



Explorer 660

Chartplotter and Fishfinder





Installation and Operation Manual

NORTHSTAR★

www.northstarnav.com

IMPORTANT SAFETY INFORMATION

Please read carefully before installation and use.

	This is the safety alert symbol. It is used to alert you to potential personal injury hazards, Obey all safety messages that follow this symbol to avoid possible injury or death.
	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
	CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.
	CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

DISCLAIMER: It is the owner's sole responsibility to install and use the instrument and transducers in a manner that will not cause accidents, personal injury or property damage. The user of this product is solely responsible for observing safe boating practices.

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FCC Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a normal installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an output on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced technician for help.
- A shielded cable must be used when connecting a peripheral to the serial ports.

Contents

Important	6
1 Introduction	7
1-1 Cleaning and maintenance	7
1-2 Plug-in cards	8
1-3 Removing and replacing the display unit	9
2 Basic Operation.....	10
2-1 Turning on and off / auto power	11
2-2 Backlight	11
2-3 Man overboard (MOB).....	11
2-4 Alarms	12
2-5 Simulate mode	12
2-6 The main displays	13
3 Navigation: Chart.....	17
3-1 Introduction to navigating.....	17
3-2 Chart display	18
3-3 Distance and bearing calculator	20
3-4 GOTO: Navigating to a point or along a route.....	20
3-5 Projected course	21
3-6 Tracks and tracking.....	21
4 Navigation: Highway display.....	22
5 Navigation: Waypoints.....	23
5-1 Waypoints display	23
5-2 Managing waypoints	24
5-3 Navigating to a waypoint.....	25
6 Navigation: Routes	26
6-1 Routes display	26
6-2 Managing routes	26
6-3 Navigating a route.....	28
7 Satellites	29
7-1 Satellite display	30

8 Sonar fishfinding: Introduction	31
8-1 Using the Explorer 660	31
8-2 Interpreting the display.....	32
8-3 Single and Dual frequency fishfinding	34
8-4 Fish detection and display.....	36
8-5 Gain, threshold and range	37
9 Sonar fishfinding: Displays	39
9-1 Sonar history display - no split	39
9-2 Sonar Zoom display	40
9-3 Sonar Bottom display.....	40
9-4 Sonar 50/200 display	41
9-5 Sonar A-Scope display	41
10 Data display	42
11 Fuel display	43
12 Tides display	44
13 User card display	45
14 About display	46
15 Setting up the Explorer 660	47
15-1 Setup > System	47
15-2 Setup > Chart	49
15-3 Setup > Sonar	51
15-4 Setup > GPS	53
15-5 Setup > Fuel	54
15-6 Setup > Track	55
15-7 Setup > Logs	55
15-8 Setup > Alarms.....	56
15-9 Setup > Units.....	57
15-10 Setup > Comms	57
15-11 Setup > Calibrate.....	58
15-12 Setup > Time	59
15-13 Setup > Favorites	60
15-14 Setup > Simulate	60

16 Installation	61
16-1 What comes with this product?	61
16-2 Options and Accessories	62
16-3 Mounting the display unit	63
16-4 Mounting the GPS antenna and transducers	64
16-5 Wiring the power/data cable	66
16-6 Systems of several instruments	67
Appendix A - Specifications	68
Appendix B - Troubleshooting	70
B-1 General problems	70
B-2 GPS navigation problems	71
B-3 Sonar fishfinding problems	71
B-4 Fuel consumption problems	73
Appendix C - Glossary and navigation data	74

Important

It is the owner's sole responsibility to install and use the instrument in a manner that will not cause accidents, personal injury or property damage. The user of this product is solely responsible for observing safe boating practices.

Global Positioning System: The Global Positioning System (GPS) is operated by the US Government which is solely responsible for its operation, accuracy and maintenance. The GPS system is subject to changes which could affect the accuracy and performance of all GPS equipment anywhere in the world including the Explorer 660. Whilst the Northstar Explorer 660 is a precision navigation instrument, it can be misused or misinterpreted, which can result in its use being unsafe. To reduce the risk of misusing or misinterpreting the Explorer 660, the user must read and understand all aspects of this Installation and Operation manual. We also suggest that the user practice all operations using the built in simulator before using the Explorer 660 at sea.

Electronic Chart: The electronic chart used by the Explorer 660 is an aid to navigation and is designed to supplement the use of official government charts not replace them. Only official government charts supplemented by notices to mariners contain the information required for safe and prudent navigation. Always supplement the information provided by the Explorer 660 with other plotting sources such as observations, depth soundings, radar and hand compass bearings. Should the information not agree then the discrepancy must be resolved before proceeding any further.

Sonar fishfinder: The accuracy of the sonar depth display can be limited by many factors, including the type of the transducers, the location of the transducers and water conditions. It is the user's responsibility to ensure the Explorer 660 transducers are installed and used correctly.

Fuel Computer: Fuel economy can alter drastically depending on the boat loading and sea conditions. The fuel computer should not be the sole source of information concerning available fuel onboard and the electronic information should be supplemented by visual or other checks of the fuel load. This is necessary due to possible operator induced errors such as forgetting to reset the fuel used when filling the tank, running the engine with the fuel computer not switched on or other operator controlled actions that may render the device inaccurate. Always ensure that adequate fuel is carried onboard for the intended trip plus a reserve to allow for unforeseen circumstances.

Failure to adhere to these warnings may lead to death, serious injury or property damage. Northstar disclaims all liability for installation or use of this product that causes or contributes to death, injury or property damage or that violates any law.

As Northstar is continuously improving this product we retain the right to make changes to the product at any time which may not be reflected in this version of the manual. Please contact your nearest Northstar office if you require any further assistance.

The Explorer 660 is set up with default units of feet, °F (Fahrenheit), US gallons and knots. To change the units, see section 15-9.

1 Introduction

The Northstar Explorer 660 is a compact, rugged, highly integrated GPS navigation chartplotter and sonar fishfinder. It is designed to be easy to use and has a large, easy to read color display. Complex navigation or fishfinding functions can be performed with a few key presses, taking the hard work out of boating.

This manual describes how to install and operate the Explorer 660 and gives troubleshooting and operating tips.

GPS Navigation

The Explorer 660 has a built-in chart of the world, suitable for route planning and general interest. To see chart details for a region, plug in a C-MAP™ chart card (an electronic chart).

The Explorer 660 receives GPS position information from an external GPS antenna and displays the boat's position and speed.

The Explorer 660 can navigate to a point or can navigate along a route. When the boat is navigating to one of these points, the Explorer 660 displays course information for the helmsman to follow. The Explorer 660 can control an autopilot.

Sonar fishfinding

The Explorer 660 has a 50 kHz / 200 kHz dual frequency sonar transducer and a 600 W RMS power output to ensure that the Explorer 660 operates effectively in shallow and deep water.

1-1 Cleaning and maintenance

The Explorer 660 screen is covered by a proprietary anti-reflection coating. To avoid damage, clean the screen **only** with a damp cloth and mild detergent when dirty or covered in sea salt. Avoid abrasive cleaners, petrol or other solvents. If a plug-in card gets dirty or wet, clean it with a damp cloth or mild detergent.

Cover or remove a transom-mounted transducer when repainting the hull. If painting over a through hull transducer with antifouling paint, use only one coat of paint. Remove the previous coat of antifouling paint by sanding it lightly.

The Explorer 660 can detect the bottom to a depth of 3300 feet (1000 metres) depending on the clarity of the water, the ultrasonic frequency chosen and the type of transducer used.

The Explorer 660 can be used to find fish, to locate features on the bottom such as reefs or wrecks and to help recognize favorite fishing spots from the bottom profile.

The Explorer 660 uses Northstar's proprietary SBN technology for sonar processing. Digital adaptive filter algorithms enhance all returned signals and filter false returns. Active noise control rejects interference, which can often be mistaken by fishfinders for true returns.

Other functions

With an optional fuel kit, the Explorer 660 becomes a sophisticated yet easy to use fuel computer. Navigation data can be saved to a plug-in user card so that it can be easily transferred to another Northstar chartplotter.

The Explorer 660 is part of the Northstar family of instruments, which includes instruments for speed, depth, wind and repeaters. These instruments can be connected together to form an integrated data system (see section 16-6).

For maximum benefit, please read this manual carefully before installing and using the unit. Special terms are explained in Appendix C.

To optimize performance, avoid walking on or jamming cables and connectors. Keep the transducer free of weed, paint and debris. Do not use a high pressure water blast on a speed sensor paddlewheel as it may damage the bearings.

Push the dust cover over the display when the Explorer 660 is turned off.

1-2 Plug-in cards

The Explorer 660 can use two kinds of plug-in card:

- **C-MAP™ chart cards** have chart details required for navigating in a particular region. When a chart card is plugged in, the extra details automatically appear on the Explorer 660 chart display.
- **C-MAP™ user cards** are used to store navigation data. Each user card expands the Explorer 660 memory and allows the data to be transferred to another Explorer 660 easily (see section 13).

Note: *The older 5 volt user cards are not supported.*

Changing the plug-in card

The Explorer 660 has two card slots and can use two plug-in cards at the same time. It does not matter which slot a card is inserted in.

CAUTION

Handle plug-in cards carefully. Keep them in their protective cases when not plugged into the Explorer 660.

Keep the holders in place in the Explorer 660 at all times to prevent moisture from entering the card compartment.



1
Turn Explorer 660 off (see section 2-1).
Remove cover from right side of case.



2
Pull old card out of its slot.
Put the old card in its case.



3a
To insert card into front slot:

Hold card with gold contacts visible; push card fully into front slot.



3b
To insert card into back slot:

Hold card with gold contacts underneath; push card fully into back slot.



4
Hold cover correct way round, push back in place.
Turn Explorer 660 on (see section 2-1).

1-3 Removing and replacing the display unit

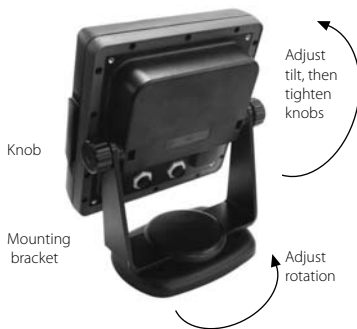
If the display unit is bracket mounted then the display unit can easily be removed and replaced for security or protection.

Removing the display unit:

- 1 Turn the Explorer 660 off (see section 2-1)
- 2 Push the dust cover over the display unit.
- 3 Hold the display unit and remove the knobs from the mounting bracket.
- 4 Unplug each plug from the back of the display unit by turning the locking collar anticlockwise and pulling the plug out.
- 5 Push the attached dust covers over the exposed ends of the plugs to protect them.
- 6 Store the display unit in a dry clean place, such as the optional Northstar carry bag.

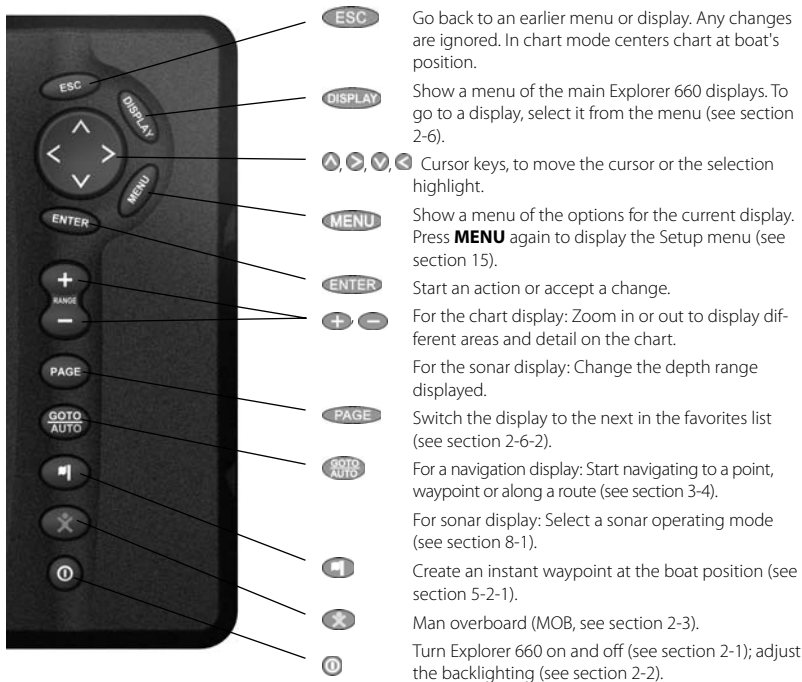
Replacing the display unit

- 1 Remove the dust covers from the plugs. Plug the plugs into the back of the display unit:
 - Match the plug color to the socket color.
 - Insert each plug and turn the locking collar clockwise.Nothing will be damaged if a cable is plugged into the wrong socket by mistake.
- 2 Hold the display unit in place in the mounting bracket. Fit the mounting bracket knobs into the display unit and do up the knobs loosely.
- 3 Adjust the tilt and rotation of the display for best viewing, then hand tighten the knobs on the mounting bracket. Remove the dust cover.



2 Basic Operation

Overview of the keys



In this manual:

Press means to push the key for less than a second.

Hold means to hold the key down.

The internal beeper beeps when a key is pressed (to disable or enable the beep, see section 13-1).

Selecting an item in a menu

The Explorer 660 is operated by selecting items from menus shown on the display.

- 1 Press **▼** or **▲** to move the highlight to the item.
- 2 Press **ENTER** to select the item.

Changing a number or word

To change a number or word on the display:


- 1 Press **◀** or **▶** to move the highlight to the digit or letter to change.
Press **▼** or **▲** to change the digit or letter.
- 2 Repeat the above step to change any other digits or letters.
- 3 Press **ENTER** to accept the change.

2-1 Turning on and off / auto power

Auto power




If the Explorer 660 is wired for auto power (see section 16-5), then the Explorer 660 automatically turns on and off with the boat power, and can not be turned on or off manually.

Turning on manually

If the Explorer 660 is not wired for auto power, turn the unit on by pressing . If necessary, adjust the display to be easy to read (see section 2-2).

2-2 Backlight

The display and keys are backlit, with a choice of 16 brightness levels. To change the backlight level:


1. Press  briefly to show the display controls.
2. Press  to dim or  to brighten.
3. Press **ENTER** to confirm.

2-3 Man overboard (MOB)


The MOB feature saves the boat's position and then navigates back to this point.


WARNING

MOB will not work if the Explorer 660 does not have a GPS fix.

1. Press .
The Explorer 660 stores the boat's position as a waypoint called MOB.
2. The Explorer 660 changes to the chart display, with the MOB waypoint at the centre of the chart.
The chart zooms in for accurate navigation. If the chart can not show the required small scale, the Explorer 660 changes to plotter mode (a white display with crosshatching and no chart details, see section 15-2).
3. If the autopilot output (NMEA) is off (see section 15-10) the Explorer 660 immediately starts navigating back to the MOB waypoint. If the autopilot output is on, the Explorer 660 asks if the autopilot is active. Select:
No: The Explorer 660 immediately starts navigating back to the MOB waypoint.

Turning off manually

If the Explorer 660 is not wired for auto power, turn the unit off by holding down  until the display turns off.

Press  twice to return to the maximum backlight setting.

Yes: The Explorer 660 asks if the boat is to go to the MOB waypoint.

Select:



- **Yes:** To immediately start navigating to the MOB waypoint.

WARNING

This might result in a sudden and dangerous turn.

- **No:** To allow time to disengage the autopilot; then use Goto to navigate back to the MOB waypoint (see section 3-4).

To cancel MOB or set another MOB.

1. Press  again to display a menu.
 2. Select an option from the menu.
-  **Tip:** The MOB waypoint remains on the chart after the MOB has been cancelled. To delete the MOB waypoint, see section 5-2-5.

2-4 Alarms

When the Explorer 660 detects an alarm condition, it displays a warning message on the display, the internal beeper sounds and any external beepers or lights operate.

Press **ESC** to clear the alarm. The alarm will sound again if the alarm condition occurs again.

The Explorer 660 has twelve user settable alarms (see section 15-8).

In addition, the Explorer 660 has a fixed alarm for loss of GPS fix.

2-5 Simulate mode

Simulate mode allows a user to become familiar with the Explorer 660 off the water. There are two simulate modes:

- In GPS simulation mode, data from the GPS receiver is ignored and the Explorer 660 generates this data internally. **GPS simulation** flashes at the bottom of the display.
- In sonar simulation mode, data from the sonar transducers is ignored and the Explorer 660 generates this data internally. **Sonar simulation** flashes at the bottom of the display.

Otherwise, the Explorer 660 functions normally. If both GPS and sonar simulation are selected, **Simulate** flashes at the bottom of the display.

To start and stop Simulate mode, see section 15-14.

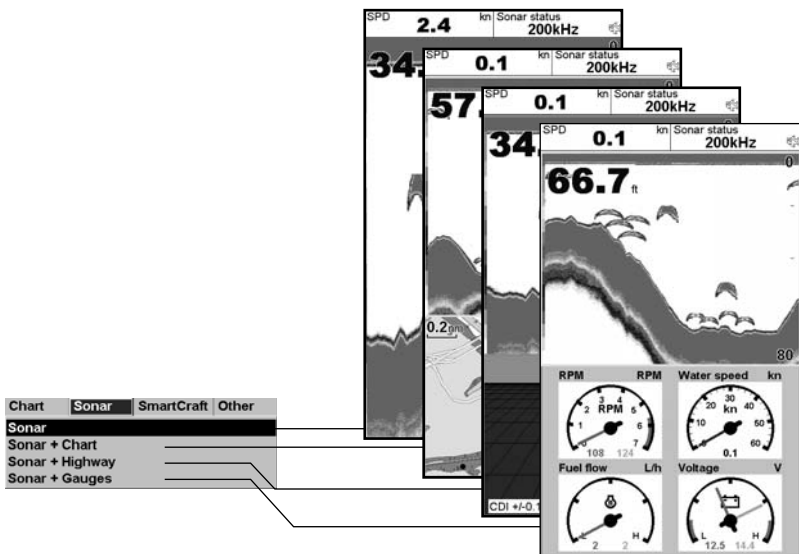
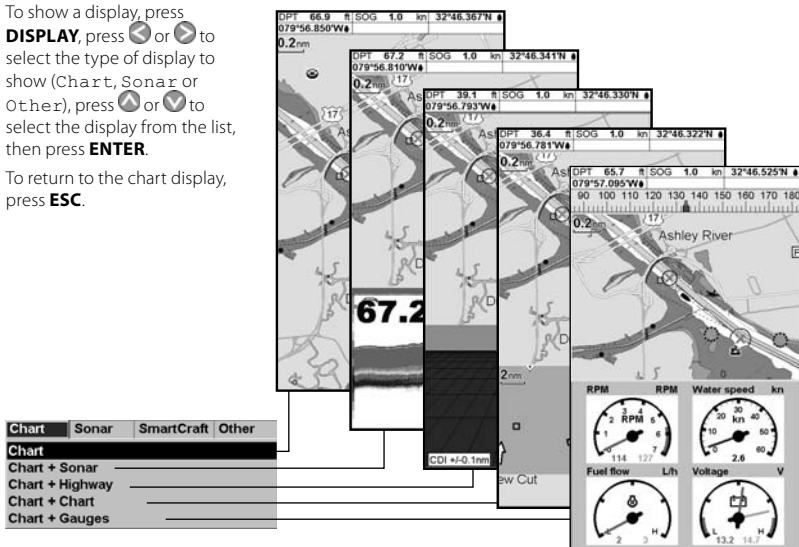


Never have Simulate mode on when the Explorer 660 is navigating on the water.

