

# FURUNO

## OPERATOR'S MANUAL

COLOR SCANNING SONAR

MODEL CSH-7



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# SAFETY INSTRUCTIONS

## **WARNING**



### **Do not open the equipment.**

Hazardous voltage which can cause electrical shock, burn or serious injury exists inside the equipment. Only qualified personnel should work inside the equipment.

### **Do not disassemble or modify the equipment.**

Fire, electrical shock or serious injury can result.

### **Turn off the power immediately if water leaks into the equipment or the equipment is emitting smoke or fire.**

Continued use of the equipment can cause fire or electrical shock.

### **Do not place liquid-filled containers on the top of the equipment.**

Fire or electrical shock can result if a liquid spills into the equipment.

### **Do not operate the equipment with wet hands.**

Electrical shock can result.

### **Keep heater away from equipment.**

Heat can alter equipment shape and melt the power cord, which can cause fire or electrical shock.

## **CAUTION**

### **Use the proper fuse.**

Use of a wrong fuse can result in fire or permanent equipment damage.

### **Do not use the equipment for other than its intended purpose.**

Personal injury can result if the equipment is used as a chair or stepping stool, for example.

### **Do not place objects on the top of the equipment.**

The equipment can overheat or personal injury can result if the object falls.

### **Do not exceed speed noted in the specifications when operating the equipment or lowering or raising the transducer.**

The transducer may become damaged.

### **The zinc block attached near the transducer must be replaced yearly.**

The junction between the transducer and main shaft may corrode, which can result in loss of the transducer or water leakage inside the ship.

### **POSSIBILITY OF INJURY**

1. If breaker (hull unit) trips do the following:

- 1) Turn off power switch on hull unit.
- 2) Wait 60 sec after breaker has tripped.
- 3) Press breaker.

2. Turn off hull unit before using hand crank.

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## A Word to CSH-7 Owners

Congratulations on your choice of the FURUNO CSH-7 Color Scanning Sonar. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 40 years FURUNO Electric Company has enjoyed an enviable reputation for quality marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

This equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless operated and maintained properly. Please carefully read and follow the recommended procedures for operation and maintenance.

We would appreciate hearing from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO equipment.

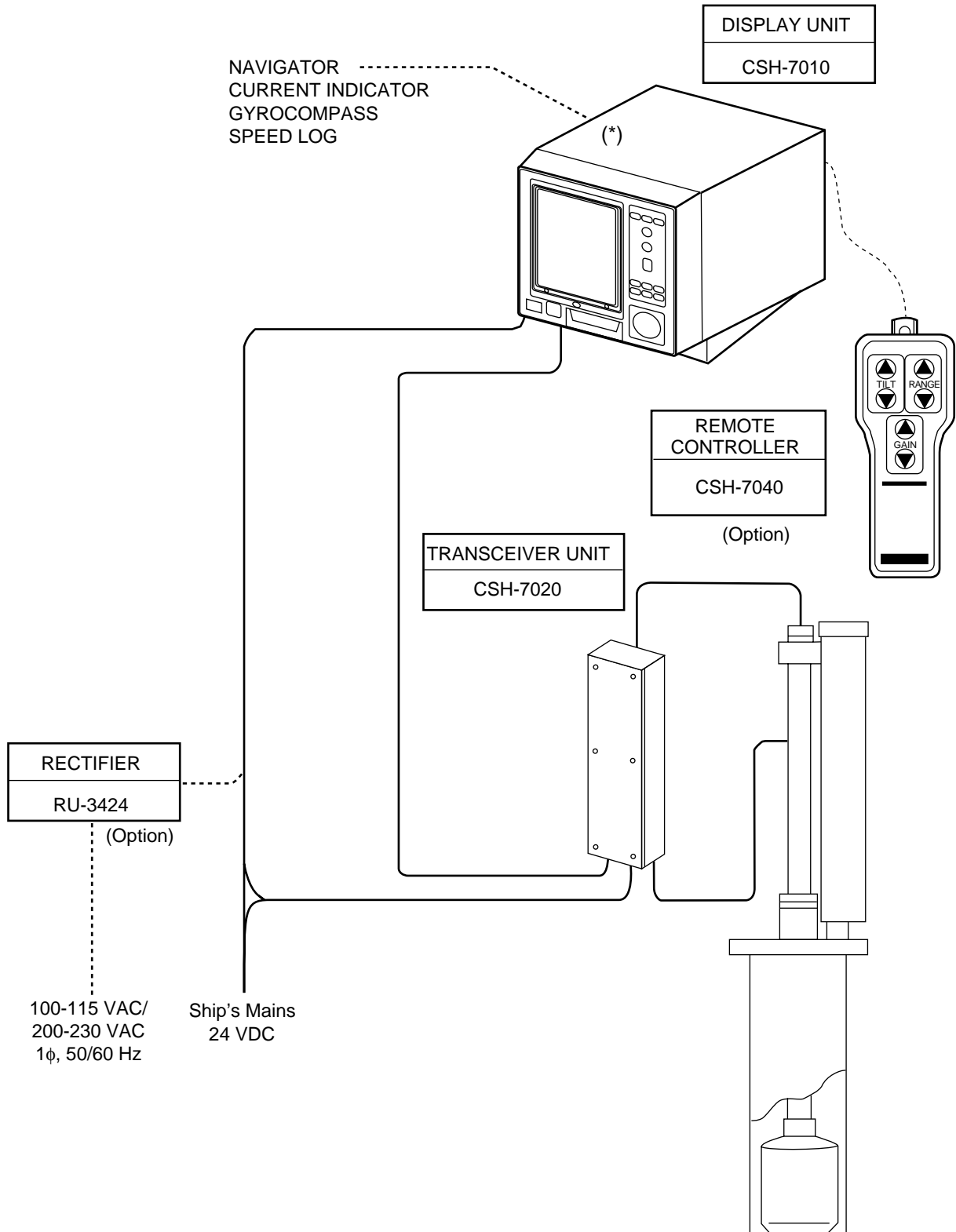
## Features

The FURUNO CSH-7 Color Scanning Sonar is a full-circle, multibeam electronic scanning sonar which detects and instantaneously displays fish schools and underwater conditions in 16 colors on a 10" non-glare, high resolution CRT screen. Its ease of operation, versatility and compact size make it the perfect match for any class of fishing vessel.

The main features of the CSH-7 are

- Compact size permits installation on smaller fishing boats.
- Vivid 16-color display provides intuitive recognition of seabed and concentration, distribution and volume of fish schools.
- Markers and indications keep the operator abreast of fishing conditions.
- Remote controller (option) provides for armchair control of gain, range and tilt functions.
- New gain, range or tilt setting appears in large characters whenever corresponding control is adjusted.
- Function keys automatically setup the equipment to perform specific task.
- High power MOS FET transmitter ensures reliable operation under any condition.

# System Configuration



\* Interface Module CSH-7050 (option)  
required to connect external equipment.

# OPERATIONAL OVERVIEW

## Equipment Overview

All operations of the CSH-7 are carried out through the display unit and the remote controller (option). The uncluttered, straight-forward control panel of the display unit provides intuitive operation. If you change a control setting you will see the associated reaction on the display almost immediately.

The handy remote controller provides armchair control of range, gain and tilt functions.

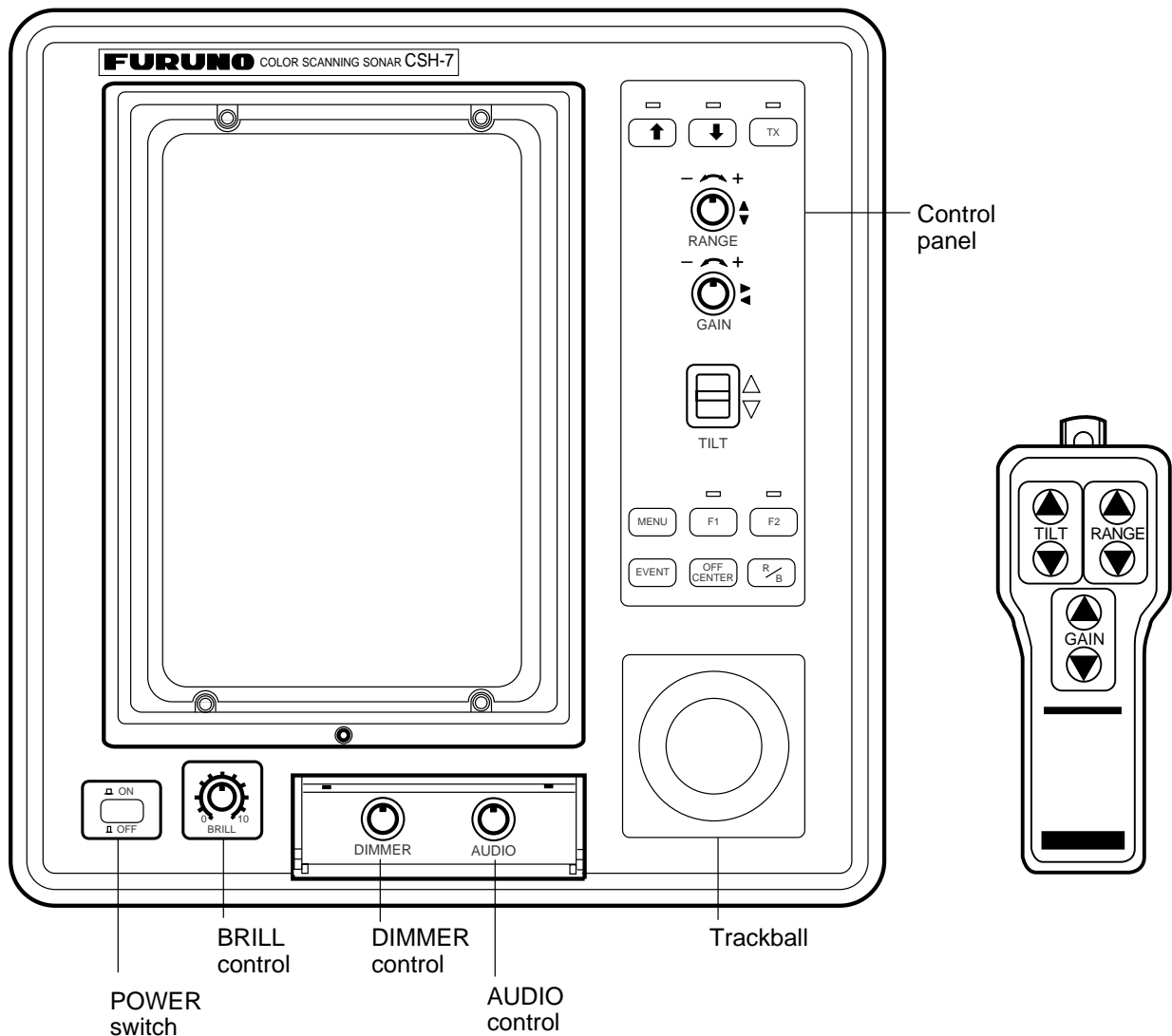


Figure 1-1 Display unit, Remote controller



# Display Unit Control Panel Description

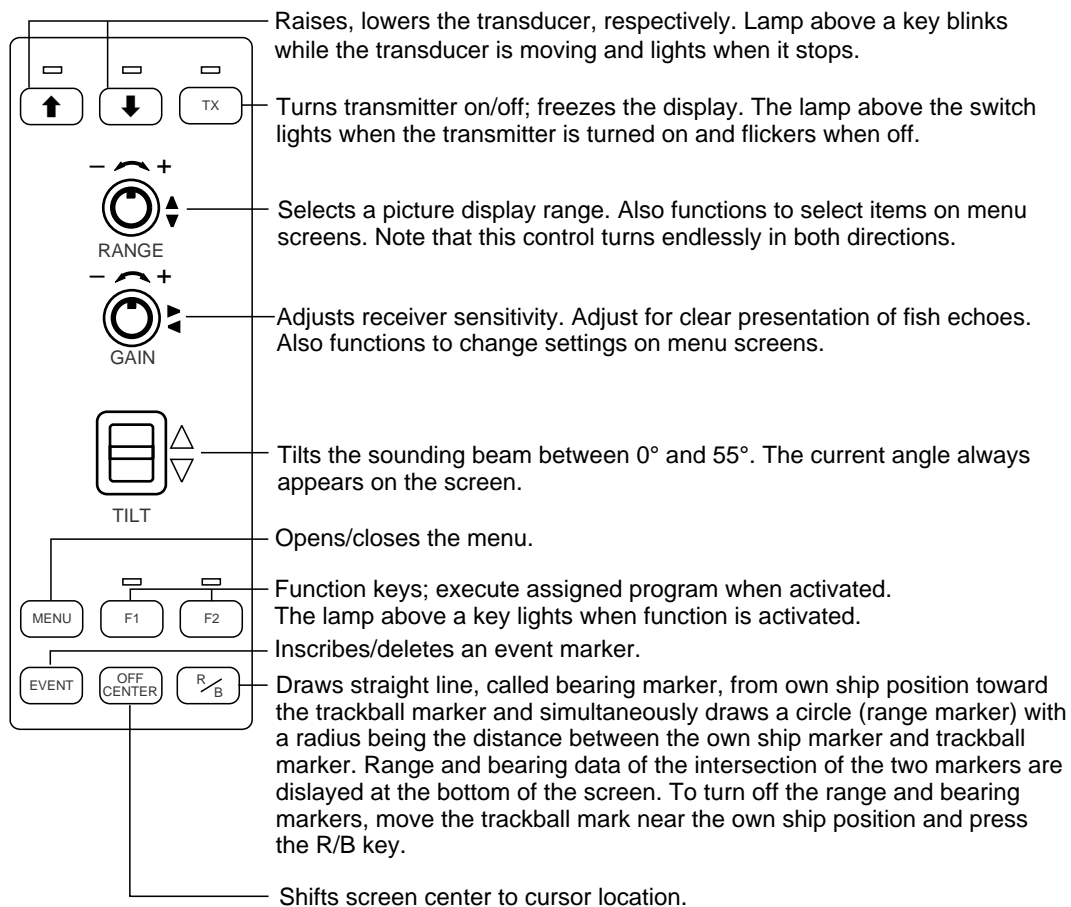


Figure 1-2 Control panel description

## Turning the Power On/Off

### Power on

Press the power switch at the lower left corner of the display unit to turn the power on/off. When the display unit is turned on it checks itself for proper operation. (This test is described in Chapter 8.)

