoes with a signal strength above this value are displayed in the strongest color. Those with a weaker value are divided equally between the remaining colors. Setting a low value produces a wide band for the weakest color, but a small signal band for the other colors; setting a high value gives a wide band for the strongest color, but a small signal band for the other colors.

TVG (Time Varied Gain)

The TVG (Time Variable Gain) reduces clutter by varying the gain throughout the water column. This function is useful for reducing the appearance of 'noise'.

Increasing the TVG value increases the maximum depth to which TVG is applied; decreasing it reduces the maximum depth. A low TVG value has little effect on gain in shallow water; a high value decreases the gain in shallow water so that only the strongest echoes are displayed.

Power setting

The power setting controls the power level of the transducer.

Auto

This is the default setting. When it is selected the DSM automatically determines the required power setting based on the current depth, speed, and (bottom) signal strength.

Manual

If you wish to manually adjust the power to suit current conditions, you can adjust the power level between 0% and 100%, in 10% increments. Lower power levels are normally used in depth ranges less than 8 ft. (2.4 m) and higher power levels are typically selected for depths greater than 12 ft. (3.7 m).

To change the power setting

1. Press the **ADJUST** softkey for the preset you are using.

2. Press to the manual or auto setting on the **POWER** softkey.

3. In manual mode, use the rotary controller or trackpad to choose the power setting you want to use.

4. Press **OK**.

6.9 Measuring depth and distance

The fishfinder display gives you various methods of measuring depth and distance:
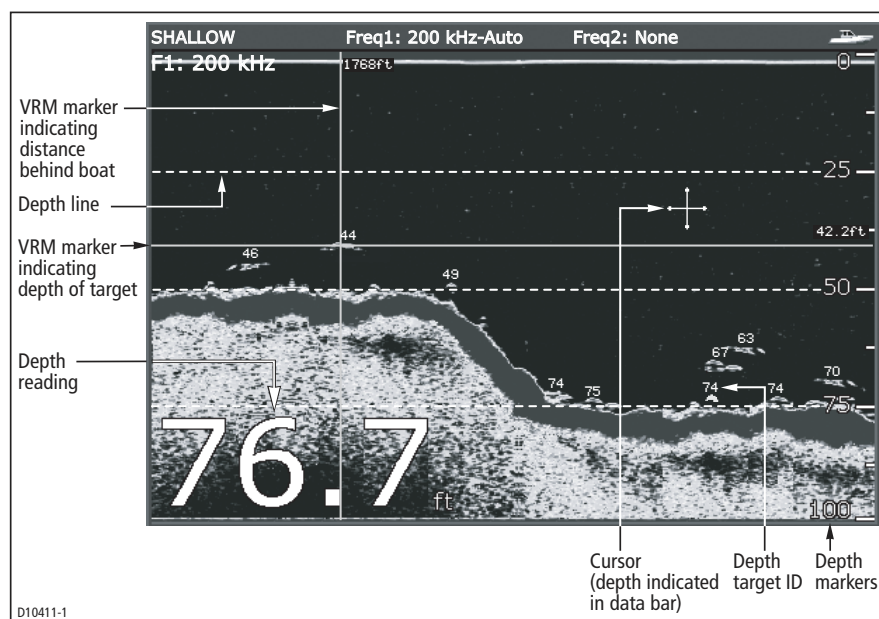
- **Depth reading** - your current depth. The size and position of this readout can be changed in the Fishfinder display Setup menu (see *page 139*).

- **Depth lines** - horizontal dashed lines drawn at regular intervals to indicate the depth from the surface. These are switched on/off in the Fishfinder Display Setup menu (see *page 139*).

- **Depth Target ID** - depths noted against recognized targets. The sensitivity of these IDs is directly linked to the Fish Alarm sensitivity; the greater the fish alarm sensitivity, the greater the number of labelled returns. These targets are switched on/off in the Fishfinder Display Setup menu (see *page 139*).

- **Cursor depth** - the depth and the distance from your boat marked by the cursor, is indicated in the data bar at the top of the screen. This performs in a similar way to a VRM, but without lines.

- **VRMs** - to indicate the distance behind your boat and the depth below of selected objects.

Note: *When multiple fishfinder windows are open, we recommend you have the depth reading displayed in at least one window.*

Measuring depth and distance with VRM

You can use a Variable Range Marker (VRM) to determine the depth and distance-behind-boat of an object. These markers consist of a horizontal (depth) line and a vertical (distance-behind-boat) line; each of which are marked with the appropriate measurement and are controlled individually.

Note: *VRMs set up in Fishfinder are unrelated to those set up in Radar.*

To make a measurement using VRM

1. Press the **PRESENTATION** softkey.

2. Press the **VRM** softkey.

3. Toggle to **ON**.

4. Pause the display to make it easier to position the VRM over the object.

5. Take your measurements:
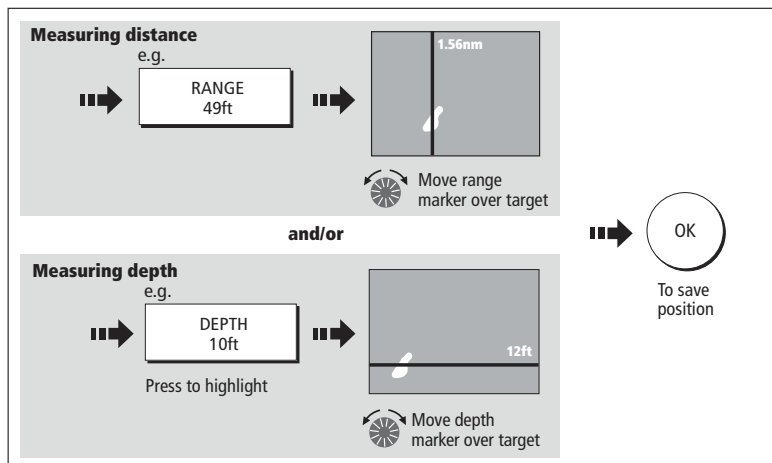
To return the marker to its previous position, press **CANCEL**.