2-6 The main displays

To show a display, press **DISPLAY**, press \leftarrow or \rightarrow to select the type of display to show (Chart, Sonar or Other), press \uparrow or \downarrow to select the display from the list, then press **ENTER**.

To return to the chart display, press **ESC**.



Speed	kn	Course	M
1.0		135	
Dist to next	nm	Bearing	M
0.51		134	
XTE	nm	Time to next	
R0.02			

Highway

Remaining	L	Depth	ft	F
0.0		33.8		
Range	nm	Economy	L/nm	
2.0		4.02		

Fuel

Port flow	Air temp	°C	Weather
2.4	21.4		
Port used	Baro	mB	Baro history
0.1			

Data

Speed	kn
1.0	
Fish forecast	
1.0	
COI +/-0.1n	
27	

Name	Latitude	Longitude	DST(nm)	BRG(M)	Dngr	Disp
X AKL0	36°50.338'S	174°40.429'E	7237	241	No	LN
X AKL1	36°49.945'S	174°49.021'E	7235	241	No	LN
X AKL2	36°49.070'S	174°49.021'E	7234	241	No	LN

Waypoints

Speed kn	27
Depth	34
Depth ft	69
0	6
14	
20	
25	
47	

Name	Start	End	Legs	Dist
AKLDEMO	AKL0	AKL4	4	5.25 nm
AMSDemo	AMSD0	AMSD3	3	6.45 nm
CAEDEMO	CAED0	CAED3	3	6.45 nm

Routes

Depth ft	34
0	6
14	
20	
25	
47	

Satellite	
Simulate	
10:47:23	
01/Jan/05	
HDOP 1.25	
Used in file	<input type="checkbox"/>
Not used	<input type="checkbox"/>
No signal	<input type="checkbox"/>
SYDDEM	<input type="checkbox"/>

Satellite

Used in file	<input type="checkbox"/>
Not used	<input type="checkbox"/>
No signal	<input type="checkbox"/>
SYDDEM	<input type="checkbox"/>
to page	

Tides	
SOUTH ASHLEY BRIDGE, ...	
Distance	0.66nm
10:48:25	
01/Jan/05	

Tides

User card			
Slot 1			
Name	Type	Date	Time

User card

About	
Explorer 660	
Software: 1.5.9, Jul 13 2005	
Copyright © 2006 Bushwick New Technologies Inc.	
Hardware	18.10
Bootloader	0.0.0
Keyboard software	1
Cartography	6.124
World chart	
Background Cartridge 2.0	
CANLAND AREA DEMO 2.0	
Slot 1: CHAM303.00 CAPE TOWN AREA DEMO	
Slot 2: CHAM307.00 LA ROCHELLE AREA DEMO	
Waypoints	3000 51 Used
Routes	25 10 Used
Tracks	5 1 Used
Power/comms cable	
1 Black	Ground
2 Brown	+5V out
3 White	NMEA out
4 Blue	NavData
5 Red	120MHz
6 Orange	NavData+
7 Yellow	Ignition
8 Green	Ext Alarm
GPS cable	
1 Black	Ground
2 Red	+5V out
3 Green	NMEA from GPS
Fuel cable	
1 Black	Ground
2 White	NMEA in
Sonar cable	
1 Blue	

About

Chart	Sonar	Other
Highway		
Fuel		
Data		
Waypoints		
Routes		
Satellite		
Tides		
User card		
About		

2-6-1 Dual displays

The Explorer 660 can show two displays at once, for example Chart + sonar or Sonar + highway (see section 2-6). When two displays are shown at once, one of the displays, called the active display, is controlled by the user. For example:

- If Chart is the active window, then pressing MENU will display the options for Chart.
- If Sonar is the active window, then pressing MENU will display the options for Sonar.

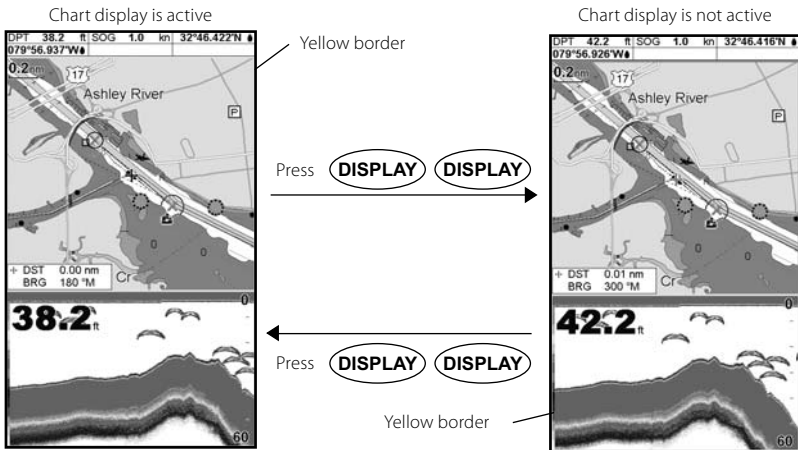
The active display has a yellow border.

To change the active display, press

DISPLAY twice:

For example, if Chart + sonar is shown:

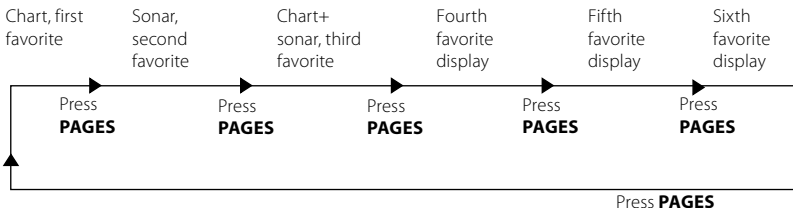
- If Chart is the active window, then press **DISPLAY** twice to make Sonar the active display.
- If Sonar is the active window, then press **DISPLAY** twice to make Chart the active display.



2-6-2 Favorite displays

The Explorer 660 has a list of commonly used displays, called favorite displays. There can be up to six favorite displays and three can be selected by the user (see section 15-13).

To change the display to the next favorite, press **PAGES**. For example, with five favorites:




2-6-3 Data header and compass

The chart, sonar and highway displays can show data and a compass at the top of the display.

The data header

- 1 Press **MENU** and select Data header.
- 2 To turn the data header off or on:
 - i Select Data.
 - ii Select Off or On.
- 3 To choose the size of the numbers:
 - i Select Size.
 - ii Select:
 - Small**: displays three fields per line and up to four lines.
 - Medium**: displays two fields per line and up to six lines.
 - Large**: displays same amount of data as medium but with a larger font.
- 4 To change the data header:
 - i Select Data setup.
 - ii Change a data field:
 - a Press the cursor keys to highlight the field.
 - b Press **ENTER** to display a menu of the data that can be shown in the field.
 - c Select the data to show in the field; select **None** to leave the field empty.
 - iii Repeat the above step to set the other data fields. Press **ESC**.

 **Tip:** If less than the maximum number of lines of data are used, the data will take up less of the display area.

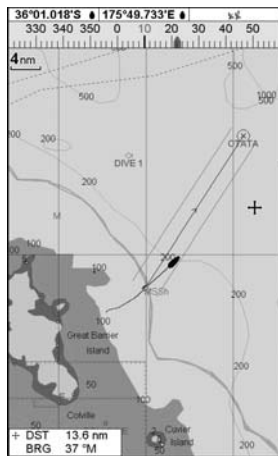
- 5 Press **ESC** to return to the chart display.

The compass

When the boat is navigating to a point, the compass shows the bearing to the destination (BRG) in the middle and the boat's course over ground (COG), for example here BRG is 4° and COG is 12°:

A typical display with data and compass

Data header



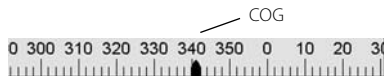
Compass

Otherwise the compass shows the boat's COG in the middle, for example here COG is 12°:



To turn the compass off or on

- 1 Press **MENU** and select Data header.
- 2 Select Compass and select Off or On.
- 3 Press **ESC** to return to the display.




3 Navigation: Chart

The chart display shows the chart, the boat's position course and navigation data. To show the Chart display, press **ESC** until the chart is displayed.

3-1 Introduction to navigating

The Explorer 660 has two ways of navigating, going straight to a point or following a route.

Enter waypoints at points of interest before starting to navigate (see section 5-2-1).


 **Tip:** Create a waypoint at the start of the trip to navigate back to.

Goto: Going straight to a point

The Explorer 660 can navigate straight to a waypoint or to any arbitrary point:

- 1 Switch to the chart display (see section 2-6).
- 2 Start navigating using the **GOTO/AUTO** key (see section 3-4).

When the Explorer 660 is navigating, the chart, data and highway displays show navigation data. The chart shows:

- The boat position 
- The destination point marked with a circle.
- The boat's plotted course to the destination.
- Two CDI lines, parallel to the boat's plotted course (see Appendix C, CDI).

If the Explorer 660 is connected to an autopilot, the Explorer 660 will send data to the autopilot to steer the boat to the destination. Start the autopilot.

If the XTE alarm is enabled, an alarm will sound if the boat deviates too much from its intended course (to set the XTE alarm, see section 15-8).


- 3 If the arrival radius alarm is enabled, then, when the boat comes within the arrival radius of the destination, an alarm will sound to show that the boat has reached the destination (to set the arrival radius alarm, see section 15-8).
- 4 To stop the Goto, see section 3-4.

Following a route

A route is a list of waypoints that the boat can follow (see section 6).

- 1 To create waypoints before creating the route, see section 5-2-1.
- 2 To create a route, see section 6-2-1.
- 3 To start the route, see sections 3-4 or 6-3-1.

When the Explorer 660 is navigating, the chart, data and highway displays show navigation data. The chart shows:

- The boat position 
- The waypoint at the end of the current leg marked with a circle.
- The boat's plotted course along the leg.
- Two CDI lines, parallel to the boat's plotted course (see Appendix C, CDI).

If the Explorer 660 is connected to an autopilot, the Explorer 660 will send data to the autopilot to steer the boat to the destination. Start the autopilot.

If the XTE alarm is enabled, an alarm will sound if the boat deviates too much from its intended course (see section 15-8).

If the arrival radius alarm is enabled, then, when the boat comes within the arrival radius of the waypoint at the end of the current leg, an alarm will sound (to set the arrival radius alarm, see section 15-8).

- 4 The Explorer 660 stops navigating to the waypoint at the end of the current leg and starts the next leg of the route:
 - a When the boat comes within 0.025 nm of the waypoint.
 - b Or when the boat passes the waypoint.
 - c Or if the waypoint is skipped (see section 6-3-2).
- 5 When the boat has reached the final waypoint, or to stop the boat following the route at any time, cancel the route (see section 6-3-3).

3-2 Chart display

A typical chart display shows:

Data header. To turn the data off or on or to change what data is displayed, see section 2-6-3.

The chart. To change the types of information displayed, (see section 15-2).

Boat position (see section 3-2-1).

Boat track (see section 3-6).

Boat course and CDI lines (see Appendix C, CDI).

Boat is going to the waypoint called FISH06.

Distance and bearing of cursor from boat.



A compass (see section 2-6-3).

Typical waypoint (see section 5).

The cursor (see section 3-2-1).

Sea
Land

3-2-1 Chart modes

The Chart has two modes, centre on boat mode and cursor mode. These are explained below.

Centre on boat mode

To switch to centre on boat mode in the chart display, press **ESC**. The boat is at the centre of the chart. As the boat moves through the water, the chart automatically scrolls to keep the boat in the centre of the chart. The cursor (see below) is turned off.

Cursor mode

The keys **▲**, **▼**, **▶** and **◀** are called cursor keys. To switch to cursor mode in the chart display, hold down a cursor key. The cursor **+** appears and moves away from the boat:

- Press the key which points in the direction that the cursor will move, for example press **▼** to move the cursor down.

- Press midway between two of the cursor keys to make the cursor move diagonally.
- Hold a cursor key down to make the cursor move continuously across the display.

In Cursor mode:

- The distance (+DST) and bearing (+BRG) of the cursor from the boat are displayed at the bottom, left corner of the display.
- The chart does not scroll as the boat moves.
- If the cursor reaches the edge of the display, the chart will scroll.

For example, hold down **▶** to move the cursor to the right side of the display and the chart will scroll to the left.

3-2-2 Latitude and longitude

Latitude and longitude can be displayed in the data header. Normally the position is the boat's position, and the latitude and longitude has a boat symbol to show this:

△	36° 29.637' S	Latitude
△	175° 09.165' E	Longitude
Degrees	Minutes, to 3 decimal places (about 2 m (6 ft) resolution)	



If the cursor has been moved in the last ten seconds, then the position is the cursor's position, and the latitude and longitude has a cursor symbol to show this:

+ 36° 29.684' S
+ 175° 09.201' E

WARNING

When reading the boat position, make sure the position is not the cursor position.

3-2-3 Chart scale

Press  to zoom in and display a smaller area of the chart in more detail. Press  to zoom out and display a bigger area in less detail.

The chart scale can be displayed (e.g. scale = 8 nm, see below). The scale is the vertical distance across the currently visible chart area. For example if the scale is 8 nm then a portion of chart eight nautical miles high is currently displayed.

3-2-4 Chart symbols and information



The chart will show symbols, such as waypoints and chart symbols (for example buoys, beacons, wrecks and marinas). When the cursor is placed over a symbol for at least two seconds, a data window appears at the bottom left of the display with information about the symbol.

To see stored information about a point on the chart (for example, a chart symbol):

- 1 Move the cursor to that point on the chart.
- 2 Press **MENU** and select `Chart info`.
- 3 A menu of objects is displayed:
 - i Select an object to display.
 - ii Press **ESC** to return to the menu. Select other objects.
 - iii Finally, press **ESC** to return to the chart.

3-2-5 Find nearby places

To find and display nearby places of interest:

- 1 To see places near the boat's position, press **ESC** to switch to centre on boat mode. To see places near a different point, move the cursor to that point on the chart.
- 2 Press **MENU** and select `Find`.
- 3 Select the type of place. There are three types, Ports, Port services and Tide stations. For a Port service, select the type of service to find.
- 4 A list of places is displayed. If there are more places than will fit on the display, press  or  to scroll up or down a page at a time.

To search for a port by name:

- i Press **MENU** and select `Find`.
 - ii Enter some or all of the letters of the port name. Press **ENTER**.
- 5 Select the place and press **ENTER**. The chart display changes to show the selected place in the middle of the display.
 - 6 To see stored information about the selected place, press **MENU** and select `Chart info` (see section 3-2-5). To display a tide chart for a selected tide station, select `Tide height` from the chart info.

3-3 Distance and bearing calculator

The distance and bearing calculator can plot a course of one or several legs and to show the bearing and length of each leg, as well as the total distance along the course. The completed course can be converted into a route.

To use the distance and bearing calculator:

- 1 Press **ESC** until the chart display is displayed. Press **MENU** and select **Distance**.
- 2 Move the cursor to the start of the first leg. It does not matter if this point is a waypoint or not. Press **ENTER**.
- 3 To add a leg to the course, move the cursor to the end of the leg. It does not matter if this point is a waypoint or not. The display shows the bearing and length of the leg, as well as the total distance along the course. Press **ENTER**.

- 4 To remove the last leg from the course, press **MENU** and select **Remove**.
- 5 Repeat the above two steps to enter the whole course.
- 6 To save the new course as a route, press **MENU** and select **Save**. This also saves any new points on the course as new waypoints, with default names. If necessary, edit the route later (see section 6-2-2) and edit any new waypoints later (see section 5-2-3).
- 7 Finally, press **ESC** to return to the chart display.

Note: See section 15-7 for Log functions.

3-4 GOTO: Navigating to a point or along a route

The GOTO/AUTO key is a shortcut to start navigating to a point on the chart, to a waypoint or along a route.

Starting to navigate

Navigating to a point on the chart

- 1 Press **ESC** until the chart display is displayed.
- 2 Move the cursor to the destination point.
- 3 Press **GOTO/AUTO** and select **Goto cursor**.

Navigating to a waypoint

See section 5-3-1.

Navigating along a route

See section 6-3-1.



Make sure the course does not pass over land or dangerous waters.

The Explorer 660 navigates to the destination as described in section 3-1.

Canceling navigation

Canceling navigating to a point on the chart or to a waypoint

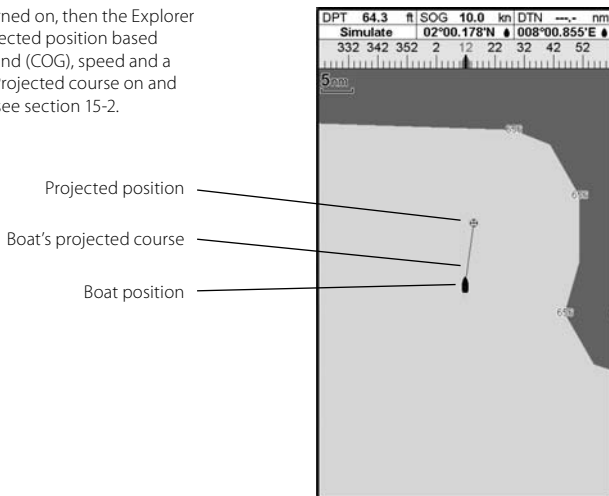
- 1 Press **ESC** until the chart display is displayed.
- 2 Press **GOTO/AUTO** and select **Cancel goto**.

Canceling navigating along a route

See section 6-3-3.

3-5 Projected course

If Projected course is turned on, then the Explorer 660 will display the projected position based on the course over ground (COG), speed and a specified time. To turn Projected course on and off and to set the time, see section 15-2.



3-6 Tracks and tracking

Tracking records the boat's position to memory at regular intervals, which can be:

- Time intervals.
- Or distance intervals.

The track of where the boat has been can be displayed on the chart. The Explorer 660 can display one track while recording another.

To work with tracks, (see section 15-6).

The Explorer 660 can store five tracks:

- Track 1 can hold up to 2000 points and is intended to record the normal progress of the boat.
- Tracks 2, 3, 4 and 5 can hold up to 500 points each and are intended to record sections to be retraced accurately, for example entering a river mouth.

Tip: Record the tracks in good conditions.

When recording is on and the track becomes full then recording continues and the oldest points in the track are deleted.