### Power off

Press the **↑** switch to retract the transducer. Wait until the lamp above the switch lights and then press the power switch to turn off the system.


**Note:** The transducer is automatically retracted into the tank even if the power switch is pressed before retracting the transducer. However, make it a habit to retract the transducer before turning off the power.

# Adjusting Screen Brilliance, Control Panel Backlighting

The BRILL control adjusts screen brilliance, and the DIMMER control adjusts control panel backlighting.

## Lowering the Transducer

Press the ↓ switch. The lamp above the switch blinks, and lights when the transducer is fully lowered.

 <b>CAUTION</b>
<p><b>Do not exceed speed noted in the specifications when operating the equipment or lowering or raising the transducer.</b></p> <p>The transducer may become damaged.</p>
<p><b>Do not press the ↑ switch during lowering of the transducer, and do not press the ↓ switch during raising of the transducer.</b></p> <p>The equipment may become damaged.</p>

## Selecting a Display Range

Operate the RANGE control to select a display range. The range selected appears at the top center of the screen.

## Setting the Tilt Angle

The tilt angle shows the direction to which the sound wave is emitted. When the sound wave is emitted horizontally, the tilt angle is said to be zero degrees and when emitted vertically, 90 degrees.

To set a tilt angle, operate the TILT lever. Watch the tilt angle indication at the top right corner on the screen. The tilt angle can be set in one-degree steps from 0 to 55 degrees.

Finding a proper tilt angle is important when searching for fish. Below are tips for selecting tilt angle.

## Seabed echo and tilt angle

### Case 1: Tilt angle 30 to 40 degrees

This tilt angle will display the entire seabed since it is captured by the full width of the beam.

### Case 2: Tilt angle 10 to 20 degrees

This tilt angle will only display half the seabed since it is only captured by the lower half of the beam.

### Case 3: Tilt angle 0 to 10 degrees

This tilt angle may or may not capture the seabed since the returning echo is weak.

## How to discriminate fish echoes from the seabed

The figure below illustrates how two fish schools (a) and (b) are displayed on the screen using three different tilt angles.

Case 1: Tilt angle 30 to 40 degrees. Fish school is obscured by the seabed.

Case 2: Tilt angle 10 to 20 degrees. Fish school is located above the seabed (midwater).

Case 3: Tilt angle 0 to 10 degrees. Fish school is located close to the seabed.

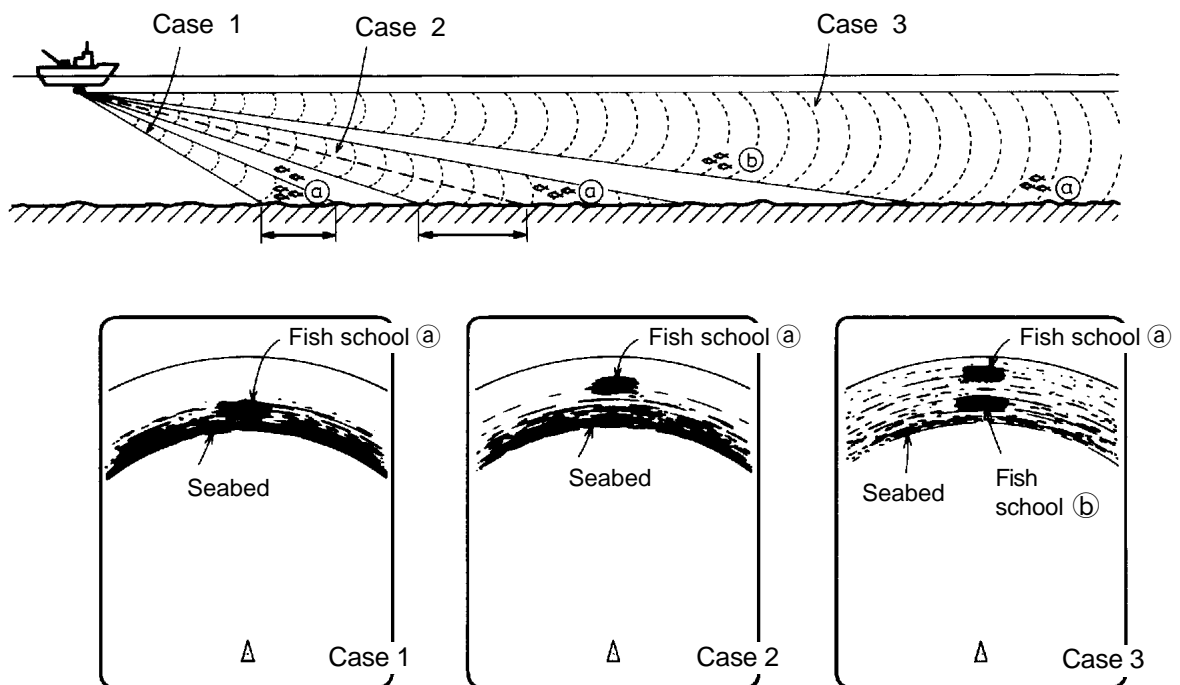


Figure 1-3 Fish echo and tilt angle

## Points to consider

- Normally, a vertically distributed fish school is a better sonar target than the seabed, because it reflects the transmitted pulse back toward the transducer.
- In case 3, both fish schools (a) and (b) are presented. Generally speaking, however, midwater fish schools tend to be larger than bottom fish schools and they are often displayed near the seabed on the display.
- It is difficult to detect bottom fish when they are not distributed vertically.

## Tilt angle for surface fish

Sound emitted from the sonar transducer forms a circle-shaped beam with a width in the vertical directions (vertical beam width) of approximately 16 degrees for Tx and 19 degrees for Rx. The tilt angle is indicated by the angle between the center line of the beam and the horizontal plane. Then, if the tilt angle is set to 0 degrees, the center line is parallel with the sea surface and one half of the emitted sound goes upward, toward the sea surface.

This causes one half of the emitted sound to be reflected toward the transducer and displayed on the screen as sea surface reflections. When the sea is calm, since the sound is reflected just like a light hitting a mirror at a narrow incident angle, it propagates away and the sea surface reflections become negligible.

However if the sea is not calm enough, they will become dominant and interfere with observation of wanted echoes. To minimize these sea surface reflections and to search surface fish schools effectively, the tilt angle is usually set between 5 and 6 degrees so the upper portion of the beam becomes almost parallel with the sea surface. When the sea is rough, it is often set to a little larger angle.

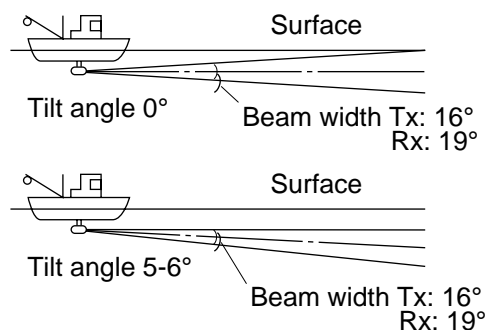


Figure 1-4 Tilt angle and sea surface reflections

## Suitable tilt angle

The figure below illustrates the relationship among tilt angle, depth and detection range. Refer to it to find out the suitable tilt angle for a given depth/detection range.

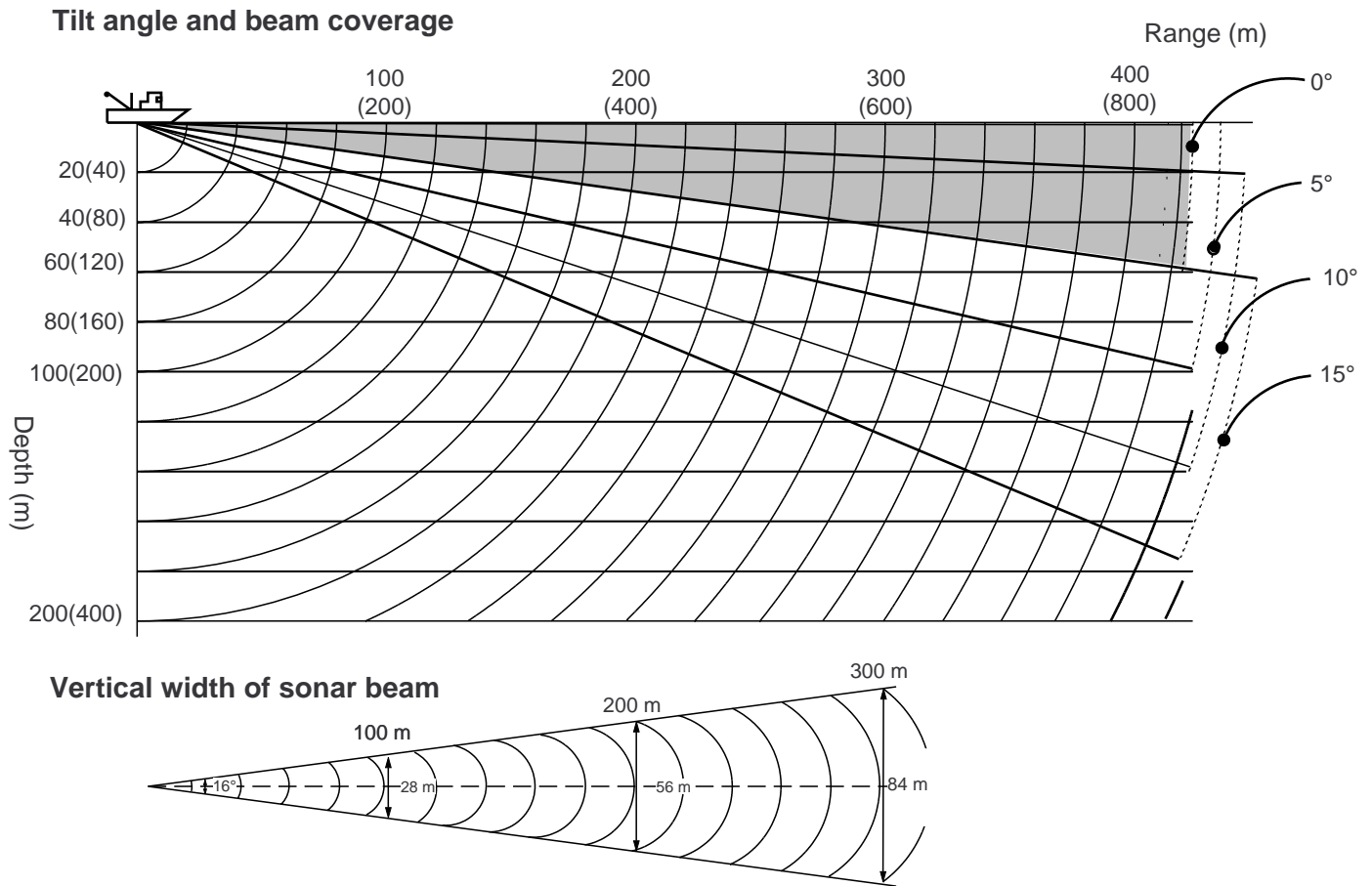
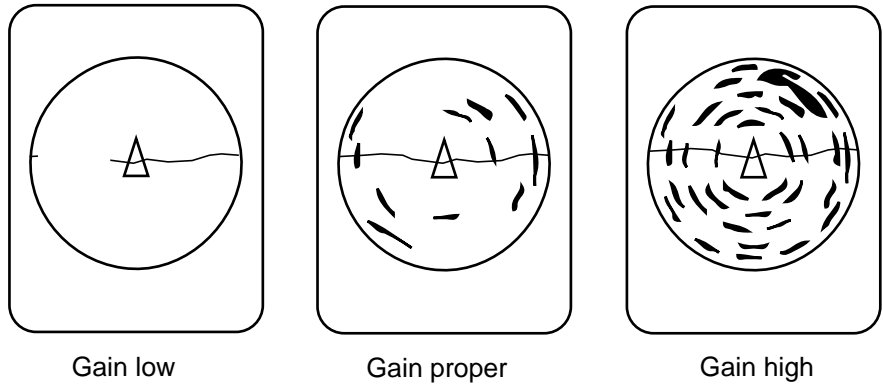


Figure 1-5 Tilt angle and beam coverage

## Adjusting the Gain

The GAIN control adjusts receiver sensitivity (gain). Adjust it so fish echoes are clearly displayed with minimal noise on the screen. Too high a setting not only displays excess noise and makes it difficult to discriminate wanted echoes but also causes seabed echoes to be painted in strong colors, resulting in echoes being masked by seabed reflections. Normally, set the control somewhere between positions “3” and “7”.