Adjusting the scroll mode and speed

You can adjust the speed at which the display scrolls, but the same section of the bottom is displayed regardless of scrolling speed. A faster speed displays more detail. This is useful when you are looking for fish. If you select a slower speed the information remains on the display for longer.

The following options are available:

- **Manual -** This allows you to set the scroll speed as a percentage of the maximum scroll rate for that depth. The lower the percentage, the slower the image will scroll. The default is manual adjustment with a full speed scroll (100%).

To select the scroll mode and speed
1. Open the **Fishfinder Setup Menu**.
2. Set your preferred values in the Manual Scroll Speed setting.

Pausing scroll

You can pause the display to see a 'snapshot' of the image. When a display is paused, scrolling stops but the depth indication continues to be updated. Scroll pause/resume affects the frequency showing on your display (both frequencies if two are selected) while other displays continue to scroll.

This allows you to inspect a paused image, place waypoints or VRMs, while the other frequency continues to scroll and detect fish.

To pause or resume scrolling
1. Press the **PRESENTATION** softkey.
2. Toggle settings on the **SCROLL** key.
3. Press **OK**.

Viewing frequencies within a preset

If the preset you are using has two frequencies, you can view either one or both of those frequencies in separate windows.

To set frequency views

1. Press the **PRESENTATION** softkey.

2. Toggle to **F1**, **F2** or **BOTH** on the **VIEW** softkey.

3. Press **OK**.

Placing waypoints

You can pause the scrolling image to place a waypoint at a position or target that you want to return to at a later date. When a waypoint is placed, its details are added to the Waypoint List and a vertical line labelled WPT is placed on screen. You can edit waypoints and navigate to them in an active fishfinder window.

6.10 Fishfinder alarms

In addition to the system alarms (see *page 288*), the following alarms can be set when you are connected to a DSM or when the simulator is on:

- **Fish Alarms** - sound when a target meets the specified sensitivity level and, is within the depth limits (if enabled). The greater the fish alarm sensitivity, the greater the number of target image depths displayed.

- **Shallow/Deep Alarms** - sound when the DSM detects that the depth is less than the shallow limit, or greater than the deep limit.

You can switch the alarms on, set the limits and specify the fish alarm sensitivity.

6.11 Editing presets

You can select frequencies for each preset from the Setup Frequency Preset screen. All available frequencies are detected by the system and made available on this menu. You can:

- Specify one or two frequencies for each of the four presets.

- Edit preset names (EDIT NAME softkey).

- Reset all presets to factory defaults (RESET ALL softkey).

- Reset a selected preset to factory defaults (RESET <PRESET> softkey).

The fishfinder can can handle only one set of frequency presets across Nav Stations. It is not possible to set one Nav Station up with a different set of fishfinder frequencies to another.

To open the Setup Frequency Preset screen
1. With a fishfinder window active, press the **MENU** button.

2. Select **Configure Frequency Presets**.

Manual frequency selection

If you select a frequency manually, the fishfinder operates at that fixed frequency.

To set frequencies manually
1. Open the **Configure Frequency Presets** screen.

2. Select the frequency use wish to use from the list available.

Automatic frequency selection

The behaviour of automatic frequency selection varies according to the configuration of your system and whether you are using a DSM300 or DSM400. The table below summarises this behaviour.

	Frequency 1	Behaviour	Frequency 2	Behaviour
DSM400	AUTO	Automatically adjusts to suit depth.	NONE/MAN	Manual setting is fixed.
	MANUAL	Fixed at selection.	NONE/MAN	Manual setting is fixed.
	AUTO	Automatically selects highest frequency and widest beam.	AUTO	Automatically adjusts to suit depth.
DSM300	AUTO	Changes with depth; alternate pings of 50 Khz and 200 Khz.	MANUAL	Fixed at selection.
	AUTO	Changes with depth; alternates between 50 Khz and 200 Khz.	NONE	-
	AUTO	Frequency set to 200 Khz.	AUTO	Frequency set to 50 Khz.

6.12 Fishfinder configuration

This section describes the settings you can change using the fishfinder setup menu. The setup menu contains settings that are likely to be changed infrequently.

For information on how to use setup menus, see *Menus* on *page 12*.
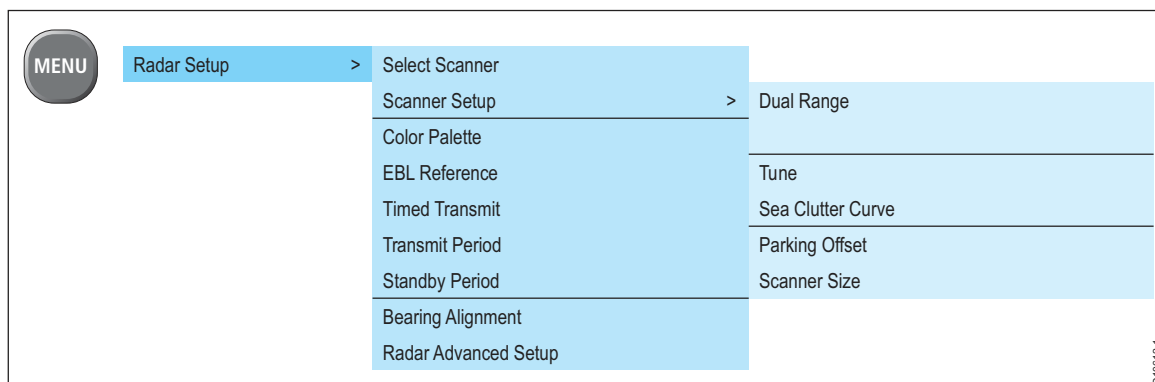
To open the fishfinder setup menu

1. Make a fishfinder window active.

2. Press the **MENU** button.

3. Select **Fishfinder Setup**.

DSM and transducer setup

Nearby vessels equipped with a fishfinder, or certain physical conditions (like hard seabeds), can affect the DSM. Its setup menus enable you to change settings to allow for this.