The maximum length of a track depends on the selected track interval: a small interval will give a shorter, more detailed track and a long interval will give a longer, less detailed track, as shown in these examples:

Time intervals

Interval	Track 1	Track 2, 3, 4 or 5
1 sec	33 minutes	8 minutes
10 sec	5.5 hours	1.4 hours
1 min	33 hours	8 hours

Distance intervals

Interval	Track 1	Track 2, 3, 4 or 5
0.01	20	5
1	2,000	500
10	20,000	5,000

The track lengths are in the current distance units, for example nm.

4 Navigation: Highway display

The highway display has a bird's eye view of the boat's course to a destination:

To show the Highway display, press **DISPLAY**, select **Other**, then select **Highway**.

WARNING

The highway display does not show land, dangerous waters or chart symbols.

The highway display shows:

Optional data header (see section 2-6-3)

Optional compass (see section 2-6-3)

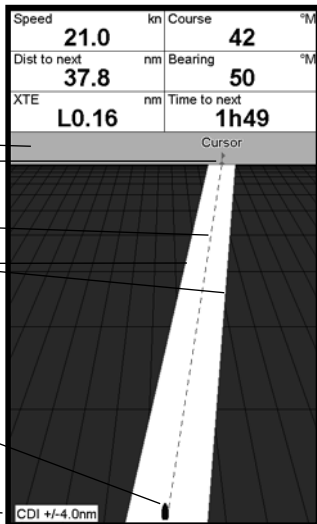
Destination waypoint

Boat's plotted course to destination

CDI lines, parallel to the boat's plotted course (see Appendix C, CDI). The CDI lines are like a highway over the water where the boat will move.

Boat position is at the bottom, centre of the display

CDI scale



5 Navigation: Waypoints

A waypoint is a position of interest that is saved by the Explorer 660, for example a fishing spot or a point on a route. The Explorer 660 can have up to 3000 waypoints. A waypoint can be created, changed or deleted. A waypoint has:

- A name (up to eight characters).
- An icon showing what kind of waypoint it is.



The available icons are:

- A position.
- A color for the waypoint symbol and name on the chart.

5-1 Waypoints display

To go to the waypoints display, press **DISPLAY**, select **Other**, then select **Waypoints** (see right).

The waypoints display is a list of the waypoints that have been entered, each with waypoint symbol, name, latitude and longitude, distance and bearing from the boat, type and display option.

If there are more waypoints than will fit on the display, press **+** or **-** to scroll up or down a page at a time.

- A type:

Normal: A normal waypoint can be navigated to or included in a route.

Danger: A danger waypoint is a point to avoid. If the boat comes within the danger radius of a danger waypoint the unit can sound an alarm (see section 15-8).

- A display option:

Controls how the waypoint is displayed when the *Waypoints* setup option is set to *Selected* (see section 15-2):

Off: The waypoint is not displayed.

Icon: The waypoint icon is displayed.

I+N (Icon and Name): The waypoint icon and name are displayed.

If there are many waypoints, use this feature to select which waypoints are displayed on the chart.

Note: *The other choices for the Waypoints setup option are Hide all (no waypoints are displayed on the chart) and Show all (all the waypoints are displayed on the chart) (see section 15-2).*

Waypoints				
Name	Latitude	Longitude	DST(nm) BRG(°M)	Dngr Disp
X CHAN A	36°16.871'S	175°06.810'E	9.95 251	No I+N
□ COLVILLE	36°23.478'S	175°37.987'E	16.5 94	No I+N
○ DIVE 1	35°46.232'S	175°42.006'E	35.8 12	No I+N
X MARINA	36°21.880'S	175°04.166'E	13.1 228	No I+N
X OTATA	35°51.522'S	175°55.070'E	38.6 30	No I+N
X WPT002	35°58.045'S	175°04.065'E	24.2 311	No I+N

to page up / down

5-2 Managing waypoints



Do not create a navigation waypoint on land or in dangerous water.

5-2-1 Creating a new waypoint

Creating a new waypoint from any display

Press **⏏**. A new waypoint is created at the boat position with the default name and data. To change the default data, see section 5-2-3.

Creating and editing a new waypoint from the chart display

- 1 To create a waypoint at the boat position, press **ESC** to switch the chart to centre on boat mode.

Or, to create a waypoint at a different point, move the cursor to that point on the chart.

- 2 Press **MENU** and select **New waypoint**.
- 3 A new waypoint, with the default name and data is created.
- 4 Change the waypoint data if necessary (see section 5-2-7). Select **Save**.

Creating a new waypoint from the waypoints display

- 1 In the waypoints display, press **MENU** and select **Create**.
- 2 A new waypoint, with a default name and data, is created at the boat position.
- 3 Change the waypoint data if necessary (see section 5-2-7). Select **Save**.

Note: Waypoints can also be created when a route is created (see section 6-2-1).

5-2-2 Moving a waypoint

Moving a waypoint from the chart display

- 1 In the chart display, move the cursor to the waypoint to move.
- 2 Press **MENU** and select **Move**.
- 3 Move the cursor to the new position and press **ENTER**.

Moving a waypoint from the waypoints display

To move a waypoint from the waypoints display, edit the waypoint (see section 5-2-3) and change the latitude and longitude.

5-2-3 Editing a waypoint

Editing a waypoint from the chart display

- 1 In the chart display, move the cursor to the waypoint to edit.
- 2 Press **MENU** and select **Edit**.
- 3 Change the waypoint data (see section 5-2-7). Select **Save**.

Editing a waypoint from the waypoints display

- 1 In the waypoints display, press **⏏** or **⏏** to highlight the waypoint to edit. Press **MENU** and select **Edit**.
- 2 Change the waypoint data (see section 5-2-7). Select **Save**.

5-2-4 Displaying a waypoint on the chart

This goes to the chart display, and shows the selected waypoint at the centre of the display.

- 1 In the waypoints display, press **⏏** or **⏏** to highlight the waypoint to display. Press **MENU** and select **Display**.
Or, in the Chart display, press **MENU**, select **Find**, then select **Waypoints**. Select a waypoint from the list.
- 2 The Explorer 660 switches to the chart display, with the selected waypoint at the centre of the chart.

5-2-5 Deleting a waypoint

A waypoint can not be deleted if the boat is navigating to it or if the waypoint is used in more than one route. A waypoint that is used in one route can be deleted.





When a waypoint is deleted from a route, check that the changed route does not cross land or dangerous waters.

Deleting a waypoint from the chart display

- 1 In the chart display, move the cursor to the waypoint to delete.
- 2 Press **MENU** and select **Delete**.
- 3 Select **Yes** to confirm.

Deleting a waypoint from the waypoints display

- 1 In the waypoints display, press  or  to highlight the waypoint to delete. Press **MENU** and select **Delete**.
- 2 Select **Yes** to confirm.

5-2-6 Deleting all waypoints

- 1 In the waypoints display and press **MENU** and select **Delete all**.
- 2 Select **Yes** to confirm.

5-2-7 Changing a waypoint's data

To change the waypoint data when it is displayed in a window:

- 1 Select the data to change.
Press **ENTER**.
Use the cursor keys to change the data.
Press **ENTER**.
- 2 If necessary, repeat the above step to change other data.
- 3 Select **Save**.



5-3 Navigating to a waypoint

5-3-1 Starting to navigate to a waypoint

From the chart or highway display

- 1 Press **GOTO/AUTO** and select **Waypoint**.
- 2 Select a waypoint from the list.

From the waypoints display

- 1 Press  or  to highlight the waypoint to go to.
- 2 Press **MENU** and select **Go to**.



Make sure the course does not pass over land or dangerous waters.

The Explorer 660 navigates to the waypoint as described in section 3-1.

5-2-8 Sort Waypoints

To change how the waypoints list is displayed:

- 1 Press **MENU** and select **Sort by**.
- 2 Select how to display the list:
Name: In alphabetical order by name.
Icon: Grouped by icon type.
Distance: In order of distance from the boat.

An arrow at the top of a column indicates how the waypoints are sorted.

5-3-2 Cancelling navigation to a waypoint

- 1 Press **ESC** until the chart display is displayed.
- 2 Press **GOTO/AUTO** and select **Cancel goto**.

6 Navigation: Routes

A route is a list of waypoints that the boat can navigate along. Routes can be created, changed and deleted.

The Explorer 660 can have up to 25 routes. Each route can have up to 50 waypoints.

A route can:

- Start and stop at the same waypoint .
- Include waypoints more than once.

6-1 Routes display

The routes display is a list of the routes that have been entered, each with route name, start waypoint, end waypoint, number of legs and total distance.

To go to the routes display, press **DISPLAY**, select **Other**, then select **Routes**.

If there are more routes than will fit on the display, press **←** or **→** to scroll up or down a page at a time.

The Explorer 660 can navigate along a route in either direction. Waypoints on the route can be skipped.

Routes are a powerful feature when the Explorer 660 is connected to an autopilot, allowing the vessel to be automatically guided along the route.



WARNING

Make sure the course does not pass over land or dangerous waters.

Routes			
Name	Start	Legs	Dist
AKLDEMO	AKL0	4	
	AKL4		5.25 nm
AMSDemo	AMS0	3	
	AMS3		0.45 nm
CAEDEMO	CAE0	4	
	CAE4		6.22 nm
CPTDEMO	CPT0	4	
	CPT4		11.1 nm
GOADEMO	GOA0	4	
	GOA4		4.83 nm
LRHDEMO	LRH0	4	
	LRH4		4.56 nm
OSLDEMO	OSL0	5	
	OSL5		5.05 nm
SFODEMO	SFO0	5	
	SFO5		3.10 nm
SOUDEMO	SOU0	4	
	SOU4		3.03 nm
SYDDEMO	SYD0	4	
	SYD4		4.43 nm

6-2 Managing routes



WARNING

After creating or changing a route, display the route on the chart and check that it does not cross land or dangerous water.

6-2-1 Creating a new route

A. Creating a new route from the chart display

While creating the route:

- Press **+** or **←** to change the range; scroll the chart by moving the cursor to the edge of the chart.
- A data box at the top, left of the display shows the route name and total distance. If the cursor is near a leg, it shows the length and bearing of the leg as well.
- The legs of a route must start and end at waypoints. If a leg does not start or end at an existing waypoint then a new waypoint will

be created automatically (to change the new waypoint data, see section 5-2-7).


- 1 In the chart display, press **MENU** and select **New route**.
- 2 The route is given a default name:
 - i Change the name if necessary.
 - ii Select **Ok**.
- 3 To enter the first leg of the route:
 - i Move the cursor to the start of the route and press **ENTER**.
 - ii Move the cursor to the end of the first leg and press **ENTER**.
- 4 To add a waypoint at the end of the route:
 - i Press **ENTER**.
 - ii Move the cursor to where the new route waypoint will be.
 - iii Press **ENTER**.

- 5 To insert a waypoint in the route:
 - i Move the cursor to the chosen leg to insert the waypoint.
 - ii Press **MENU** and select **Insert**.
 - iii Move the cursor to where the new route waypoint will be.
 - iv Press **ENTER**.
- 6 To move a waypoint in the route:
 - i Move the cursor to the waypoint to move.
 - ii Press **MENU** and select **Move**.
 - iii Move the cursor to where the waypoint will be.
 - iv Press **ENTER**.
- 7 To remove a waypoint from the route:
 - i Move the cursor to the waypoint to remove from the route.
 - ii Press **MENU** and select **Remove**. The waypoint is removed from the route, but the waypoint is not deleted.
- 8 Repeat this process until the route is finished. Review the route and check that the route does not cross land or dangerous water.

Then press **ESC**.

Or, to delete the route that is being created:



- i Press **MENU** and select **Delete**.
- ii Select **Yes** to confirm.

 **Tip:** The distance and bearing calculator can also be used to enter a course and save it as a route (see section 3-3).

B. Creating a new route from the routes display

- 1 In the routes display, press **MENU** and select **Create**.
- 2 A new route, with a default name and no waypoints, is displayed.
- 3 To change the route name:
 - i Select the route name at the top of the display and press **ENTER**.
 - ii Change the name if necessary.
 - iii Press **ENTER**.

- 4 To insert a waypoint in the route:
 - i Select where the waypoint will be:
 - To insert the first waypoint in a new route, select Leg 1.
 - To insert a waypoint at the end of the route, select the unused leg at the end of the list of waypoints.
 - Otherwise, select the waypoint to insert the new waypoint in front of.
 - ii Press **ENTER**. A list of waypoints is displayed. Select the waypoint to use.

As waypoints are inserted, the distance and bearing of each leg is shown automatically. If the route has more waypoints than will fit on the display, press  or  to see them.



- 5 To remove a waypoint from the route:
 - i Select the waypoint to remove.
 - ii Press **MENU** and select **Remove**.
- 6 Repeat this process until the route is finished.
- 7 Press **ESC**.
- 8 Display the route on the chart (see section 6-2-3) and check that the route does not cross land or dangerous water.

6-2-2 Editing a route

Editing a route from the chart



- 1 In the routes display, select the route to edit. Press **MENU** and select **Edit on chart**.
- 2 The selected route is displayed on the chart, with a circle around the first waypoint.
- 3 Edit the route as described in section 6-2-1 A, starting at step 4.

Editing a route from the routes display

- 1 In the routes display, press  or  to highlight the route to edit. Press **MENU** and select **Edit**.
- 2 The selected route is displayed: the route name and a list of the waypoints.
- 3 Edit the route as described in section 6-2-1 B, starting at step 3.

6-2-3 Displaying a route on the chart



To view the selected route at the centre of the display:

- 1 In the routes display, press  or  to highlight the route to display. Press **MENU** and select **Display**.
Or, in the Chart display, press **MENU**, select **Find**, then select **Route**. Select a route from the list.
- 2 The Explorer 660 displays the selected route on the chart.

6-3 Navigating a route

6-3-1 Starting a route



To start the boat navigating along a route:

- 1 In the routes display, press  or  to highlight the route to use. Press **MENU** and select **Start**.
Or, from the chart or highway display, press **GOTO/AUTO** and select **Route**, then select a route from the list.
- 2 The Explorer 660 asks for the direction to traverse the route.
Select **Forward** (the order the route was created) or **Reverse**.
- 3 It displays a chart with the route marked and starts navigating from the start of the route.

WARNING

Make sure the course does not pass over land or dangerous waters.

6-2-4 Deleting a route

- 1 In the routes display, press  or  to highlight the route to delete. Press **MENU** and select **Delete**.
- 2 Select **Yes** to confirm.

6-2-5 Deleting all routes

- 1 In the routes display, press **MENU** and select **Delete all**.
- 2 Select **Yes** to confirm.

The Explorer 660 navigates along the route as described in section 3-1.

6-3-2 Skipping a waypoint in a route

To skip a waypoint when the boat is navigating along a route:

- In the chart display, press **MENU** and select **Skip**.

The Explorer 660 starts navigating straight towards the next waypoint on the route.

CAUTION

Skipping a waypoint with the autopilot on might result in a sudden course change.

6-3-3 Cancelling a route

To stop the boat navigating along a route:

- In the chart display, press **MENU** and select **Cancel route**.

7 Satellites

GPS worldwide navigation

The US Government operates the GPS system. Twenty-four satellites orbit the earth and broadcast position and time signals. The positions of these satellites are constantly changing. The GPS receiver analyses the signals from the closest satellites and calculates exactly where it is on earth. This is called the GPS position.

The accuracy of the GPS position is typically better than 10 m (33 ft) for 95% of the time. A GPS antenna can receive signals from the GPS satellites when it is almost anywhere on earth.

DGPS

A DGPS system uses correction signals to remove some of the errors in the GPS position. The Explorer 660 can use one of two types of DGPS system:

- **WAAS and EGNOS DGPS**

WAAS and EGNOS are two satellite based DGPS systems. The correction signals are broadcast by satellites and are received by the Explorer 660's standard GPS antenna. The accuracy of the corrected GPS position is typically better than 5 m (16 ft) for 95% of the time.

WAAS covers all of the USA and most of Canada. EGNOS will cover most of Western Europe when it becomes operational.

- **Differential beacon DGPS**

Differential beacons are land based radio transmitters that broadcast correction signals that can be received by a special receiver on the boat. Differential beacons are usually only installed near ports and important waterways, and each beacon has a limited range. The accuracy of the corrected GPS position is typically better than 2 to 5 m (6 to 16 ft).

GPS antennas

The Explorer 660 must be used with an external GPS antenna:

- Normally, use the GPS antenna supplied.
- Fit an optional differential beacon DGPS antenna to give enhanced accuracy within range of land based differential beacons in areas where WAAS or EGNOS are not available. Such a DGPS antenna has both a GPS receiver and a beacon receiver, and it automatically applies the beacon correction to the GPS position.
- The Explorer 660 can use GPS satellite data from an optional compatible instrument or antenna connected by NavBus or NMEA (see section 16-6). In this case, the Explorer 660 does not need its own antenna.

To configure the Explorer 660 for different antenna options, see section 15-4. For more information, contact your Northstar dealer.

Startup

Each time a GPS receiver is turned on, it normally takes about 50 seconds before it outputs the first position. Under some circumstances it will take up to two minutes or longer.

7-1 Satellite display

The satellite display has information about the GPS satellites and GPS position.

To go to the satellite display, press **DISPLAY**, select **Other**, then select **Satellite**.

The satellite display shows:

Time and date from GPS satellites. Time is local time (UTC [GMT] plus local offset, see section 15-12)

HDOP: The error in the GPS position caused by satellite geometry. A low value indicates a more precise fix, a high value a less precise fix

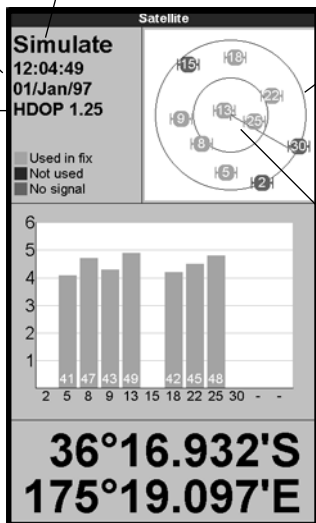
Signal strengths of up to twelve visible GPS satellites. The higher the bar the stronger the signal

Status of GPS antenna, for example **Acquiring**, **GPS fix**, **No GPS**. If the unit is in **GPS Simulate** mode it displays **GPS Simulation** (see section 2-5)

Positions of visible GPS satellites:

- Outer circle is horizon
- Inner circle is 45° elevation
- Centre is directly above
- North is at top of display

If the boat is moving, COG is a line from centre



Boat position

8 Sonar fishfinding: Introduction

This section explains how to interpret the sonar displays, when and why to use the different frequencies and how fish are detected and displayed.

8-1 Using the Explorer 660

The Explorer 660 uses a sonar transducer attached to the hull. The transducer generates an ultrasonic pulse (sound that is above the hearing range of the human ear), which travels down towards the bottom at a speed of about 4800 ft/sec (1463 m/sec), spreading out into a cone shape.