*Figure 1-6 Gain settings and resulting picture*

# MARKERS AND DATA

## Standard Markers and Data

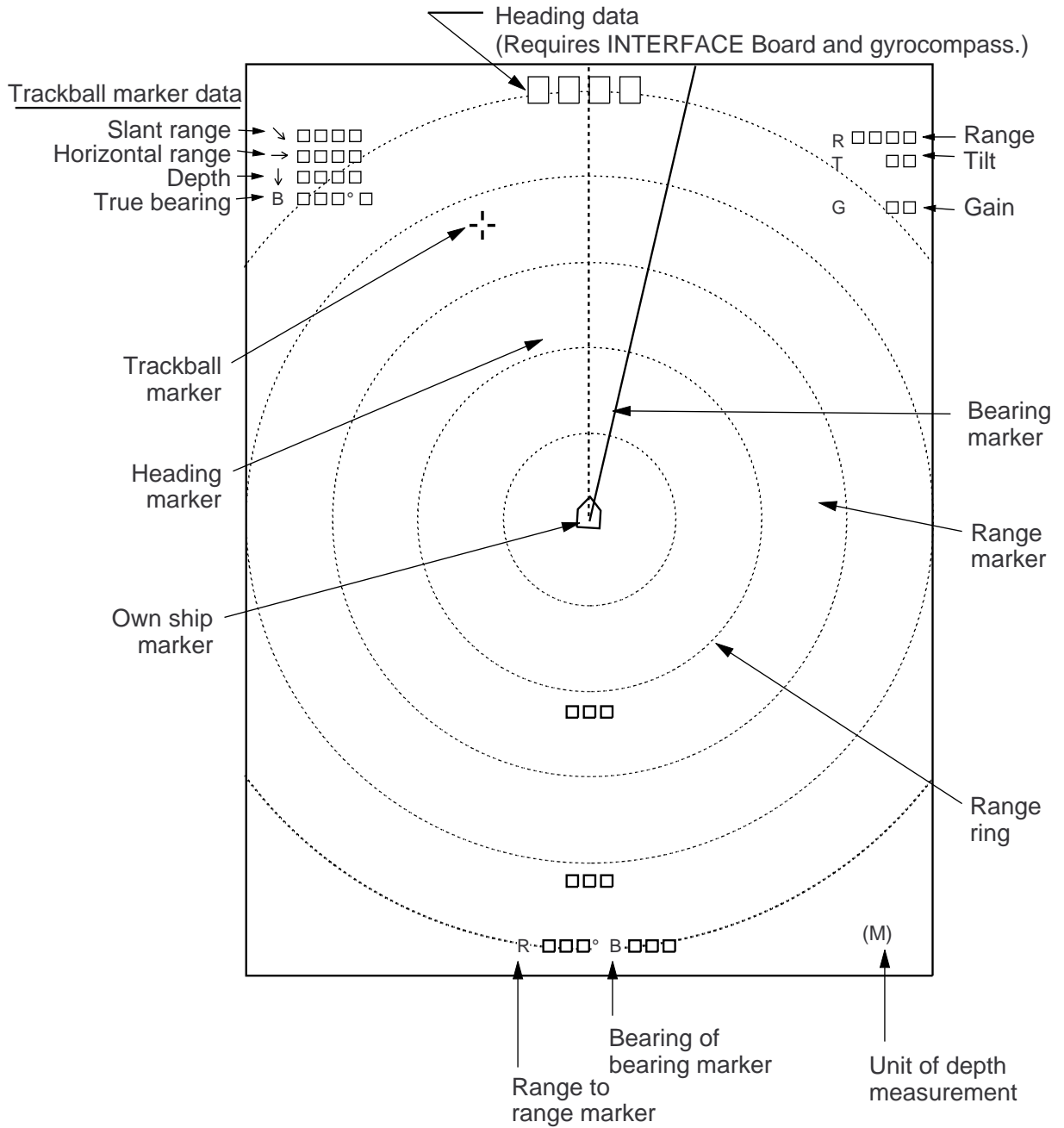


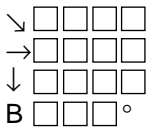
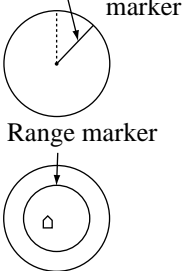



Figure 2-1 Standard markers and data

*Table 2-1 Standard markers and data description*

Marker/Data	Description								
Own Ship Marker 	Marks position on the screen. Direction of arrow is heading.								
Trackball Marker 	The trackball marker selects location for markers and own ship's position. The trackball moves the marker over the entire screen.								
Trackball Data 	Trackball data: ↘ : Slant range → : Horizontal range ↓ : Depth B : Bearing  Bearing is shown in 360; or -180; indication system, relative to ship's heading. In the latter case, "B" is indicated as follows: B□□□P.... on the port side B□□□P.... on the starboard side								
Bearing and Range Markers   Range and Bearing Marker Data R□□□° B□□□□	The bearing marker bisects the trackball marker location when the R/B key is pressed to monitor fish echoes with audible sound. Furthermore, the radius of the range marker is at the trackball marker location. These markers may be erased by placing the trackball marker near the own ship marker and pressing the R/B key.  The slant range to the range marker and the bearing of the bearing marker are displayed.								
Range Rings 	The range rings are inscribed at intervals of 1/4 of the range in use. Range ring data is also provided every two range rings. The range ring interval can be changed from 1/4 to 1/2 through the menu.								
Range Data R□□□□	Shows the range scale set with the RANGE control.								
Tilt Data T□□°	The tilt angle set with the TILT lever is displayed in 1; steps between 0; and 55;.								
Gain	Gain setting is displayed in increments of 0.5 between 0 and 10.								
Setting Change Data	When the controls in the table below are changed new setting appears in large characters at the top of the screen for five seconds. <table border="1" data-bbox="635 1832 1230 2033" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th data-bbox="635 1832 932 1883">Control</th> <th data-bbox="936 1832 1230 1883">Display</th> </tr> </thead> <tbody> <tr> <td data-bbox="635 1890 932 1942">RANGE</td> <td data-bbox="936 1890 1230 1942">R□□□□</td> </tr> <tr> <td data-bbox="635 1948 932 2000">TILT</td> <td data-bbox="936 1948 1230 2000">T□□°</td> </tr> <tr> <td data-bbox="635 2007 932 2033">GAIN</td> <td data-bbox="936 2007 1230 2033">G□.□</td> </tr> </tbody> </table>	Control	Display	RANGE	R□□□□	TILT	T□□°	GAIN	G□.□
Control	Display								
RANGE	R□□□□								
TILT	T□□°								
GAIN	G□.□								



# Optional Markers and Data

Various markers and data are available with connection of the INTERFACE Board and appropriate external equipment.

## Optional markers and data in the normal mode

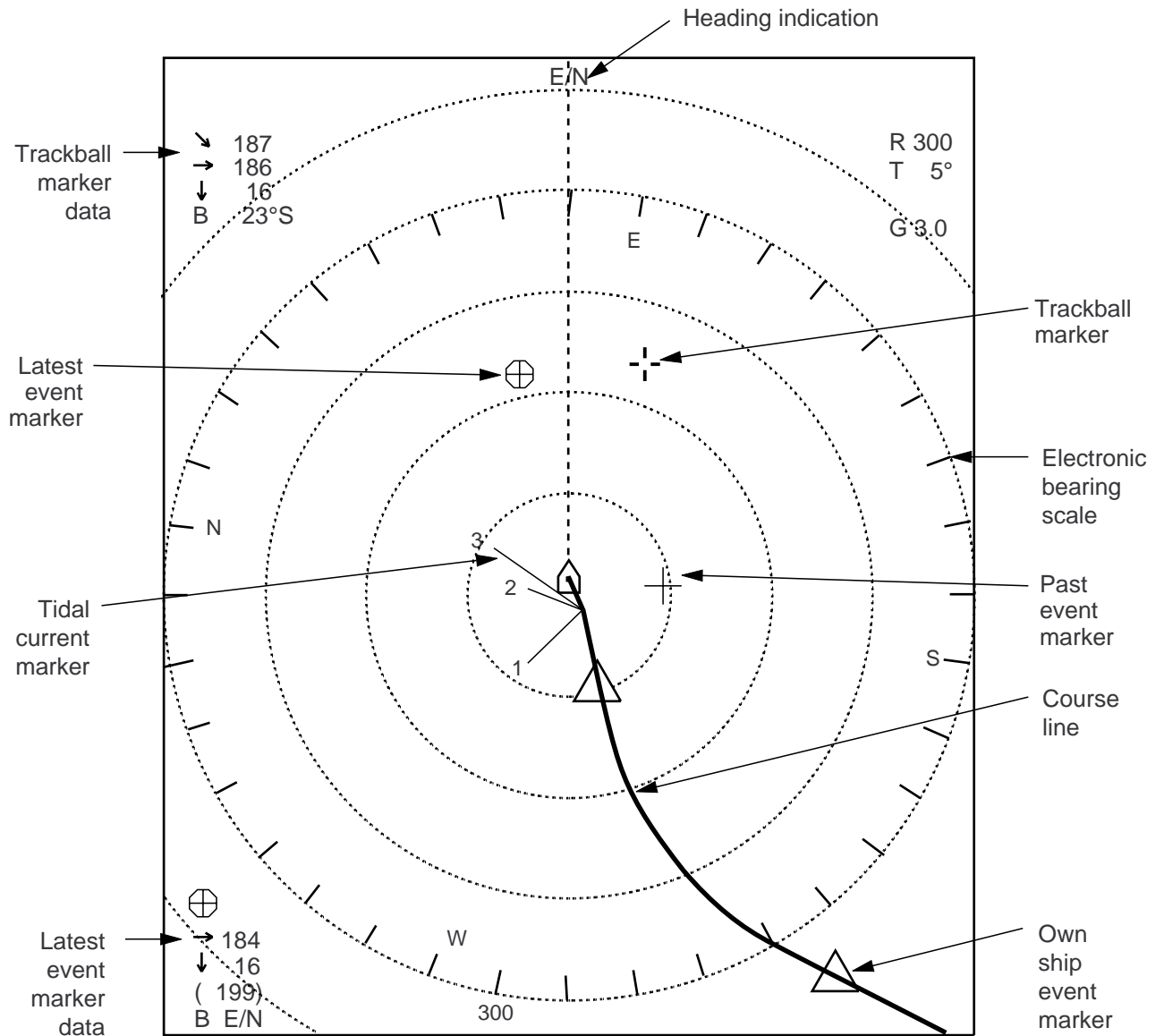


Figure 2-2 Optional markers and data in the normal mode

## Optional markers and data in the normal plus text mode

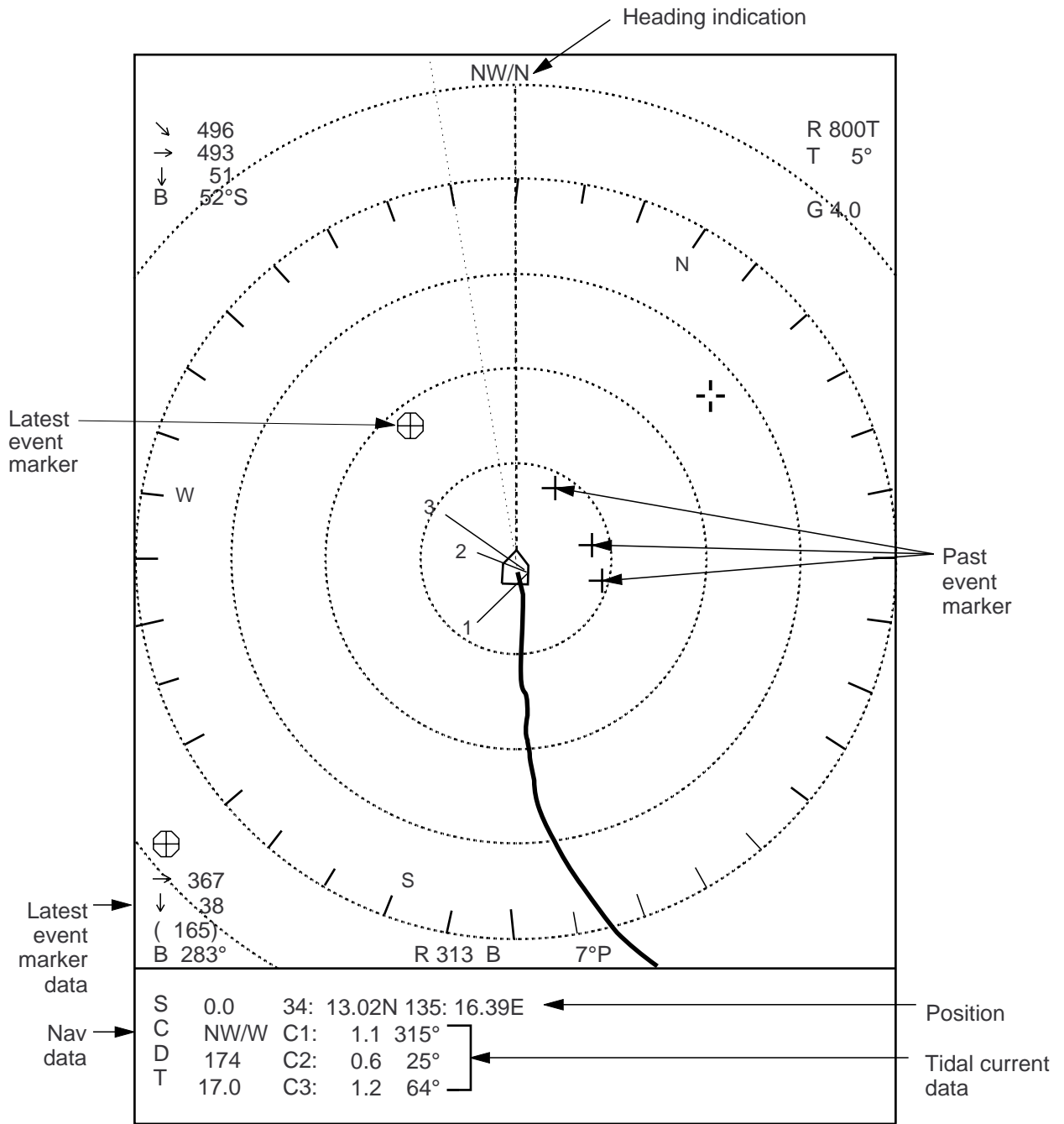
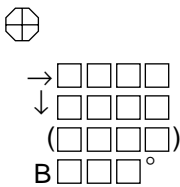