The system automatically adjusts the following settings to optimize the fishfinder image.

- Operating frequency.
- Gain modes (Gain, Color Gain, TVG).
- Power setting.

Note: *The setup options available depend upon the DSM fitted to your vessel. Fishfinder settings should not ordinarily require adjustment.*

Configure preset frequencies

Change the settings for one or more of the fishfinder presets. The settings available depend upon the transducer fitted.

Target depth ID
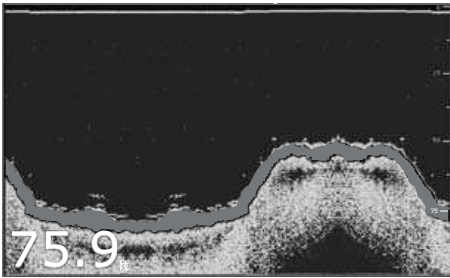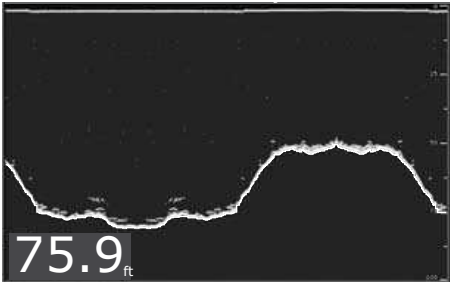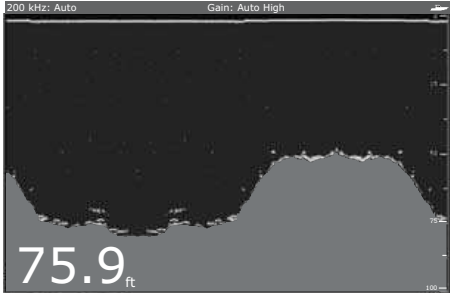
Depth readings for identified targets.

Depth lines

Horizontal lines indicating depth.

White line and bottom fill

Distinguish between echoes from fish near the bottom and from the bottom itself. (See illustration.)

Standard fishfinder image

The standard fishfinder image displays the bottom as a combination of features (mud, sand, fish targets etc) with various sonar signal strengths.

White line

When this feature is applied, a white lIne is drawn along the bottom (as defined by the digital depth value) and the detail below the bottom removed.

Fish near the bottom can now be seen more easily.

Bottom fill

When this feature is applied, the detail below the bottom is removed and replaced by a single contrasting color.

The bottom is now clearly defined and the fish near the bottom can be seen more easily.

White line and bottom fill

When both White Line and Bottom Fill are applied, the bottom is defined by a white line and the detail below it replaced by a single contrasting color.

Both the bottom and fish near the bottom are now clearly defined.

Color Palette

Choose the color palette to suit your conditions or personal preference.

Manual Scroll Speed

Specify the speed at which the fishfinder view updates and scrolls.

Select Transducer

When selecting a transducer, the DSM reports to the E-Series whether it sees a 600W or 2kW transducer. This allows you to select an appropriate transducer from the list.

Select Speed Transducer

This option is only available if the selected transducer is one that does not include an integrated speed transducer.

Frequency Calibration

Hides the setup menu and brings up a set of soft keys to tune the transducer frequencies.

Depth Offset (waterline)

Offset represents the depth of the transducer (relative to the waterline)

Speed and temperature offsets

Calibrate the speed transducer and thermistor (if fitted).

DSM Reset

Restores all settings to factory default.

Trip Counter Reset

Zero the trip counter.

Interference Rejection

Removes spikes caused by interference from other fishfinder-enabled vessels.

2nd Echo Interference Rejection

Finely adjust the ping rate according to the 2nd echo level.

Ping Rate Limit (per sec)

Provides a speed limiter. It can be useful to adjust ping rate to suit local conditions, for example when you are over a hard seabed or in shallow water.

Ping Enable

Normally enabled, you can disable the ping when appropriate: to test other equipment, or if there is a diver beneath the vessel, for example.

Chapter 7: Using the Radar

7.1 Introduction

This chapter describes the basics of radar and the things that can affect your radar picture. It then shows you how to use your radar and its various functions including:

- Changing orientation and motion mode.
- Getting the best radar picture.
- Measuring distances and bearings.
- Collision avoidance using Guard Zones, MARPA and AIS.
- Using waypoints to mark positions.
- Setting up the radar display.
- Radar alarms.
- View AIS data.

7.2 What is radar?

Radio Detection And Ranging (RADAR) is something that is in use all around us, although it is normally invisible. One of the most common uses of radar at sea is to detect the presence of objects, known as 'targets' at a distance, and if they are moving, detect their speed.

This chapter of the Reference manual provides the information and instructions to enable you to start using the radar so that you know what is around you and use the in-built Mini Automatic Radar Plotting Aid (MARPA) functions to help in collision avoidance.

Until you are familiar with interpreting the radar display, every opportunity should be taken to compare the radar screen patterns with visual targets, such as other boats, buoys and coastal structures. You should practise harbor and coastal navigation during daylight hours and in clear weather conditions.