When the pulse meets an object, such as a fish or the bottom, it is partly reflected back up towards the boat as an echo. The depth of the object or bottom is calculated by the Explorer 660 by measuring the time taken between sending a pulse and receiving the echo. When an echo has been returned, the next pulse is sent.

The Explorer 660 converts each echo into an electronic signal, displayed as a vertical line of pixels. The most recent echo appears on the extreme right of the display, with the older echoes being scrolled towards the left, eventually disappearing off the display.

The scroll speed depends upon the water depth and scroll speed setting. See sections 15-3 and section 8-2, for more information.

The appearance of echoes displayed are affected by:

- the Explorer 660 settings (see section 8-5)
- echoes (different fish types, different bottom types, wrecks and seaweed; see section 8-2)
- noise (water clarity and bubbles; see section 8-2).

It also describes Gain and Range and shows examples of some of the different sonar displays.

Cruise, Fishing and Manual Modes

The Explorer 660 has three sonar operating modes:

- **Cruise mode:** Use this when on the move. The Explorer 660 automatically adjusts its settings to compensate for water clarity and to display the bottom.
- **Fishing mode:** Use this when fishing. The Explorer 660 automatically adjusts its settings to compensate for water clarity and to best display fish, the bottom and other details.
- **Manual mode:** Use this to fine-tune the Explorer 660 settings by hand. Best results are often achieved in manual mode, but practice and experience are required to obtain the optimum settings for different conditions.

To select an operating mode, press **GOTO/AUTO** and select the mode. When you select Manual mode, the Explorer 660 reverts to your last manual settings. For more information on operating modes and the Explorer 660 settings, see section 8-5.



Use the automatic Cruise or Fishing modes when learning to use the Explorer 660 or when travelling at speed.

8-2 Interpreting the display

The sonar displays do not show a fixed distance travelled by the boat; rather, they display a history, showing what has passed below the boat during a certain period of time.

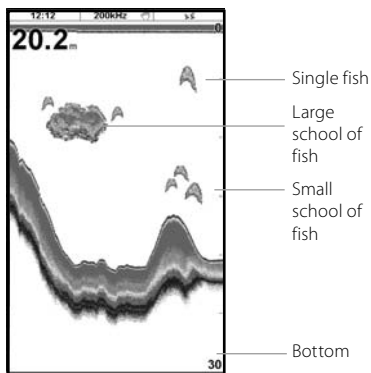
The history of the sonar signal displayed depends the depth of the water and the scroll speed setting.

In shallow water, the echoes have a short distance to travel between the bottom and the boat. In deep water, the history moves across the display more slowly because the echoes take longer to travel between the bottom and the boat. For example, when the scroll speed is set to **F**ast, at depths over 1000 ft (300 m) it takes about 2 minutes for the data to move across the display, whereas at 20 ft (6 m) it takes only about 25 seconds.

The scroll speed can be set by the user to display either a longer history with less fish information or a shorter history with more fish details (see section 15-3).

If the boat is anchored, the echoes all come from the same area of bottom. This produces a flat bottom trace on the display.

The screen shot shows a typical sonar display with the Fish symbols turned **O**ff.

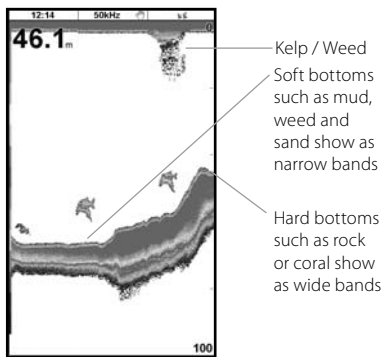


Strength of echoes

The colors indicate differences in the strength of the echo. The strength varies with several factors, such as the:

- Size of the fish, school of fish or other object.
- Depth of the fish or object.
- Location of the fish or object. (The area covered by the ultrasonic pulse is a rough cone shape and the echoes are strongest in the middle.)
- Clarity of water. Particles or air in the water reduce the strength of the echo.
- Composition or density of the object or bottom.

Note: Planing hulls at speed produce air bubbles and turbulent water that bombard the transducer. The resulting ultrasonic noise may be picked up by the transducer and obscure the real echoes.



Bottom types

Mud, weed and sandy bottoms tend to weaken and scatter the sonar pulse, resulting in a weak echo. Hard, rocky or coral bottoms reflect the pulse, resulting in a strong echo. See section 9-3.

Frequency and cone width

The sonar pulse generated by the Explorer 660 transducer travels down through the water, spreading outwards in a cone shape. The cone width is dependent upon the frequency of the pulse; at 50 kHz it is approximately 45°, and at 200 kHz it is approximately 11°.

The differences in the cone width affect what is displayed. See section 8-3.

Water Depth	Cone width at 50 kHz	Cone width at 200 kHz
25	20	5
50	40	10
100	80	20
150	130	30
200	170	40
300	250	60
400	330	80
600	500	120
800	660	150
1000	830	190

45° cone

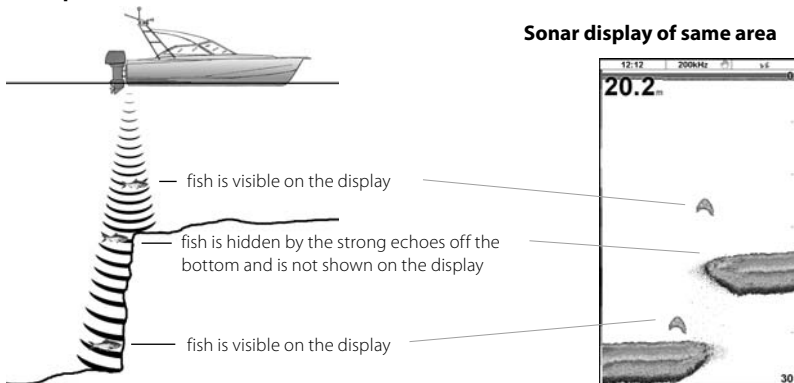
11° cone

Shadows

Shadows are created around areas where the ultrasonic beam cannot 'see'. These areas include hollows on the bottom or beside rocks and ledges, where the strong echoes returned off the rocks obscure the weak echoes of the fish and may also create a double bottom trace. See following for an example of the sonar display in such an environment. A double bottom trace is shown on the display.

When looking for fish with the wide angled 50 kHz frequency, be aware of increased shadows. Use the high frequency 200 kHz in areas that have rocks and ledges because this frequency reduces the shadow effect considerably.

Example of shadows



8-3 Single and Dual frequency fishfinding

Sonar frequencies

The Explorer 660 has two sonar frequencies, 200 kHz and 50 kHz. To select the sonar frequency to use, set Frequency (see section 15-3).

When to use 200 kHz

The 200 kHz frequency is especially suitable for use in shallow and medium depth water, typically less than 500 ft (150 m) and while running at speed.

At 200 kHz, the narrow cone reduces any noise caused by air bubbles.

The 200 kHz frequency generates a higher definition pulse which produces little shadow and returns excellent detail over a small area of bottom. Therefore, it gives excellent bottom discrimination capability and is particularly good at showing individual fish, including bottom dwellers.

When to use 50 kHz

The 50 kHz frequency is particularly suitable for use in deep water, typically greater than 500 ft (150 m).

At 50 kHz, the cone covers an area of water about four times wider than the 200 kHz cone and penetrates to a greater depth with minimal loss of the return signal.

However, it produces a lower definition display with more shadow compared to the 200 kHz frequency. This means that a group of small fish, for example, could be displayed as a single item, while any fish very close to the bottom may not be found at all.

This frequency is useful for getting a deep, wide overview of the area so that any areas of interest can be identified and then examined in detail with the 200 kHz frequency.

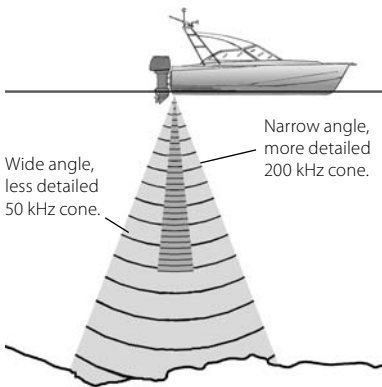
When to use Mixed

The Mixed frequency combines the 200 kHz and the 50 kHz echoes on one sonar display, filling in detailed echoes in the centre of the sonar cone.

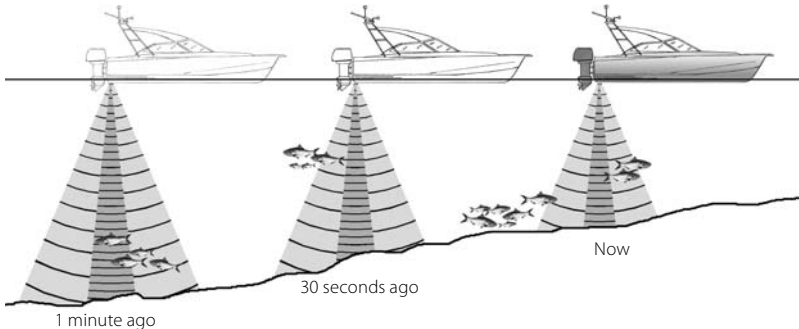
When to use 50/200 kHz

Operating the Explorer 660 at both 50 kHz and 200 kHz simultaneously on a split display can be very useful when operating in shallow to medium water, typically less than 500 ft (150 m), because the 50 kHz section of the display shows the general area, while the 200 kHz section can be viewed simultaneously for a more detailed look at any interesting feature.

To use 50/200 kHz, select the Split 50/200 display (see section 9-4).



Comparison of the same fish scenario displayed at different frequencies:



50 kHz display



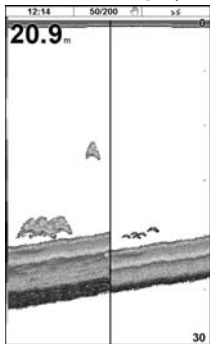
Note the wider bottom trace

200 kHz display



Note the smaller, defined fish arches and more bottom detail.

50/200 kHz display



Dual screen

50+200 display



8-4 Fish detection and display

Where to find fish

Underwater features like reefs, wrecks and rocky outcrops attract fish. Use the 50 kHz or 50/200 kHz frequency display to find these features, then look for fish by passing over the feature slowly several times using the Zoom display (see section 9-2). If there is a current, the fish will often be found downstream of the feature.

When fishing with the Explorer 660 with the Fish symbols $\text{O}\ \text{F}\ \text{E}$, a weak fuzzy band may appear between the bottom trace and surface. This might indicate a thermocline - a rapid change in water temperature, such as the edge of a warm or cold current. The temperature difference can form a barrier which the fish may not swim through. In fresh water, fish often collect around a thermocline.

Fish symbols

The Explorer 660 uses Northstar's SBN technology to analyse sonar echoes and identify which are likely to be fish. The Explorer 660 can be set up to display a fish symbol and the depth over these echoes (see section 15-3, Fish symbols). While SBN is very sophisticated it is not foolproof - there will be times when the Explorer 660 will not be able to differentiate between fish and large air bubbles or rubbish.

Depending on the strength of a fish signal, the Explorer 660 can display a small, medium or large symbol (see section 15-3, Fish filter).

To see the maximum amount of information from the echoes, turn Fish symbols off. Fish appear as arches on the display.

Fish arches

In good conditions, a fish passing through the cone-shaped ultrasonic pulse is displayed as a fish arch. The 50 kHz frequency uses a wider cone than the 200 kHz frequency. This makes the fish arches easier to see.

A fish arch starts when a fish enters the weak edge of the sonar cone, generating a weak echo that is displayed as the start of the fish arch. As the fish moves closer to the middle of the cone, the distance between the transducer and the fish reduces and the echo is displayed at progressively shallower depths, producing a rising shape. When the fish passes directly beneath the middle of the cone, the echo becomes strongest and thickest. As the fish passes out of the middle of the cone the reverse happens with a progressively weaker and deeper echo.

There are many reasons why fish arches may not be seen. For example:

- Poor transducer installation (see *Transom Transducers Installation Guide*).
- If the boat is anchored then fish will tend to show on the display as horizontal lines as they swim into and out of the transducer sonar beam. Slow speeds in deeper water give the best fish arch returns.
- Range is important. It will be much easier to see fish arches when using zoom mode to concentrate on a particular section of water, rather than just displaying everything from the surface to the bottom. Zooming increases screen resolution and is necessary for good fish arches.
- It is difficult to get fish arches in shallow water as the transducer sonar beam is very narrow near the surface and fish do not stay within the beam long enough to display an arch. Several fish in shallow water tend to display as randomly stacked areas of color.
- Wave motion may result in distorted fish arches.



Fun fish symbol



Normal fish symbol



Fun symbol + depth



Fish arch

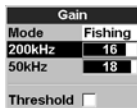
8-5 Gain, threshold and range

The Explorer has three settings that affect the sonar display:

- **Gain:** The gain of the sonar receiver. The gain should be high to display good detail, but if the gain is too high then information from the strong bottom signal is lost and false echoes might be displayed. There is a separate gain setting for each sonar frequency, 50 kHz and 200 kHz.
- **Threshold:** Return echoes less than the threshold are ignored. The threshold should be as low as possible, but if the threshold is too low, unwanted noise will be displayed. Threshold is set as a percentage of gain. For example, if the threshold is 50 %, then return echoes less than 50 % of the maximum signal are ignored. There is a separate threshold setting for each sonar frequency, 50 kHz and 200 kHz.

To display the current settings for gain and threshold, select a sonar display and press

ENTER:



Gain	
Mode	Fishing
200kHz	16
50kHz	18
Threshold	<input type="checkbox"/>

This display is called the gain window.

- **Range:** The vertical depth covered by a Explorer 660 sonar display. For example, if the range is 100 m, then the sonar display shows depths between 0 and 100 m. The range is displayed at the bottom, right corner of a sonar display.

If the bottom is deeper than the specified depth range, it will not be shown on the display.

The Explorer 660 has three operating modes, Cruise, Fishing and Manual (see section 8-1). In Cruise and Fishing modes, the Explorer 660 automatically adjusts gain and threshold for good performance and adjusts range to always show the bottom. In manual mode, you can hand adjust the settings.

8-5-1 Changing between automatic and manual modes

Select a sonar display before changing mode (see section 9).

a Using an automatic mode

Press **GOTO/AUTO** and select Cruise or Fishing (see section 8-1). The Explorer 660 will adjust gain, threshold and range automatically.


b Using manual mode

Press **GOTO/AUTO** and select Manual. The Explorer 660 reverts to your last manual settings (see section 8-1).

c Adjusting gain or threshold manually

- 1 Press **ENTER** to display the gain window:
- 2 Press **▲** or **▼** to select the setting to adjust.
- 3 Press **◀** or **▶** adjust the setting.

If the Explorer 660 is in Cruise or Fishing modes, it will stop adjusting gain and threshold automatically but will continue to adjust range automatically.

 **Tip:** Use the A-scope display to help set gain or threshold manually (see section 8-5-2).

To revert to automatic:

- Either press **GOTO/AUTO** and select Cruise or Fishing.
- Or press **ENTER** to display the gain window, select **Manual** and press **▶**. The Explorer 660 will not adjust threshold automatically; if gain is manual it will stay manual.

d Adjusting range manually

- Either press **+** or **-** to increase or decrease range.
- Or press **MENU**, select **Range** and select **Manual**. Range does not change.

If the Explorer 660 is in Cruise or Fishing modes, it will stop adjusting range automatically but will continue to adjust gain and threshold automatically.

Manual range is useful in areas of rapidly changing bottom depth, such as around pinnacles, to prevent the display from redrawing often to always show the bottom.

To revert to automatic range, with the bottom always displayed:

- Either press **GOTO/AUTO** and select Cruise or Fishing.
- Or press **MENU**, select Range and select Auto. If gain and threshold are manual, they will stay manual.

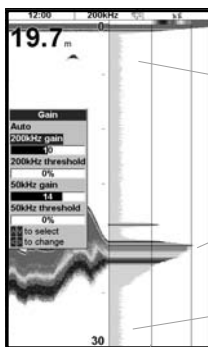
8-5-2 Using the A-scope to set gain and threshold manually

It is convenient to use the A-scope display when adjusting gain and threshold manually. Follow this procedure to adjust gain and threshold for normal circumstances:

- 1 If necessary, select the sonar frequency to adjust the settings for (see section 15-3).
- 2 Select the sonar display (see section 2-6). If necessary, press **+** or **-** to adjust range so that the bottom is displayed.
- 3 Press **MENU**, select Sonar splits then select Split A-scope.
- 4 Press **ENTER** to display the Gain window. To adjust gain or threshold for a frequency, press **▲** or **▼** to select the setting to adjust, then press **◀** or **▶** to change the setting.

- 5 Set threshold to zero.
- 6 Adjust Gain so the peak of the strong signal from the bottom just touches the gain line.
- 7 Adjust threshold so that it is just to the right of the noise.
- 8 Press **ESC** to close the gain window.
- 9 If required, repeat these steps to adjust gain and threshold for the other frequency.

Note: Setting the gain higher will display more detail from weak echoes, like fish, but will lose detail from the strong echo from the bottom.



9 Sonar fishfinding: Displays

To show the Sonar display, press **DISPLAY**, select **Chart** or **Sonar**, then select a sonar display.

There are five kinds of sonar display. To use a display:

- 1 Press **MENU** and select **Sonar splits**.

Options	
Sonar splits	No Split
Gain	No Split
Range	Split Zoom
A-Scope	Split Bottom
	Split 50 / 200
Data header	Split A-Scope
MENU for setup	

Sonar history display at a single or mixed frequency - not split (see section 9-1)

Sonar split display: history plus a zoomed section (see section 9-2)

Sonar split display: history plus a flat bottom trace in a zoomed section (section 9-3)

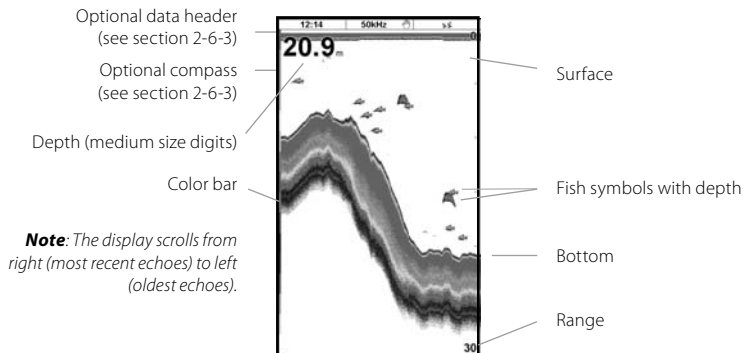
Sonar split display: histories at 50 and 200 kHz frequencies (section 9-4)

Sonar split display: history plus echo strength (section 9-5)

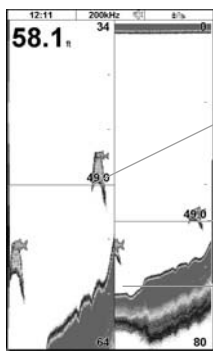
Select the type of display to use.