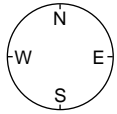





Figure 2-3 Optional markers and data in the normal plus text mode

Table 2-2 Optional markers and data description

Marker	Description
<p>Latest Event Marker Data</p> 	<p>The position data of the latest event marker, that is, horizontal range (→), current depth (↓) and bearing. (□□□□) shows the latest event marker's original depth, and remains unchanged regardless of ship's movement or tilt angle. When the event marker is erased the above data disappears from the screen.</p> <p>To erase an event maker, place the trackball maker on the event marker and press the EVENT key.</p>
<p>Own Ship Event Marker </p>	<p>You can plot ten own ship event markers on the course line. This marker can be erased.</p>
<p>Electronic Bearing Scale</p> 	<p>The electronic bearing scale is available with gyrocompass connection. It rotates with own ship's movement.</p>
<p>Course Line Marker</p> 	<p>With gyrocompass or speed log connection, own ship's course line is plotted by a solid line. Course line length is selectable from 5 to 10 times the range in use. Course line can be erased through the menu.</p>
<p>Tidal Current Marker</p> 	<p>With current indicator connection, the tidal current marker shows the speed and direction of three tide layers, numbered 1 through 3. The tide speed is shown by vector length. However, no vectors develop if the tide speed is 0.1 knots or less. Tidal current markers can be erased.</p>
<p>Tidal Current Data</p> <p>C1: □.□□□□  C2: □.□□□□  C3: □.□□□□</p>	<p>In the normal mode plus text, tide speed and direction for three tide layers appear in the text area. The method for displaying current direction can be selected through the menu.</p>
<p>Nav Data</p> <p>S: □□ . □  C: □□□  D: □□□□  T: □□ . □</p> <p>Own Ship Data</p> <p>□□° □□.□□N  □□° □□.□□E</p>	<p>Own ship speed(S), Heading(C), Depth(D) and Water temperature(T) can be displayed on the text area. (Requires appropriate sensors.)</p>
<p>North Marker</p> 	<p>The north marker is displayed with gyrocompass connection.</p>

# MENU OVERVIEW

The menu system consists of four menus: Scan menu, Menu-1, Menu-2, and System. The Scan menu can be opened while transmitting, and contains items which the user will often change during the course of operation. Menu-1 (similar to the Scan menu), Menu-2 and System menus can be opened with the transmitter turned off. Menu-2 and the System menus contain items which once set do not require frequent adjustment.

## Scan Menu Operation

### Displaying the scan menu

1. Press the TX switch to light the lamp (transmitter on state) above it, if it is not already lit.
2. Press the MENU key. The first five items of the Scan menu appear. (The figure below shows the entire menu.)

**SCAN MENU **		(RANGE SW: U/D GAIN SW: L/R)			
DEGAUSS	: EXECUTE				
AUTO DEGAUSS	: OFF	TIMER		GYRO	
DISPLAY MODE	: NORM	TEXT			
TX OUTPUT	: 10				
PULSELENGTH	: 10				
TX CYCLE	: 10				
TVG NEAR	: 10				
TVG FAR	: 10				
AGC	: 10				
NOISE LIM	: 10				
VP	: 0				
IR	: 0				
MARK ERASE	: COURSE	SHIP			
# HOR BEAM ANGL	: WIDE	NARROW			
# RES COL CURVE	: LINEAR	1	2	3	
# COLOR EMPHASIS	: 1 (LOW)	2	3	4 (HIGH)	
FUNC1 PROG	: USER1	SETUP1	SETUP2	SETUP3	
FUNC2 PROG	: USER2	SETUP1	SETUP2	SETUP3	
USER PROG	: USER1	USER2			

Requires INTERFACE Board.

# Locked setting (in red). To change, select item, adjust GAIN control to display YES, and press the TX key. Selected item appears in green; setting may now be changed.

Figure 3-1 Scan menu

3. Operate the RANGE control to scroll the menu and select item. The selected item is highlighted in green and current setting in white.
4. Operate the GAIN control to change setting.
5. Press the MENU key to register selections and close the menu.

**Note:** Gain or range cannot be changed while the Scan menu is displayed.

### Scan menu description

*Table 3-1 Scan menu description*

Item	Description
DEGAUSS	Enables degaussing of the screen by pressing the TX key on the menu screen.
AUTO DEGAUSS	Selects how to automatically degauss the screen. TIMER degausses the screen every three minutes, and GYRO degausses the screen whenever the ship turns approximately 45°.
DISPLAY MODE	Selects a picture display mode. NORM: Displays the sonar picture on entire screen TEXT: Displays sonar picture on upper 9/10 of screen and text on bottom 1/10, Text includes position, speed, course, depth and tidal current.
TX OUTPUT	Sets output power in eleven steps; 0 is minimum, 10 maximum. Set to 10 for normal use, and use a lower power when sea surface reflections or seabed echo obscures fish schools in short range and shallow water operations. Note that the output power changes 10 seconds after the setting is changed.
PULSELENGTH	Sets a transmission pulselength in eleven settings; 0 is minimum and 10, maximum.
TX CYCLE	Sets transmission repetition rate in eleven settings; 1 for longest and 10, shortest.
TVG NEAR TVG FAR	Controls receiver sensitivity at short and long ranges, respectively. FAR: Over 100 m; position "5" is the standard setting. NEAR: Within 100 m; position "5" is the standard setting.
AGC	Suppresses echo tail of strong targets such as the seabed, for easy recognition of fish schools adjacent to the bottom. Position "1" or "2" is the standard setting.
NOISE LIM	Rejects noise displayed over the entire screen in light blue or blue. Position "3" is the usual setting.
VP	Adjusts the after-image of the echoes for proper period – echoes are stretched in the radial direction. Set to "0" when its function is not required.

*Table 3-1 Scan menu description (con't.)*

<b>Item</b>	<b>Description</b>
IR	Rejects random noise and interference caused by other echo sounders or sonars.
MARK ERASE	Erases all own ship markers or course line.
HOR BEAM ANGL	Selects horizontal beam angle. Select wide for general use; narrow for better bearing discrimination.
RES COLOR CURVE	Sets the balance between weak and strong echoes. LINEAR varies output proportionally with input (actual echo strength). Select a higher setting to better emphasize weak echoes – weak echoes are displayed in stronger echo colors as the setting goes higher. The standard setting is LINEAR.
COLOR EMPHASIS	Sets the proportion of red in the color display; the higher the setting the greater the proportion of echoes displayed in red.
FUNC1 PROG	Selects program to use with the F1 key.
FUNC2 PROG	Selects program to use with the F2 key.
USER PROG	Enables programing of USER1 and USER2 programs.

## **Menu-1, Menu-2, System Menu Operation**

## Displaying menu-1, menu-2, system menu

1. Press the TX switch to blink the lamp (transmitter off state) above it, if it is not already blinking.
2. Press the MENU key. The last-used menu among Menu-1, Menu-2, and System appears. The menu below is Menu-1.

** MENU - 1 **		(RANGE SW: U/D GAIN SW: L/R)		
MENU MODE	:	MENU - 1	MENU - 2	SYSTEM
DISPLAY MODE	:	NORM	TEXT	
TX OUTPUT	:	8		
PULSELENGTH	:	8		
TX CYCLE	:	10		
TVG NEAR	:	6		
TVG FAR	:	7		
AGC	:	0		
NOISE LIM	:	0		
VP	:	0		
IR	:	0		
# HOR BEAM ANGL	:	WIDE	NARROW	
# RES COLOR CURVE	:	LINEAR	1	2 3
# COL EMPHASIS	:	1 (LOW)	2	3 4 (HIGH)
FUNC1 PROG	:	USER1	SETUP1	SETUP2 SETUP3
FUNC2 PROG	:	USER2	SETUP1	SETUP2 SETUP3
USER PROG	:	USER1	USER2	
DEGAUSS	:	EXEC		
AUTO DEGAUSS	:	OFF	TIMER	GYRO

Requires INTERFACE Board.

# Locked setting

*Figure 3-2 Menu-1*

3. Operate the RANGE control to select item. The selected item is highlighted in green and current setting in white.
  4. Operate the GAIN control to change setting.
- Note:** Items in red are locked.
5. Press the MENU key to register selections and close the menu.

### Menu-1 description

This menu contains the same items as the Scan menu. See page 3-2 for description.

### Menu-2 description

** MENU - 2 **		(RANGE SW: U/D GAIN SW: L/R)			
MENU MODE		MENU - 1	MENU - 2	SYSTEM	
#	EXT KP SYNC	: OFF	ON		
#	RANGE MARKER	: 1/4R	1/2R	OFF	
#	BEARING SCALE	: ON	OFF		
#	CURRENT MARK	: ON	OFF		
#	COURSE MARK	: 10R	5R	OFF	
#	HEADING INDI	: 32 - AZI	TRUE		
#	CURRENT INDI	: 32 - AZI	TRUE	±180°	360°
#	EVENT INDI	: 32 - AZI	TRUE	±180°	360°
#	MARK INDI	: ±180°	360°		
#	POSITION DATA	: L/L	TD		

Requires INTERFACE Board.

# Locked setting

Item	Description
EXT KP SYNC	Turns external KP synchronization on/off.
RANGE MARKER	Selects range marker length from 1/4 of range or 1/2 of range.
BEARING SCALE	Turns electronic bearing scale on/off.
CURRENT MARK	Turns the current (tide) mark on/off.
COURSE MARK	Selects length of the course line plot from 10 times or 5 times the range in use.
HEADING INDI	Selects heading indication; 32-azimuth, or true bearing.
CURRENT INDI	Selects current (tide) indication; 32-azimuth, true bearing, ±180°, or 360°.
EVENT INDI	Selects event indication; 32-azimuth or true bearing, ±180°, or 360°.
MARK INDI	Selects mark indication; ±180°, or 360°.
POSITION DATA	Displays position in latitude and longitude, or LOP (Line Of Position).

Figure 3-3 Menu-2 description



## System menu description

** SYSTEM MENU **		(RANGE SW: U/D GAIN SW: L/R)			
MENU MODE	:	MENU - 1	MENU - 2	SYSTEM	
#	HEADING ADJ	:	0°		
#	UNIT	:	METERS	FEET	FATHOMS PA/BRA
#	SHIP'S SPD/BR	:	LOG/GY	CI	NAV
#	LOG PULSE	:	200	400	
#	CI BAUD RATE	:	4800	2400	1200
#	NAV FORMAT	:	CIF	NMEA183	NMEA182
#	NAV BAUD RATE	:	4800	2400	1200
#	NAV DATA	:	GPS	LC	DEC DR
		:	LA	ALL	
	MENU SELECT	:	LOCK	UNLOCK	
#	SUB TEXT INDI	:	OFF	ON	
#	LANGUAGE	:	ENGLISH	ø / ø	ESPANOL DANSK
	SELF TEST	:	SINGLE	PANEL	COLOR GRAY
		:	CONTI	SIO	ECHO-1 ECHO-2
	DEFAULTS	:	EXECUTE		

Requires INTERFACE Board.  
# Locked setting

Item	Description
HEADING ADJ	Compensates for flange (in hull unit) alignment error. The picture rotates with RANGE switch operation. Resolution is to the nearest degree.
UNIT	Selects unit of depth measurement; meters, feet, fathoms, or passi/braza.
SHIP'S SPD/BR	Selects source of ship's speed/bearing input; log/gyrocompass, current indicator, or navigator.
LOG PULSE	Selects specifications of speed log connected; 200 or 400 pulses/mile. Consult the operator's manual of the speed log.
CI BAUD RATE	Selects current indicator baud rate; 4800, 2400, or 1200 baud. Consult the operator's manual of the current indicator.
NAV FORMAT	Selects format of connected navigator; CIF, NMEA0183 or NMEA0182. Consult the operator's manual of the navigator.
NAV BAUD RATE	Select current indicator baud rate; 4800, 2400, or 1200 baud. Consult the operator's manual of the navigator.
NAV DATA	Selects source of position data; GPS, LC (Loran C), DC (Decca), DR (Dead Reckoning) LA (Loran A) or AUTO. AUTO selects position data with the highest priority; GPS has the highest priority.
MENU SELECT	Locks/unlocks settings.
SUB TEXT INDI	For use by technicians.
LANGUAGE	Selects language to use.
SELF TEST	Selects a self test.
DEFAULTS	Resets to default settings by pressing the TX key.

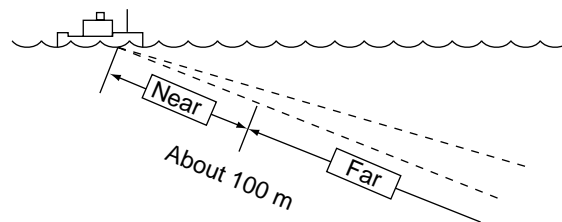
Figure 3-4 SYSTEM Menu description

# FINE TUNING THE PICTURE

## Eliminating Unwanted Feeble Echoes

Echoes from targets such as seabed and fish return to the transducer in order of distance to them, and when we compare their intensities at the transducer face, those from nearer targets are generally stronger when their reflecting properties are nearly equal. The sonar operator will be quite inconvenienced if these echoes are directly displayed on the screen, since he can not judge the actual size of the target from the size of echoes displayed on the screen. To overcome this inconvenience, the TVG function is incorporated. It compensates for propagation loss of sound in water; amplification of echoes on short range is suppressed and gradually increased as range increases so that similar targets are displayed in the similar intensities irrespective of the ranges to them.

The CSH-7 has two TVG functions, NEAR and FAR, and they mainly compensate for propagation loss on short and long ranges respectively, centered at the ranges shown below. The higher the TVG setting the greater the amplification of echoes.



*Figure 4-1 Principle of TVG*

The TVG is also used to suppress unwanted echoes and noise which appear in a certain range area on the screen such as sea surface reflections and cruising noise. To set TVG properly, do the following:

### How to adjust TVG

1. Press the MENU key to display the Scan menu.
2. Set both TVG NEAR and TVG FAR to “5”. These are the standard settings and you can maintain them in most cases.
3. When sea surface reflections or plankton (displayed in weak colors) disturb the picture, decrease TVG NEAR by 1 or 2 to eliminate it.