Detecting targets

Radar works by transmitting radio pulses, then detecting reflections of these pulses (echoes) from objects in the area and displaying the reflections as targets on your display.

Maximum radar range

Maximum radar range is essentially line-of-sight, so is limited by the height of the scanner and the height of the target as illustrated below:
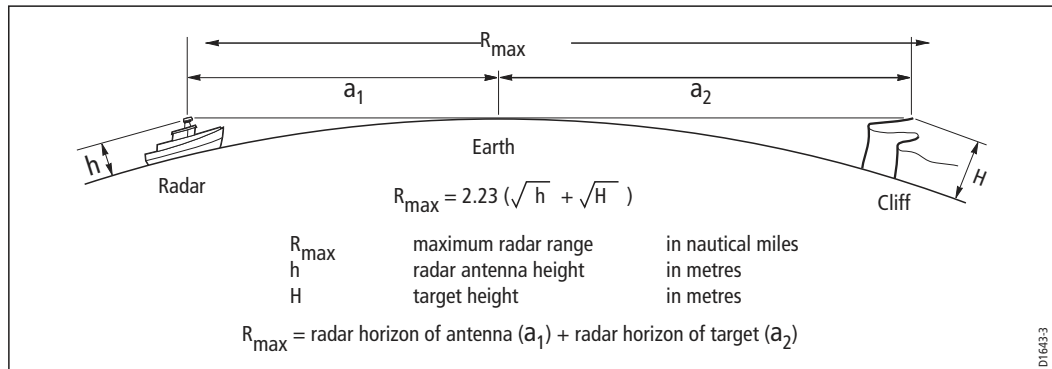
The table below shows typical maximum radar ranges for various radar antenna heights and target heights. Remember that although the radar horizon is greater than the optical horizon, the radar can only detect targets if a large enough target is above the radar horizon.

Antenna height (m)	Target height (m)	Maximum range (nm)
3	3	7.7
3	10	10.9
5	3	8.8
5	10	12.0

Factors impairing a radar picture

Not all radar echoes are produced by valid targets. Spurious echoes may be caused by:

- Side lobes.
- Indirect echoes.
- Multiple echoes.
- Blind sectors.
- Sea, rain or snow clutter.
- Interference.

Through observation, practice, and experience, you can generally detect these conditions very quickly and use the radar controls to minimize them.

Side lobes

Side lobe patterns are produced by small amounts of energy from the transmitted pulses that are radiated outside the narrow main beam.

The effects of side lobes are most noticeable with targets at short ranges (normally below 3 nm), and in particular with larger objects. Side lobe echoes form either arcs on the radar screen similar to range rings, or a series of echoes forming a broken arc.
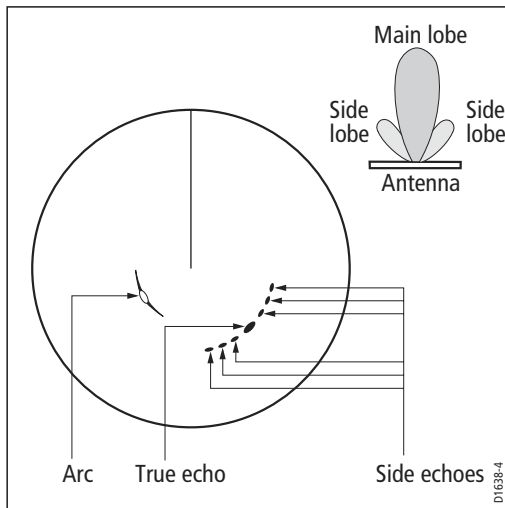

Indirect echoes

There are several types of indirect echoes or ghost images. These sometimes have the appearance of true echoes, but in general they are intermittent and poorly defined.
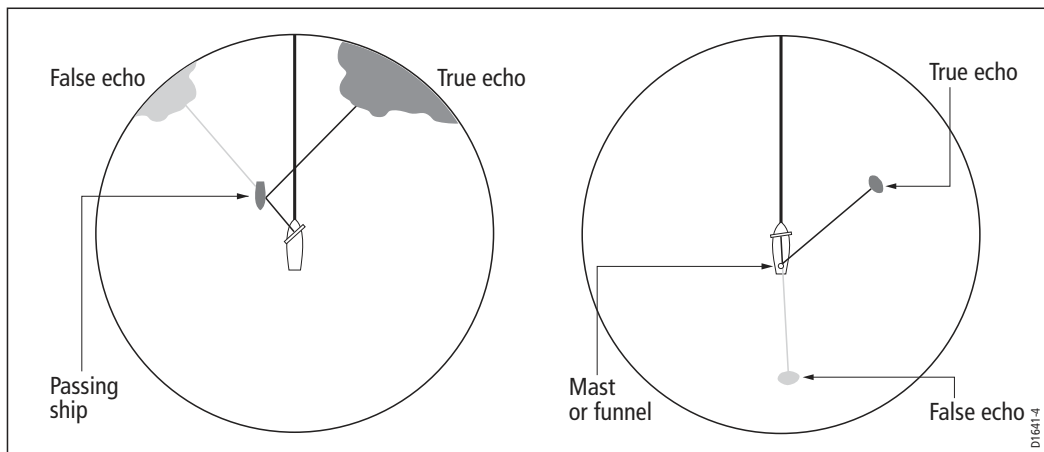
Multiple echoes