- 2 If the display is split, adjust the split ratio if required:
 - a Press **MENU** and select **Sonar window split**.
 - b Press **←** or **→** to adjust the ratio.
 - c Press **ENTER**.

9-1 Sonar history display - no split



9-2 Sonar Zoom display



Depth line marks the centre of the zoomed area

Zoom bar

Divider line

Zoom section Sonar history

The display shows the sonar history on the right and the zoomed section on the left.

The zoom bar on the far right shows the area of the history that is magnified in the zoom section:

- Press ◀ or ▶ to adjust the zoom range (the range of depths included in the zoom section).
- If Bottom Lock is on, the zoom depth (the depth of the zoom section) is adjusted automatically so that the bottom is always displayed in the zoom section.

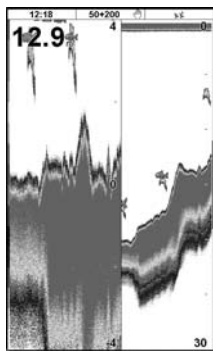
If Bottom Lock is off, press ▲ or ▼ to manually adjust the zoom depth. If bottom lock is on it will turn off.

Bottom lock

To turn Bottom Lock on or off:

- 1 Press **MENU** and select **Bottom Lock**.
 - 2 Select **On** or **Off**.
- or If Bottom Lock is on, pressing ▲ or ▼ will turn it off.

9-3 Sonar Bottom display



Zoomed bottom Sonar history signal

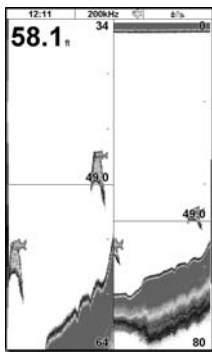
The display shows the sonar history on the right and the bottom signal as a flat trace in the centre of the zoom section on the left. The flat trace make it easy to compare the echo strengths shown in the bottom signals. This can help to identify the type of bottom and objects close to the bottom.

The zoom bar on the far right shows the area of the history that is magnified in the zoom section:

- Use the ◀ or ▶ keys to adjust the zoom range.
- The Explorer 660 calculates the zoom depth automatically.

It is not necessary to turn Bottom Lock on for this display.

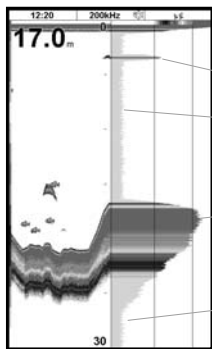
9-4 Sonar 50/200 display



50 kHz sonar history 200 kHz sonar history

The display shows the 50 kHz sonar history on the left and the 200 kHz sonar history on the right. Gain can be set independently for each frequency (see section 8-5). Range applies to both frequencies (see section 8-6).

9-5 Sonar A-Scope display



Sonar history A-scope display

The display shows the sonar history on the left and the A-Scope display on the right. The A-Scope shows:

- the strengths of echoes from different depths
- the longer the horizontal line the stronger the signal

- a vertical line showing the gain threshold, the weakest echo to display on the sonar history
- a vertical line showing the gain setting; echoes above this strength will display as the maximum signal strength

Use the A-Scope while adjusting the gain and threshold settings manually (see section 8-5).

Fish recognition

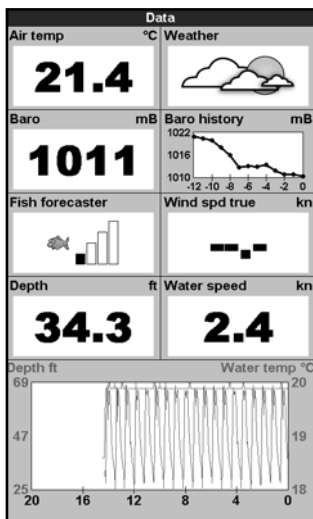
The echo strengths shown on the A-scope can be useful in recognising the type of fish. Different species of fish have different sizes and shapes of swim bladders. The air in the swim bladder reflects the ultrasonic pulse, so the strength of the echo varies between fish species according to the size and shape of the swim bladder.

When catching fish from a school, note the species and the strength of the echo that it returns on the A-scope. Then, when that particular echo is seen again, it is likely to be the same fish species.

Bottom type

The shape of the echo strengths in the A-Scope can help you to recognise the type of bottom.

10 Data display



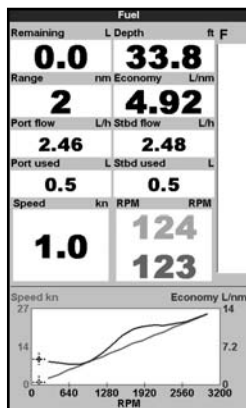
The data display has eight large numeric data fields, four lines with two fields per line, plus a graph of the water temperature and depth over the last 20 minutes.

To show the data display, press **DISPLAY**, select **Other**, then select **Data**.

To select what data is displayed:

- 1 Press **MENU** and select **Data** setup.
- 2 Change a data field:
 - i Press the cursor keys to highlight the field.
 - ii Press **ENTER** to display a menu of the data that can be shown in the field.
 - iii Select the data to show in the field; select **None** to leave the field empty.
- 3 Repeat the above step to set the other data fields.
- 4 Press **ESC**.

11 Fuel display



To show the Fuel display, press **DISPLAY**, select **Other**, then select **Fuel**. The Fuel display can only be used when the optional single or twin engine fuel kit has been installed. See section 15-5 for information about setting up the fuel display. If the number of engines is set to 0, the fuel features are turned off.

Used shows total fuel used since this was last reset with the **Clear Used** command.

Remaining shows the amount of fuel remaining in the tank(s).

Flow shows the fuel consumption per hour. For twin engine installations, the fuel flow for each engine is shown separately. This is useful for checking that both engines are under the same load.

Economy is the distance travelled per unit of fuel used. The Explorer 660 calculates this from the boat speed and fuel used. The bigger this number, the better the fuel economy. Adjust the throttle and trim to achieve the best fuel economy. Note that the Explorer 660 uses a paddlewheel transducer to measure speed, used to calculate the fuel economy. Therefore, calibration of the boat speed measurement is essential for an accurate fuel economy reading. See section 15-11.

12 Tides display

The tides display shows tide information at a tide station for the selected date.

To show the tides display for the tide station nearest to the boat, press **DISPLAY**, select **Other**, then select **Tides**.

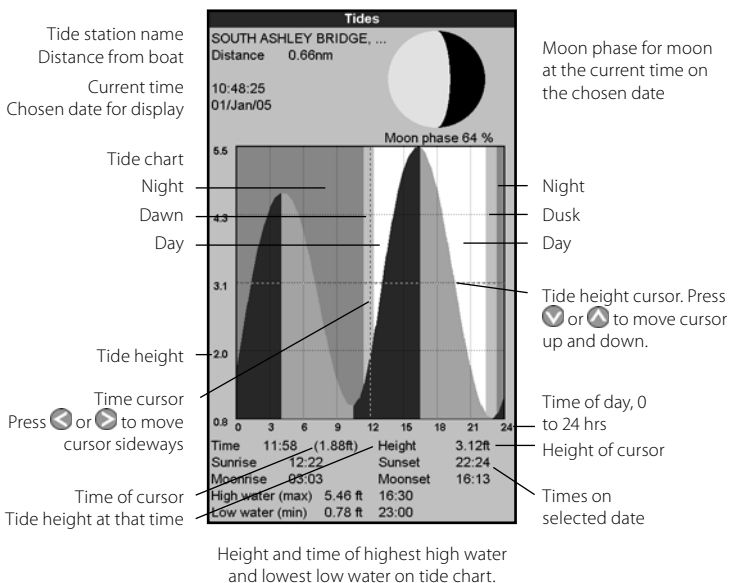
To go to the tides display for any tide station:

- 1 From the chart display, press **MENU** and select **Find**.
- 2 Select **Tide stations**.
- 3 A list of tide stations are displayed. Select the tide station to display. The chart redraws with the tide station centred.
- 4 Press **MENU** and select **Chart info**.
- 5 Select **Tide height**.

Choosing the date of the tide chart

- 1 Press **MENU**.
- 2 Select **Today**, **Next day** or **Prev day**.
To choose a different date from these, select **Set date**, edit the date, press **ENTER**.

The tides display shows data for the chosen date:



- A routes file: The new routes are added to any existing routes in the Explorer 660. If a new route has the same name as an existing route but has different data then the Explorer 660 asks which route to keep.
- A track file: The new track will replace the existing track in the Explorer 660.

To load a file to the Explorer 660:

- 1 Select the file to load.
- 2 Press **MENU** and select **Load**.

Deleting a file from the user card

- 1 Select the file to delete.
- 2 Press **MENU** and select **Delete**.
- 3 Select **Yes** to confirm.

Reading the file information

This reads the file names from the user card and displays them. Reading does not load any file data into the Explorer 660.

- 1 Press **MENU** and select **Card**.
- 2 Select **Read**.

Formatting the user card

Formatting prepares a user card for use. Format the card if there is an error message saying that the card is not formatted. Any data files on the card are deleted.

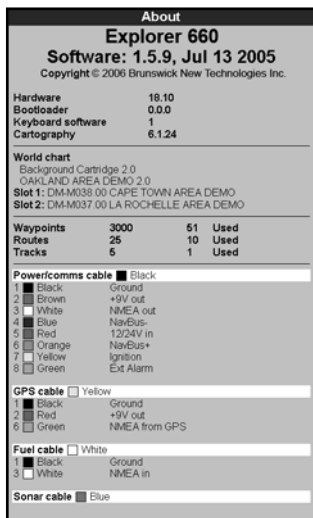
- 1 Press **MENU** and select **Card**.
- 2 Select **Format**.
- 3 Select **Yes** to confirm.

Sorting the file names

This sorts the displayed file names.

- 1 Press **MENU** and select **Sort**.
- 2 Select sort by **Name**, **Type** or **Time**.

14 About display



To show the about display, press **DISPLAY**, select **Other**, then select **About**.



The about display shows:

- The software version and date.
- The world chart version.
- Any card fitted.
- The number of waypoints, routes and tracks in the Explorer 660.
- Wiring information for the Explorer 660 connectors.

In the unlikely event of having to contact a Northstar dealer for service, quote the software version number and date.

15 Setting up the Explorer 660

The Explorer 660 has a number of advanced features which are set up through the setup menu. We recommend that you become familiar with the operation of the unit using the default settings before making any changes to the data in these menus.

Press **MENU** one or more times, to show the Setup menu, then select a particular option using the  or  cursor keys. (Section 2 describes how to use the keys in more detail.)

15-1 Setup > System

Press **MENU** once or more until the Setup menu is displayed, then select System:

System	
Language	English
Backlight	15
Night mode	<input type="checkbox"/>
Key beep	<input checked="" type="checkbox"/>
Auto power off	<input type="checkbox"/>
Instant display changing	<input type="checkbox"/>
Factory reset	
Sonar	<input checked="" type="checkbox"/>
SmartCraft	<input checked="" type="checkbox"/>
Buddy track	<input checked="" type="checkbox"/>

Language

Select the language for the displays. The options are: English, Italian, French, German, Spanish, Dutch, Swedish, Portuguese, Finnish and Greek.

Tip: In case you can't read the current language, the language setting is found at the top of the system menu.

Backlight

The backlight control is displayed. The bar setting represents the current level of backlighting.

Key beep

Enables or disables the beep when a key is pressed.

Auto power off

Select On to have the Explorer 660 power off automatically every time the boat's ignition is switched off. This applies only if the display unit is wired for Auto Power. See section 6-5 Wiring Options.

The Setup menu and options are summarized on the next page. **The factory default settings are shown where applicable.**

Each Setup menu option is explained in the following sections.

Factory reset

This option returns all of the Explorer 660 settings (except the language) to the default factory settings shown on the next page.

A warning box asks: **Are you sure?** Select **Yes** and press **ENTER** to confirm.

Instant display changing

Controls how the display changes when you press the **DISPLAY** key and use the display menu to choose a new display (see section 2-6). The options are:

Off: The display only changes when you press finally **ENTER** to choose a display..

On: The display changes each time you highlight another display in the display menu.

Sonar

Disable any sonar transducer and disable sonar functions.

A sonar transducer is fitted. Enable sonar operation.

SmartCraft

No SmartCraft gateway is fitted. Disable SmartCraft functions.

SmartCraft gateway is fitted. Enable SmartCraft operation.

Buddy track

No DSC VHF radio is fitted. Disable Buddy track.

A DSC VHF radio is fitted. Enable Buddy track.

Setup menu and options

Factory default settings are shown where applicable.

System (see 15-1)

System	
Language	English
Backlight	15
Night mode	<input type="checkbox"/>
Key beep	<input checked="" type="checkbox"/>
Auto power off	<input type="checkbox"/>
Instant display changing	<input type="checkbox"/>
Factory reset	<input type="checkbox"/>
Sonar	<input checked="" type="checkbox"/>
SmartCraft	<input checked="" type="checkbox"/>
Buddy track	<input checked="" type="checkbox"/>

Chart (see 15-2)

Chart	
Rotation	North up
Projected course	Off
CDI scale	0.1 nm
Plotter mode	<input type="checkbox"/>
Mixing levels	<input type="checkbox"/>
Palette	Normal
Compass mode	COG in center
Map datum	WGS-84
NMEA datum offset	<input type="checkbox"/>
Map shift	Off
Waypoints	Selected
Lat/lon grid	<input type="checkbox"/>
Boundaries	Off
Names	<input checked="" type="checkbox"/>
Attention areas	<input checked="" type="checkbox"/>
Water features	<input checked="" type="checkbox"/>
Water depth	<input type="checkbox"/>
Tidal flow	<input checked="" type="checkbox"/>
Lights	On
Nav-aids	INT
Land features	<input checked="" type="checkbox"/>
Land elevation	<input checked="" type="checkbox"/>
Text/icon Size	Large
AntiClutter	<input checked="" type="checkbox"/>

Sonar (see 15-3)

Sonar	
Frequency	200kHz
Scroll speed	Fast
Fish symbols	Off
Fish filter	Small
Fish sensitivity	Medium
Digit size	Medium
Depth line	<input checked="" type="checkbox"/>
Colour bar	<input type="checkbox"/>
Zoom bar	<input checked="" type="checkbox"/>
Palette	White
Interference filter	<input type="checkbox"/>
Noise filter	Off
Pulse length	Auto
Pulse power	Auto
Receiver filter	Wide

Fuel (see 15-5)

Fuel	
Num engines	2
Port engine	<input type="checkbox"/>
Stbd engine	<input type="checkbox"/>
Dual tanks	<input type="checkbox"/>
Port tank	<input type="checkbox"/>
Stbd tank	<input type="checkbox"/>
Fuel consumption curve	<input type="checkbox"/>
Speed source	GPS speed
RPM	<input type="checkbox"/>

Water depth (see 15-2)

Water depth	
Bathymetric lines	<input checked="" type="checkbox"/>
Spot soundings	<input checked="" type="checkbox"/>
Depth area limit1	20 ft
Depth area limit2	167 ft
Bath & sndgs min	0 ft
Bath & sndgs max	50 ft

GPS (see 15-4)

GPS	
GPS source	NMEA
DGPS source	WAAS/EGNOS
Restart GPS	<input type="checkbox"/>
Static navigation	Off
Speed filter	5
Course filter	4

Smartcraft

SmartCraft	
Tanks	<input type="checkbox"/>
Troll window	On idle
Troll mode	RPM
Trim	<input type="checkbox"/>
Steering angle	<input type="checkbox"/>
Speed type	Paddle
Pitot type	100 psi

Track (see 15-6)

Track	
Record	1
Display	1
Plotting interval	Distance
Distance	0.1 nm
Time	10 sec
Memory used	100%
Send track	<input type="checkbox"/>
Delete track	<input type="checkbox"/>

Logs (see 15-7)

Logs	
Reset trip dist	<input type="checkbox"/>
Reset total dist	<input type="checkbox"/>
Reset engine hours	<input type="checkbox"/>
Trip dist	0.00 nm
Total dist	0.00 nm
Engine hours	0 hrs

Alarms (see 15-8)

Alarms	
Arrival radius	Off
Anchor alarm	Off
XTE	<input type="checkbox"/>
Danger	Off
Too shallow	Off
Too deep	Off
Fish	<input type="checkbox"/>
Temperature	Off
Temperature rate	Off
Low battery	Off
Port low fuel	Off
Stbd low fuel	Off
DGPS	<input checked="" type="checkbox"/>

Units (see 15-9)

Units	
Distance	nm
Speed	kn
Depth	ft
Height	m
Fuel	Litres
Compass	°M
Temperature	°C
Wind	True
Pressure	kPa
Baro	mB

Comms (see 15-10)

Comms	
NMEA out	Off
NMEA data	<input type="checkbox"/>
Lat/Lon d.p's	3
NavBus	Off
NavBus group	0

Calibrate (see 15-11)

Calibrate	
Speed	<input type="checkbox"/>
Speed filter	Off
Temperature	<input type="checkbox"/>
Temp filter	5
Port engine	<input type="checkbox"/>
Stbd engine	<input type="checkbox"/>
Keel offset	0.0 ft
Speed range	Low
Max fuel flow	100 L
Max RPM	3000

Time (see 15-12)

Time	
Local offset	+00:00
Time format	24 hour
Date format	dd/MMM/yy

Favorites (see 15-13)

Favourites	
Favourite 1	Chart
Favourite 2	Sonar
Favourite 3	Chart + Sonar
Favourite 4	None
Favourite 5	None
Favourite 6	None

Simulate (see 15-14)

Simulate	
Simulate	<input checked="" type="checkbox"/>
Mode	Demo
Speed	1.0 kn
Course	7 °M
Route	CAEDMO

15-2 Setup > Chart

Press **MENU** once or more until the Set up menu is displayed, then select **Chart**:

Chart	
Rotation	North up
Projected course	Off
CDI scale	0.1 nm
Plotter mode	<input type="checkbox"/>
Mixing levels	<input type="checkbox"/>
Palette	Normal
Compass mode	COG in center
Map datum	WGS-84
NMEA datum offset	<input type="checkbox"/>
Map shift	Off
Waypoints	Selected
Lat/lon grid	<input type="checkbox"/>
Boundaries	Off
Names	<input checked="" type="checkbox"/>
Attention areas	<input checked="" type="checkbox"/>
Water features	<input checked="" type="checkbox"/>
Water depth	<input checked="" type="checkbox"/>
Tidal flow	<input checked="" type="checkbox"/>
Lights	On
Nav-aids	INT
Land features	<input checked="" type="checkbox"/>
Land elevation	<input checked="" type="checkbox"/>
Text/icon Size	Large
AntiClutter	<input checked="" type="checkbox"/>


Water depth	
Bathymetric lines	On
Spot soundings	On
Depth area limit1	20 ft
Depth area limit2	167 ft
Bath & sndgs min	0 ft
Bath & sndgs max	50 ft

Rotation

The options for chart rotation are:

North up: North is always at the top of the chart display.