4. Locate a fish school on a long range setting which is approaching own ship. Adjust the tilt to keep the fish school in the center of the sonar beam, namely, fish school is displayed in strongest colors possible. Confirm that the fish echo is displayed in the same color as it approaches. If the color suddenly changes to weaker colors as the fish enters FAR and NEAR areas, the TVG is improperly set. Adjust the TVG. If this again produces sea surface reflections and noise try to remove them with AGC and NOISE LIM on the Scan menu.
5. Press the MENU key to close the menu.

## Displaying Surface Fish Clearly

When you are searching for surface fish with the tilt set to a narrow angle, sea surface reflections may disturb or mask wanted fish echoes. In this case, in addition to the TVG adjustment described earlier set the AGC between positions “0” and “3” on the Scan menu.

## Suppressing Seabed Tail

As noted earlier, fish schools (echoes) located near the seabed are sometimes difficult to detect because you have to discriminate them in the seabed reflections. The AGC and PULSELENGTH in the Scan menu, if used properly, decrease the tail of seabed reflections, making it easier to discriminate bottom fish.

### AGC

The AGC functions to automatically reduce the receiver gain only against strong echoes such as the seabed or a large fish school. Since weak echoes remain unaffected, a small fish school becomes easier to detect. Adjust it so that the AGC works only on seabed reflections. Do not set it too high; weak echoes may be missed.

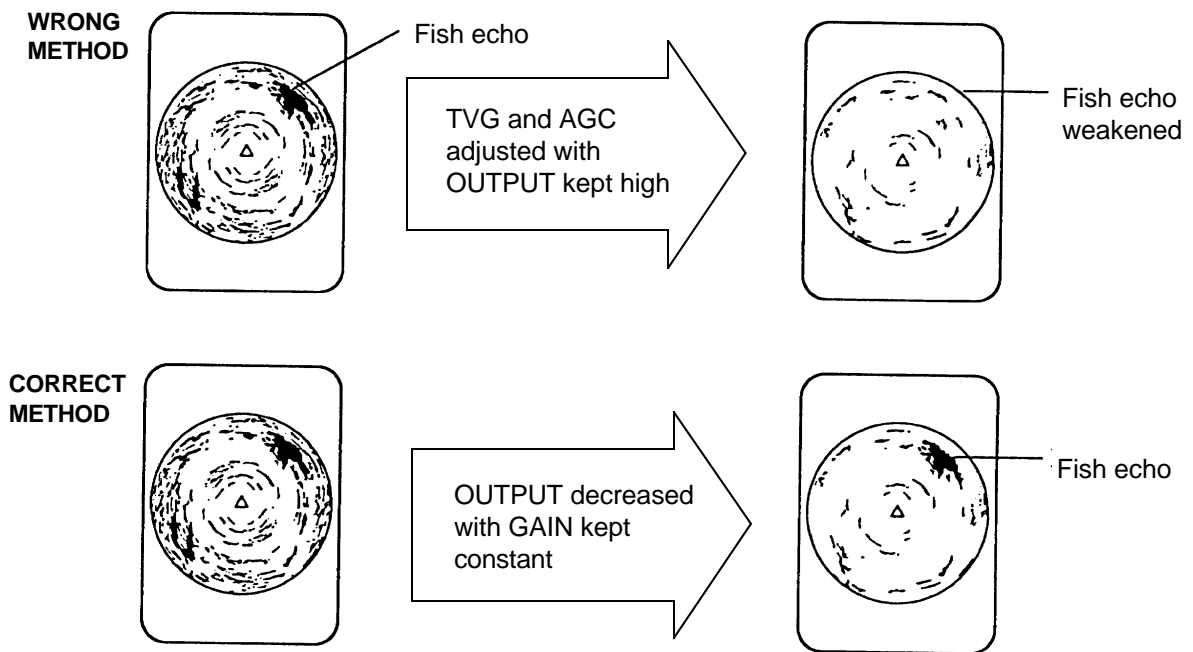
### Pulselength

The pulselength control determines the length of the transmission pulse emitted into the water. While a longer pulse is advantageous for long range sounding, it has the disadvantage of being poor in discrimination of targets, that is, ability to separate several closely located targets. When searching bottom fish, therefore, it is useful to shorten the pulselength in order to separate

fish echoes from seabed reflections. Decrease the PULSELENGTH setting on the Scan menu to shorten the pulselength. For search of surface and midwater fish in which seabed reflections are not so strong, use the longest pulselength “10”.

## Suppressing Seabed and Sea Surface Reflections in Shallow Waters

In shallow fishing grounds with hard or rocky bottom, seabed reflections often interfere with wanted fish echoes and they can not be eliminated sufficiently with the aforementioned TVG and AGC, especially when the TILT is set to a larger angle in order to track fish schools approaching within 400 m. In such cases try to reduce the output power with OUTPUT in the Scan menu without turning down the GAIN. The picture becomes clearer when output power is reduced rather than when the GAIN is decreased as illustrated below.



*Figure 4-2 How to suppress seabed and sea surface reflections in shallow waters*

# Rejecting Sonar Interference and Noise

While observing the sonar picture, you may encounter occasional or intermittent noise and interference. These are mostly caused by on-board electronic equipment, engine or propeller noise, or electrical noise from other sonars being operated nearby.

## Identifying noise source

To eliminate noise effectively, you should first identify the noise source as follows:

1. Turn off the TX switch and operate all on-board equipment one by one while observing the picture.
2. Run the boat at various speeds to check if the noise is speed dependent.

If neither of the above two steps has effect on the picture, adjust the IR (Interference Rejector) and NOISE LIM (Noise Limiter) on the Scan menu as follows.

## Rejecting noise with IR on the scan menu

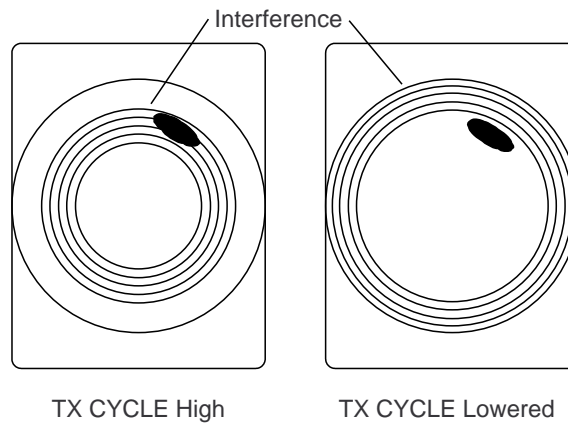
This control is similar to the interference rejector on echo sounders and radars. It is effective for rejecting random noise and sea surface reflections in rough sea conditions. Set it so that noise is just eliminated. Do not use an unnecessarily high setting since it may also reject small wanted echoes.

## Rejecting noise with NOISE LIM on the scan menu

Weak, unwanted reflections, colored light blue or green, are displayed when water is contaminated or plankton layers exist or due to ship's noise. These echoes gradually become bluish as the NOISE LIM setting is raised. Usually, setting "3" or "4" is suitable.

## Rejecting interference with TX cycle

When other sonars operate nearby at the same transmission interval as that of own ship's sonar, an interference ring caused by other sonars is displayed. To erase the interference ring from the screen, reduce the TX CYCLE setting on the Scan menu.



*Figure 4-3 How TX cycle works*

**Note:** When the sonar is used in a shallow water with the range set between 100 m and 200 m and the TX CYCLE at “10”, seabed reflections may appear on the screen. Reduce the TX CYCLE setting to “7” or “8” to reject them.

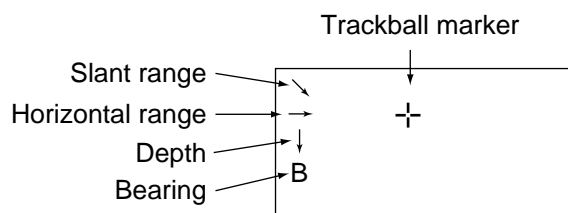
## Selecting horizontal beamwidth

If you wish to have better bearing discrimination (ability to distinguish two closely located targets at the same range and different bearings) for fish schools and also wish to examine the contour of seabed, select HOR BEAM ANGL to NARROW on the Scan menu.

# ADVANCED OPERATION

## Measuring the Range and Bearing to a Target

Operate the trackball to place the trackball marker (+) on the target you want to measure the range and bearing. The range and bearing are displayed at the top left corner on the screen.



*Figure 5-1 Location of range and bearing indications*

**Note:** The bearing is shown in either 360° or 180° indication system relative to the ship's heading. In the latter case, "B" is indicated as follows:

B    P ----- on the port side  
B    S ----- on the starboard side

The 360° or 180° indication system can be selected on Menu-2.

## Detecting Fish Schools Aurally

Occasionally you will be preoccupied with other tasks and unable to concentrate on watching the sonar picture. In such cases you can use the audio function to aurally monitor fish echoes through the built-in speaker.

1. Operate the trackball to move the trackball marker to the direction you want to monitor through the speaker.
2. Press the R/B key. The bearing marker will appear in the direction of the trackball mark and echoes in that direction are monitored through the speaker. Adjust the volume with the AUDIO control on the front panel.
3. To turn off the audio function, erase the bearing marker by placing the trackball marker near own ship marker and pressing the R/B key.

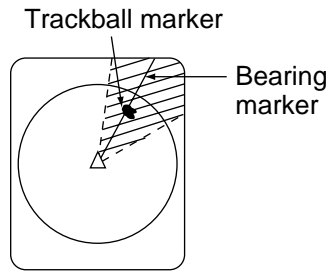


Figure 5-2 Area monitored in audio function (sample)

## Relocating Fish School for Easy Observation

When a fish school is located near the edge of the screen and inconvenient for observation, use the off-center function to relocate the fish school to the desired place on the screen.

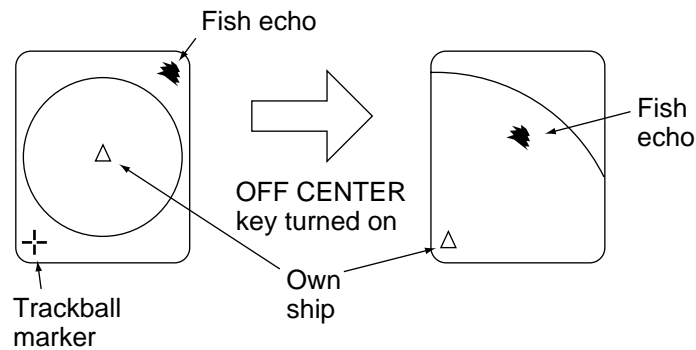


Figure 5-3 Off-center function

1. Move the trackball marker to the position where the own ship mark is to be moved.
2. Press the OFF CENTER key.
3. To cancel the off-center function and shift own ship marker back to the center of the screen, press the OFF CENTER key again.



## Function Keys (F1, F2)

Function keys F1 and F2 work like the auto dialing feature on a telephone, instantly calling out desired settings to perform specially assigned functions. These keys provide optimum sonar settings for a specific purpose with a single key operation.

Each function key can be assigned a combination of particular sonar settings which will be most suited to a specific objective, for example, detection of a fish school. Five programs are available: two user programs (User 1, 2) and three task-specific programs (Setup 1, 2, 3). The default settings of these programs are shown in the table below. Note that the “Setup” programs cannot be changed.

*Table 5-1 Default programs*

Item	Program Setting			
	User 1, 2	Setup 1 (Fish school)	Setup 2 (Wreck, reef)	Setup 3 (Long range detection)
TX OUTPUT	10	8	10	10
PULSELENGTH	2	8	2	10
TX CYCLE	10	10	10	10
TVG NEAR	3	5	3	3
TVG FAR	7	6	7	8
AGC	3	1	3	2
NOISE LIM	5	3	5	4
IR	1	2	1	1
VP	1	1	1	1
HOR BEAM ANGLE	NARROW	NARROW	NARROW	NARROW
RES COLOR CURVE	LINEAR	1	LINEAR	1
COL EMPHASIS	4	3	4	3

## **Programming user programs**

1. Press the TX switch to blink the lamp above it, if it is not already blinking.
2. Press the MENU key and select Menu-1.
3. Using the RANGE and GAIN controls, set menu options as desired.
4. Operate the RANGE control to select USER PROG.
5. Operate the GAIN control to select USER1 (for F1 key) or USER2 (for F2 key).
6. Press the TX key to register the settings.
7. Press the MENU key to register settings and close the menu.

**Note:** When you change the contents of USER 1 or USER 2, do the next procedure “Selecting program to use”.

## **Selecting program to use**

1. Press the F1 or F2 key to light the lamp above it.
2. Press the TX switch to blink the lamp above it, if it is not already blinking.
3. Press the MENU key and select Menu-1.
4. Operate the RANGE control to select FUNC1 PROG or FUNC2 PROG, selected at step 1.
5. Operate the GAIN control to select program to use; USER1 (or USER2), SETUP1, SETUP2, or SETUP3.
6. Press the TX key to register the setting.
7. Press the MENU key to close the menu.

## **Enabling, disabling a program**

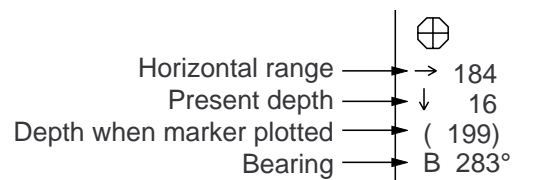
Press the F1 or F2 key to light the lamp above it to enable program. Press key again to disable.