Multiple echoes are not very common but can occur if there is a large target with a wide vertical surface at a comparatively short range. The transmitted signal will be reflected back and forth between the target and your own ship, resulting in multiple echoes, displayed beyond the range of the true target echo, but on the same bearing.
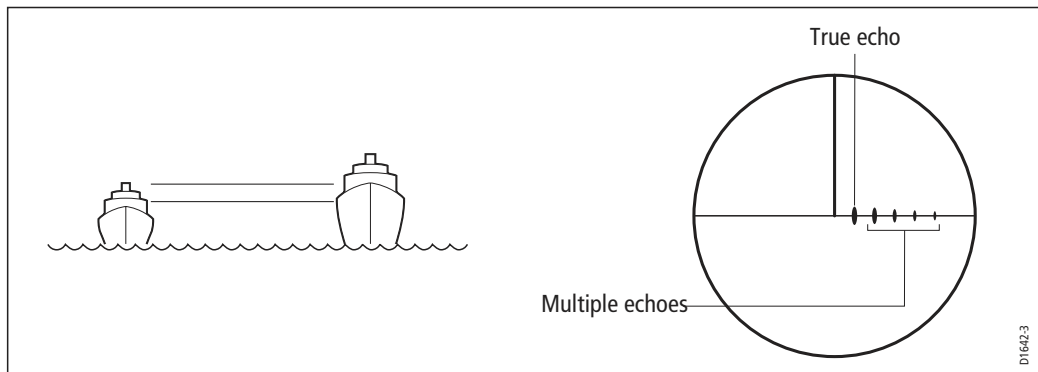

Blind sectors

Obstructions such as funnels and masts near the radar antenna may obstruct the radar beam and cause radar shadows or 'blind sectors'. If the obstruction is relatively narrow, there will be a reduction of the beam intensity, though not necessarily a complete cut-off. However, for wider obstructions there may be a total loss of signal in the shadow area. There may also be multiple echoes which extend behind the obstruction. Blind sector effects can normally be minimized by careful selection of the scanner site prior to installation.

Sea clutter

Radar returns from waves around the vessel can clutter the centre of the radar picture, making it difficult to detect real targets. Such 'sea clutter' usually appears as multiple echoes on the display at short range scales, and the echoes are not repetitive or consistent in position. With high winds and extreme conditions, echoes from sea clutter may cause dense background clutter in the shape of an almost solid disc.
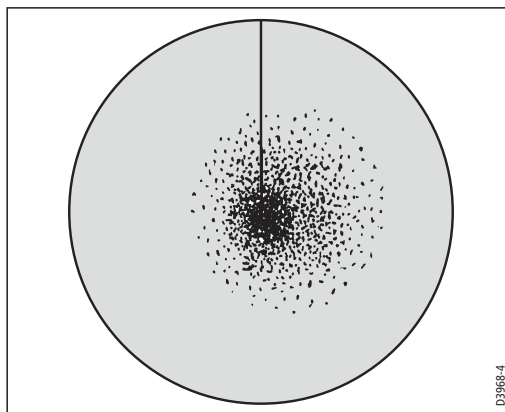
Rain or snow clutter

The radar can see echoes from rain or snow. Returns from storm areas and rain squalls consist of countless small echoes that continuously change size, intensity and position. These returns sometimes appear as large hazy areas, depending on the intensity of the rainfall or snow in the storm cell.
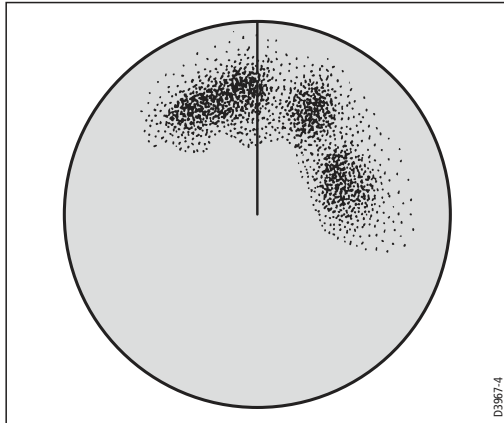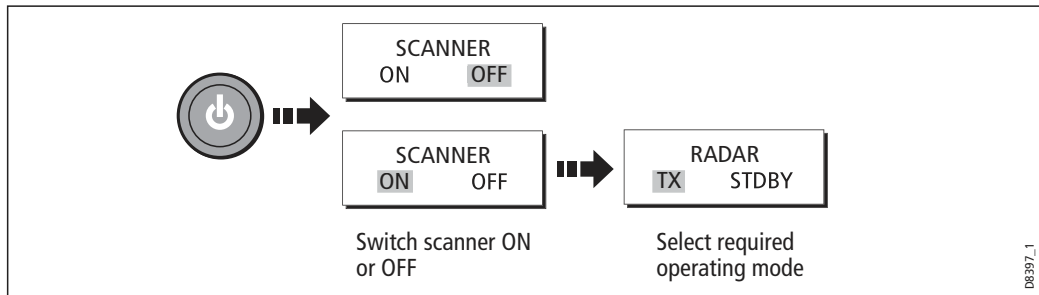

Interference

When two or more radar-equipped vessels are operating within range of each other mutual radar interference can occur. This usually appears as a spiral of small dots from the display centre This type of interference is most noticeable at long ranges.
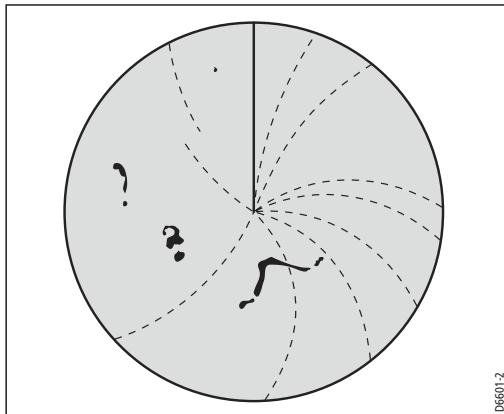
7.3 Powering on/off the various scanner operating modes