Track up: The chart is rotated so that the boat direction is to the top of the display. This option is useful for navigating narrow harbours or rivers. The Explorer 660 asks for a course deviation; this is how much the boat direction needs to change to make the chart redraw.

 **Tip:** If the chart redraws too frequently, increase the course deviation setting.

Course up: This option is only available if the boat is navigating to a destination. The chart is rotated so that the plotted course to the destination is vertical.

Projected course

The Explorer 660 can estimate the course after a given time, based on the current speed and heading (see section 3-5). The options are 2 minutes, 10 minutes, 30 minutes, 1 hour, 2 hours or Off.

CDI Scale

The CDI Scale is described in Appendix C, CDI. The options are 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 4.0 and 10.0 distance units.

Plotter mode

Occasionally it is desirable to use a chart scale which is not available on a chart card. Examples are:

- To zoom in to a small scale to track very small boat movements.
- If there is no detailed chart for an area, for example when crossing an ocean.

If **Plotter mode** is On, then if the chart zooms to a scale which is not available, the Explorer 660 will enter plotter mode and will only display the boat position and track (if enabled). Chart information will no longer be displayed and the display is white with black crosshatch lines.

For normal use, turn **Plotter mode** to Off.

Mixing levels

Mixes lower detail charts with higher detail charts on chart boundaries.

- : Lower detail chart is not shown.
- : Lower detail chart shown; this is slower to redraw.

Palette

Select the color scheme for the LCD display. The options are:

Normal

Sunlight: Brighter colors, more visible in sunlight.

Night: Reversed colors for night, to preserve night vision.

Compass mode

COG in center: Displays course over ground in center of compass

BRG in center: Displays bearing in center of compass

Map datum

Explorer 660 GPS positions are based on a worldwide reference (datum) known as WGS 84. Most paper charts are based on WGS 84. However, some paper charts are based on other datums. In these cases, the latitude and longitude coordinates of objects on the Explorer 660 chart display are different to the latitude and longitude coordinates of these objects on the paper chart. This applies to all objects, such as the boat, waypoints, tracks, lines of latitude and longitude and cartographic features such as land, rocks, buoys and depth contours.

Use **Map datum** to select the Explorer 660 map datum to match the datum of the paper chart. Then, the latitude and longitude coordinates of objects displayed on the Explorer 660 will change to match the corresponding coordinates on the paper chart.

Setting map datum

- 1 In the Chart setup menu, select **Map datum**.
- 2 Select the map datum for the paper chart you are using.
- 3 The Explorer 660 asks if you want to apply the datum offset to latitude and longitude coordinates sent on the NMEA output. The options are:

Yes: Latitude and longitude coordinates displayed on any NMEA repeaters match the coordinates on the Explorer 660. However, latitude and longitude coordinates broadcast on any NMEA VHF transmitter will be slightly offset from coordinates on a WGS 84 chart.

No: Latitude and longitude coordinates displayed on any NMEA repeater do not match the coordinates on the Explorer 660. Latitude and longitude coordinates broadcast on any NMEA VHF transmitter will be the same as the coordinates on a WGS 84 chart.

WARNING

When you change to a chart with a different datum, change the Explorer map datum again.

Map shift

Some charts have consistent position errors. To correct this, apply a map shift. After a map shift:

- The positions of cartographic features (such as land, rocks, buoys and depth contours) move on the Explorer 660 chart display to where they should be.
- The positions of the boat, waypoints, tracks, and lines of latitude and longitude on the Explorer 660 chart display remain unchanged.

WARNING

Map shift is for eliminating minor offsets. It should not be used if the correct datum is available. Use map shift with caution: incorrect application will cause incorrect boat positions.

Applying a map shift

- 1 Move the boat to a known point on the chart, for example a marina berth.
- 2 In the Chart setup menu, select **Map shift**.
- 3 Move the cursor to the position on the chart where the boat actually is.
- 4 Press **ENTER** to set the new map shift. The boat will now be displayed at its actual location.

Clearing the map shift

Clearing the map shift removes any map shift from the cartographic features on the Explorer 660 chart display.

- 1 In the Chart setup menu, select **Map shift**.
- 2 Press **MENU** and select **Clear**.

Waypoints

Controls how waypoints are displayed on the chart. The options are:

Hide all: No waypoints are displayed (except for waypoints on any selected route).

Show all: All waypoints are displayed.

Selected: Waypoints with their display option set to **Icon** or **I+N** (Icon and Name) are displayed (see section 5).

Chart display options

The other chart setup options allow an extensive range of chart card features to be shown. Configure the most useful display format.


Bathymetric Lines and soundings

Chart cards contain a large amount of spot sounding and depth contour data. This can be selectively displayed by turning Bathymetric Lines and Spot Soundings on, then selecting the range to display with Bath and Sndgs Min and Max.

Attention Areas

Areas of importance, such as restricted anchorages and shallow areas, are highlighted as Attention Areas.

The options are:

On: displays attention area boundaries and information icons .

Off: does not display attention area boundaries or information icons .

15-3 Setup > Sonar

Press **MENU** once or more until the Set up menu is displayed, then select Sonar:

Sonar	
Frequency	200kHz
Scroll speed	Fast
Fish symbols	Off
Fish filter	Small
Fish sensitivity	Medium
Digit size	Medium
Depth line	<input checked="" type="checkbox"/>
Colour bar	<input checked="" type="checkbox"/>
Zoom bar	<input checked="" type="checkbox"/>
Palette	White
Interference filter	<input type="checkbox"/>
Noise filter	Off
Pulse length	Auto
Pulse power	Auto
Receiver filter	Wide


Frequency

There is a choice of: 200 kHz, 50 kHz and 50+200. For information about selecting a suitable frequency for the water conditions, see section 8-3.

Scroll speed

Use this to set the scroll speed on the display. There is a choice of: Very Fast, Fast, Medium, Slow and Pause. The depth of the water also affects the speed of the display.

Faster scroll speeds combined with a slow boat speed (typically between 2 and 6 knots) shows the most fish detail. Medium or Slow scroll speeds result in sonar information being displayed over a longer period, but with less detail (see Section 8-2).

Note: In some early chart cards the information icons  are inactive.

Depth area limits

The depth area limits control the chart water colors for different depths. There are three water colors:

Surface to Depth area limit 1:
Shallow water color.

Depth area limit 1 to Depth area limit 2:
Medium water color.



Below Depth area limit 2:
Deep water color.

The actual water colors depend on the palette in use (see above).

Fish symbols

The Explorer 660 always displays echoes from fish (fish arches, see section 8-4). If fish symbols are on, a symbol is displayed over the arch (see section 8-4). The options are:

- **Off:** No fish symbol is displayed..
- **Fun** or **Normal:** A fish symbol is displayed.

• **Fun**  **depth** or **Normal** 
depth: A fish symbol is displayed and the depth shown beside the fish symbol.



Fish filter

Use this to select the minimum fish size to be displayed and to trigger the Fish alarm. The options are: Small, Medium and Large.

Digit size

Use this to remove or change the size of the depth display on the sonar displays. There is a choice of: Small, Medium and Large.

Depth line

This is a horizontal line that can be moved up or down using the  or  cursor keys. The depth line can be used to find the depth of a fish or other object shown. When in the Sonar Zoom display, the depth line marks the centre of the zoomed area.

It can be switched **On** or **Off**. If switched **On**, it appears on all the sonar displays.

Color bar

This shows the range of colors used for the selected color palette.

It can be switched On or Off. If switched On, it is displayed down the left hand side of all the sonar displays.

Zoom bar

This shows the vertical range that is enlarged in the Zoom section.

It can be switched On or Off. If switched On, it appears as a vertical scroll bar displayed on the right hand side of all the sonar displays.

Palette

Use this to select a color palette. Each color within the palette represents a different echo strength, as shown on the sonar displays.

There is a choice of five color palettes: Black, Blue, White, Vivid and 8 color. The first four palettes display more detail, and each color covers a 1.5 dB signal range. The 8 color palette displays less detail, and each color covers a 3 dB signal range.

Interference filter

This filters the echo signal to reduce high-level, spiky interference, such as engine noise.

It can be switched On or Off.

Pulse length

This can be used to specify the length of the transmitted ultrasonic pulse. A short pulse length improves the display detail but contains less energy, therefore it does not penetrate as deeply into the water as a longer pulse.

There is a choice of Auto, Short, Medium or Long. The Auto setting is recommended.

Pulse power

This can be used to specify the power output of the transmitted ultrasonic pulse. Low power output conserves the battery and produces a clear display in shallow water.

There is a choice of Auto, Low, Medium or High. The Auto setting is recommended.

15-4 Setup > GPS

Press **MENU** once or more until the Setup menu is displayed, then select System:

GPS	
GPS source	NMEA
DGPS source	None
Static navigation	Off
Speed filter	5
Course filter	4

GPS Source

There are two options:

- **NMEA:** Use the external GPS antenna supplied or an external GPS or DGPS source connected via NMEA (see section 16-6).
- **NavBus:** Use an external GPS or DGPS source connected via NavBus (see section 16-6).

DGPS Source

Enables or disables the satellite based DGPS correction (see section 7). The options are **None** or **WAAS/EGNOS**. Do not enable WAAS/EGNOS outside their coverage areas or the accuracy of the position might be degraded.

WAAS covers all of the USA and most of Canada. To use WASS, the GPS antenna must have a clear view of the sky towards the equator. EGNOS will cover most of Western Europe.

Static Navigation

When the boat stops or moves very slowly, the calculated GPS speed and course become erratic. Static navigation is a number, and the options are:

- **0.01 to 99.9:** If the boat speed is slower than this, the speed is displayed as zero and the course stays unchanged.
- **0 (Off):** The calculated speed and course are always used.

Speed and Course Filter

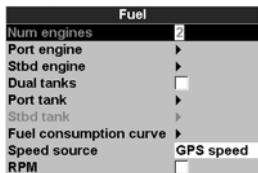
Waves and wind cause the boat's speed and course to fluctuate slightly. To give stable readings, the Explorer 660 calculates these values by taking several measurements and averaging them.

- A lower value averages measurements over a shorter period of time. This gives the most accurate value but has the most fluctuations.
- A higher value averages measurements over a longer period of time. This gives the most stable value but will ignore some true speed changes.

Set the Speed and Course filters to the lowest values which give stable readings. The range of each filter is 1 to 60 seconds or Off (0).

15-5 Setup > Fuel

These features can be used only when the optional single or twin engine fuel kit has been installed. Press **MENU** once or more until the Setup menu is displayed, then select **Fuel**:



WARNING

Northstar fuel kits are only suitable for petrol/gasoline engines. Fuel consumption can change drastically depending upon the boat loading and the sea conditions. Always carry adequate fuel for the journey, plus a reserve.

It is recommended that the fuel tank capacity is measured by draining the fuel tank, then filling it to capacity. After filling, note the reading from the fuel dispenser's gauge.

Note: *Beware of air pockets, especially in underfloor tanks.*

Tank full

Select **Tank full** each time the fuel tank(s) are completely refilled. When asked **Are you sure?** select **Yes**. Otherwise, the Fuel display and the Low Fuel Alarm are meaningless.

Set remaining

Before doing a partial refill of the tank or removing fuel manually from the tank (for example, by siphoning it off):

1. Note the **Remaining** reading on the Fuel display.
2. Note how much fuel is added or removed.
3. Calculate how much fuel is now in the tank.
4. Select **Set remaining** and update the reading.

It is essential to do this whenever some fuel is added or removed. Otherwise, the Fuel display and the Low Fuel Alarm are meaningless.

Clear Used

Select **Clear used** to set **Used** (the amount of fuel used) to zero. Do this to start measuring the amount of fuel used over a certain time or distance.

When asked **Are you sure?** select **Yes**.

Tank size

Enter the capacity of the fuel tank.

Num. engines

Set the number of engines to 0, 1 or 2. If 0 is selected the fuel features are turned off.

Calibrate

See section 15-11 Setup > Calibrate, for information about calibrating the fuel transducer(s).

Flow filter

Most engines do not draw fuel from the tank at a steady rate. To give a stable fuel flow reading, the Explorer 660 calculates the flow value(s) by taking several measurements and averaging them. Use the **Flow filter** to set the period over which the fuel flow is averaged.

The **Flow filter** can be set from 0 to 30 seconds. Use the lowest value which gives a stable flow. Usually a value of 5 to 10 seconds will give a satisfactory result for two-stroke carburettor engines. Fuel injected or four-stroke engines may require a larger value.

This setting affects the **Fuel flow** and **Fuel economy** reading on the Fuel display but it does not affect the **Fuel used** reading.

15-6 Setup > Track

Press **MENU** one or more times until the Setup menu is displayed, then select Track:

Track	
Record	1
Display	1
Plotting interval	Distance
Distance	nm
Time	10 sec
Memory used	6%
Send track	
Delete track	

Tracking records and displays the boat's course on the chart (see section 3-6). Five different tracks can be recorded: track 1 has up to 2000 points and tracks 2, 3, 4 and 5 have up to 500 points each.

Record

Off: The Explorer 660 stops recording a track.

1 to 5 (select a track number): The Explorer 660 starts recording the boat's course into the selected track.

Display

Off: No track is shown on the chart.

1 to 5 (select a track number): The selected track is shown on the chart.

15-7 Setup > Logs

Press **MENU** one or more times until the Setup menu is displayed, then select Logs:

Logs	
Reset trip dist	
Reset total dist	
Reset engine hours	
Trip dist	0.00 nm
Total dist	0.00 nm
Engine hours	0 hrs

Plotting Interval

The options are Distance or Time.

Distance


Select the distance plotting interval: 0.01, 0.05, 0.1, 0.5, 1.0, 2.0, 5.0 or 10.0 distance units.

Time

Select the time plotting interval: 1, 5, 10 or 30 seconds or 1 minute.

Memory used

The percentage of memory used in the track being recorded.

 **Tip:** Use the user card display to check the number of points recorded in each track (see section 13).

Send track

This option is included for compatibility with older units. For information, see your Northstar dealer.

Delete track

The data in the track selected for Record (see above) is deleted.

The values can be changed independently of each other. These log values are saved when the unit is turned off.

Reset trip dist

This resets the trip distance to zero.

Reset total dist

This option resets the total distance to zero.

Reset engine hours

Use this option to reset the engine hours to zero. This can be useful after an engine service or to count the engine hours between service intervals.

15-8 Setup > Alarms

Press **MENU** one or more times until the Setup menu is displayed, then select **Alarms**:

Alarms	
Arrival radius	Off <input type="checkbox"/>
Anchor alarm	Off <input type="checkbox"/>
XTE	<input type="checkbox"/>
Danger	Off <input type="checkbox"/>
Too shallow	Off <input type="checkbox"/>
Too deep	Off <input type="checkbox"/>
Fish	<input type="checkbox"/>
Temperature	Off <input type="checkbox"/>
Temperature rate	Off <input type="checkbox"/>
Low battery	Off <input type="checkbox"/>
Port low fuel	Off <input type="checkbox"/>
Stbd low fuel	Off <input type="checkbox"/>
DGPS	<input checked="" type="checkbox"/>

The Explorer 660 has thirteen alarms. All except **Loss of GPS fix** can be turned on (enabled) or off (disabled).

The **Fish** and **Loss of DGPS fix** alarms can be set to **on** or **off**. For the other alarms, enter a trigger value to turn the alarm on. The alarm will sound each time the alarm value equals the trigger value. For example, the **Too shallow** alarm will sound if the depth is less than its trigger value and the **Too deep** alarm will sound if the depth is more than its trigger value. To turn these alarms off, enter a trigger value of 0 (zero).

Icons for alarms that are on can be displayed in the data header (see sections 2-6-3 and 10). An alarm icon is normally black and turns red when the alarm sounds.

Symbol	Alarm	Alarm sounds when it is on and the:
	Arrival radius	boat is closer to the destination or to a waypoint than the alarm trigger value
	Anchor alarm	boat moves by more than the alarm trigger value
	XTE	boat moves off course by more than the alarm trigger value
	Danger	boat comes closer to a danger waypoint than the alarm trigger value
	Too shallow	depth is less than the alarm trigger value
	Too deep	depth is greater than the alarm trigger value
	Fish	echo matches the profile of a fish
	Temperature	temperature equals the alarm trigger value
	Temperature rate	rate of change of temperature equals the alarm trigger value
	Low battery	battery voltage is less than the alarm trigger value
	Low fuel	fuel remaining equals the alarm trigger value
	Loss of DGPS fix	Explorer 660 can not receive the DGPS signal (beacon, WAAS or EGNOS)
	Loss of GPS fix	Explorer 660 can not receive the GPS signal (this alarm is always on)

15-9 Setup > Units

Press **MENU** one or more times until the Setup menu is displayed, then select **Units**:

Units	
Distance	nm
Speed	kn
Depth	ft
Fuel	USGal
Compass	°M
Temperature	°F
Wind	True

The default units are shown in this example.

Distance

Select from:

- nm (nautical miles)
- mi (miles)
- km (kilometres)

Speed

Select from:

- kn (knots)
- mph (miles per hour)
- kph (kilometres per hour)

15-10 Setup > Comms

Use this feature when the Explorer 660 is connected to other Northstar instruments through NavBus or any compatible NMEA instrument.

Press **MENU** once or more until the Setup menu is displayed, then select **Comms**:

Comms	
NMEA out	Off
NMEA data	▶
Lat/Lon d.p's	3
NavBus	Off
NavBus group	0

NMEA

NMEA is generally used with third party instruments (see section 16-6). Select **On** to transmit NMEA sentences, for example to an autopilot. Otherwise, select **Off**.

Depth

Select from:

- ft (feet)
- m (metres)
- fa (fathoms)

Fuel

Select from:

- Litres
- USGal (US gallons)
- ImpGal (Imperial Gallons)

Compass

Select either:

- °T (True north)
- °M (Magnetic north)

Temperature

Select either:

- °F (Fahrenheit)
- °C (Celsius)

Wind (optional)

Select either:

- True
- App (Apparent)

Note: that the units for wind speed are the speed units.

NMEA data

Use this to specify which NMEA sentences will be transmitted (see Appendix A).

NavBus

NavBus is the preferred method for connecting the Explorer 660 to other Northstar instruments. Select **On** if the instruments are connected using NavBus. Otherwise, select **Off**.

NavBus Group

Use this when a group of Northstar instruments are connected together using NavBus, to specify a group of instruments for backlighting, if required. Then, if the backlight setting on one instrument in the group is adjusted, the other instruments change automatically. Otherwise, select **0**.