## Event Markers, Own Ship Event Markers

The event marker denotes important items on the display, such as a fish school, and the own ship event marker marks own ship position. Ten event markers and ten own ship event markers may be entered. The CSH-7 denotes the latest event marker as ⊕ and other event markers as +. The own ship event marker is a triangle △. When more than ten of either marker is entered the eldest corresponding marker is erased to make room for the latest. Note that this function requires a gyrocompass (navigator for own ship event marker) and the INTERFACE Board.

### Entering an event marker, own ship event marker

1. Place the trackball marker on the location desired for an event marker. For own ship event marker, place the trackball marker at own ship marker at screen center.
2. Press the EVENT key. The latest event marker appears at the cursor location and event marker data (horizontal distance, present depth, depth when marker was plotted, and bearing) is displayed at the lower left side of the screen.



*Figure 5-4 Latest event marker data*

### Erasing all own ship event markers

All own ship event markers can be erased as follows:

1. Press the MENU key to display the SCAN menu.
2. Select MARK ERASE.
3. Select SHIP.
4. Press the MENU key.

### Erasing an event marker

1. Place the trackball marker on the event marker.
2. Press the EVENT key.

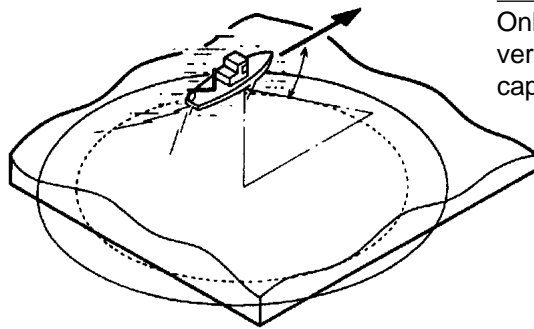
# INTERPRETING THE DISPLAY

## Seabed Echoes

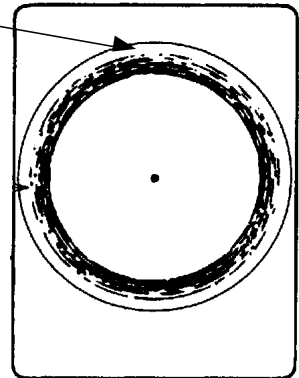
When the tilt angle is widened, the seabed echo illustrated below will appear on the display. When the tilt is narrowed, the seabed trace becomes wider and weaker. By observing the seabed condition on the display, the skipper can prevent net damage.

### (A) Flat seabed

Tilt angle: 10° to 15°

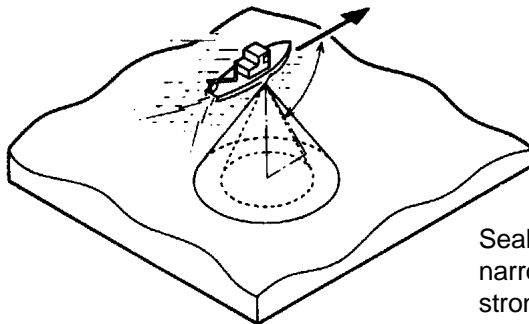


Narrow tilt angle  
Only half of  
vertical beam width  
captures the seabed.

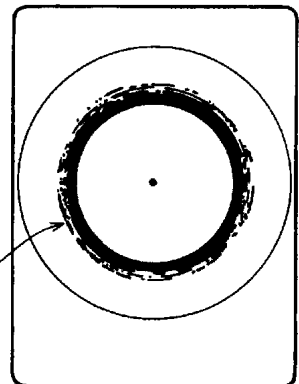


### (B) Flat seabed

Tilt angle: 20° or more

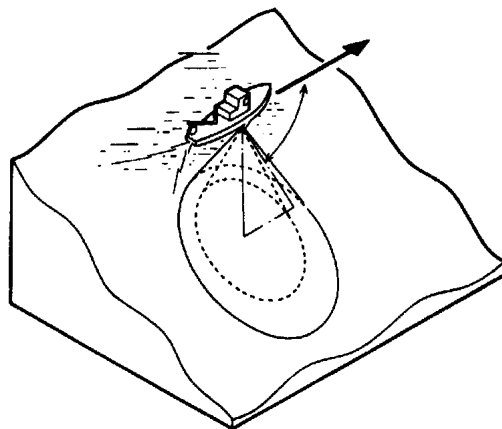


Seabed is displayed  
narrower and in  
stronger colors when  
compared to (A).



### (C) Sloping seabed

Tilt angle: 20° or more



Shallow bottom  
is displayed in  
a strong color  
and with a  
short tail.

Seabed

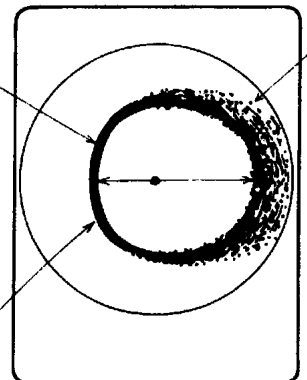


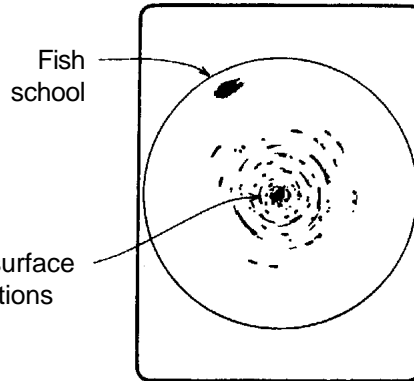
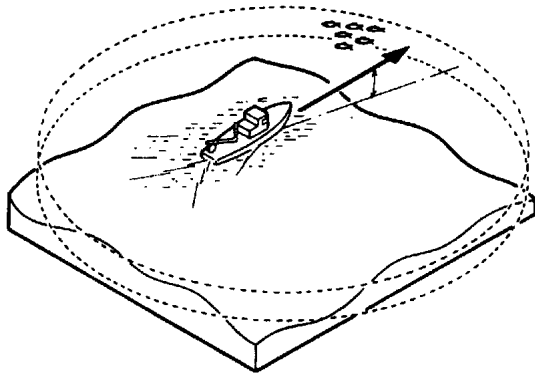
Figure 6-1 Seabed echoes

# Fish Schools

A fish school appears as a mass of echoes on the screen. The color of the mass shows the density of fish schools on the sonar beam. To find distribution and center point of a fish school, try several different tilt angles.

**(A) Sea surface fish**

Tilt angle:  $-5^{\circ}$  to  $10^{\circ}$

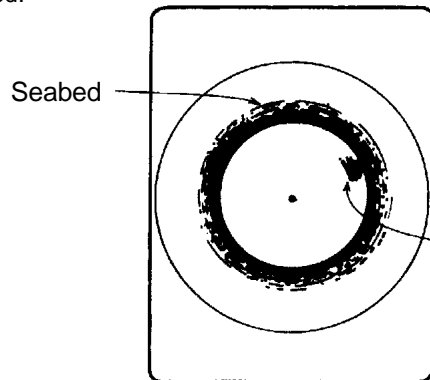
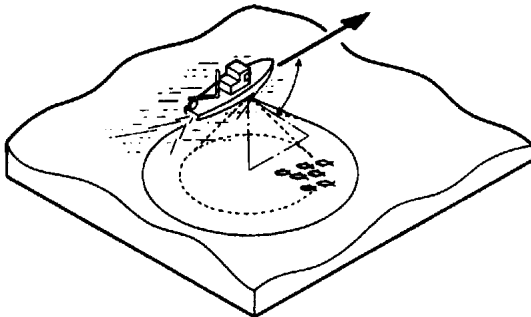


Seabed echo not displayed because of narrow tilt angle. Sea surface reflections are present.

**(B) Midwater, bottom fish**

Tilt angle:  $30^{\circ}$  or more

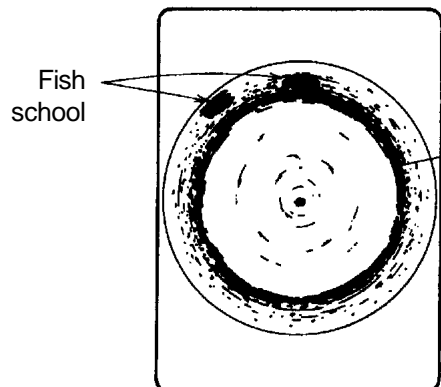
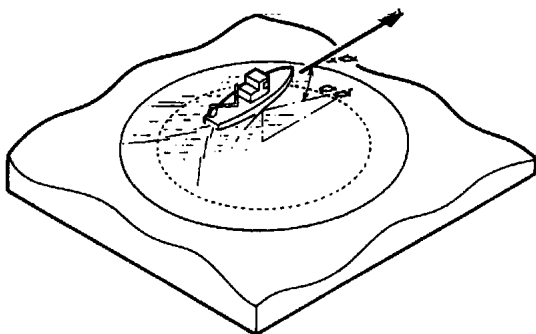
Fish echo which appears before seabed can be detected.



Fish school  
Large midwater fish school is present.

Tilt angle:  $-0^{\circ}$  to  $20^{\circ}$

Fish echo which appears together with or after seabed can be detected.



Seabed

*Figure 6-2 Fish schools*

# Sea Surface Reflections

To reduce sea surface reflections, set the tilt angle to 5° or higher, so the upper edge of the sonar beam does not hit the sea surface, or adjust TVG. When a narrow tilt angle is used, sea surface reflections cover a large area as illustrated below.

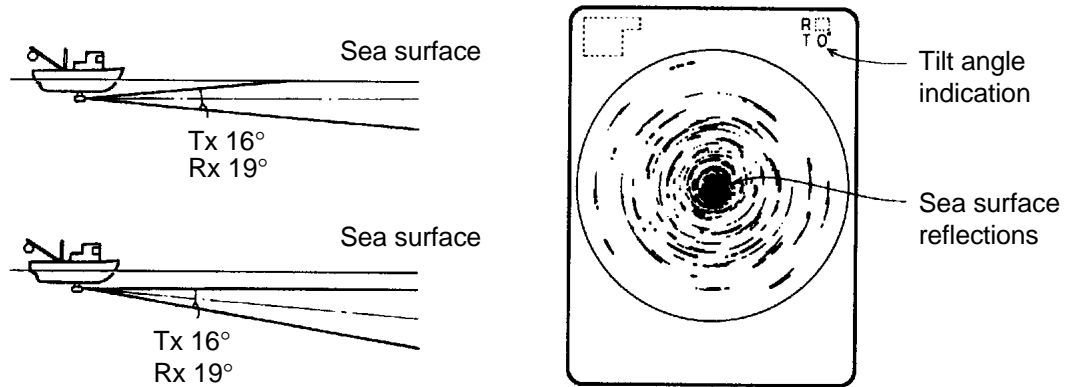


Figure 6-3 Sea surface reflections

# Wake

A wake produced by own ship or another ship can be a strong reflecting object when a narrow tilt angle is used. As the wake appears as a thick continuous line, it can be easily distinguished from a fish school. A wake contains many air bubbles which attenuate ultrasonic energy, making it difficult to sound beyond the wake.

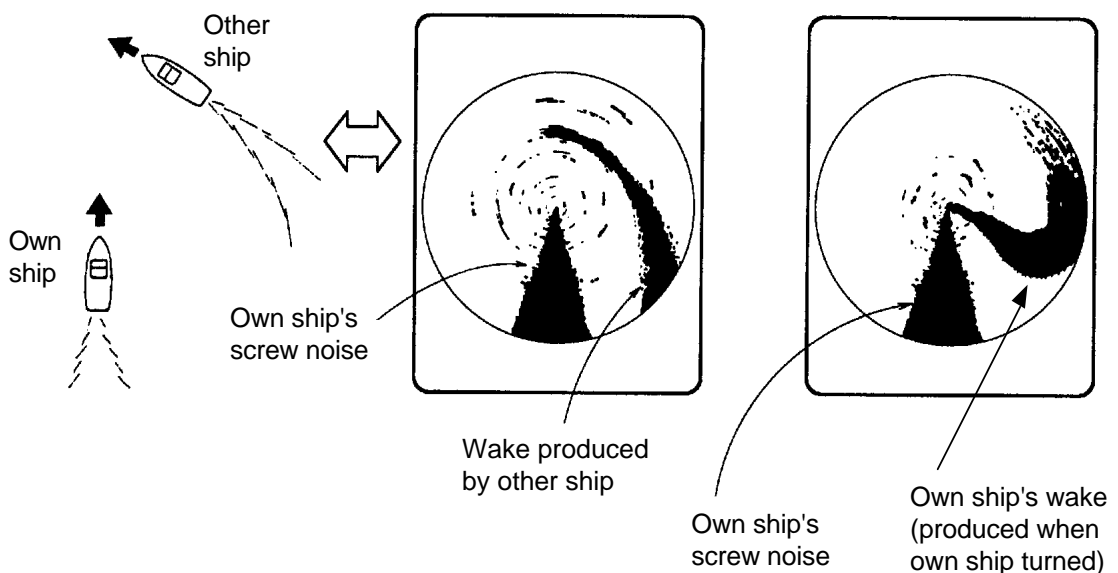


Figure 6-4 Wake appearance on the display

## False Echo by Sidelobe

An ultrasonic wave is emitted only in the direction set by the TILT lever, however there are some emissions outside the main beam. These are called sidelobes. The energy of the sidelobe is fairly weak but when the water is comparatively shallow and the bottom is rocky and hard, strong signals are detected by the sidelobe. These are represented on the display as a false echo as shown below.

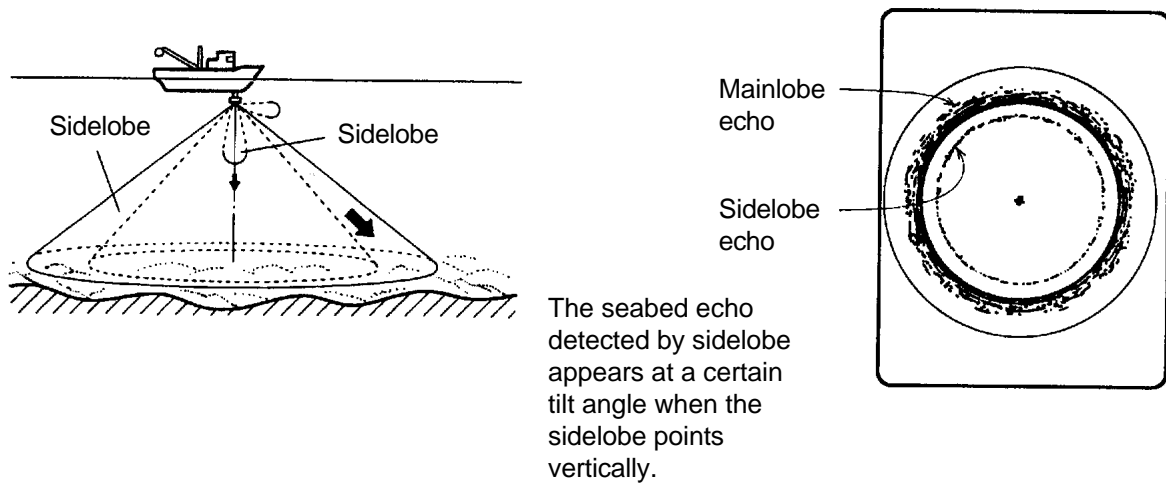


Figure 6-5 Sidelobe echoes

## Noise and Interference

Interference from a sonar on board another ship appears on the screen as shown in (A) below. This interference can be suppressed by changing the TX CYCLE setting in the Scan menu. Interference from electrical equipment on board own ship appears as shown in (B) below. Noise from marine life appears on the display as shown in (C). Electrical interference and marine life noise can be suppressed with IR on the Scan menu.

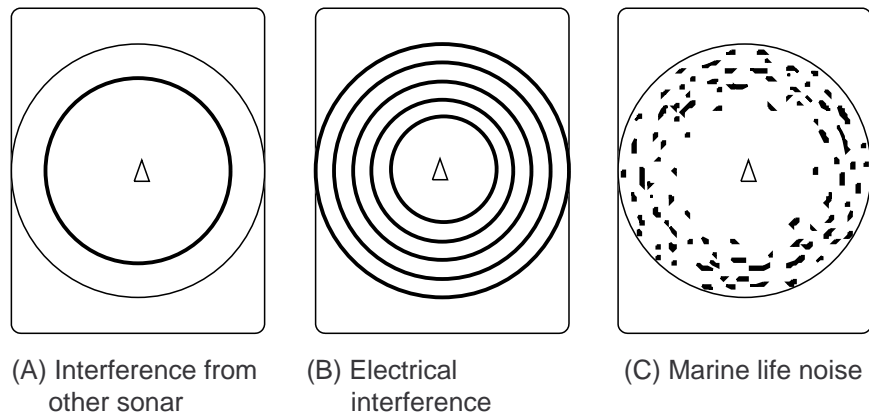



Figure 6-6 Noise and interference

# MAINTENANCE

**⚠ WARNING**

 Do not work inside the equipment unless totally familiar with electrical circuits.

Hazardous voltage which can cause electrical shock, burn or serious injury exists inside the equipment.

## Display Unit Maintenance

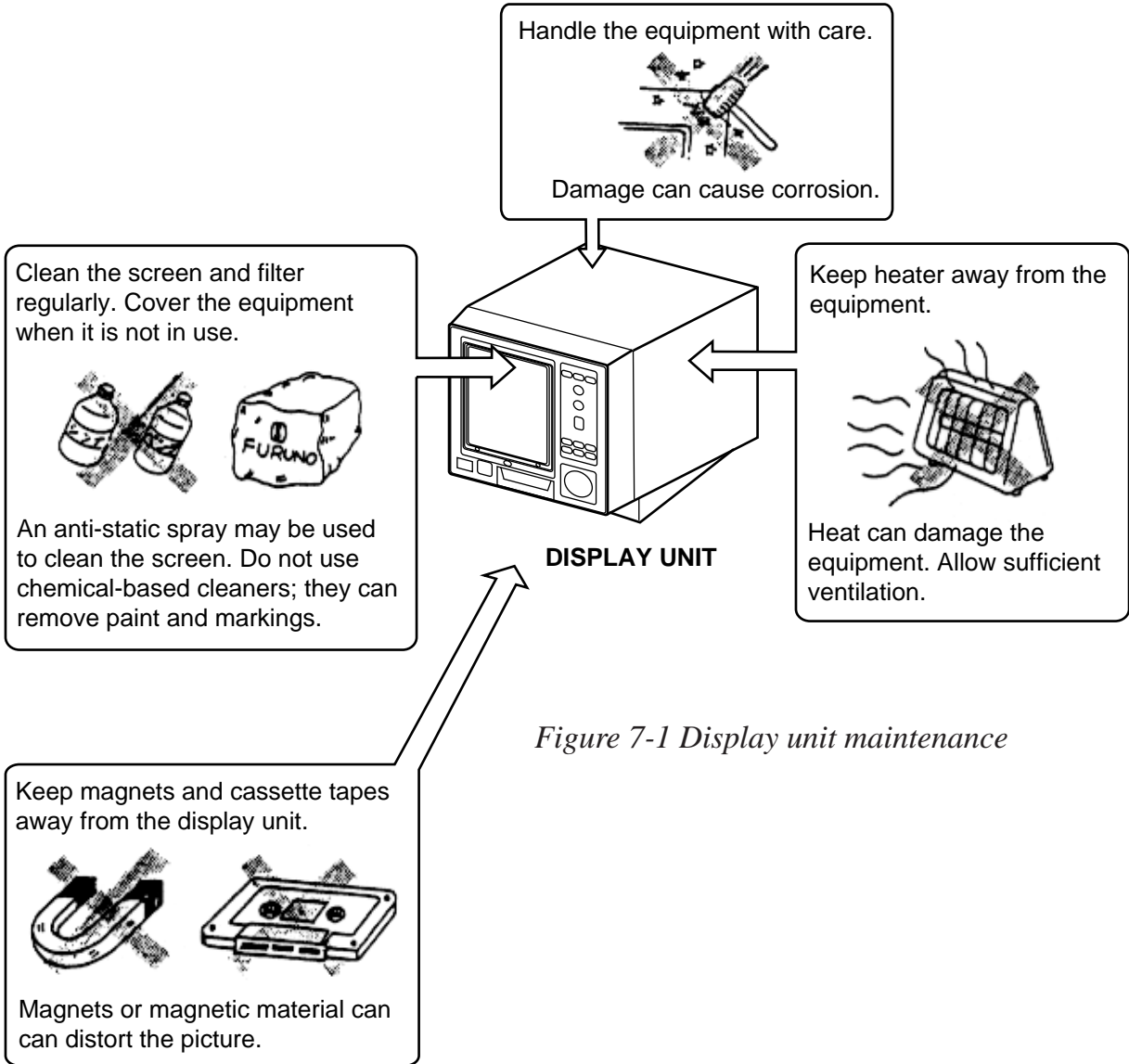


Figure 7-1 Display unit maintenance

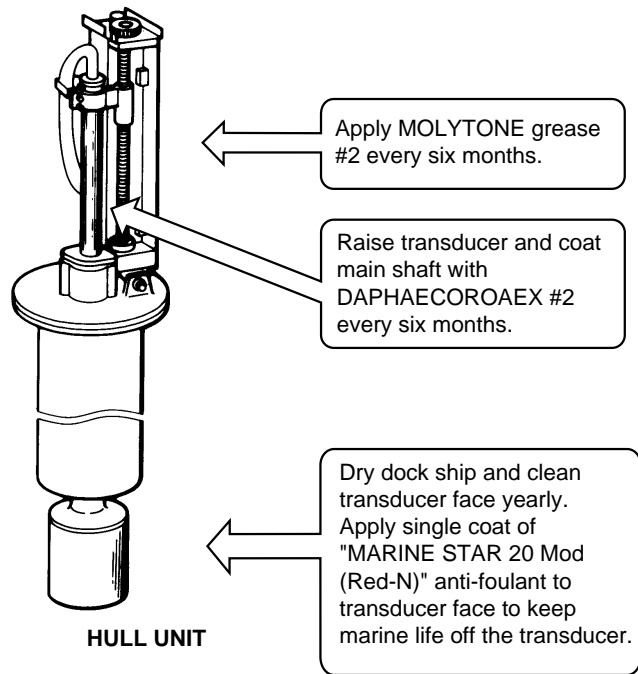


# Hull Unit Maintenance

## CAUTION

The zinc block near the transducer must be replaced yearly.

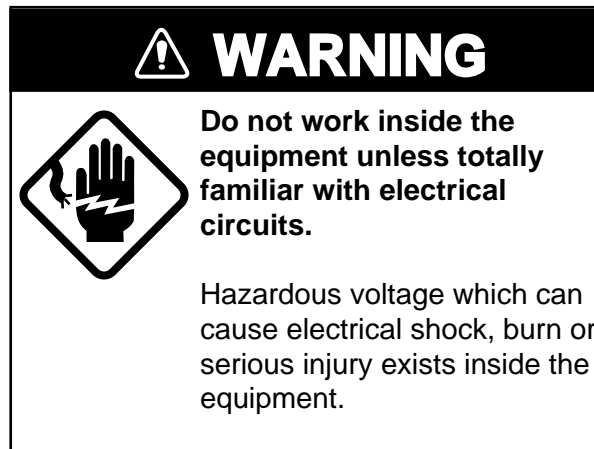
The junction between the transducer and main shaft may corrode, which can result in loss of the transducer or water leakage inside the ship.



*Figure 7-2 Hull unit maintenance*

# TROUBLESHOOTING

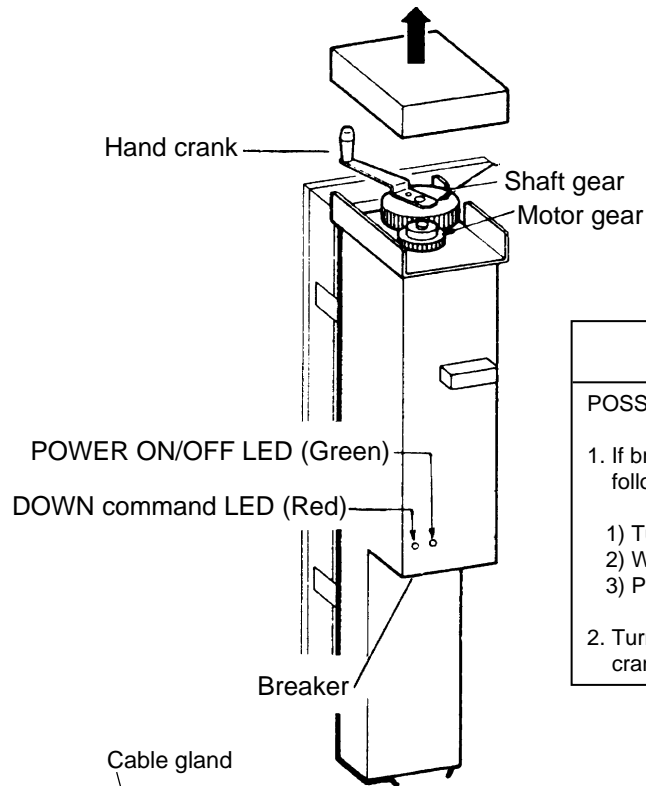
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## When the Transducer Cannot be Retracted

When the transducer cannot be completely retracted within 35 seconds after pressing **↑**, XDCR NOT RETRACTED! blinks at the screen center and the alarm sounds. If this occurs do the following:

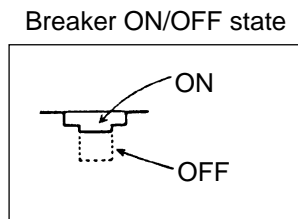
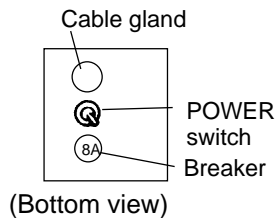
1. The power switch cannot be turned off because the transducer cannot be retracted. Turn off the main breaker for the transceiver unit to stop operation.
2. Confirm that the net is not entwined around the transducer.
3. Confirm that the breaker inside the hull unit is on.
4. Check the mains fuse in the transceiver unit.
5. Apply the power again. Check if the transducer is retracted in the tank. If it is not, the main shaft may be bent. Cut off the power again and manually raise the transducer up to the highest position possible by the hand crank. See the next page for instructions.



**⚠ CAUTION**

POSSIBILITY OF INJURY

1. If breaker (hull unit) trips do the following:
  - 1) Turn off power switch on hull unit.
  - 2) Wait 60 sec after breaker has tripped.
  - 3) Press breaker.
2. Turn off hull unit before using hand crank.

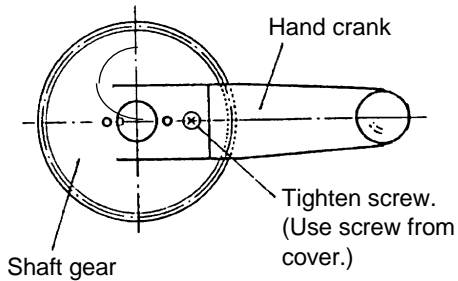


**How to use the hand crank**

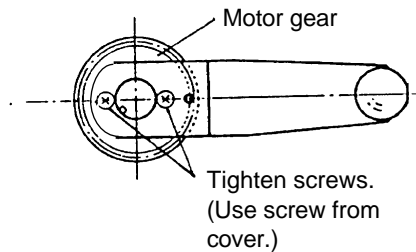
1. Turn off the POWER switch on the hull unit.
2. Remove gear cover.
3. Attach hand crank to shaft gear or motor gear.

a) When crank is attached to shaft gear  
(Requires greater force but less turns.)

b) When crank is attached to motor gear  
(Requires less force but more turns.)




Shaft moves 600 mm per 120 turns of crank.



Shaft moves 600 mm per 210 turns of crank.

*Figure 8-1 How to use the hand crank*

# Diagnostic Tests

 <b>CAUTION</b>
<b>Raise the transducer before conducting the diagnostic tests.</b>
In the diagnostic tests the MENU key raises the transducer. Thus, personal injury can result if the key is operated while someone is near the transducer.

This unit has eight diagnostic test which check it for proper operation. These tests are mainly for use by service technicians, however the user may execute them to identify possibly defective components.

## Starting, quitting diagnostic tests

1. Press the MENU key.
2. Operate the GAIN control to select the System menu.
3. Operate the RANGE control to select SELF TEST.
4. Operate the GAIN control to select a test.
5. Press the TX switch to start the test.
6. To exit a test, press the MENU key for several seconds.

**Note:** After the SINGLE test is completed control is returned to the System menu.

## Diagnostic tests description

### Single test

This test checks the MAIN Board in the display unit and the transceiver unit for proper operation one time, after which normal operation is restored. After the test is completed, the results of each device checked are indicated as OK or NG (No Good), to the right of the device checked.

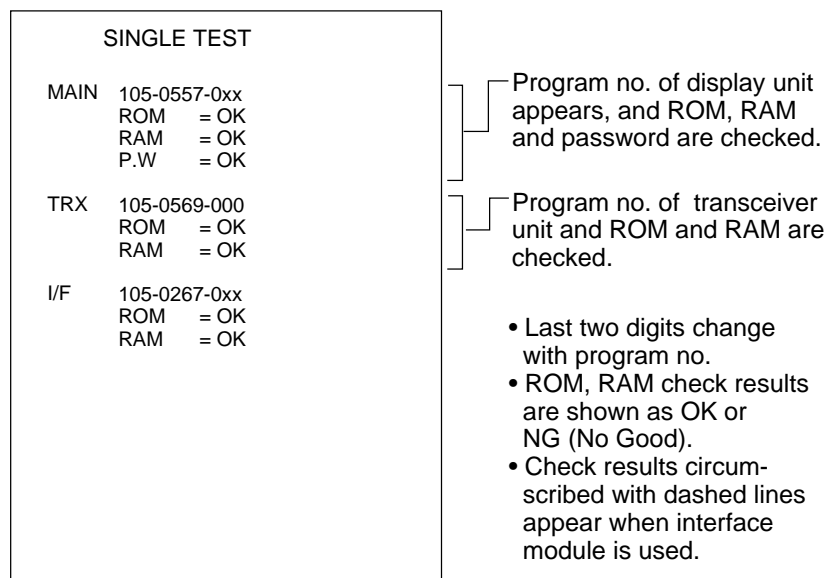
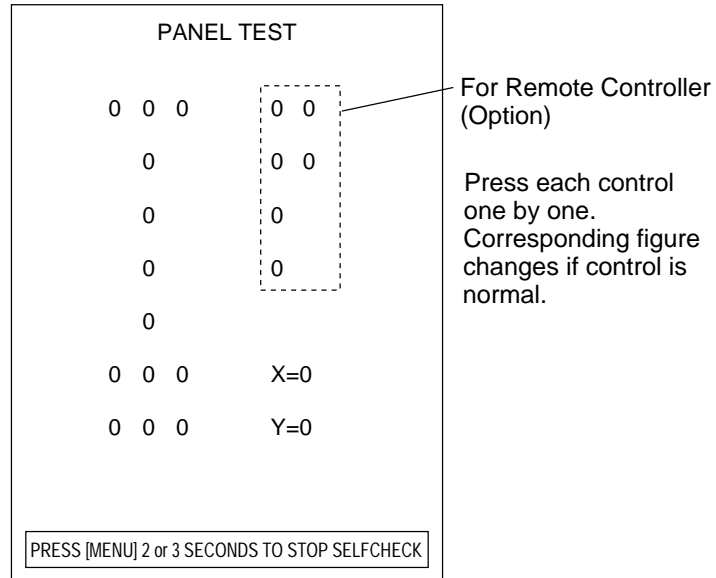


Figure 8-2 Results of single test

**Note:** When the transducer is fully lowered, pressing the MENU key at the diagnostic test raises the transducer.

### Panel test

This test checks the control panel for proper operation.



*Figure 8-3 Results of panel test*

### Color test

The color test checks for proper display of all colors.

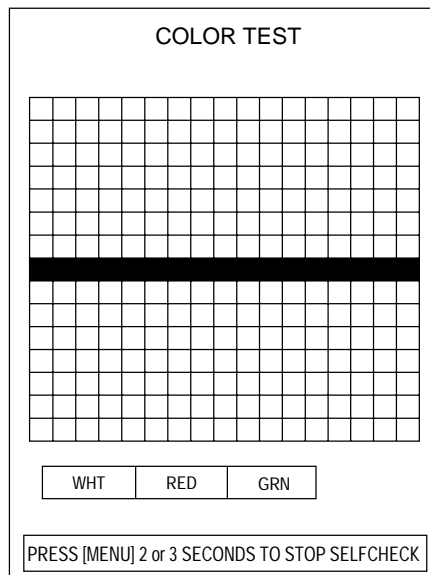


Figure 8-4 Color test display

### Gray test

This test checks for proper display of monochrome characters and markers. Concentric rings and a monochrome test bar are displayed.

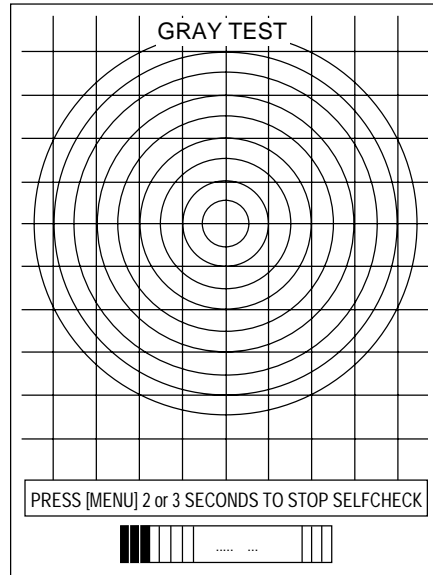


Figure 8-5 Gray test display

### Conti test

This test continuously checks the display and transceiver units. In addition to the devices checked in the single test, the DROM and DRAM are also checked.

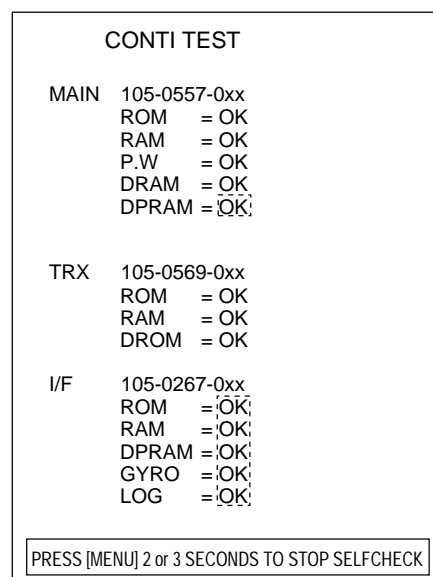


Figure 8-6 Results of continuous test

### SIO test

This test checks transceiver unit input and output.

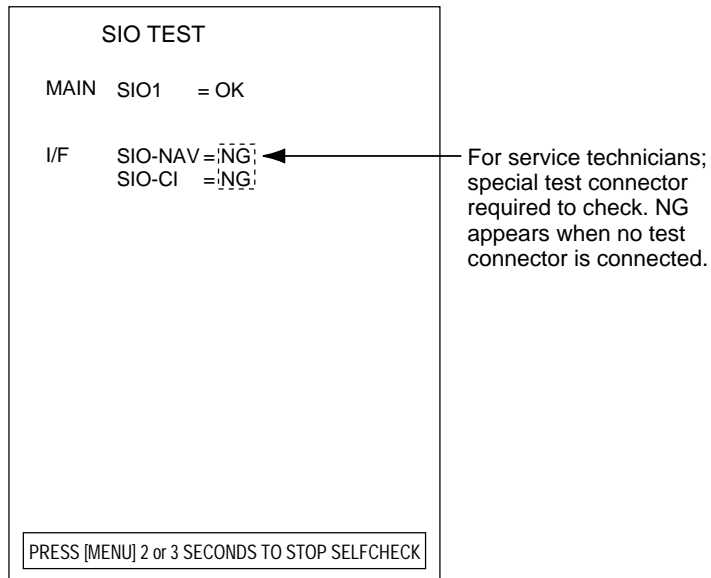
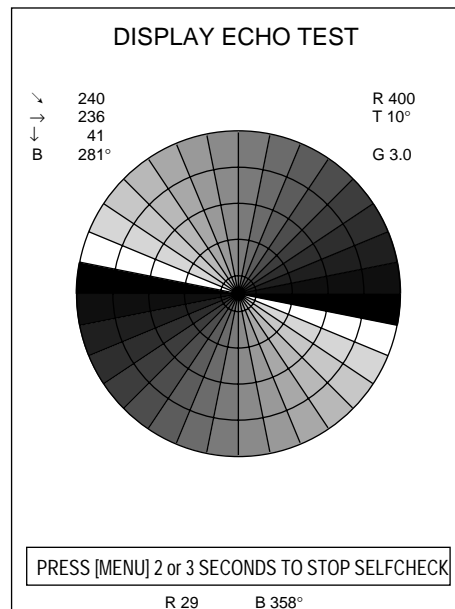


Figure 8-7 Results of SIO test

### Echo-1 test

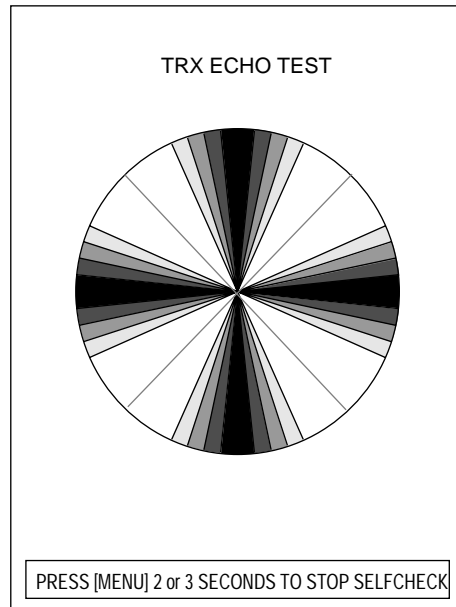
This test checks the echo processing circuits in the display unit for proper operation.



*Figure 8-8 Echo-1 test display*

### **Echo-2 test**

This test checks echo processing circuits in the display unit and transceiver unit.



*Figure 8-9 Echo-2 test display*

**Note:** Appearance of above test pattern may vary slightly depending on the frequency or internal settings.



# SPECIFICATIONS

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## Model

CSH-7-xx (55: 55 kHz, 70: 70 kHz)

## Display

Display	PPI display on 10" non-glare high resolution CRT
Display color	16 colors according to echo strength
Display mode	Normal, *Normal plus text
Display resolution	512 x 384 dot
Markers, indications	Own ship marker, Heading marker, Trackball marker, *Own ship event marker, *Event marker, Unretracted transducer indication, Bearing marker, Range marker, Range rings, *Course line marker, *North marker, *Tidal current marker, *Electronic bearing scale
Data	Scan data (range, tilt angle, gain), Trackball marker data (slant range, horizontal range, depth, bearing), *Event marker data (horizontal range, and depth and bearing at time of entry), Bearing and range marker data (bearing, range), Setting data (New gain, range or tilt setting appears in larger characters for five seconds), *Nav data (speed, course, depth, water temperature), *Own ship data (position in L/L or TDs), *Tidal current data (speed, direction and set depth for three layers)
Units of measurement	Meters, feet, fathoms, passi/braza
Standard features	Interference rejector, video processing, noise limiter, digital data, markers, course line with erasure, unretracted transducer alarm

*\* Requires Interface Module CSH-7050 (option) and appropriate sensor.*

## Range, TX cycle, pulselength

Range, range display

Range (m)	Maximum display range (m)	
	Off-center OFF	Off-center ON
85	110	135
100	130	160
150	195	240
200	260	320
250	325	400
300	390	480
350	455	560
400	520	640
450	585	720
500	650	800
600	780	960
800	1040	1280

1. Ranges shown for off-center on are maximum.
2. Fish school may not be detected depending on its nature or sea conditions, even if it is located within the display range in use.

Pulselength

0.5 to 10 msec, interlocked with range, eleven settings

TX cycle

0.2 sec to 4.0 sec, interlocked with range, eleven settings, can be synchronized with external keying pulse

## Audio Search

Searching method

Echoes in the direction of the bearing marker are audibly monitored with built-in loudspeaker.

Audio output

2 W

Audio frequency

1 kHz

## Transmitter Unit

Transmitter section

High power MOS FET amplifier

Receiver section

Low noise superheterodyne, continuously scanning beam forming, GAIN, TVG (near, far), AGC

Tx frequency

55 kHz or 70 kHz

## Tilt Angle

Tilt beam angle 0° to 55°, continuously variable

## Hull Unit

	CSH-7030	CSH-7031
Transducer travel	600 mm	400 mm
Raising time	25 sec	20 sec
Lowering time	20 sec	14 sec
Driving system	Remote electric control	
Allowable ship's speed	18 knots max, 16 kts during raise/lower operation	

## Power Supply, Power Consumption

24 VDC, 160 W (average), maximum 280 W (ship's speed 16 knots, raising transducer)  
(100 VAC operation with optional rectifier)

## Color

Display unit Panel: N 3.0 Newton No. 5, Cover: 2.5GY 5/1.5

Transceiver unit, hull unit Munsell 2.5G 7/2 Newton No.5

## Environmental Conditions

Temperature 0°C to +50°C

Humidity Less than 85%