To control the power to the radar:

The scanner icon in the data bar indicates the chosen status and is described as:

Radar Mode	Radar status icon	Status description/use
Transmit (TX)	(Rotating icon)	**Scanner on and transmitting.** When SCANNER set to ON, select this mode to activate scanner. This is the usual mode of operation.
Standby (STDBY)	(static icon)	**Scanner on but not transmitting and antenna not rotating.** Antenna does not rotate, the scanner does not transmit and the radar data is removed from the screen. This is a power save mode used when radar not needed for short time periods. When you return to transmit mode, the magnetron does not need to warm up. This is the default mode.
Off	(grayed-out icon)	**Scanner powered off** When radar not required but display in use for other applications e.g. chart. When selected, system countdowns - during this time you cannot re-power the scanner.
Timed transmit	(rotating/static icon)	**Scanner switches between on/transmitting & standby mode** Power save mode when constant use of radar not required. To set up this option, see *page 172*

Notes: (1) *When an open array antenna is fitted, the system stops the antenna in the forward facing position when Standby mode is selected.*

(2) *Dual radar support will only allow one radar to be active at any one time. You cannot set up two radar windows, each using a different scanner.*

7.4 The radar picture

You will need heading and position data for full functionality of your radar. A fast heading sensor is also needed for operation of MARPA and can maximize the performance of radar/chart overlay.

With your radar scanner connected and the radar in transmit mode, the radar picture, provides a map-like representation of the area in which the radar is operating e.g.
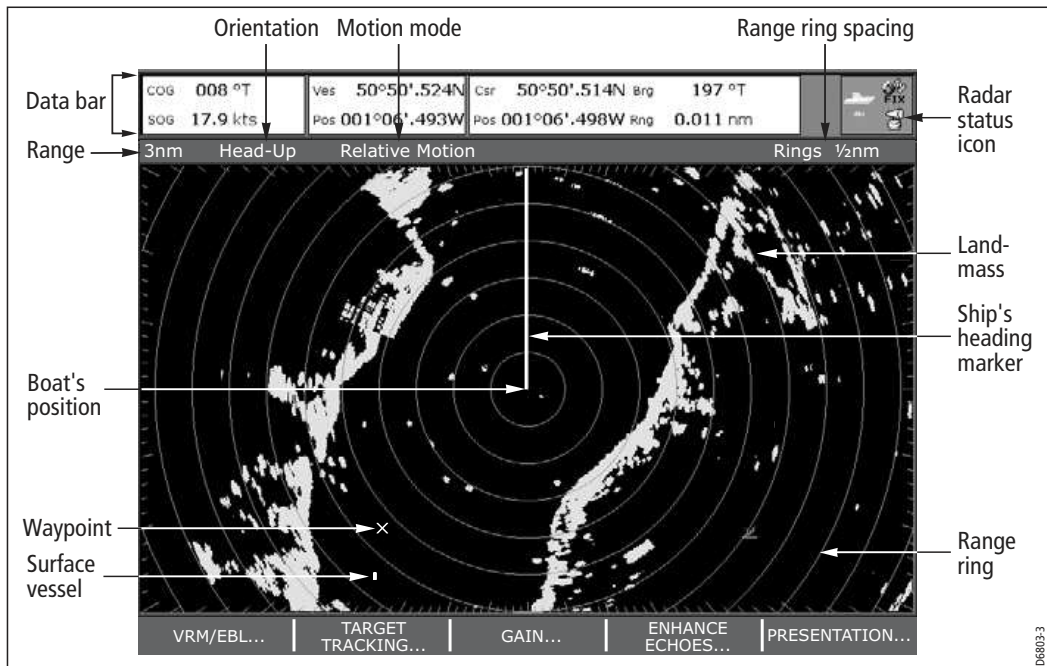
Typically, your boat's position is at the centre of the display, and its dead ahead bearing is indicated by a vertical heading line, known as the Ship's Heading Marker (SHM).

On-screen targets may be large, small, bright or faint, dependent on the size of the object, its orientation and surface. Strongest target returns are displayed in yellow with weaker returns in two shades of blue. Be aware that the size of a target on screen is dependent on many factors and may not necessarily be proportional to its physical size. Nearby objects may appear to be the same size as a distant larger objects.

With experience, the approximate size of different objects can be determined by the relative size and brightness of the echoes. You should bear in mind that:

The size of each on-screen target is affected by:

- The physical size of the reflecting object.
- The material from which the object is made. Metallic surfaces reflect signals better than non-metallic.
- Vertical objects such as cliffs reflect signals better than sloping ones such as sand-banks
- High coastlines and mountainous coastal regions can be observed at longer radar ranges. Therefore, the first sight of land may be a mountain several miles inland

from the coastline. Although the coastline may be much nearer, it may not appear on the radar until the vessel is closer to shore.

- Some targets, such as buoys and small boats, can be difficult to discern, because they do not present a consistent reflecting surface as they bob and toss about in the waves. Consequently, these echoes tend to fade and brighten and at times, to disappear momentarily.

- Buoys and small boats often resemble each other, but boats can often be distinguished by their motion.

7.5 Marking a position on the radar screen

You can mark a position by using a waypoint. Waypoints are positions marked on the screen as a reference or destination point and are stored in the Waypoint list. They can also be used to build routes and assist in passage planning.

Waypoints are placed on the radar screen via the **WPTS/MOB** button in the same way as they are placed on a chart.

You can edit waypoints and navigate to waypoints in the radar window

For full details on using waypoints and passage planning see *Chapter 3:Working with Waypoints* and *Chapter 4:Using the Chart*.