15-11 Setup > Calibrate

Press **MENU** once or more until the Setup menu is displayed, then select **Calibrate**:

Calibrate	
Speed	
Speed filter	Off
Temperature	
Temp filter	5
Port engine	
Stbd engine	
Keel offset	0.0 ft
Speed range	Low
Max fuel flow	100 L
Max RPM	3000

The fuel options can be calibrated only when the optional single or twin engine kit is installed on petrol/gasoline engines.

Speed

This calibrates the speed from the paddlewheel transducer. Calibration may be required because different hull shapes have different flow characteristics. Obtain an accurate measurement of the boat's speed from a GPS receiver; or by following another boat travelling at a known speed; or by making a timed run over a known distance.

Note: for accurate calibration:

- The speed from a GPS receiver should be greater than 5 knots.
- The speed from another paddlewheel transducer should be between 5 and 20 knots.
- Best results are achieved in calm conditions where there is minimal current (best at high or low tide).

Press **←** or **→** to change the displayed speed to the true value.

Speed filter

Waves and wind cause the boat speed from the paddlewheel transducer to fluctuate slightly. To give stable readings, the Explorer 660 calculates these values by taking several measurements and averaging them. Set the Speed filter to the lowest value which gives stable readings. The range is 1 to 30 seconds or Off (0).

Temperature

The factory settings should be sufficiently accurate for normal usage. To calibrate the temperature readout, first measure the water temperature with a thermometer known to be accurate.

Use the cursor keys to display the temperature readout box, then increase or decrease the value to match the measured temperature. The temperature can be set from 32° to 99.9°F (0° to 37.7°C) with a resolution of 0.1° unit.

To change the units between °F (Fahrenheit) or °C (Celsius), see section 15-9.

Temperature filter

Water turbulence and currents cause the water temperature to fluctuate slightly. To give stable readings, the Explorer 660 calculates these values by taking several measurements and averaging them. Set the Temperature filter to the lowest value which gives stable readings. The range is 1 to 30 seconds or Off (0).

Fuel

Calibrating the fuel usage can improve the accuracy of fuel measurements.

Twin engine installations require each fuel transducer to be calibrated. This can be done at the same time with two portable tanks or at different times using one portable tank.

Calibrating the fuel transducer(s) requires accurate measurement of the fuel consumption. This is best done using a small portable tank. At least 4 gallons (15 litres) of fuel should be used to ensure an accurate calibration.

It is often very difficult to fill underfloor tanks to the same level twice due to air pockets, so the more fuel used, the more accurate the calibration.

To calibrate the fuel transducer(s), perform the following steps:

1. Record the level of the fuel in the tank(s).
2. Connect the portable tank(s) to the engine through the fuel transducer(s).
3. Run the engine at normal cruising speed until at least 4 gallons (15 litres) of fuel has been used per engine.

4. Check the actual amount of fuel used per engine by refilling the portable tank(s) to the original level and noting the reading(s) from the fuel dispenser's gauge.
5. Select **FUE1**. Use the cursor keys to change the reading for each engine to match that on the fuel dispenser's gauge.
6. Press **ENTER** when the reading is correct.

Note: If the fuel calibration options appear to give erroneous readings after a while, first check that the fuel sensor has been installed correctly according to the installation instructions supplied with it, then see Appendix B - Troubleshooting.

Keel Offset

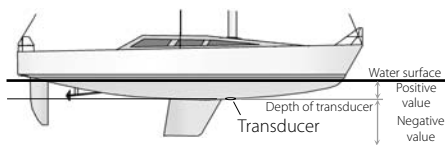
Keel offset is a depth correction representing the vertical distance between the depth transducer and the location from which the depth is to be measured.

Enter a **positive** keel offset value when the transducer is located below the water surface but the total depth is required.

Enter a **negative** keel offset value when the depth below the deepest part of the boat is required (such as the keel, the rudder or the propeller) and the transducer is located closer to the water surface.

Use the cursor keys to select **Keel offset**, then press **▶** to display the Keel offset box.

Use the **▲** or **▼** cursor keys to adjust the value.



Note: Boat illustrated uses a through hull transducer

15-12 Setup > Time

Press **MENU** once or more until the Setup menu is displayed, then select **Time**:

Time	
Local offset	+00:00
Time format	24 hour
Date format	dd/MMM/yy

Local offset

The difference between local time and UTC (GMT). Change local offset when daylight saving time starts and ends. The range is 0 to ± 13 hours, in 30 minute steps.

Time format

The options are 24 hour or 12 hour.

Date format

The options are dd/MMM/yy, MMM/dd/yy, dd/MM/yy or MM/dd/yy.

15-13 Setup > Favorites

Press **MENU** once or more until the Setup menu is displayed, then select **Favorites**. The favorites are used by the **PAGES** key (see section 2-6-2).

The first three favorites are preset to Chart, Sonar and Chart + sonar, and can not be altered. To select a display for Favorite 4, 5 or 6:

- 1 Select the favorite to set.
- 2 A list of choices is displayed. Select one.

Favourites	
Favourite 1	Chart
Favourite 2	Sonar
Favourite 3	Chart + Sonar
Favourite 4	None
Favourite 5	None
Favourite 6	None

15-14 Setup > Simulate

Simulate mode is a way of becoming familiar with the Explorer 660 (see section 2-5).

Press **MENU** once or more until the Setup menu is displayed, then select **Simulate**:

Simulate	
Sonar Simulation	Off
GPS Simulation	Off
Mode	Normal
Speed	1.0 kn
Heading	0 °M
Route	

WARNING

Never have sonar or GPS simulate mode on when the Explorer 660 is navigating on the water.

Sonar simulation

The data from the sonar sensor is ignored and the Explorer 660 generates this data internally to simulate the depth of the water. Turn sonar simulation **Off** or **On**.

GPS simulation

The data from the GPS receiver is ignored and the Explorer 660 generates this data internally to simulate the movement of the boat. Turn GPS simulation **Off** or **On**.

Mode

There are two choices for Mode:

Normal


Simulates the boat moving from the selected start point at the given speed and heading. The options required for Normal are:


Speed: The simulated boat speed to use.

Heading: The simulated bearing for the boat to follow.

Note: To select the start point, go to the chart display before starting the simulation. Then:

- To start the simulation from the boat position, press **ESC** to switch to centre on boat mode.
- To start the simulation from a different point, move the cursor to that point on the chart.

 **Tip:** To calculate a heading, use the cursor (see section 3-3).

 **Tip:** As the boat moves, vary Heading to simulate the boat moving off course.

Demo

Simulates the boat moving along a route at a given speed. When it reaches one end it retraces the route in the other direction. Before setting this mode enter at least one route (see section 6-2-1). The options required for Demo are:

Speed: The simulated boat speed to use.

Route: The route to follow.

16 Installation

Correct installation is critical to the performance of the unit. There are three components to install, the Explorer 660 display unit, the sonar transducer and the GPS antenna. In addition, install the optional fuel kit to use the Explorer 660 as a fuel computer.

The Explorer 660 can:

- Drive external beepers or lights for the alarm.
- Send and receive data from other Northstar instruments connected via NavBus. The backlight setting is shared (see section 16-6).
- Send NMEA data to an autopilot or other instrument.
- Accept and display NMEA wind data from an optional compatible wind instrument.

The Explorer 660 can be wired for auto power so that it automatically turns on and off with the boat power and can not be turned on or off manually. Wire auto power if the fuel option is installed, so that the Explorer 660 records all the fuel that is used (see section 16-5).

It is vital to read the entire installation section of this manual and the documentation that comes with the antenna and any other units before starting installation.

16-1 What comes with this product?

- Explorer 660 display unit, with a holder for plug-in cards and blanking cap for fuel connector.
- Dust cover for display unit
- Power cable
- Mounting bracket (screws included)
- Warranty registration card
- This manual
- Northstar 124 GPS antenna
- Flush mounting kit
- Dual frequency transom sonar transducer (includes cable kit and screws)
- Transom Mount Transducer Installation Manual.



16-2 Options and Accessories

- Through hull dual frequency sonar transducer
- Through hull speed/temperature transducer
- Fuel kit for single or twin petrol/gasoline engines.

If a fuel kit is installed, wire auto power on so that the Explorer 660 is on all the time the engine is on and no fuel consumption is missed (see section 15-3).

If the NMEA input on the fuel sensor cable is used, then a Northstar special fuel cable is required (see section 16-6).

- Replacement paddle wheel
- Northstar's Explorer R310 (see section 16-6).
- C-MAP™ chart cards.
- C-MAP™ user cards (3 V) for storing data. (The older 5 volt cards are not supported)
- Beeppers with built-in drivers or lights. The Explorer 660 output is switched to ground, 30 V DC and 200 mA maximum. If the beepers and lights require more than 200 mA, fit a relay.
- 5 m (16 ft) extension cable for Northstar 133 GPS antenna.
- GPS or DGPS antenna (see section 7).
- Northstar carry bag.

Please consult your Northstar dealer for more information.



Fuel flow kit

Through hull speed/temperature Transducer



Through hull dual frequency Transducer



16-3 Mounting the display unit

There are two mounting arrangements:

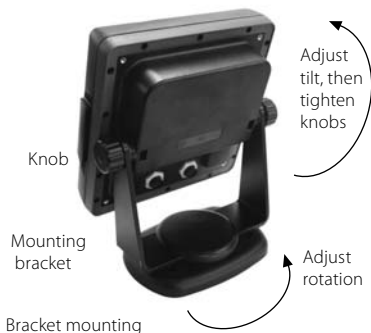
- **Flush mounting** requires a solid panel with access behind for wiring and mounting screws. After flush mounting, the Explorer 660 cannot be tilted or moved after installation to reduce any unwanted glare or reflections. Carefully select the best viewing position before installation. This would generally be in a shaded area.
- **Bracket mounting** requires a panel for mounting the bracket. Ensure that the panel is not likely to deform and is not subject to excessive vibration. The bracket can be tilted and rotated so the Explorer 660 can be removed after each use.

Select a position where the display unit will be:

- At least 4" (100 mm) away from the compass.
- At least 12" (300 mm) away from any radio transmitter.
- At least 4 ft (1.2 m) away from any antenna.
- Easy to read and operate. If possible, mount the display unit in front of the navigator or to the right of the navigator because the LCD display is more readable from these positions.
- Not exposed to the direct sun or water.
- Protected from physical damage during rough sea passages.
- Easy to access the 12 / 24 V DC power source.
- Convenient to route the transducer cables.

Flush Mounting

- 1 Cut a hole in the bulkhead for the display unit using the flush mount template.
- 2 Drill four holes for the mounting studs using the flush mount template.
- 3 Screw the four studs into the brass inserts in the back of the display unit.
- 4 Sit the display unit in place and fit the washers and nuts to the studs.



Bracket Mounting

- 1 Fix the mounting bracket onto the boat using the three stainless steel screws. Do not overtighten the screws, as the bracket may not rotate.
- 2 Hold the display unit in place in the mounting bracket. Fit the mounting bracket knobs into the display unit and do up the knobs loosely.
- 3 Adjust the tilt and rotation of the display for best viewing, then hand tighten the knobs on the mounting bracket.

16-4 Mounting the GPS antenna and transducers

GPS antenna

Fit the GPS antenna (see section 7) and install the antenna cable back to the Explorer 660. Follow the instructions in the manual supplied with the antenna. Connect the antenna to the Explorer 660:

- The cable on the GPS antenna supplied has a plug with a yellow collar. Plug this into the connector on the back of the Explorer 660 with a yellow nut. Tighten the locking collar.
- If the GPS source is NavBus or NMEA, see section 16-6.

Sonar transducer

Either:

- Fit the transom mount sonar transducer supplied, following the instructions in the Transom Mount Transducer Installation Manual supplied with the Explorer 660.
- For enhanced performance, fit an optional through hull dual frequency sonar transducer and through hull speed/temperature transducer. Contact the nearest Northstar dealer for more information.

The sonar transducer cable has a plug with a blue collar. Plug this into the connector with a blue nut on the back of the Explorer 660. Turn the collar to lock the connector.

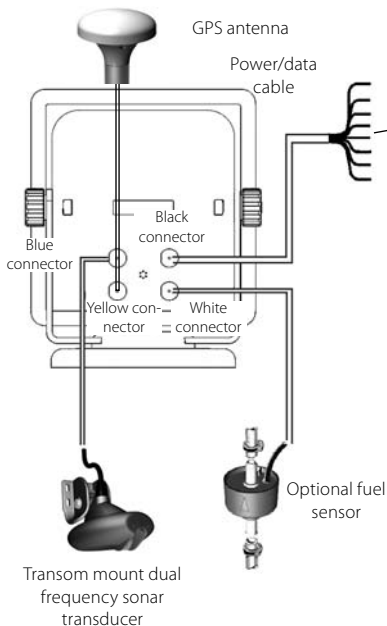
Optional fuel kit

- 1 Fit the optional fuel kit following the instructions supplied with the kit.

Note: If the NMEA input on the fuel sensor cable is used, then a Northstar special fuel cable is required (see section 16-6).

- 2 Wire the Explorer 660 for auto power (see section 16-5)
- 3 The fuel sensor cable has a plug with a white collar. Plug this plug into the connector with a white nut on the back of the Explorer 660. Turn the collar to lock the connector.

Connections



Power/data cable


Pin Wire	Function
1 Black	Ground: power negative, NMEA ground


Note: The cable has two wires with black coverings, the black wire (pin 1) and the shield (covered with heatshrink). These wires are connected within the cable and therefore it does not matter which black wire you use.

2 Brown	Power out, 9 V DC (NOT USED)
3 White	NMEA out
4 Blue	NavBus-
5 Red	Positive power in, 10 to 35 V DC
6 Orange	NavBus+
7 Yellow	Auto power in (connect to red wire [positive power in] to enable Auto power).
8 Green	External beeper or light out, switched to ground, 30 V DC 200 mA maximum.

16-5 Wiring the power/data cable

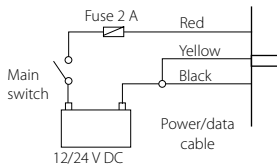
1 Wire the power:

- Either **Basic wiring**: When the main switch is on, the Explorer 660 must be powered on manually with the  key. The engine hours counter and fuel counter are disabled.
- Or **Auto power wiring**: The Explorer 660 turns on and off automatically when the ignition is turned on and off. The engine hours counter and fuel counter are enabled. Choose auto power when the optional fuel kit is fitted.

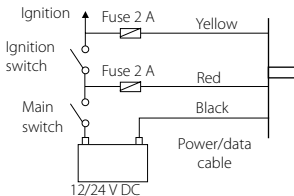
Note: With auto power, the Explorer 660 can not be turned off using the  key.

- 2 Wire any external beepers or lights. If the current is more than 200 mA, fit a relay.
- 3 The power/data cable has a plug with a black collar. Plug this plug into into the connector with a black nut on the back of the Explorer 660. Turn the collar to lock the connector.

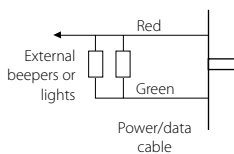
Basic wiring



Auto power wiring



Wiring external beepers or lights



16-6 Systems of several instruments

Several Northstar instruments can be connected together to share data. There are two ways of connecting instruments together, NavBus or NMEA.

NavBus

NavBus is a Northstar proprietary system that allows systems of multiple instruments to be built using a single set of transducers. When instruments are connected by NavBus:

- If the units, alarms or calibration are changed in one instrument, then the values will automatically change in all other instruments of the same type.
- Each instrument can be assigned to a group of instruments (see section 15-10). If the backlight is changed in an instrument in group 1, 2, 3 or 4 then the backlight will automatically change in the other instruments in the same group.

If the backlight is changed in an instrument in group 0 then no other instruments are affected.

- If an alarm sounds, mute it by clearing the alarm on any instrument which can display that alarm.

NavBus and the Explorer 660

The Explorer 660 can:

- Display wind speed and direction from an optional Wind instrument, such as a Northstar W310 or W315.
- Receive data from an optional GPS or GPS/DGPS source.
- Send data to optional Northstar instruments, for example to a repeater.

NMEA

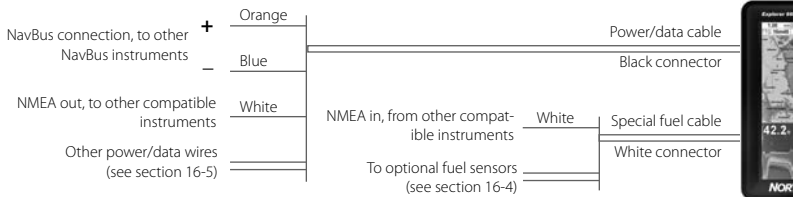
NMEA is an industry standard, but is not as flexible as NavBus as it requires dedicated connections between instruments. The Explorer 660 can:

- Receive and display wind data from an optional compatible wind instrument.
- Receive data from an optional compatible GPS or GPS/DGPS source.

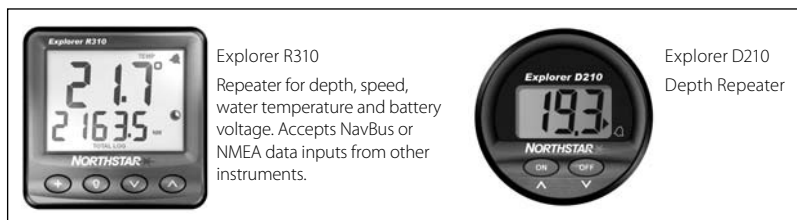
Note: To use the NMEA input, a Northstar special fuel cable is required (see below).

- Send GPS position and other navigation data to an autopilot or other instrument. An autopilot requires APB, APA and VTG sentences (see section 15-10).

Connecting the Explorer 660 to other instruments



To set up the Explorer 660 for these options, see sections 15-4 and 15-10.



Appendix A - Specifications

GENERAL

Size: 201 mm H x 190 mm W x 72 mm D (7.9" x 7.5" x 2.8").

Weight: display unit 115 g (2.2 lb).

Display: 6.4" diagonal, TFT color, 800 x 480 pixels.

Backlight: Display and keys

Supply voltage: 10.5 to 30.5 V DC.

Supply current: at 13.8 V

350 mA min - no backlighting.

1 mA max - full backlighting.

External beeper or light output: Switched to ground to sound alarm, 30 V DC, 1 A maximum.

Operating temperature

0° to 50°C (32° to 122°F)

ALARMS:

- User set: Arrival radius, anchor, XTE, danger, too shallow, too deep, fish, temperature, temperature rate, low battery, low fuel (optional), loss of DGPS fix
- Fixed: Loss of GPS fix

GPS NAVIGATION

Chart and user cards:

- Capacity: Two cards
- Type: C-MAP™ NT cards and NT+ cards, 3.3 V C-MAP(tm) user cards.

Waypoints: Up to 3000, with default or user-defined alphanumeric names up to eight characters.

Routes: 25 Routes, with up to 50 points each

Tracks: By time or distance, one track of 2000 points and four of 500 points.

Chart datums

- 121 Chart datums (see next page)
- One user-defined map shift.

Chart scale: 0.05 to 4096 nm for chart (chart dependent) down to 0.01 nm in plotter mode.

SONAR FISHFINDING

Depth range:

0.6 m (2 ft) to 1000 m (3300 ft)

Sonar output:

- Power: Variable, up to 600 W RMS

- Dual frequency: 50 kHz and 200 kHz

Transom transducer cable length:

10 m (33 ft)

Depth acquisition time from startup:

Typically 2 seconds at 30 m (100 ft)

Temperature:

- Range 0° to 37.7°C (32° to 99.9°F)
- Resolution of 0.1° unit.

Speed (from paddlewheel transducer):

1 to 96.6 kph (57.5 mph, 50 kn).

FUEL COMPUTER

(Optional fuel sensor(s) required)

Engine types:

- Outboard carburetted two stroke and EFI petrol/gasoline engines: 50 to 300 hp.
- Outboard four stroke petrol/gasoline engines: 90 to 300 hp.
- Inboard petrol/gasoline engines: 70 to 400 hp.

Flow rate:

- Minimum: 5 litres per hour (1.3 U.S. gallons per hour).
- Maximum: 130 litres per hour (34 U.S. gallons per hour).

COMMUNICATIONS

NavBus

Connection to other Northstar instruments.

NMEA

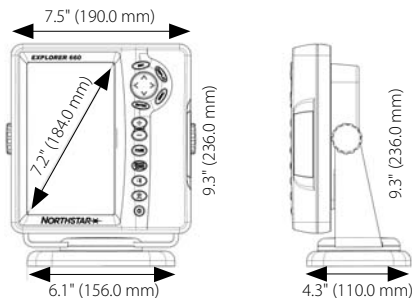
- NMEA 0183 ver 2 4800 baud
- Input, from GPS or DGPS receiver: GGA, GLL, GSA, GSV, RMC, VTG
- Input, from a wind sensor: MWV
- Output, for autopilot or other instrument: APA, APB, BWR, GGA, GLL, GSA, GSV, RMB, RMC, VTG, XTE, DBT, DPT, VHW, MTW, XDR

STANDARDS COMPLIANCE

EMC:

- USA: FCC Part 15 Class B.
- Europe: (CE) EN64000-6-1 and EN64000-6-3
- New Zealand and Australia: (C Tick) AS-NZS 3548.

Environment: IPx6/IPx7/CFR46 (with card holder and connections in place)



List of datums

Adindan	Afgooye	AIN EL ABD 1970
American Samoa 1962	Anna 1 Astro 1965	Antigua Island Astro 1943
ARC 1950	ARC 1960	Ascension Island 1958
Astro Beacon 'E' 1945	Astro DOS 71/4	Astro Station 1952
Astro Tern Island (Frig) 1961	Australian Geodetic 1966	Australian Geodetic 1984
Ayabelle Lighthouse	Bellevue (IGN)	Bermuda 1957
Bissau	Bogota Observatory	Bukit Rimpah
Camp Area Astro	Campo Inchauspe 1969	Canton Astro 1966
Cape	Cape Canaveral	Carthage
Chatham Island Astro 1971	Chua Astro	Co-ord. Sys.1937 Estonia
Corrego Alegre	Dabola	Deception Island
Djakarta (Batavia)	DOS 1968	Easter Island 1967
European 1950	European 1979	Fort Thomas 1955
Gan 1970	Geodetic Datum 1949	Graciosa Base Sw 1948
Guam 1963	Gunung Segara	GUX 1 Astro
Herat North	Hermannskogel	Hjorsey 1955
Hong Kong 1963	Hu-Tzu-Shan	Indian
Indian 1954	Indian 1960	Indian 1975
Indonesian 1974	Ireland 1965	ISTS 061 Astro 1968
ISTS 073 Astro 1969	Johnston Island 1961	Kandawala
Kerguelen Island 1949	Kertau 1948	Kusaie Astro 1951
L. C. 5 Astro 1961	Leigon	Liberia 1964
Luzon	M'Poraloko	Mahe 1971
Massawa	Merchich	Midway Astro 1961
Minna	Montserrat Island Astro 1958	Nahrwan Masirah Is. Oman
Nahrwan United Arab Emirates	Nahrwan Saudi Arabia	Naparima, BWI
North American 1927	North American 1983	North Sahara 1959
Observatorio Meteorolog. 1939	Old Egyptian 1907	Old Hawaiian
Oman	Ord. Survey Great Britain 1936	Pico de las Nieves
Pitcairn Astro 1967	Point 58	Pointe Noire 1948
Porto Santo 1936	Provis. South American 1956	Provis. South Chilean 1963
Puerto Rico	Pulkovo 1942	Qatar National
Qornoq	Reunion	Rome 1940
S-42 (Pulkovo 1942)	Santo (DOS) 1965	Sao Braz
Sapper Hill 1943	Schwarzeck	Selvagem Grande 1938
Sierra Leone 1960	S-JTSK	South American 1969
South Asia	Tananarive Observatory 1925	Timbalai 1948
Tokyo	Tristan Astro 1968	Viti Levu 1916
Voirol 1874	Voirol 1960	Wake Island Astro 1952
Wake-Eniwetok 1960	WGS 84	Yacare
Zanderij		

Appendix B - Troubleshooting

This troubleshooting guide is written with the assumption that the user has read and understood the relevant sections in this manual.

It is possible in many cases to solve difficulties without having to send the display unit back to the manufacturer for repair. Please follow this troubleshooting section before contacting the nearest Northstar dealer.

There are no user serviceable parts. Specialized methods and testing equipment are required

to ensure that the display unit is reassembled correctly and is waterproof. Users who service the product themselves will void the warranty.

Repairs to the product may only be carried out by a service centre approved by Northstar. If the product must be sent into a service centre for repair, it is essential to send in the transducer(s) at the same time.

More information can be found on our Website: www.northstarnav.com.

B-1 General problems

1-1 The Explorer 660 won't turn on:

- a The Explorer 660 is designed to operate on a 12/24 volt battery system, where the voltage may vary from 10 to 35 volts. If an excessive voltage is supplied, a fuse will be tripped, turning the display unit off. Check the fuse.
- b Check that the power cable connector at the back of the display unit is securely plugged in and the collar is locked in place. The collar must be secure for watertight connection.
- c Measure the battery voltage while the battery is under load - turn on some lights, radio or other electrical equipment connected to the battery. If the voltage is less than 10 volts:
 - the battery terminals or wiring on the terminals may be corroded.
 - the battery may not be charging correctly or may need replacing.
- d Inspect the power cable from end to end for damage such as cuts, breaks, squashed or trapped sections.
- e Ensure that the red wire is connected to the positive battery terminal and the black wire to the negative battery terminal. If wired for the Auto Power option, ensure the yellow wire is connected to the ignition circuit. Also check the boat's main switch circuit (see section 16-5).
- f Check for corrosion on the power cable connector and clean or replace if required.

- g Check fuses that are placed in line with the power cable. A fuse can be blown despite appearing to be good or the fuse may be corroded. Test the fuse or replace it with a fuse known to be good.

1-2 The Explorer 660 won't turn off:

The Explorer 660 may have been wired for Auto power. In this case, the Explorer 660 cannot be turned off while the ignition power is on (See Auto power in section 16-5).

1-3 If the Explorer 660 beeps when turned on but nothing is displayed:

The Explorer 660 may be operating, but the backlight settings may have been set too low (see section 2-2).

1-4 The wrong language is displayed:

See section 15-1.

B-2 GPS navigation problems

2-1 No GPS fix or long time to get fix at startup:

- a May occur occasionally if the antenna does not have a clear view of the sky. The satellite positions are constantly changing.
- b Antenna cable not connected to display unit.

2-2 Explorer 660 GPS position different from true position by more than 10 m (33 ft):

- a Explorer 660 in simulate mode. Turn simulate mode off (see section 15-14).
- b The normal error in GPS position will exceed 10 m (33 ft) for about 5% of the time.
- c Under special circumstances the US Department of Defence may introduce a deliberate and changing error in the GPS positions of up to 300 m (1000 ft).

2-3 Explorer 660 position different from same position on local charts:

- a Explorer 660 in simulate mode. Turn simulate mode off (see section 15-14).
- b Incorrect chart datum. Select the correct chart datum (see section 15-2).
- c Map shift has been applied wrongly. Clear map shift, then reapply if necessary (see section 15-2).

2-4 Can not see boat on chart:

- Press ESC to switch to centre on boat mode (see section 3-2).

2-5 The time or date on satellite display is wrong or off:

- a No GPS fix.
- b In simulate mode. Turn simulate mode off (see section 15-14).
- c Local time offset is wrong (see section 15-12). The Local Time Offset must be changed when daylight saving time starts or ends.

2-6 Autopilot not responding to Explorer 660; no NMEA output:

- a NMEA output disabled or the required NMEA sentences are not turned on. Check NMEA settings (see section 15-9).
- b Check that the instrument is connected correctly.

2-7 No DGPS fix or loss of DGPS fix:

- a To receive a DGPS fix, WAAS/EGNOS must be enabled or an optional DGPS antenna fitted (see section 7).
- b With WAAS/EGNOS: Boat out of coverage area (see section 7).
- c With WAAS: GPS antenna does not have a clear view of the horizon towards the equator.
- d With beacon DGPS: boat out of range of a DGPS beacon.

B-3 Sonar fishfinding problems

3-1 The Explorer 660 operates erratically:

- a Check that the transducer does not have debris (e.g. weed, plastic bag) caught around it.
- b The transducer may have been damaged during launching, running aground or while underway with debris etc. If the transducer has been impacted, it may have been kicked up on the bracket. If it is not physically damaged, reset the transducer back to its original position. (See the *Transom Transducer Installation Guide*.)
- c When the transducer is less than 2 ft (0.6 m) from the bottom, the depth readings may become inconsistent and erratic.
- d Manual Gain may be set too low, which may cause weak bottom echo or no fish signals. If in Manual Gain, try increasing the Gain.
- e Ensure the back of the bottom surface of the transducer is slightly lower than the front and the front is as deep in the water as possible in order to minimize the generation of bubbles through cavitation. (See the *Transom Transducers Installation Guide*.)
- f Check the transducer and power cable connectors at the back of the display unit are securely plugged in and the collars are locked in place. The collars must be secure for watertight connection.

- g Inspect the power cable from end to end for damage such as cuts, breaks, squashed or trapped sections.
- h Ensure there is not another fishfinder or depth sounder turned on, which may interfere with this Explorer 660.
- i Electrical noise from the boat's engine or an accessory may be interfering with the transducer(s) and/or the Explorer 660. This may cause the Explorer 660 to automatically decrease the Gain unless using Manual Gain. The Explorer 660 thus eliminates weaker signals such as fish or even the bottom from the display. This may be checked by switching off other instruments, accessories (e.g. bilge pump) and the motor until the offending device is located. To stop problems from electrical noise, try:
 - re-routing the power and transducer cable(s) away from the boat's other electrical wiring.
 - routing the display unit's power cable directly to the battery with an in-line fuse.

3-2 Bottom is not displayed:

- a The Explorer 660 may have Manual Range selected and the depth may be outside the range value selected. Either change the Explorer 660 to Auto Range or select another depth range (see section 8-5).
- b The depth may be outside the Explorer 660's range. While in Auto Range, the display unit will display "--:" to indicate that there is no bottom detected. A display of the bottom should reappear when in shallower water.

3-3 The bottom is displayed too far up the screen:

The Explorer 660 may have Manual Range selected and the selected Range value is too high for the depth. Either change the Explorer 660 to Auto Range or select another depth range (see section 8-5).

3-4 Bottom echo disappears or erratic digital reading while the boat is moving:

- a Ensure the back of the bottom surface of the transducer is slightly lower than the front and the front is as deep in the water as possible in order to minimise the generation of bubbles through cavitation. (See the *Transom Transducers Installation Guide*, for more information.)
- b The transducer may be in turbulent water. Air bubbles in the water disrupt the echoes returned, interfering with the Explorer 660's ability to find the bottom or other targets. This often happens when the boat is reversed. The transducer must be mounted in a smooth flow of water in order for the Explorer 660 to work at all boat speeds.
- c Electrical noise from the boat's motor can interfere with the Explorer 660. Try some suppression spark plugs.

3-5 There is a double bottom trace displayed:

- a The boat may be in an area that generates shadows (see section 8-2).
- b In shallow water, the echoes may bounce. Reduce the gain setting (see section 8-5) and/or reduce the sonar pulse power (see section 15-3).
- c Decrease the Range.

B-4 Fuel consumption problems

Note: For the Explorer 660 to measure fuel consumption, the optional fuel flow kit must be fitted.

4-1 Fuel used or remaining seem inaccurate:

- a If the engine is run while the Explorer 660 is powered off, the Explorer 660 does not record the amount of fuel used during that engine run. Consequently, the `Fuel remaining` value will be higher than the actual amount of fuel remaining in the tank. To avoid this problem, use the Auto Power Wiring option (see section 16-5). This ensures that the Explorer 660 powers on automatically whenever the boat's ignition is switched on.
- b In rough seas, fuel may surge back and forth through the fuel transducer, resulting in incorrect readings. Try installing a one-way valve between the fuel transducer and the fuel tank.
- c The `Set remaining` fuel value must be reset after every refuelling (see section 15-5).
- d The fuel tank may not refill to the same capacity each time due to air pockets. This is particularly noticeable with underfloor tanks.
- e Fuel transducers wear out over time and should be replaced after every 5000 litres of fuel.

4-2 Flow indicates no fuel or low fuel:

- a Check that the number of engines is set to 1 (see section 15-5).
- b Check that the fuel cable connectors are securely plugged in and the collar is locked in place. The collar must be locked in place to give a watertight connection.
- c A fuel transducer may be clogged. If so, remove the transducer from the fuel line and gently blow through it in the opposite direction to the fuel flow.

A fuel filter between the fuel transducer and the fuel tank must be installed as per the fuel installation guide. Failure to do so will void the warranty.

- d Inspect the fuel cable from end to end for damage such as cuts, breaks, trapped or squashed sections.
- e Check that the fuel filter is clean.

4-3 A twin engine installation shows only one flow rate:

- a Check that the number of engines is set to 2 (see section 15-5)

4-4 Erratic Fuel Flow readings:

- a The fuel flow transducer may have been mounted too close to the fuel pump or may be subject to excessive vibration. Refer to the installation instructions supplied with the fuel transducer.
- b Check for leaks in the fuel line or in the fuel pickup in the tank.
- c The `Flow filter` value is not suitable for the engine. Check that the value is not set to zero, then try increasing the value until a steady flow rate is shown (see section 15-5)

4-5 There is no reading for fuel economy:

- a The boat must be travelling through the water to generate an `Economy` reading.
- b Check that the paddlewheel on the transducer is spinning freely and that the two magnets in the paddlewheel are still in place.

Appendix C - Glossary and navigation data

Glossary


Attention Area - An important area on a chart, such as a restricted anchorage or a shallow area (see section 15-2).

Bathymetric line - A depth contour line on the chart.

Chart card - A plug-in card that stores chart data for a region (see section 1-2).

C-MAP™ chart card - See Chart card.

C-MAP™ user card - See User card.

Cursor - A  symbol on the display (see section 3-2).

DGPS - Differential Global Positioning System. A navigation tool based on GPS with some errors corrected (see section 7).

Goto - A simple way of navigating straight to a waypoint or to the cursor position (see section 3-4).

GPS - Global Positioning System. A satellite-based navigation tool (see section 7).

Leg - The straight segments of a route between waypoints. A route with four waypoints has three legs.

MOB - Man overboard.

MOB function - Starts navigating back to the place where someone fell overboard (see section 2-4).

NavBus - A way of connecting Northstar instruments together to share data (see section 16-6).

NMEA - National Marine Electronics Association.

NMEA 0183 - A standard for interfacing marine electronic devices (see section 16-6).

Route: Two or more waypoints linked in sequence to form a course for the boat (see section 6).

User card - A plug-in card that stores waypoints, routes and tracks (see section 1-2).

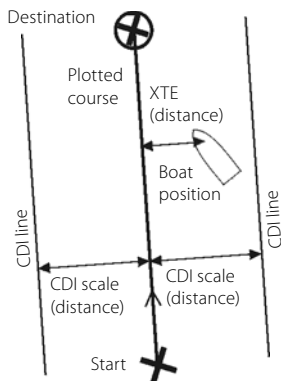
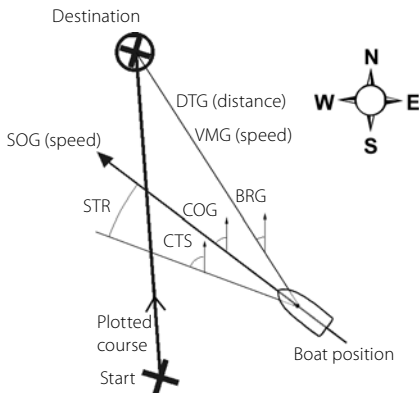
UTC - Universal Time Coordinated or Coordinated Universal Time, which is a standard world time, formerly called Greenwich Mean Time (GMT).

Waypoint - A user-definable chart position (see section 5).

Navigation data

The boat is sailing from the start to the destination and has moved off the plotted course from the start to the destination.

- BRG Bearing to Destination: Bearing to the destination from the boat.
- +BRG Bearing to cursor: Bearing to cursor from boat (cursor mode, see section 3-2)
- CDI Course Deviation Indicator: When the boat is navigating to a point, the chart and highway displays show a parallel line on either side of the plotted course. These two lines are called the Course Deviation Indicator (CDI) lines. The distance from the plotted course to a CDI line is the CDI scale.
- Set the CDI scale (see section 15-2) to the maximum distance that the boat should deviate from the plotted course. The chart and highway displays show the CDI lines, which are like a highway over the water where the boat will move. The displays show how far the boat has deviated from the plotted course and if the boat is approaching a CDI line. If the XTE alarm is enabled (see section 15-8) an alarm will sound if the boat reaches a CDI line.
- COG Course Over Ground: Direction in which the boat is moving over the ground.
- CTS Course To Steer: Optimum course to steer to return to the plotted course.
- DTG Distance To Go: Distance from the boat to the destination.
- ETA Expected Time of Arrival: At the destination, assuming that SOG and COG remain constant.
- +RNG Range to cursor: Distance from boat to cursor (cursor mode, see section 3-2)
- SOG Speed Over Ground: Current boat speed over the ground. This is not necessarily the same as the boat speed through the water nor the speed at which it is approaching the destination.
- STR Steering: The difference between COG and CTS.
- TTG Time To Go: The estimated time to reach the destination.
- XTE Cross Track Error: The distance from the boat to the nearest point of the plotted course. XTE may have a letter: R means steer to the right to return to the plotted course, L means steer to the left.
- VMG Velocity Made Good: The speed at which the boat is approaching the destination.



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