7.6 Changing what you see in the radar window

The radar screen can be tailored to your particular needs. You can:

- Change how the radar is orientated (see *page 150*).
- Change where your boat is positioned (motion mode) in relation to the radar (see *page 152*).
- Show or hide waypoints (see *page 45*).
- Show or hide range rings (see *page 154*).
- Change the bearing mode for EBLs (see *page 154*).
- Show AIS targets.

Note: *The radar settings are locally applied and will therefore only affect the individual display on which you are working.*

### Setting the orientation of the radar

The orientation of the radar refers to the relationship between the radar and the direction that you are travelling in. There are three orientation modes to choose from:
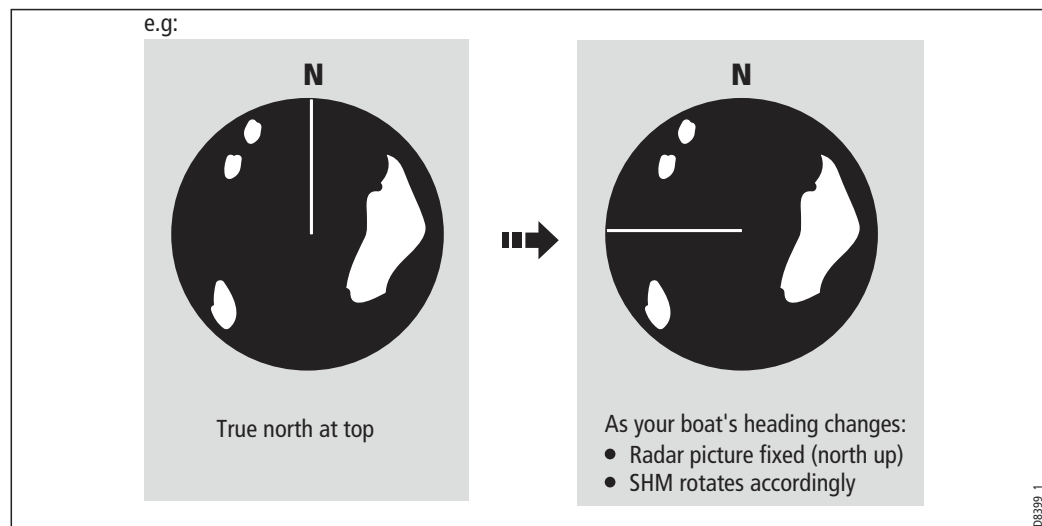
- Head up.
- North up.
- Course up.

These orientation modes are used in conjunction with motion mode (see *page 152*) to control how your boat and radar relate to one another and how they are displayed on screen. Any changes that you make to the orientation of the radar are retained when you switch off.

Head Up (H-UP)

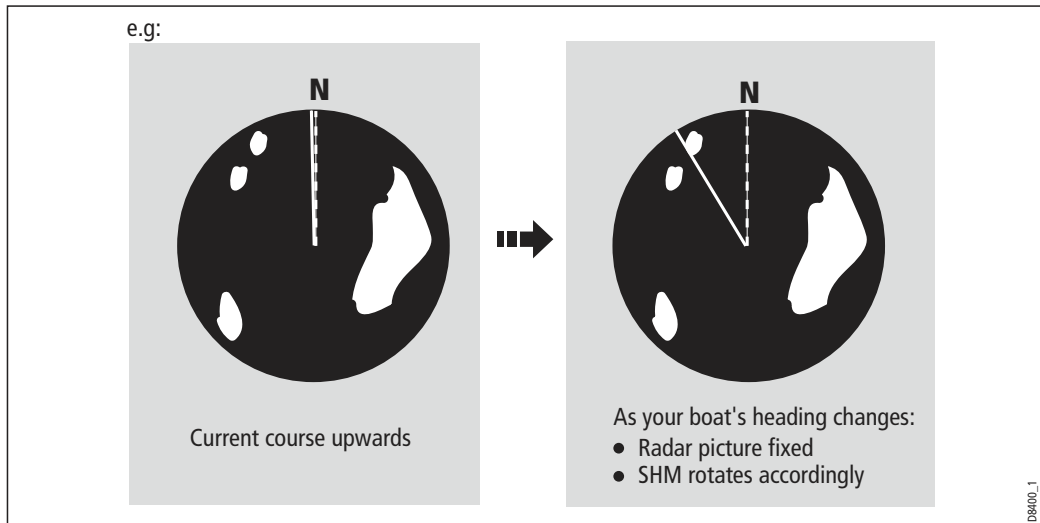This is the default mode for the radar application.
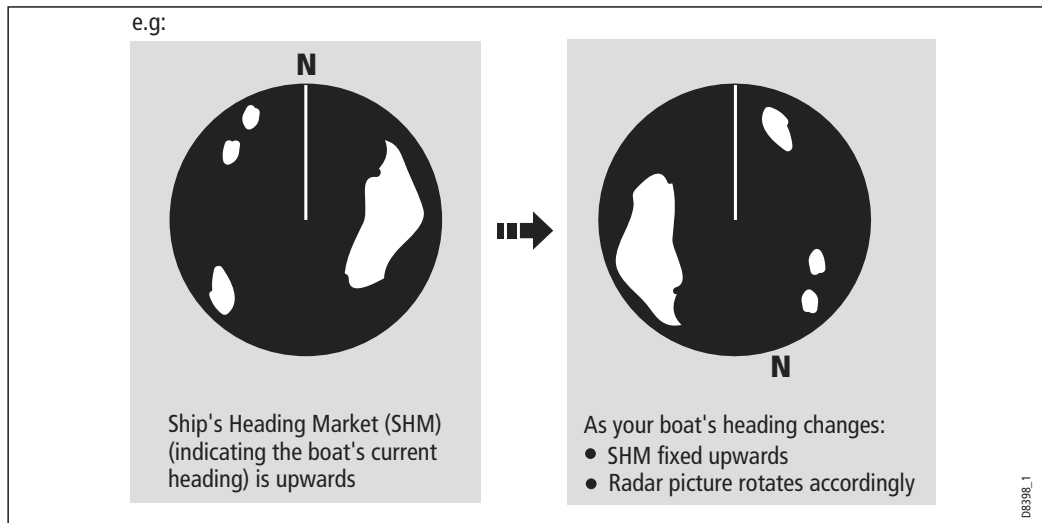
North Up (N-UP)

Notes: (1) *If heading data becomes unavailable whilst in this mode, a warning message will be shown, the status bar indicates North-Up in brackets and the radar uses 0° heading in relative motion. When heading data becomes available once more, North-Up mode is reinstated.*

(2) *It is not possible to select Head Up mode when the motion mode is set to True.*

Course Up (C-UP)

e.g:

Current course upwards

As your boat's heading changes:
- Radar picture fixed
- SHM rotates accordingly

If you select a new course, the picture will reset to display the new course upwards.

The reference used for Course-Up depends upon the information available at a given time. The system always prioritizes this information in the following order.:

1. Bearing from origin to destination, i.e. intended course.

2. Locked heading from an Autopilot.

3. Bearing to waypoint.

4. Instantaneous heading.

Note: *If heading data becomes unavailable whilst in this mode, a warning message will be shown, the status bar indicates the Course Up in brackets and the radar uses 0° heading in relative motion. When heading data becomes available once more, Course-Up mode is reinstated.*

To select the orientation mode:

PRESENTATION...   ➠   RADAR MODE & ORIENTATION...   ➠   ORIENTATION H-UP N-UP C-UP
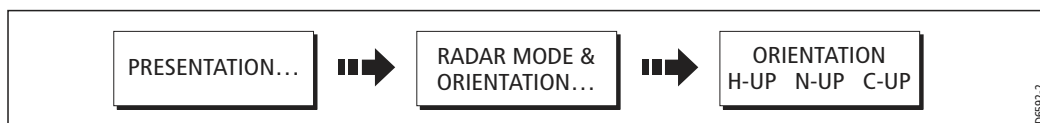
The selected motion mode is displayed in the status bar.

Setting the motion mode

The motion mode controls the relationship between the radar and your boat. There are two modes:

- Relative motion.
- True motion.

The selected motion mode is displayed in the status bar. The default setting is relative motion with zero offset

## Relative motion (RM) with optional vessel offset

When the motion mode is set to Relative, the position of your boat is fixed on the screen and all the targets move relative to the boat.

You can specify whether the boat is fixed in the centre of the window (0 offset) or offset by 1/3 or 2/3 to increase the view ahead i.e.

| 0 offset | 1/3 offset | 2/3 offset |
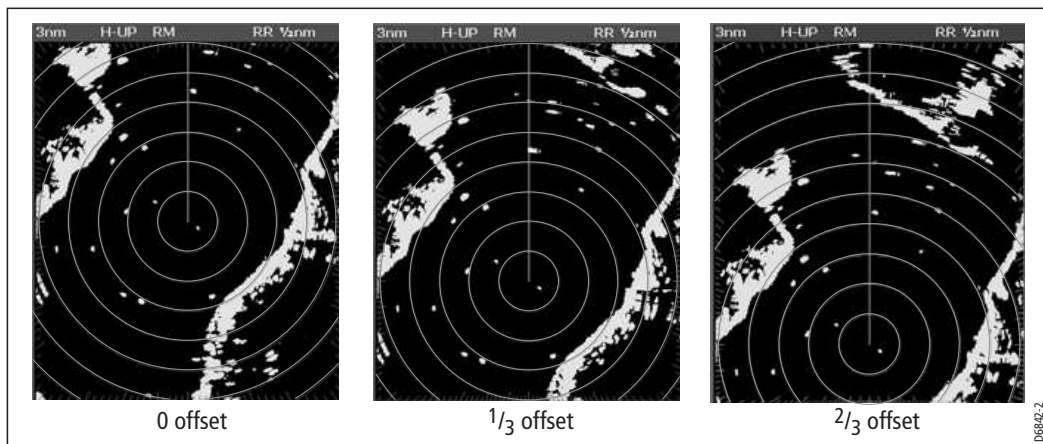
The default mode for the radar application is Relative with zero offset.

To change the vessel offset:
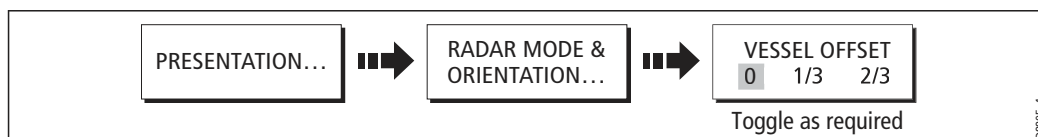
Note: *If no position data is available, the status bar shows the motion mode in brackets.*

True Motion (TM)

When the motion mode is set to True, fixed radar targets maintain a constant position and moving vessels (including your boat) travel in true perspective to each other and to fixed landmasses on the screen. As the boat's position approaches the edge of the screen, the radar picture is automatically reset to reveal the area ahead of the boat.

Notes: (1) *If heading and position data become unavailable when True motion is selected, a warning message will be shown, the mode will revert to relative motion and be noted in the status bar in brackets e.g. (TM)*

   (2) *It is not possible to select True Motion when the orientation is set to Head Up.*

To change the motion mode: