FURUNO

OPERATOR'S MANUAL

COLOR SCANNING SONAR

Model   **FSV-35**

FURUNO ELECTRIC CO., LTD.

www.furuno.com

ECF

(Elemental Chlorine Free)

The paper used in this manual
is elemental chlorine free.

FURUNO ELECTRIC CO., LTD.

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・FURUNO Authorized Distributor/Dealer

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IMPORTANT NOTICES

General
- This manual has been authored with simplified grammar, to meet the needs of international users.
- The operator of this equipment must read and follow the instructions in this manual.
  Wrong operation or maintenance can void the warranty or cause injury.
- Do not copy any part of this manual without written permission from FURUNO.
- If this manual is lost or worn, contact your dealer about replacement.
- The contents of this manual and the equipment specifications can change without notice.
- The example screens (or illustrations) shown in this manual can be different from the screens you see on your display. The screens you see depend on your system configuration and equipment settings.
- Save this manual for future reference.
- Any modification of the equipment (including software) by persons not authorized by FURUNO will void the warranty.
- The following concern acts as our importer in Europe, as defined in DECISION No 768/2008/EC.
  - Name: FURUNO EUROPE B.V.
  - Address: Ridderhaven 19B, 2984 BT Ridderkerk, The Netherlands
- The following concern acts as our importer in UK, as defined in SI 2016/1025 as amended SI 2019/470.
  - Name: FURUNO (UK) LTD.
  - Address: West Building Penner Road Havant Hampshire PO9 1QY, U.K.
- All brand, product names, trademarks, registered trademarks, and service marks belong to their respective holders.

**How to discard this product**
Discard this product according to local regulations for the disposal of industrial waste. For disposal in the USA, see the homepage of the Electronics Industries Alliance (http://www.eiae.org/) for the correct method of disposal.

How to discard a used battery
Some FURUNO products have a battery(ies). To see if your product has a battery, see the chapter on Maintenance. If a battery is used, tape the + and - terminals of the battery before disposal to prevent fire, heat generation caused by short circuit.

In the European Union
The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.
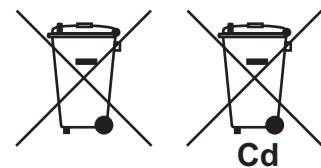
In the USA
The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled. Take the used batteries to a battery collection site according to local laws.
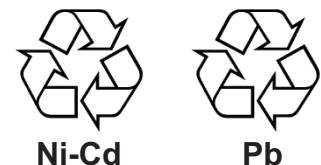
In the other countries
There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycle symbols in the future.

⚠ SAFETY INSTRUCTIONS

The operator of this equipment must read the safety instructions before attempting to operate the equipment.

⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ 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, may result in minor or moderate injury.

⚠ Warning, Caution	🚫 Prohibitive Action	❗ Mandatory Action

⚠ DANGER

Keep away from raise/lower shaft in hull unit when it is moving.

Gears in hull unit will cause serious injury.

⚠ WARNING

Do not open the equipment.

Only qualified personnel should work inside the equipment.

Immediately turn off the power at the switchboard if water leaks into the equipment or something is dropped into the equipment.

Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.

Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.

⚠ WARNING

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Do not install the equipment where it may be subject to rain or water splash.

Fire or electrical shock can result if water leaks in the equipment.

Use the proper fuse.

Use of a wrong fuse can result in damage to the equipment or cause fire.

Do not operate the equipment with wet hands.

Electrical shock may result.

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.

Turn off the power immediately if you feel the equipment is behaving abnormally.

Turn off the power at the switchboard if the equipment becomes abnormally warm or is emitting odd noises. Contact a FURUNO dealer or agent for advice.

⚠ CAUTION

🚫 **Maximum speed while the transducer is projected and being raised or lowered is as below, to prevent damage to the transducer.**

	Projected	Raising/ Lowering
1200 mm stroke	Max. 18 kn	Max. 15 kn
1600 mm stroke	Max. 15 kn	Max. 12 kn

❗ **Replace anticorrosion zinc plate yearly.**

Corrosion between the main shaft and transducer may result if not replaced, allowing water leakage and/or loss of transducer.

⚠ CAUTION

⚠ **Observe the following precautions when using industrial use lubricant.**

Precautions
- Keep lubricant away from eyes. Wear protective goggles when working with the lubricant. The lubricant can cause inflammation of the eyes.
- Do not touch the lubricant. Wear protective gloves when working with the lubricant. The lubricant can cause inflammation of the skin.
- Do not ingest the lubricant. Diarrhea and vomiting may result.
- Keep the lubricant out of reach of children.

Emergency procedures
- If the lubricant enters eyes, flush with clean water about 15 minutes. Consult a physician.
- If the lubricant contacts skin, flush area with clean water.
- If the lubricant is ingested, see a physician immediately.

Disposal of lubricant and its container
Dispose of the lubricant and its container in accordance with local regulations. If you are unclear about the disposal procedure, contact a FURUNO agent or dealer for advice.

WARNING LABELS

Warning labels are attached to the units of the system. Do not remove the labels.

If a label is missing or damaged, contact a FURUNO agent or dealer about replacement

⚠ DANGER
Keep fingers away from gears. Shaft may cause injury. Keep away from moving shaft.
⚠ 危 険
ギヤに巻込まれる恐れあり。上下動シャフトにより、けがをする恐れあり。稼動中は近づかないこと。

Name: Warning Label
Type: 10-071-5313
Code No.: 100-291-160-10

⚠ DANGER
Electrical shock hazard. Do not remove cover. No user-serviceable parts inside. Turn off power before servicing. And wait until charge lamp (green) goes off and then remove cover.
⚠ 危 険
感電の恐れあり。サービスマン以外の方は、カバーを開けないでください。内部には高圧部品が数多くあり、万一さわると危険です。サービスマンがカバーを開ける場合は、電源をOFFした後、CHARGEランプ（緑）が消灯していることを確認してから開けてください。

Name: Warning Label
Type: 10-079-6144
Code No.: 100-310-880-10

⚠ WARNING ⚠
To avoid electrical shock, do not remove cover. No user-serviceable parts inside.
⚠ 警 告 ⚠
感電の恐れあり。サービスマン以外の方はカバーを開けないで下さい。内部には高電圧部分が数多くあり、万一さわると危険です。

Name: Warning Label (1)
Type: 86-003-1011-3
Code No.: 100-236-233-10

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FOREWORD

A Word the Owner of the FSV-35

Congratulations on your choice of the FURUNO FSV-35 Color Scanning Sonar. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

Since 1948, 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.

Thank you for considering and purchasing FURUNO equipment.

Features

The FSV-35 is a full-circle, multibeam electronic color scanning sonar which detects and displays schools of fish on the monitor of your choice.

The main features of the FSV-35 are

- Sphere transducer provides 90 degrees vertical detection.
- Menu-driven operation.
- Vivid 32-color echo strength dependent display for improved recognition of bottom, fish school concentration, distribution and volume.
- Dual Display mode
- Schools of fish can be searched from horizontal (range direction), vertical (depth direction) with vertical features.
- Pitching and rolling compensation for stable picture always.
- User programs for one-touch setup of equipment.
- Function keys for direct access to desired menu item.
- Storage and replay of picture and settings.
- Wide variety of display combination modes: horizontal and vertical.
- Various marks and alphanumeric fishing and navigation information for intuitive operation.
- Fish histogram shows signal strength distribution of echo within estimate mark.
- Audio function for monitoring echoes along user-selected area through loudspeaker (option).
- Fish mark estimates fish speed.
- Fish estimate feature to compare the volume of two schools of fish.
- Net course mark shows probable drift of net against tidal current.

CE declaration
With regards to CE declarations, please refer to our website (www.furuno.com), for further information on RoHS conformity declarations.

SYSTEM CONFIGURATION

Standard configuration is shown with solid line.

The diagram shows the system configuration with the following components:

- Monitor (×2) connected to Processor Unit FSV-3503
- Processor Unit FSV-3503 with connections to:
  - USB device (mouse, etc.)
  - Junction Box FI-5002
  - NMEA IEC 61162-1 device
  - NMEA IEC 61162-1 device
  - Speaker
  - Sub Control Unit FSV-853
- Power input: 12-24 VDC
- Rectifier RU-1746B-2 (100/110/115/220/230 VAC 1ø, 50/60 Hz)
- OR
- AC/DC Power Supply Unit PR-241 (100-230 VAC 1ø, 50-60 Hz)
- IF Unit FSV-8502 connected to:
  - Control Unit FSV-8501 → Remote Controller FSV-854
  - Remote Controller FSV-854
- Transceiver Unit FSV-351 (100/110/115/220/230 VAC 1ø, 50/60 Hz)
- Extension Kit FSV-305-5 or FSV-305-15 (Incl. Junction Box)
- Hull Unit (220 VAC 3ø, 50/60 Hz)

Hull Unit	
Type	Stroke
FSV-303	1200 mm
FSV-304	1600 mm

------- : Optional equipment

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1. OPERATIONAL OVERVIEW

1.1 Control Description

1.1.1 Control unit

Function key   Trackball   Trackball unit
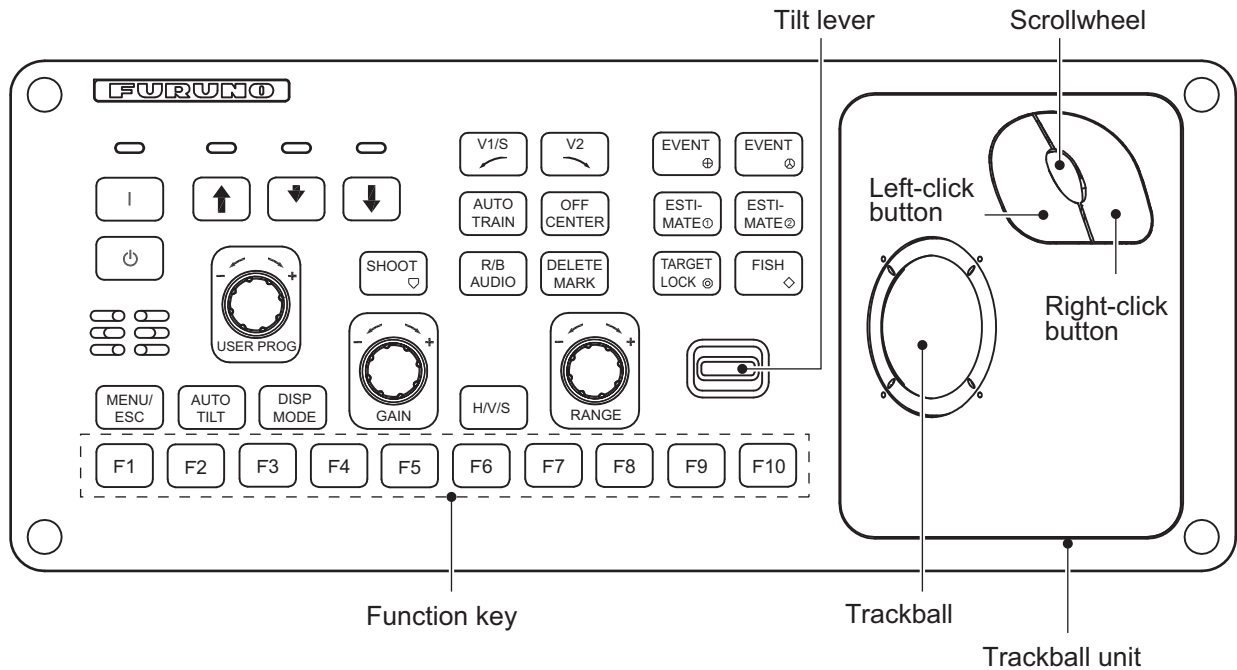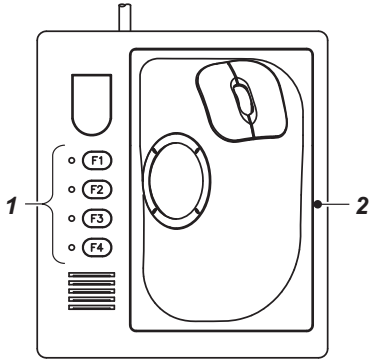
Key	Function
│	Turns power on.
⏻	Turns power off.
⬆	Raises the transducer.
⬇	Lowers the transducer (mid protrusion).
⬇	Lowers the transducer (full protrusion).
SHOOT ▽	Enters the net shooting mark or own ship mark.
V1/S ⌒	Sets vertical cross section bearing.
V2 ⌒	
AUTO TRAIN	Automatic transducer train width on audio bearing mark (horizontal mode), vertical bearing mark (vertical mode).
OFF CENTER	Off centers own ship's position (horizontal mode).
R/B AUDIO	• Displays range and bearing marks (horizontal mode). • Sets the audio bearing.
DELETE MARK	Deletes trackball-selected mark.
EVENT ⊕	Enters event mark 1 or own ship mark (horizontal mode).
EVENT ⊗	Enters event mark 2 or own ship mark (horizontal mode).
ESTIMATE 1	Turns the estimate mark on/off (horizontal mode).
ESTIMATE 2	

Key	Function
TARGET LOCK ◎	Enters target lock mark (horizontal mode).
FISH ◇	Enters fish mark (horizontal mode).
MENU/ESC	**Short-press:** Opens or closes the menu; returns to the previous menu. **Long-press:** Closes all menus.
AUTO TILT	Sets auto tilt angle.
DISP MODE	Selects display mode.
H/V/S	• Selects the mode tab on the menu. • Selects mode to adjust sensitivity, select range, set tilt, and user program number.
Function key (F1 to F10)	Execute assigned program.
USER PROG control	Selects user-programmed settings.
GAIN control	Adjusts gain for horizontal vertical scans.
RANGE control	Selects the display range for horizontal and vertical scans.
Tilt lever	Sets transducer tilt angle for horizontal scans.
Trackball unit	Trackball: • Positions cursor. • Selects items, options on menu. Left-click button: • Confirms the selected item. • Selects the item to drag and drop. Scrollwheel: • Rotate: Sets numeric data. • Rotate: Selects menu item. • Rotate: Sets tilt angle, range, bearing/train angle, gain, and user program number. • Push: Confirms the selected item. • Push: Shows the [Select Mark] window. Right-click button: • Shows pop-up menu. • Confirms the selected item.

1.1.2   Sub control unit (option)

The sub control unit lets you control the sonar from a remote location.

No.	Function (on control unit)	
1	Same as **F1**, **F2**, **F3** and **F4** key. (The program can be changed. See section 5.2.4.)	
2	Same as trackball unit on control unit.	

1.1.3   Remote controller (option)

The remote controller lets you control the sonar from a remote location.

Note: Keep the remote controller away from water and water splash. Hook the remote controller to the bracket when it is not in use.

No.	Function (on control unit)
1	Same as **F1**, **F2** and **F3** key.
2	Same as ↑, ↓, ↓ key.
3	Same as right-click button.
4	Same as the left-click button.
5	Same as [EVENT], [ESTIMATE], [TARGET LOCK] and [FISH] keys.
6	Same as trackball.
7	Same as **OFF CENTER** key.
8	Same as **USER PROG** control.
9	Same as **GAIN** control.
10	Same as **RANGE** control.
11	Same as **SHOOT** key.
12	Records the current picture.
13	Shows the still image window.
14	Same as **DISP MODE** key.
15	Same as **AUTO TRAIN** key.
16	Same as **V1/S**, **V2** key.
17	Same as **AUTO TILT** key.
18	Same as **TILT** lever.
19	Same as **H/V/S** key.

1.2 Turning the Power On/Off

<u>**Turning the power on**</u>

Press the POWER ON (|) switch. A beep sounds, and the display changes in the following sequence: FURUNO splash screen → model display → board test display. Then lamp above the switch changes as below. The last-used mode is activated in approximately 140 seconds after turning the power on.
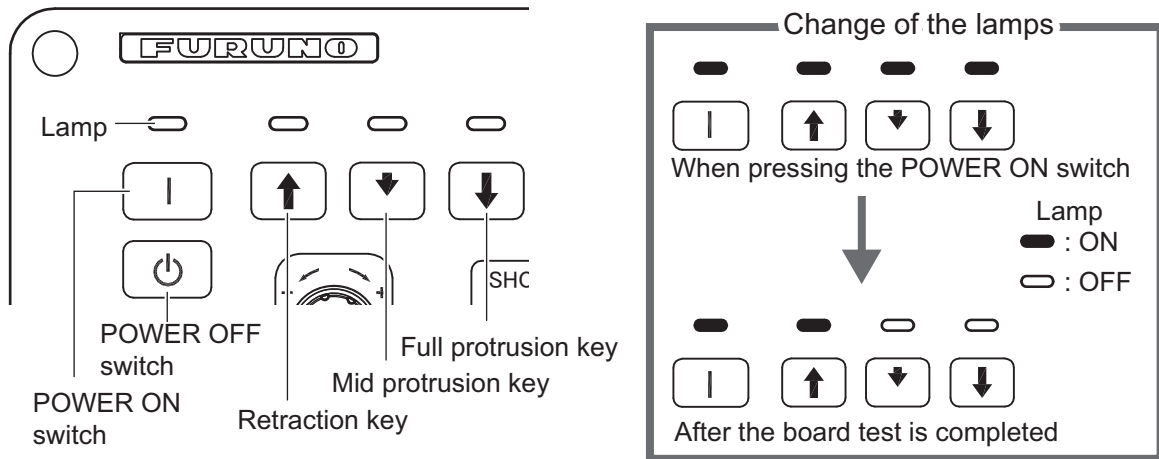
<u>**Turning the power off**</u>

1. First retract the transducer with the ⬆ key. The lamp above the ⬆ key blinks while the transducer is being raised and lights steadily when it is fully raised.
    Note: While raising the transducer, the ship speed must be no more than 12 knots (for 1600 mm stroke) or 15 knots (1200 mm stroke) to prevent damage to the transducer and hull unit.

2. After the ⬆ key lights steadily, press the POWER OFF switch.
    Note: The transducer is automatically retracted into the tank if the POWER OFF switch is pressed before retracting the transducer. However, for safety purposes, retract the transducer before turning off the power.

1.3   Lowering, Raising the Transducer

⚠ **CAUTION**

Maximum speed while the transducer is projected and being raised or lowered is as below, to prevent damage to the transducer.

	Projected	Raising/ Lowering
1200 mm stroke	Max. 18 kn	Max. 15 kn
1600 mm stroke	Max. 15 kn	Max. 12 kn

1.3.1   Lowering the transducer

With the boat at the fishing ground and the power on, press the ⬇ or ⬇ key. The lamp above the key pressed blinks during lowering and lights when the transducer is completely lowered to selected protrusion distance. It takes about 22 seconds for full protrusion in case of 1200 mm stroke and 29 seconds in case of 1600 mm stroke. In normal use fully lower the transducer. If the transducer becomes entangled in the net for some reason, partially raise the transducer with the ⬆ key. This raises the transducer by 400 mm.

1.3.2   Raising the transducer

Press the ⬆ key to raise the transducer. The lamp above the switch blinks while the transducer is being raised and lights steadily when it is fully raised.

1.4   Screen Brilliance, Panel Dimmer

1.4.1   Screen brilliance

The brilliance of an external monitor can not be adjusted from the control unit. Use the associated control on the monitor.

1.4.2   Panel dimmer

1.   Press the **MENU/ESC** key to open the main menu.

Menu	Quit
TX/RX Setting…	
Gain Setting…	
Display Setting…	
Picture Setting…	
Others…	
▼ Shortcut Menu	

2.   Select [Others] then push the left-click button.

Others	Quit
Edit User Program…	
ES Setting…	
2D-Map Disp Setting…	
Erase Marks…	
Wheel Setting…	
Display Setting…	
Alarm & Audio…	
Register…	
Record/Recall…	
Initial Setting…	

3.   Select [Display Setting] then push the left-click button.

Display Setting	Quit
Mode Selection	: Mode Key
Echo Disp Area	: Within Range
H2 DISPLAY	: Landscape
2D-Map Display	: Landscape
2nd Monitor Setting	: Portrait
V-Scan Aspect Ratio	: Fixed
V-Scan Dpt Rng	: 100
Presentation Mode	: Head Up
2D-Map Up	: North Up
TM Disp Range	: 1.6R
Full Screen Area	: 1.6R
Bearing Ref	: Ship Heading
TILT lever	: Tilt
Auto Tilt	: Narrow
F10 Net Course Mark	: Execute
F8 Dimmer	: 7
Key Beep Volume	: 5
TimerDisplay	: OFF

4. Select [Dimmer] then push the left-click button to show the setting box.
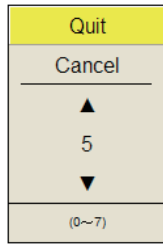
Quit
Cancel
▲
5
▼
(0~7)

5. Select ▲ (increase) or ▼ (decrease).

6. Push the left-click button several times to select a value.

7. Select [Quit] on the setting box then push the left-click button to close the box.

8. Long-press the **MENU/ESC** key to close all menus.

Note: The default function of the **F8** key adjusts the panel dimmer.

1.5   Display Mode, Display Division

There are four display modes; Horizontal, Horizontal1 + Horizontal2*, Vertical1*, and Vertical 1 + Vertical 2*.

*: If the FSV-35 is fitted with dual monitors, you can select how the picture data is shown on two displays; Dual Display or Sub Display. For details, see page 6-3.

Main monitor   Sub monitor
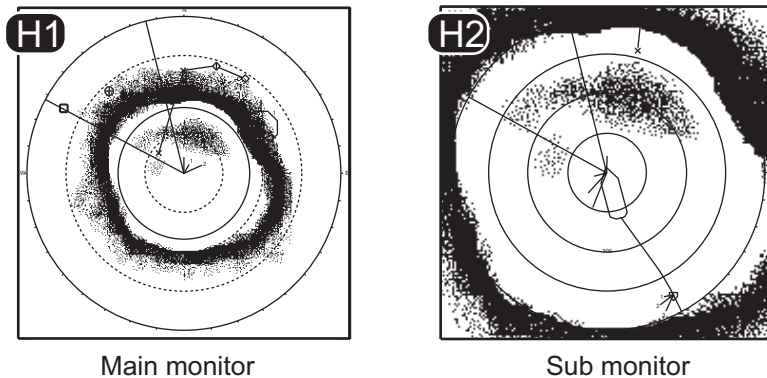
Ex; Dual Display (H1 + H2 mode)

Display format

As shown in the illustration below, you have two choices with which to show the echo display. See page 6-6 for how to select the display method. For the numeric/graphic data display, see chapter 4.
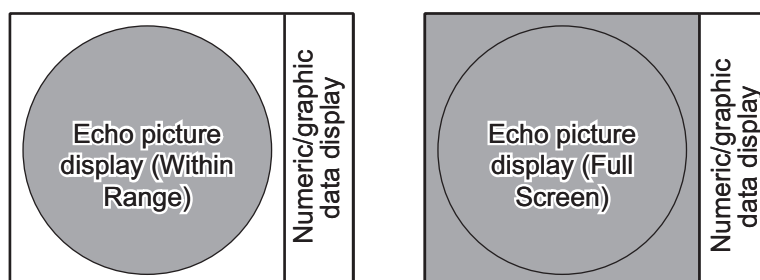
1.5.1 How to select a display mode

Press the **MODE** key several times until the desired display appears. The default modes are Horizontal, Horizontal1 + Horizontal2, Vertical1, and Vertical1 + Vertical2. You can program the **MODE** key to show any or all of the modes mentioned above. For further details, see page 6-6.

The **MODE** key may be programmed to show a pull-down menu instead of a conventional menu.

1. Push the right-click button on the numeric/graphic data display.

Right Click Pop Up Menu	Quit
Menu…	
User Program… : P4	
Display Mode…	
Erase Marks…	
Wheel Setting…	
Data Display…	
Record/Recall…	
▼ Shortcut Menu	
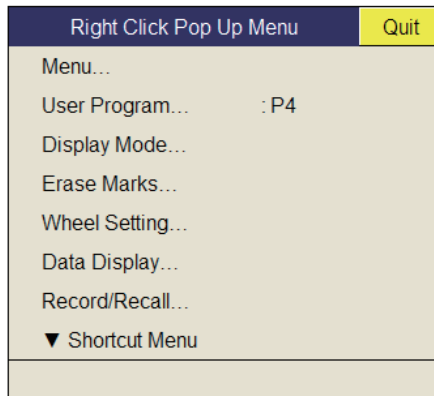
2. Select [Display Mode] then push the left-click button.

H1
H1&H2
V1
V1&V2
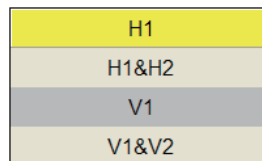
3. Select the mode to display then push the left-click button.

1.5.2 Display mode pictures

Below are typical pictures. For sake of brevity, indications and marks are not shown.

Horizontal mode

This mode provides 360-degree coverage around the vessel and it is useful for general search. For further details, see chapter 2.
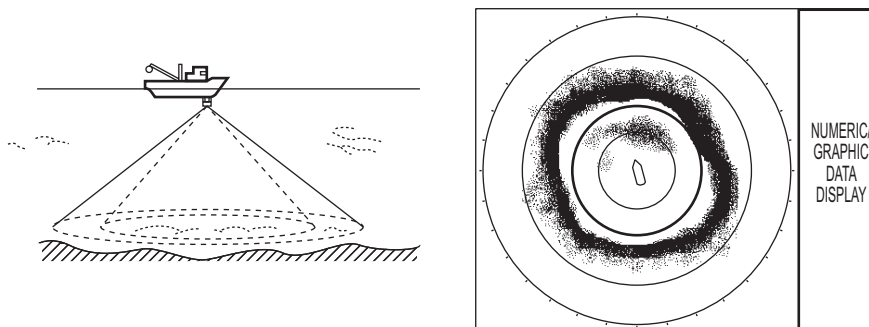
Horizontal mode

H2 mode

This mode provides two horizontal screens (H1 and H2) in one of the configurations shown below. The default configuration, Landscape, shows two horizontal displays, one up and one down. Other configurations available are as shown below. Desired configuration may be selected on [H2 Display] in the [Display Setting] menu. For further details, see chapter 2.
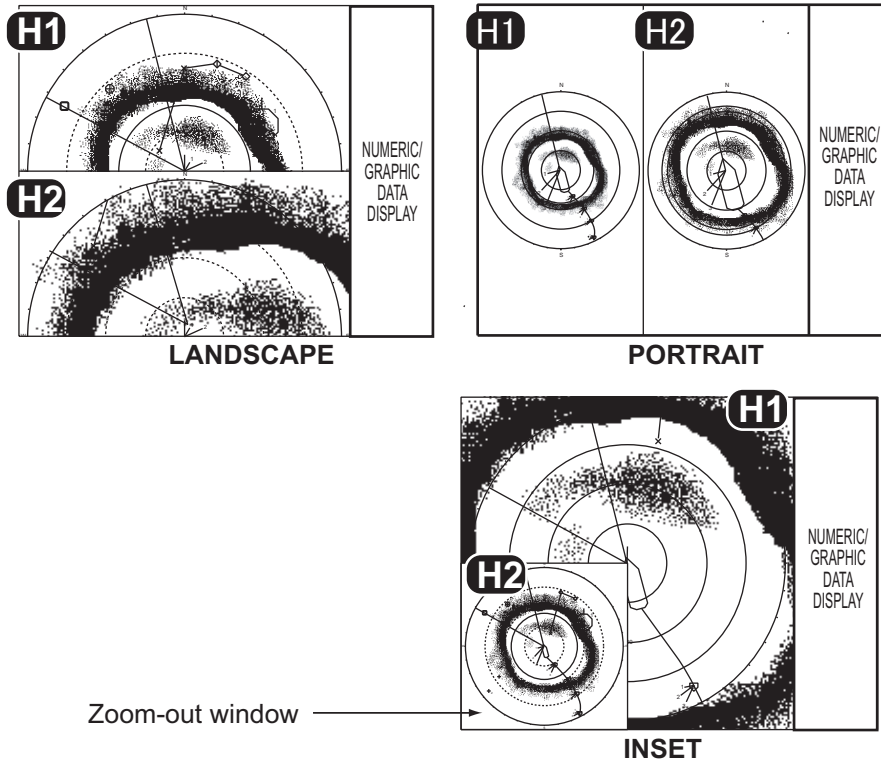
H2 mode

V1 and V2 modes

The V1 and V2 modes show a vertical slice of the bearing selected by the vertical bearing mark on the horizontal display. The vertical 2 mode provides two vertical slices. For further details, see chapter 3.

V1 mode	V1 & V2 mode
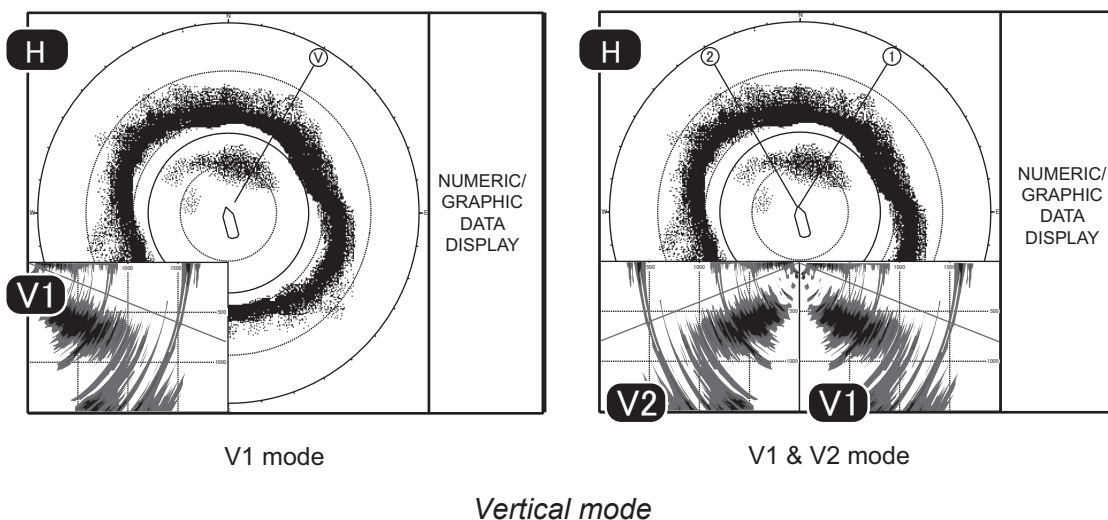
Vertical mode

1.6   How to Adjust the Gain

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

Gain too low	Gain proper	Gain too high
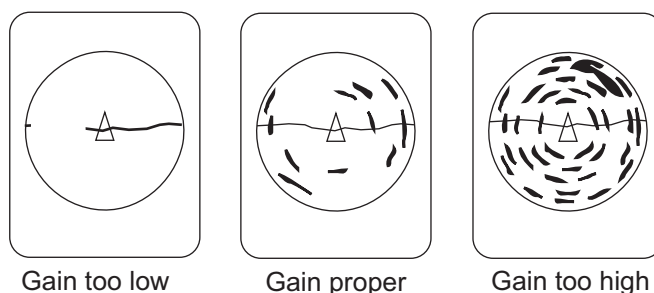
1. If the horizontal and vertical modes are active, press the **H/V/S** key to show the range and gain indications of the mode you wish to adjust. Pressing the **H/V/S** key changes the color of the range and gain indications to orange.

    • H1/H2: Horizontal1 or horizontal2

    • V1/V2: H or V display

2. Adjust the **GAIN** control.

New gain setting is momentarily displayed in large characters at the top of each display. The setting value is always displayed next to "G". (For the vertical display, the gain indication is shown at the bottom of the display.)

Note: The gain can also be adjusted from the gain indication. Put the cursor on the gain indication to highlight it in yellow then roll the scrollwheel.

1.7   How to Use the Menu

Most operations are carried out from the menu. This section provides basic menu operating information.

1. Press the **MENU/ESC** key to open the main menu.

Menu title →

Menu	Quit ←
TX/RX Setting…	
Gain Setting…	
Display Setting…	
Picture Setting…	
Others… ←	
▼ Shortcut Menu	

Select QUIT with trackball and then left click to close the menu.

"…" means that this item has sub menus.

Select "Shortcut Menu" to show the menu title you programmed. (See section 5.1.)

The descriptions for the selected item appears in this field.
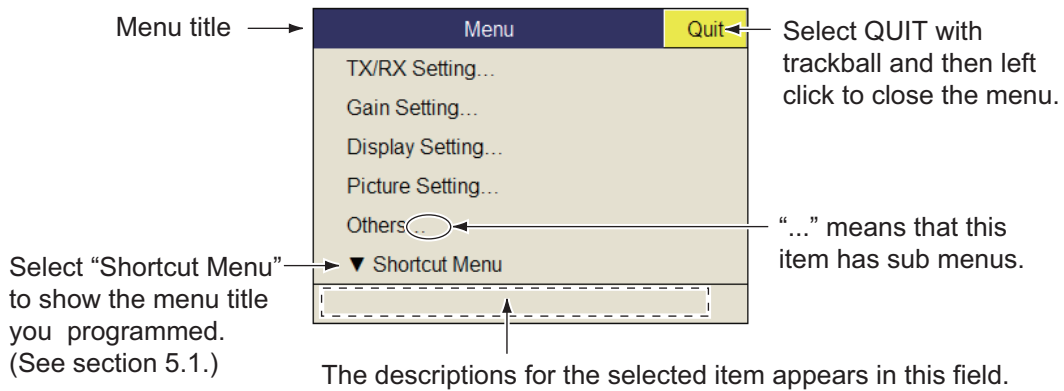
Note: You can also show the main menu by pushing the right-click button to show the pop-up menu. See page 1-12.

2. Operate the trackball to place the arrow cursor on the item you want to select. The yellow cursor marks the current selection. You can also spin the scrollwheel to select a menu item.

3. Push the left button. (If you made the selection by spinning the scrollwheel, push the scrollwheel.) If you selected [TX/RX Setting] at step 2, for example, the following menu appears.

TX/RX Setting		Quit
H1	H2	V
TX Interval	: 9	
TX Pulse Length	: 7	
TX Power	: 7	
F1 Reverberation	: 0	
Freq Shift	: 0	
Freq/Bearing Set	: 16	
Beam Width…		
Bottom Suppress	: 0	

Scanning mode tab →

This icon means that this item is assigned to a function key.

4. Press the **H/V/S** key to select the display mode.

    • H1, H2 tab: Items for horizontal display setting

    • V tab: Items for the vertical display setting

    Items which you can not set are shown in gray.

5. Select the item then push the left-click button.

Quit
Cancel
▲
9
▼
(0~9)

Quit
Cancel
Normal
Wide
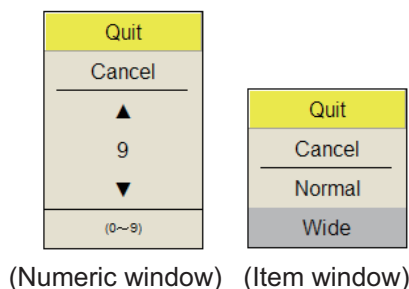
(Numeric window)   (Item window)

6. Select the setting.

   • (Numeric) Select ▲ to increase the value then push the left-click button (or roll the scrollwheel upward). To decrease the value, select ▼ and push the left-click button (or roll the cursor scrollwheel downward).

   • (Items) Select an item then push the left-click button.

7. Select [Quit] on the setting box then push the left-click button to close the box. If you want to cancel the setting, select [Cancel].

8. Long-press the **MENU/ESC** key to close all menus.
   You can also close all menus by selecting [Quit] on the active menu and long-pushing the left-click button.

You can relocate menu windows. Use the trackball to put the arrow cursor on the menu title (blue when menu is active), push the left-click button, drag the window to new location then release the left-click button. The position of the menu windows is saved.

Note 1: In the default setting, the sub menu item [Initial Setting] in the [Others] menu and some items in the [Initialization] menu are shown in red. This means these items are locked to prevent accidental change of setting. When you open one of these sub menus and select an item, the confirmation message shown below appears. To change the setting of the selected item, select [Changeable] and push the left-click button to show the dialog box for the item. To escape, select [Cancel] then push the left-click button.
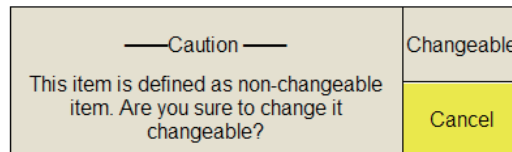
If you do not want to show the confirmation message above, see page 6-16.

Note 2: If two menu items are functionally related, the setting of one menu item may cause restriction to another menu item. In this case, the equipment ignores both settings to use different ones or invalidates the setting of the item encountering restriction. The invalid setting value or menu item is shown in gray.

Pop-up menu operation

Push the right-click button on the numeric/graphic data display to show the pop-up menu. These items can be accessed from the main menu.
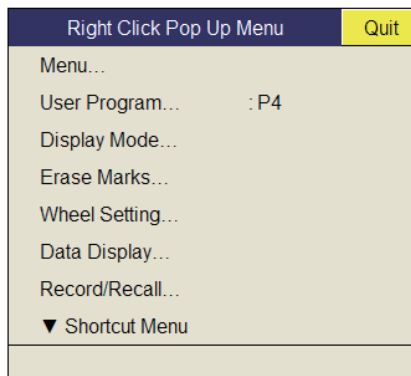
2. HORIZONTAL MODE

2.1 Basic Operating Procedure

2. Lower transducer.
   ▼: Mid protrusion
   ↓: Full protrusion

1. Turn on power.

7. Set tilt angle.

5. Select range.

4. Press to choose the screen (horizontal or vertical, or horizontal1 or horizontal2) to adjust gain and range.

6. Adjust gain.

3. Select horizontical display.
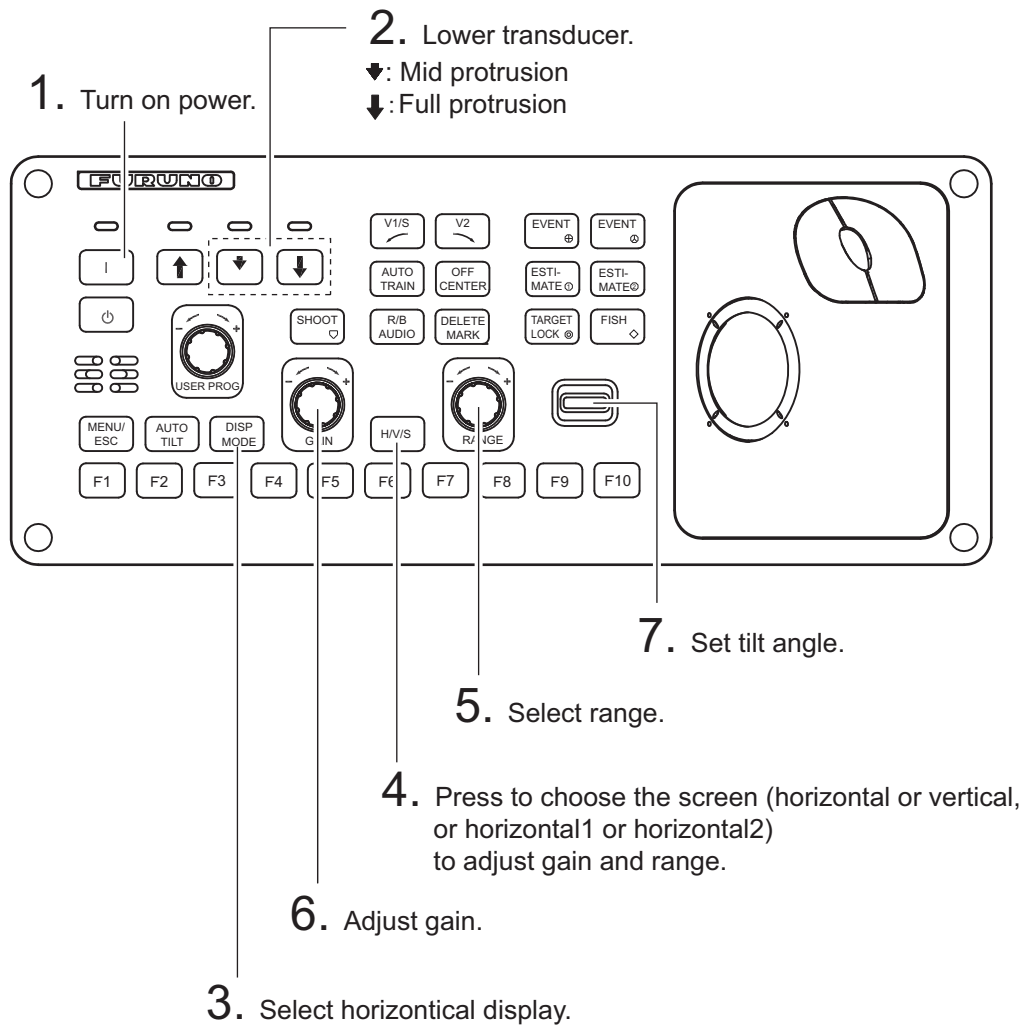
Control unit

2.2 Indications and Markers

2.2.1 Horizontal mode, full-screen display

The full-screen horizontal display provides a 360° picture around the boat. To display the full-screen horizontal picture, press the **DISP MODE** key.

Target lock mark
Fish track*
Fish mark
Net shoot data
Distance run from shooting
Time from shooting
Heading direction*,**
Line connecting fish marks
Latest fish mark
Presentation mode
Display mode
Trackball data
- Slant range
- Horizontal range
- Depth
- Relative bearing or True bearing*
Wind speed, direction*
Scan data
Range
Current auto tilt
Gain
User program no.
Latest event marks
Auto train mark
Audio bearing mark
Heading mark
North mark*
Own ship mark
Current (tide) mark*
Range ring
Bearing scale
Event mark
Fish movement vector
Fish estimate mark no.
Fish estimate mark
Fish estimate mark data
Range mark
Cursor
Own ship position mark
Ship's track*
Event mark data
- Horizontal range
- Present depth
- Depth at time of mark entry
- Relative bearing or True bearing*
Target lock/fish movement data
- Horizontal range
- Depth
- Speed
- Course
Range ring data
Cursor position
Net sonde mark*
Net shoot mark
Range mark and audio bearing mark data

148m 0.51NM
142m 5:32
45m
B 115°
W 12m/s

H-UP H R 400m
AUTO T 17°
(21°)
G 1.0
P 8

34°56.789N
123°45.678E

148m 168m
48m 48m
(210m) (210m)
B 330° B 340°

230m
70m
R 146m S 12.3kn
B 290° C 256°

* ***Requires appropriate sensor.***
** ***Appears with head-up mode.***

Note 1: When the settings listed below are changed, the setting value is shown at the top of the display for five seconds. The location of the setting value can be changed. Contact your dealer for details.

- Gain (See section 1.6.)
- Tilt angle (See section 2.4.)
- Automatic training (See section 2.13.3.)
- Display range (See section 2.3.)
- Automatic tilt (See section 2.4.2.)
- User program (See section 5.3.1.)

Note 2: The color of the event mark, fish mark, and fish estimate mark can be changed on the menu: main menu → [Others] → [Initial Setting] → Change confirmation window → [Mark Display] → [Mark Color].

2.2.2   Horizontal2 mode

The H2 mode shows one of three kinds of horizontal display combinations: Land-
scape, Portrait or Inset as shown on page 1-9. Follow the procedure shown below to
select a combination display. The zoom-out display (shown on the inset mode) can be
moved by drag and drop operation and its size changed from the menu. To show the
horizontal2 mode display, press the **MODE** key and select [H2].

1. Press the **MENU/ESC** key to show the main menu.

2. Select [Others] then push the left-click button.

3. Select [Display Setting] then push the left-click button.

Display Setting	Quit
Mode Selection	: Mode Key
Echo Disp Area	: Within Range
H2 DISPLAY	: Landscape
2D-Map Display	: Landscape
2nd Monitor Setting	: Portrait
V-Scan Aspect Ratio	: Fixed
V-Scan Dpt Rng	: 100
Presentation Mode	: Head Up
2D-Map Up	: North Up
TM Disp Range	: 1.6R
Full Screen Area	: 1.6R
Bearing Ref	: Ship Heading
TILT lever	: Tilt
Auto Tilt	: Narrow
F10 Net Course Mark	: Execute
F8 Dimmer	: 7
Key Beep Volume	: 5
TimerDisplay	: OFF

4. Select [H2 Display] then push the left-click button.

Quit
Cancel
Landscape
Portrait
Inset

5. Select the desired option then push the left-click button.

6. Select [Quit] on the setting box then push the left-click button.

7. Long-press the **MENU/ESC** key to close all menus.

Note: Range, tilt angle, gain and program keys can be adjusted for each display.

2.3 Display Range

The **RANGE** control selects the detection range and eight ranges are preset at the factory. The range selected is momentarily displayed in large characters at the top of the screen. Range is always displayed next to "R" at the top right of the screen.
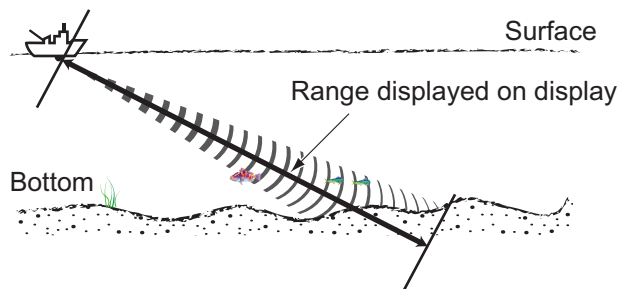
Default settings for the display range (unit: m)

Range No.	1	2	3	4	5	6	7	8
Detection range	200	400	600	1000	1600	2000	3000	4000

Note: Ranges can be preset at the [H-Scan Range] on the [Others] - [Register] menu. See page 6-6.

1. If the vertical display is active, press the **H/V/S** key to select the horizontal display. If the two horizontal displays are active, press the **H/V/S** key to select H1 or H2 to change the range. The range and gain indications of the horizontal mode must be in orange to change the range (and gain).

2. Operate the **RANGE** control to select a range.

Note 1: The range can also be adjusted from the range indication. Put the cursor on the range indication to highlight it in yellow then roll the scrollwheel.
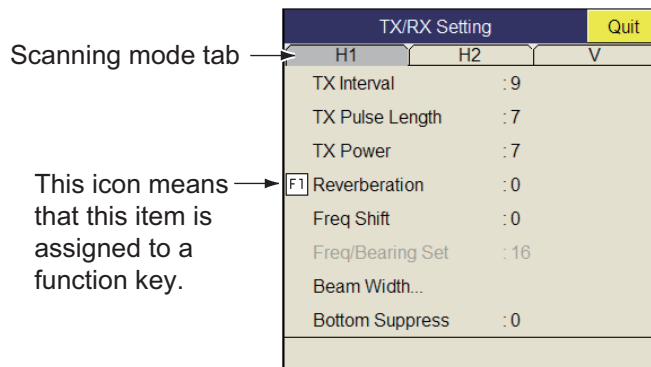
Note 2: In the target lock function, the range is automatically changed according to target position if [Tilt Interlock] on the [Target Lock] menu is selected to [Tilt & Range].

2.4 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 0° and when vertically, 90°. The tilt angle can be set between -5° (upward) to 90° (downward), in increments of 1°. The tilt angles for horizontal 1 and horizontal 2 modes can be set independently of one another.

2.4.1 How to set the tilt angle

To set a tilt angle manually, operate the **TILT** control. Watch the tilt angle indication and tilt angle indicator at the top right corner of the screen. The tilt angle is shown next to "T" at the top right of the screen.

Select tilt angle depending on target fish. For surface fish select a shallow angle (about 5°) and for bottom fish, a deep angle.
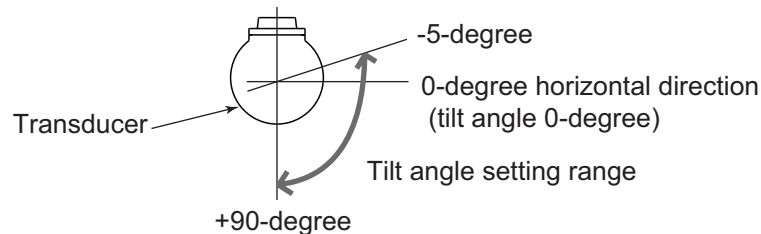
Note 1: In the factory default condition, the tilt angle can also be adjusted by rolling the scrollwheel. For the H2 display, move the cursor into the display where you want to change the setting.

Note 2: The tilt angle can also be adjusted from the tilt angle indication. Put the cursor on the tilt angle indication to highlight it in yellow then roll the scrollwheel.

Note 3: The **TILT** control functions as a bearing setting lever when the following conditions are met: [Tilt Lever] in the [Display Setting] menu is selected to [Tilt & V1], and the vertical display is chosen in the vertical mode.

2.4.2 Automatic tilt

The **AUTO TILT** key automatically scans the tilt angle within the selected width. This is useful when you want to find the center depth of a school of fish. Wide tilt angle is activated from the [Auto Tilt] on the [Others] - [Display Setting] menu.

1. Press the **AUTO TILT** key to select auto tilt angle desired. Each time the key is pressed the auto tilt angle changes in the following sequence.

2. If necessary, operate the **TILT** control to change center tilt angle.
   In automatic tilt, "AUTO" is displayed at the top right corner. To disable automatic tilt, select OFF at step 1.
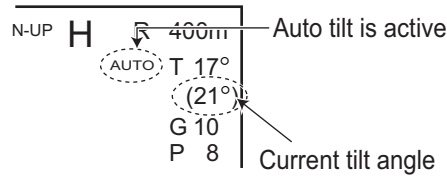
*Automatic tilt angle (narrow) with **AUTO TILT** key*

Range (m)	Width 1	Width2	Width3	Period
60, 100	±4°	±6°	±8°	Period: One transmission
150, 200	±2°	±4°	±6°	**Note**: Tilt angle changes in 2° in-
300, 400	±1°	±2°	±4°	crements for asterisk-marked
500, 600	±1°	±2°	±3°	width; 1° increments for all other
800 1000	±1°	±2°	±3°	widths.
Over 1200	±1°	±2°	±3°	
	±1°	±2°	±3°	

*Automatic tilt angle (wide) with **AUTO TILT** key*

Range (m)	Width 1	Width2	Width3	Period
60, 100, 150	±10°	±16°	±20°	Period: One transmission
200	±10°	±16°	±20°	
300, 400	±10°	±16°	±20°	
500, 600	±8°	±16°	±20°	
800 1000	±6°	±12°	±16°	
Over 1200	±4°	±8°	±12°	
	±2°	±4°	±6°	

For example, when the **RANGE** control, **TILT** control and **AUTO TILT** key are set to 800 m, 8° and width (1) respectively, the tilt angle changes at each transmission as follows: 8°→ 9°→ 8°→ 7°→ 8°.
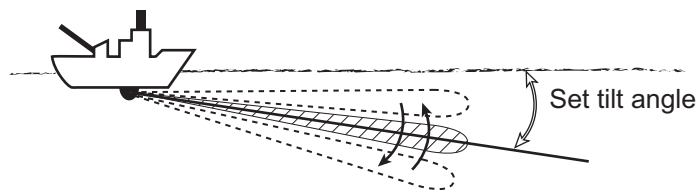
Note 1: The **AUTO TILT** key is inoperative when the target lock function is active or is made active. Auto tilt is available when the target lock is OFF.

Note 2: If the picture set with auto tilt is not visible, disable auto tilt and try again.

2.4.3   Relation between bottom echo and tilt angle

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

Case 1: Tilt angle 30° to 40°: This tilt angle will display the entire bottom since it is captured by the full width of the beam. The school of fish is obscured by the bottom.

Case 2: Tilt angle 10° to 20°: This tilt angle will only display half the bottom since it is captured by only the lower half of the beam. The school of fish is located above the bottom.

Case 3: Tilt angle 0° to 5°: This tilt angle may or may not capture the bottom since the returning bottom echo is weak. The school of fish is located close to the bottom.

Case 1   Case 2   Case 3
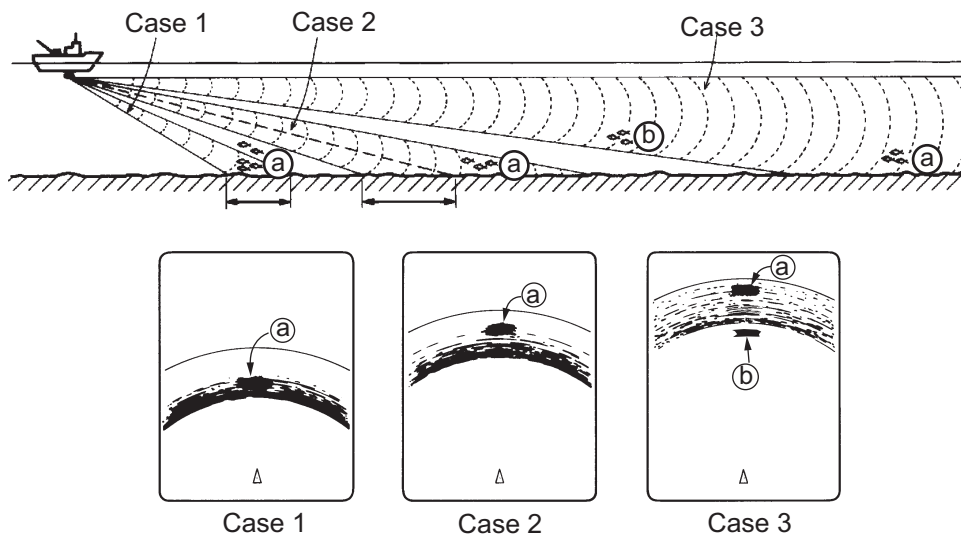
Points to consider

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

2.4.4   Tilt angle for surface fish

Sound emitted from the sonar transducer forms an oval-shaped beam with a width of approximately 18° in the vertical direction (vertical beam width at -6 dB). The tilt angle indicates the angle between the centerline of the beam and the horizontal plane. Then, if the tilt angle is set to 0°, the centerline 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 low 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 for schools of fish on the surface effectively, the tilt angle is usually set between 8° and 9° so the upper portion of the beam becomes almost parallel with the sea surface. When the sea is rough, the tilt angle is slightly increased to lessen the affect of sea surface reflections.
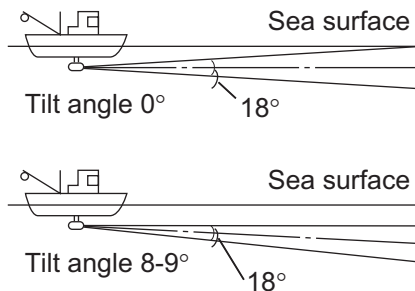
2.4.5   Suitable tilt angle

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.

Tilt angle setting: relationship between tilt angle and detection range
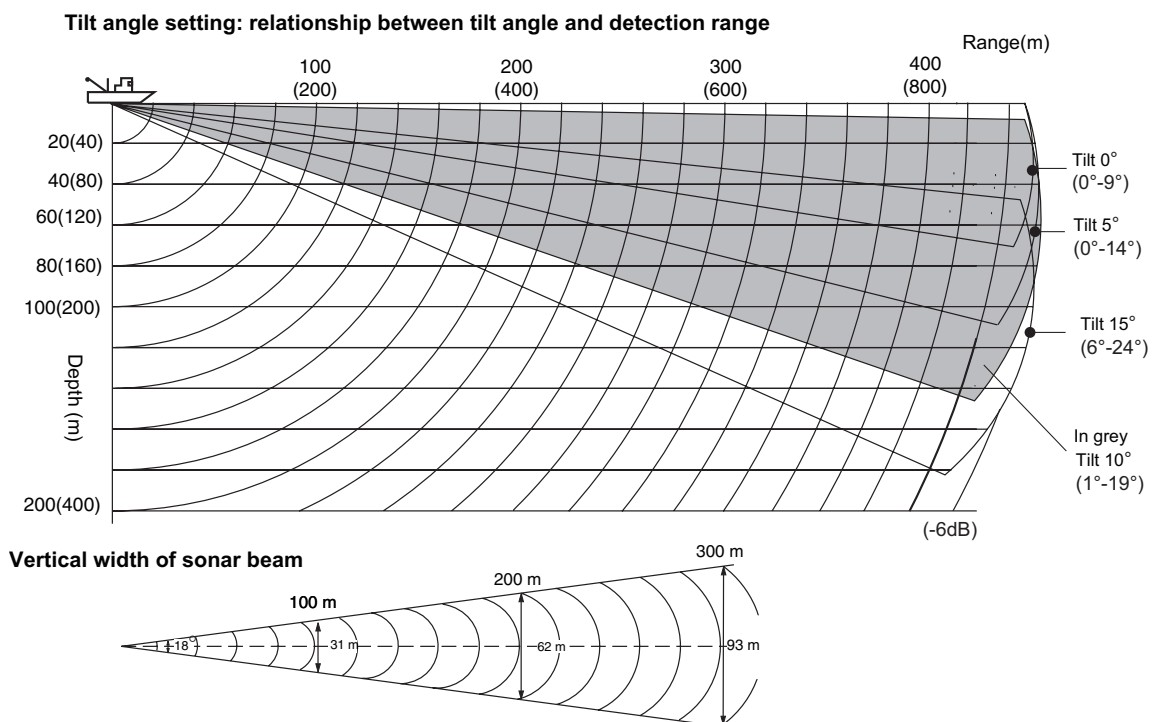
2.5 How to Measure Range and Bearing to a Target

Operate the trackball to place the cursor on the target you want to measure the range and bearing. The range, bearing and depth to the target appear at the upper left corner of the screen.

TRACKBALL DATA

↘ Slant range
→ Horizontal range
↓ Depth
B Relative or
   True bearing

Cursor

Heading line
Own ship mark

Cursor L/L position

34°56.789N
123°45.678E
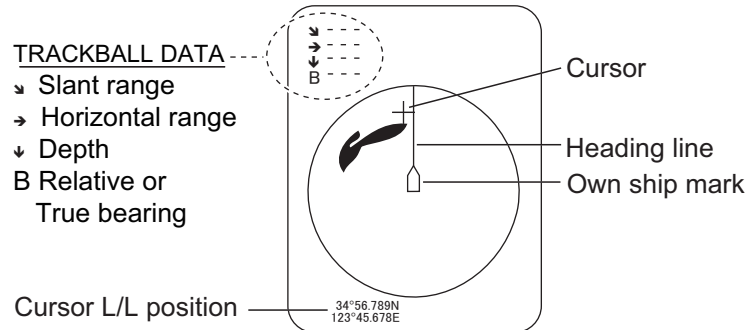
Note 1: Trackball position may also be shown in latitude and longitude. For further details, see page 6-12.

Note 2: The bearing display is available in four formats. See page 6-12.

2.6 How to Eliminate Weak Echoes

Echoes from targets such as bottom 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 due to little propagation attenuation and little absorption. If these echoes are displayed directly on the screen, the size of the displayed echo from the same school of fish may change with distance, making it difficult to judge the actual size of the school of fish. To overcome this inconvenience use the TVG curve function. This function 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.

TVG curve

Four TVG curves are available and they vary the gain from large to small.

1. Press the **MENU/ESC** key to open the main menu.
2. Select the [Gain Setting] menu then push the left-click button.

3. Press the **H/V/S** key to select [H1] or [H2] tab.

4. Select [Sel TVG Curve] then left-click.

5. Select a TVG curve then push the left-click button.
   The smaller the number, the gentler the gain changes over distance.

6. Select [Quit] on the setting box then push the left-click button.

7. Long-press the **MENU/ESC** key to close all menus.

The TVG is also used to suppress unwanted echoes (sea surface reflections, cruising noise, etc.) on near ranges. If the selected curve does not provide satisfactory results, try to adjust [TVG-Near], [TVG-Medium] or [TVG-Far], as shown below.

TVG distance and setting

This sonar has three TVG functions, NEAR, MEDIUM and FAR, and they mainly compensate for propagation loss on short, middle and long ranges respectively, centered at the ranges shown below. The higher the TVG setting, the greater the amplification of echoes.
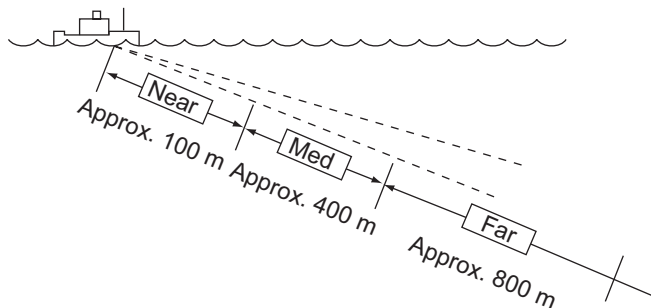
1. Press the **MENU/ESC** key then push the left-click button to open the main menu.

2. Select [Gain Setting] then push the left-click button.

3. Press the **H/V/S** key to select [H1] or [H2] tab.

4. Select [TVG Distance] then push the left-click button.

5. Select [Changeable] then push the left-click button.

Current settings ——

	▲	▲	▲	Quit
Near	Middle	Far		
50	300	680		
▼	▼	▼		Cancel
(50~150)	(300~500)	(600~1000)		

Select item with trackball; push left-click button to adjust.
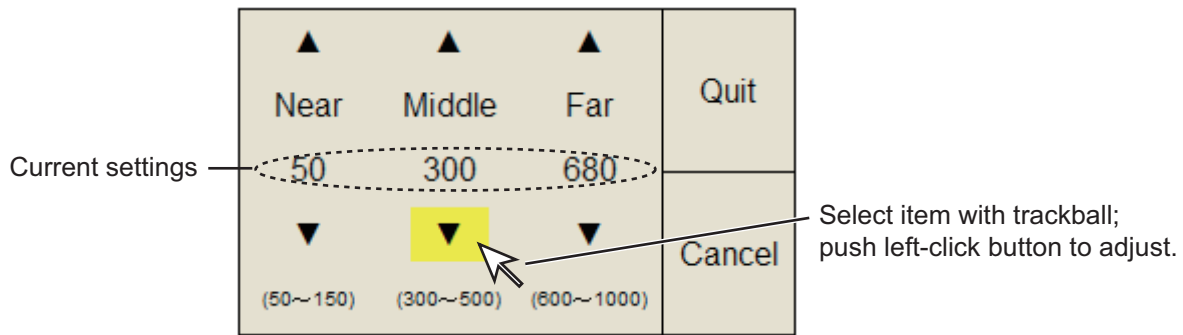
6. Select [Near], [Meddle] or [Far] as appropriate then push the left-click button to change the setting.
    Near: Setting range, 50 to 150 m, 10 m increments. Med: Setting range, 300 to 500 m, 20 m increments Far: Setting range, 600 to 1000 m, 40 m increments

7. Select [Quit] on the setting box then push the left-click button.
    Adjust the TVG level for selected TVG distance as follows.

8. Select [TVG-Near], [TVG-Med] or [TVG-Far] as appropriate then push the left-click button.

9. Select ▲ or ▼ as appropriate then push the left-click button to change the setting. The setting range is -5 to 5. The higher the setting, the higher the gain. For strong echoes such as sea surface reflections or plankton layer lower the setting by 1 or 2.

10. Select [Quit] on the setting box then push the left-click button.

11. Long-press the **MENU/ESC** key to close all menus.
    Note: When a school of fish is located on a long-range setting (about 800 meters) and is approaching own ship, do as follows:

    1) Adjust the tilt to keep the school of fish in the center of the sonar beam, namely, the school of fish is displayed in strongest colors possible.

    2) Confirm that the fish echo is displayed in the same color as it approaches.

    3) If the color suddenly changes to weaker colors as the fish enters MEDIUM and NEAR areas, the TVG is improperly set. Adjust the TVG.

    4) If this setting produces sea surface reflections and noise, try to remove them with the AGC (section 2.7.1) and noise limiter (section 2.9.5).

2.7   How to Adjust Strong, Weak Echoes

2.7.1   AGC

The AGC function automatically reduces the receiver gain only against strong echoes such as the bottom or a large school of fish. Since the AGC function does not affect weak echoes, a small school of fish becomes easier to detect. Adjust it so that the AGC works only on bottom reflections. Do not set it too high; weak echoes may be missed.

1.   Press the **MENU/ESC** key to show the main menu.

2.   Select the [Gain Setting] then push the left-click button.

3.   Press the **H/V/S** key to select [H1] or [H2].

4.   Select [AGC] then push the left-click button to show the setting box.

5.   Select ▲ or ▼ then push the left-click box to change the setting.
     The setting range is -9 to 9. The higher the setting, the higher the degree of suppression.

6.   Select [Quit] on the setting box then push the left-click button to close the box.

7.   Long-press the **MENU/ESC** key to close all menus.

2.7.2   Near AGC

When the water is shallow or heavily sedimented, the unwanted and scattered echoes from close-in may be excessively strong. In this case, a school of fish which is displayed at between 300 and 500 m may disappear gradually when the ship starts approaching the school of fish.

Use the Near AGC feature to suppress this strong echo. Normally set it between 3 and 4, however, this setting depends on the sea condition. Do not set it too high; all echoes (including noise) from near distance may be painted in red.

1.   Press the **MENU/ESC** key to show the main menu.

2.   Select the [Gain Setting] then push the left-click button.

3.   Press the **H/V/S** key to select [H1] or [H2] tab.

4.   Select [Near AGC] then push the left-click button to show the setting box.

5.   Select ▲ or ▼ then push the left-click button to change the setting.
     The setting range is -30 to 30. The higher the setting, the stronger the echo level on near range.

Near AGC	Quit
Near AGC	: 0
Near AGC Distance	: 100m

6.   Select [Quit] on the setting box then push the left-click button to close the box.

7.   Long-press the **MENU/ESC** key to close all menus.

Note: The range which Near AGC covers is set at [Near AGC Distance] in the [Near AGC] menu. The setting range is 20 to 500 m (20 m step). The setting range can be changed. For details, contact your dealer.

2.7.3 2nd AGC

While it is ideal to suppress bottom echoes with the AGC alone, there are some fishing grounds where this is not possible. (The high power sonar has the advantage of long-range detection but this can also be a disadvantage, since weaker echoes may be hidden in strong, unwanted echoes such as the bottom.) If you cannot suppress bottom echoes or sea surface reflections by the AGC function alone, use the 2nd AGC feature. Normally a setting of 1 or 2 is suitable. For especially strong echoes, use a setting of 3 or 4.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Gain Setting] then push the left-click box.
3. Press the **H/V/S** key to select the [H1] or [H2] tab.
4. Select [2nd AGC] then push left-click button.
5. Select [2nd AGC] again then push the left-click button.

2nd AGC	Quit
2nd AGC	: 2
Distance	: 0m
Type	: Normal

6. Select ▲ or ▼ then push the left-click button to change the setting.
   The setting range is 0 to 12. The higher the setting, the stronger the suppression on long range.
7. Select [Quit] on the setting box then push the left-click button to close the box.
8. Long-press the **MENU/ESC** key to close all menus.

Other AGC-related items on the [2nd AGC] menu

Distance: Set the start range for the 2nd AGC. The setting range is 0 to 2000 m, in 20 m increments. 2nd AGC is inoperative if the display range is lower than the 2nd AGC start range.

Type: Select the TVG type for 2nd AGC. Select [Normal] for everyday use.

2.7.4 How to shorten pulse length

The pulse length 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, the ability to separate several closely located targets. When searching bottom fish, therefore, it is useful to shorten the pulse length in order to separate fish echoes from bottom reflections.

Note: For search of surface and midwater fish in which bottom reflections are not so strong, use the longest pulse length "9".

1. Press the **MENU/ESC** key to show the main menu.

2. Select [TX/RX Setting] then push the left-click button.

3. Press the **H/V/S** key to select [H1] or [H2] tab.

4. Select [TX Pulse Length] then push the left-click button.

5. Select ▲ or ▼ then push the left-click button to change the setting. The setting range is 0 to 9. The higher the setting, the longer the pulse length.

6. Select [Quit] on the setting box then push the left-click button to close the box.

7. Long-press the **MENU/ESC** key to close all menus.

TX/RX Setting		Quit
H1	H2	V
TX Interval	: 9	
TX Pulse Length	: 7	
TX Power	: 7	
Reverberation	: 0	
Freq Shift	: 0	
Freq/Bearing Set	: 16	
Beam Width...		
Bottom Suppress	: 0	

2.8 How to Suppress Bottom and Sea Surface Reflections in Shallow Waters

In shallow fishing grounds with hard or rocky bottom, bottom reflections often interfere with wanted fish echoes and they can not be eliminated sufficiently with the aforementioned TVG and AGC functions, especially when the Tilt is set to a larger angle in order to track schools of fish approaching within 400 m. In such cases try to reduce the output power by adjusting the Tx power instead of turning down the gain. The picture becomes clearer when the output power is reduced rather than when the gain is decreased as illustrated below.
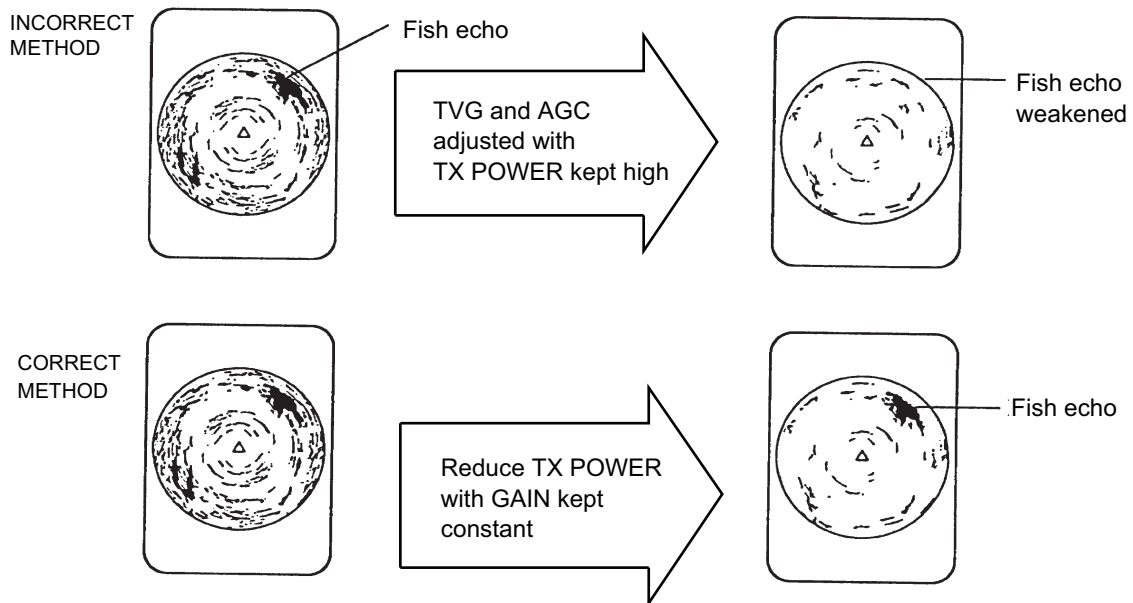
INCORRECT METHOD — Fish echo — TVG and AGC adjusted with TX POWER kept high → Fish echo weakened

CORRECT METHOD — Reduce TX POWER with GAIN kept constant → Fish echo

1. Press the **MENU/ESC** key to show the main menu.
2. Select [TX/RX Setting] then push the left-click button.
3. Press the **H/V/S** key to select [H1] or [H2] tab.
4. Select [TX Power] then push the left-click button.
5. Select ▲ or ▼ then push the left-click button to change the setting. The setting range is 0 to 9. The higher the setting the greater the TX power.
6. Select [Quit] on the setting box then push the left-click button to close the box.
7. Long-press the **MENU/ESC** key to close all menus.

2.9 How to Reject 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.

2.9.1 How to identify the noise source

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

1. On the [Test] menu, turn [TX] off to stop transmitting. Turn on the power of all on-board equipment one by one while observing the picture. If noise appears on the sonar display, that equipment is emitting noise. Check the offending equipment's ground and installation.

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 one of the following:

2.9.2 Change TX interval

When other sonars nearby are operating the same transmission interval as that of own ship's sonar, rings of interference appears on the display.

To remove the rings from the screen, do the following:

Interference

Tx interval high   Tx interval lowered

1. Press the **MENU/ESC** key to show the main menu.

2. Select [TX/RX Setting] then push the left-click button.

3. Press the **H/V/S** key to select [H1] or [H2] tab.

4. Select [TX Interval] then left-click.

5. Select ▲ or ▼ then push the left-click button to change the setting. The setting range is 0 to 9. The higher the setting, the longer the TX interval. For no external KP intput, the setting 0 gives the same TX interval as setting 9.

6. Select [Quit] on the setting box then push the left-click button to close the box.

7. Long-press the **MENU/ESC** key to close all menus.

Note: When you operate the sonar with the following settings in shallow water, the sea clutter from the previous transmission may appear in near range. To suppress the clutter, reduce the [TX Interval] by 2 or 3.

• Range: 60 to 200 m

• TX Pulse setting: 9
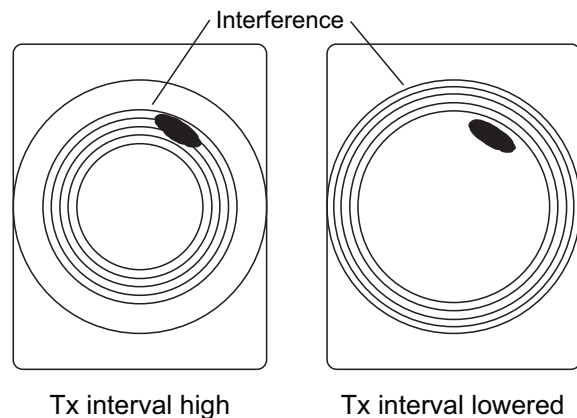
2.9.3   Interference rejector

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.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Picture Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [H1] or [H2] tab.
4. Select [Int Reject] then push the left-click button.
5. Select ▲ or ▼ then push the left-click button to change the setting. The setting range is 0 to 3. The higher the setting, the greater the degree of interference rejection.
6. Select [Quit] on the setting box then push the left-click button to close the box.
7. Long-press the **MENU/ESC** key to close all menus.

2.9.4   Shift TX frequency

If the interference cannot be suppressed by the interference rejector or change in TX interval, change the TX frequency from the [Frequency] menu.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [TX/RX Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [H1] or [H2] tab.
4. Select [Freq Shift] then push the left-click button.
5. Select ▲ or ▼ then push the left-click button to change the setting. The setting range is -30 to 30.
6. Select the [Quit] on the setting box then push the left-click button to close the box.
7. Long-press the **MENU/ESC** key to close all menus.

Note: In some cases, the TX frequency can not be changed because of operating bandwidth. In this case the TX frequency setting is grayed.

2.9.5 Noise limiter

Weak, unwanted reflections, colored light-blue or green, appear when the water is dirty, plankton layers exists, or due to ship's noise. The noise limiter can reduce the effects of these unwanted reflections. Raising the setting causes unwanted reflections to be displayed in colors of blue to background color.

1. Press the **MENU/ESC** key to show the main menu.

2. Select [Display Setting] then push the left-click button.

3. Press **H/V/S** key to select the [H1] or [H2] tab.
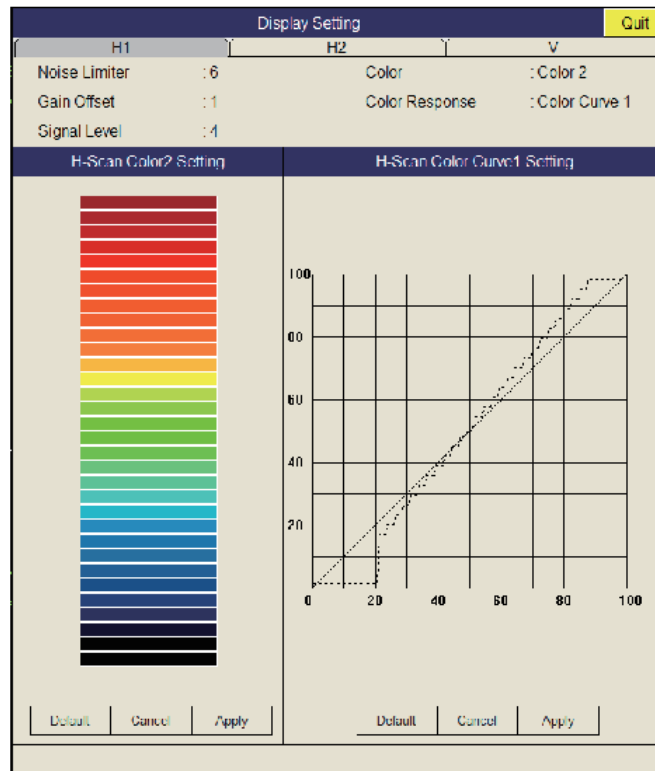
4. Select [Noise Limiter] then push the left-click button.

5. Select ▲ or ▼; then push left-click button to change setting. The setting range is 0 to 15. The higher the setting, the higher the degree of the suppression.

6. Select [Quit] then push the left-click button to close the box.

7. Long-press the **MENU/ESC** key to close all menus.

2.9.6 Reverberation

You may select the length of reverberation for the echo signal, with [Reverberation] on the [TX/RX Setting] (H1 or H2 tab). The setting range is 0 to 5. The larger the setting, the lower the reverberation effects. Set the length of reverberation properly to make it easier to see the echo signal.

2.9.7 Echo average

[Echo Average] (H1 or H2 tab) on the [Picture Setting] menu adjusts echo afterglow - the amount of time an echo signal remains on the screen. This feature can be useful for watching echo movement. The setting range is 0 to 11. **Setting between 1 and 7**: Echoes are gradually displayed and afterglow remains on the screen longer as the setting is increased.**Setting between 8 and 11**: Echoes are quickly displayed and afterglow remains on the screen longer as the setting is increased.

2.9.8 Reference bearing in frequency shift

The reference bearing in frequency shift can be changed to avoid sonar interference and noise. If noise or interference appears at a specific bearing, change the value of the [Freq/Bearing Set] in the [TX/RX Setting] (H1 or H2 tab) menu. The setting range is 0 to 31 (0° to 348.75°) and the default setting is 16 (180°).

Note: [Freq/Bearing Set] is valid when [Sidelobe Sup] is selected to other than 0°.

2.9.9 How to suppress the gain of bottom echo

Stationary echoes such as bottom echo, plankton echo, etc., may be suppressed with [Bottom Suppress] in [TX/RX Setting] (H1 or H2 tab). Moving echoes such as fish school are not affected by this setting. The setting range is 0 to 10. The higher the setting, the greater the suppression level of the bottom echoes.

Note: Do not use an unnecessarily high setting since it may also suppress slow-moving fish echoes.

2.10 How to Adjust Beamwidth

The width of the horizontal beam can be adjusted from the [Beam Width] menu.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [TX/RX Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [H1] or [H2] tab.
4. Select [Beam Width] then push the left-click button.
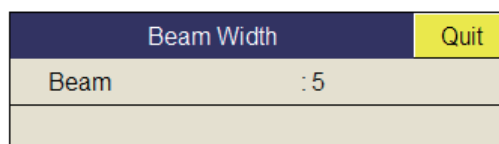
Beam Width	Quit
Beam : 5	

5. Select [Beam] then push the left-click button.
6. Select [▲] (raise setting) or [▼] (lower setting) to adjust the beamwidth. The setting range is -4 to 30 and AR.
   -4 to -1: Raise the setting to sharpen the vertical beamwidth.

0 to 4: Raise the setting to sharpen both the horizontal and vertical beamwidth.
5: Get the sharpest horizontal beam.
6 to 30: Rase the setting to sharpen the horizontal beam in five steps while changing the vertical beam width.
AR (Automatic Range): The horizontal beamwidth is automatically adjusted according to the selected range.

7. Select [Quit] on the setting box then push the left-click button to close the box.

8. Long-press the **MENU/ESC** key to close all menus.

2.11 How to Track a School of Fish

The target lock function automatically tracks a school of fish so you will not lose sight of it on the display. Two types of target lock are available: position tracking and tracking of school of fish. Select one from the menu as shown in the procedure that follows. The default setting is tracking of school of fish. Speed and bearing data are required. The FSV-35 can not track a school of fish if the level of the echo is too weak.
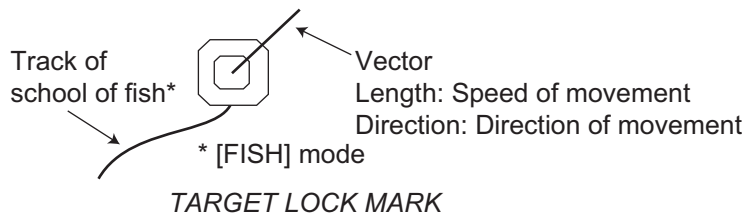
TARGET LOCK MARK

One target lock mark is shown. For the Horizontal 2 display, the mark is shown on the applicable display. The target lock mark does not appear on the displays where it can not be inscribed.

2.11.1 How to select the target lock mode

Note that the target lock mode cannot be changed while the target lock mode is displayed.

1. Press the **MENU/ESC** key to show the main menu.

2. Select [Others] then push the left-click button.

3. Select [Initial Setting] then push the left-click button.

4. Select [Changeable] then push the left-click button.

5. Select [Target Lock] then push the left-click button.

Target Lock	Quit
Tracking Method	: Fish
Tilt Interlock	: Tilt&Range
Mark Interlock	: Estimate Mark
Tracking Data	: H & V
Threshold	: 16
Bottom Threshold	: 3
Target Speed Limit	: 5kn
Smoothing	: 0.5
Target SPD Update	: 60Sec
Target Lock Window	: Small
Dimension Setup	: 25t/1000m²
Volume Setup	: 25t/1000m³

6. Select [Tracking Method] then push the left-click button.

7. Select [Fish] or [Target Mark] then push the left-click button. See section 2.11.2 and section 2.11.3.

8. Select [Quit] on the setting box then push the left-click button to close the box.

9. Long-press the **MENU/ESC** key to close all menus.

Quit
Cancel
Target Mark
Fish
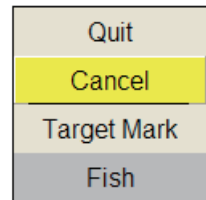
2.11.2 Fish mode

The automatic echo target lock function automatically tracks the operator-selected school of fish. When [TILT INTERLOCK] on the [TARGET LOCK] menu (previous page) is set to [TILT & RANGE], and the tracked school of fish goes out of the zone in the range direction, the range and tilt are automatically controlled according to the position of the school of fish.

1. Select [Fish] in the procedure in section 2.11.1.

2. On the horizontal display, use the trackball to select the school of fish to track.

3. Press the **TARGET LOCK** key.
   The target lock mark (⊚) with vector is put on the school of fish. The color of the mark is initially red, and turns white when the echo is recognized as a school of fish. The vector shows the speed and direction of movement of the school of fish. The tip of the vector is the estimated position of the school of fish when the vector time elapses. The target lock mark appears on the vertical display, however the vector is not shown.
   If the target is lost, the target lock mark changes to red color and the tracking mode changes to position mode (see the next section) at that position. When the sonar detects and tracks the target again, the FISH mode is restored.

Target lock mark

Track of school of fish (Turned ON or OFF on Mark Display menu.)

TARGET LOCK DATA
⊡
➡ 2975m (Horizontal range)
⬇ 153m (Depth)
S 12.3kn (Speed)
C 256° (Course)

Vector (Heading data required)

4. To disable the target lock, press the **TARGET LOCK** key.

2.11.3 Target mark mode

This mode tracks a stationary position (such as a reef) using position data fed from a navigator.
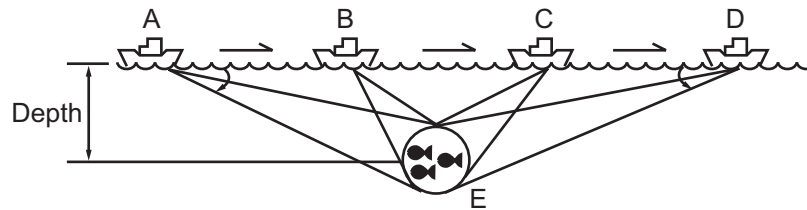
1. Select [Target Mark] in the procedure in section 2.11.1.

2. On the horizontal display, use the trackball to select the location to track.

3. Press the **TARGET LOCK** key.
   Tilt, range and vertical bearing are automatically adjusted to track the location. Using the figure above as an example, the target lock mark is placed on location E. Then, the equipment remembers the location of E and automatically changes the tilt angle as the ship moves from position A through D. As long as the school of fish E is stationary its echo is kept displayed on the screen.

4. To disable the target lock, press the **TARGET LOCK** key.

2.11.4 Target lock menu description

Target lock functions not previously mentioned are described below.

Tilt Interlock: Provides automatic change of tilt angle and range or tilt angle in target lock. (Setting options: [OFF], [Tilt], [Tilt&Range])

Mark Interlock: Turns numeric/graphic data displays ON/OFF in target lock. [Off] turns off both the estimate mark 1, 2 histogram and data display. [Estimate Mark] enables the estimate mark 1, 2 histogram. [Est & Fish Info] enables the both the estimate mark 1, 2 histogram and data display.

Tracking Data: Selects which target lock tracking data to use, horizontal or both horizontal and vertical.

Threshold: Selects the minimum signal level to use in target lock tracking. The setting range is 1 to 30. Target lock tracks a target whose signal level is greater than set here.

Bottom Threshold: When a target is judged as a bottom echo, raise this setting to differentiate bottom from target. The setting range is 0 to 5.

Target Speed Limit: Sets maximum fish speed to track. The setting range is 1 kn to 15 kn.

Smoothing: Sets smoothing rate for fish speed data. The higher the setting, the smoother the position of the target lock target. Avoid oversmoothing, to prevent delay in tracking when own ship or target moves suddenly. The setting range is 0.0 to 1.0.

Target SPD Update: Sets the interval at which fish speed data is updated. The intervals are 15, 30, 45 and 60 seconds.

Target Lock Window: Selects the size of target lock detection area; normal, large, largest. (The area is not indicated on the screen.)

Dimension Setup: Sets dimension constant for calculation of weight (ton) of school of fish from the dimension of the school of fish.

Volume Setup: Sets volume constant for calculation of weight (ton) of school of fish volume.

2.12 Presentation Mode

2.12.1 Presentation mode description

This sonar has four presentation modes, head-up, north-up, course-up and true motion. Select one with [Presentation Mode] in the [Others] - [Display Setting] menu.

Head-up   North-up   Course-up   True Motion
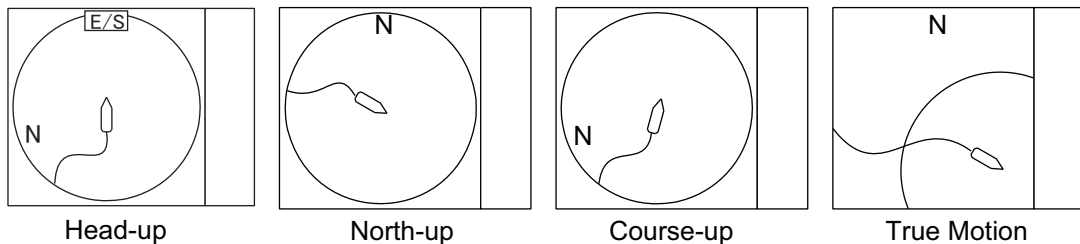
Head-up: The display is oriented toward ship's heading. The heading direction appears at the top of the display. Own ship position is fixed at the screen center. Echoes from fish and the bottom move on the screen relative to own ship's movement. This mode is useful for general use.

North-up: The display is oriented so North is at the top of the screen. Own ship position is fixed at the screen center and own ship mark pivots with ship's movement. Echoes from fish and the bottom move on the screen relative to own ship's movement.

Course-up: The display is oriented according to course. Own ship position is fixed at the screen center. Echoes from fish and the bottom move on the screen relative to own ship's movement. Targets are displayed at ship's bow.

True Motion: Stationary objects are fixed and own ship and fish echoes move on the display in accordance with their true courses and speeds. Thus you can observe own ship and fish echo movement with respect to the bottom. This mode requires speed and heading data. When own ship mark reaches an edge of the off-center effective area it is automatically returned to the screen center as below.
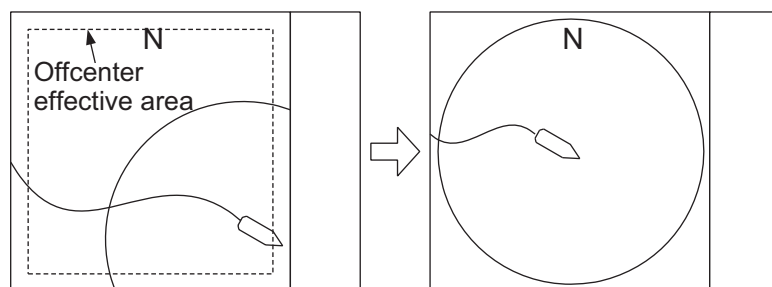
(a) Own ship mark reaches an edge of offcenter effective area

(b) Own ship mark is automatically returned to screen center

Automatic return of own ship mark in true motion

2.12.2 How to select a presentation mode

1. Press the **MENU/ESC** key to show the main menu.

2. Select [Others] then push the left-click button.

3. Select [Display Setting] then push the left-click button.

4. Select [Presentation Mode] then push the left-click button.
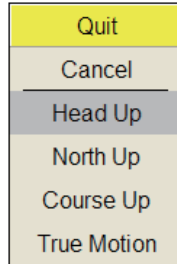
5. Select desired mode then push the left-click button.

6. Select [Quit] on the setting box then push the left-click button to close the box.
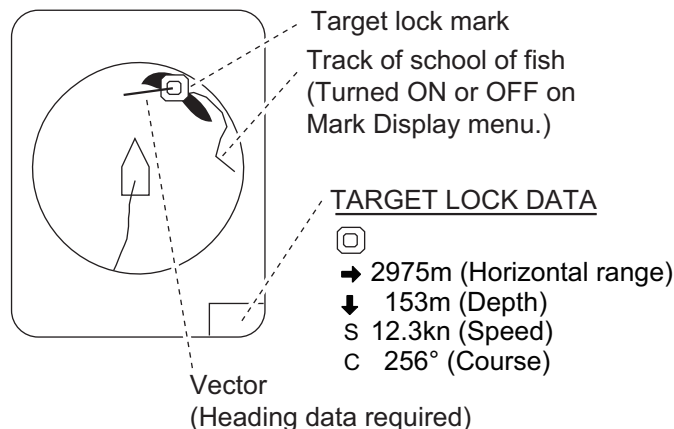
7. Long-press the **MENU/ESC** key to close all menus.

Note: The true motion display range may be set to 1.3 to 1.6 times the range with [TM Disp Range] on the [Display Setting] menu.

2.13 How to Detect Schools of Fish Aurally

Sometimes you may be preoccupied with other tasks and unable to concentrate on watching the sonar picture. In such cases it would be a good choice to use the audio function. This function enables you to monitor echoes from schools of fish and bottom through the external speaker.

2.13.1 How to set the bearing

In the default setting, the audio function is on and the audio sector is 30°.

1. Operate the trackball to place the cursor on the direction you want to monitor through the speaker.

2. Press the **R/B AUDIO** key.

The monitoring section is set on the bearing selected, in a 30°, 60°, 90°, 180° or 330° sector centering the audio bearing mark. Echoes are monitored through the speaker.
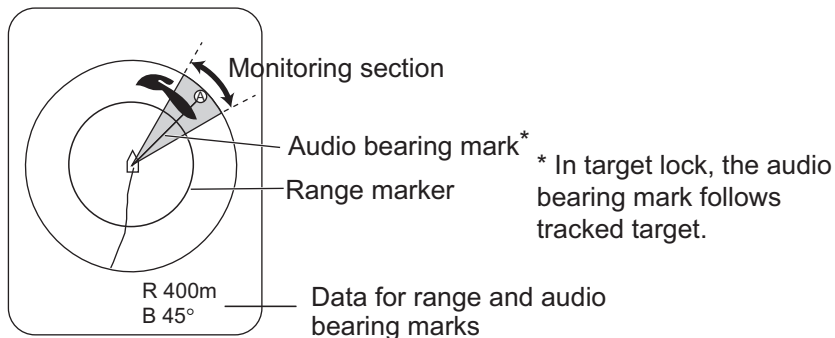
Note: To erase the range mark and its data (at the bottom of the screen), put the cursor near own ship mark (transducer position) and press the **R/B AUDIO** key. Note that the audio bearing is erased when [Audio] on the [Alarm & Audio] menu is turned off.

2.13.2 How to select the audio sector

Select the audio sector as follows. Note that you cannot see this sector on the display.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Others] then push the left-click button.
3. Select [Alarm & Audio] then push the left-click button.

Alarm & Audio	Quit
Fish Alarm	: OFF
Alarm Level	: 16
Alarm Zone…	
Ship SPD Alarm	: ON
Audio	: ON
Audio Volume	
Audio Sector	: 30°
Reverberation	: 0

4. Select [Audio Sector] then push the left click button.
5. Select desired sector then push the left-click.
6. Select [Quit] on the setting box then push the left-click button to close the box.
7. Long-press the **MENU/ESC** key to close all menus.

Quit
Cancel
30°
60°
90°
180°
330°

2.13.3 Automatic training

You may automatically scan the audio sector and audio bearing mark in the sector of ±12°, ±24° or ±36° as shown below.

1. First activate the range and audio bearing marks with the **R/B AUDIO** key.
2. While pressing and holding down the **AUTO TRAIN** key, press the **R/B AUDIO** key to select desired auto train sector among ±12°, ±24° or ±36°, or OFF to disable automatic training.
   Watch the auto train mark to know the currently selected sector. The chosen sector appears in large characters for five seconds at the top of the screen.

Auto train mark
Auto train sector
Audio bearing mark
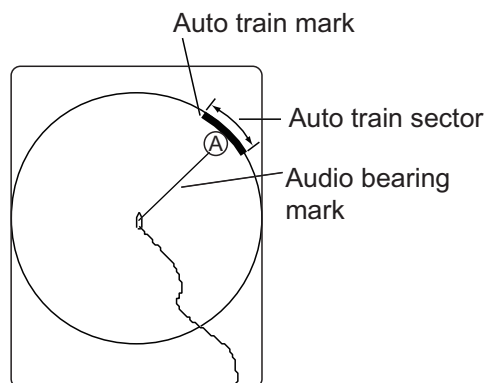
Note 1: The automatic training is inoperative when the target lock function is active. Turn off the target lock function to use automatic training.

Note 2: Select [Off] at step 2 to stop the training.

2.13.4   Reverberation for audio signal

You may select the length of reverberation of the audio signal, with [Reverberation] on the [Alarm & Audio] menu. The larger the value the longer the reverberation, which makes it easier to hear the audio signal. The setting range is 0 to 9 and the default setting is 0.

2.14   Fish Alarm

The fish alarm sounds the aural alarm when a fish echo above a preset strength enters the operator-set alarm zone.

1.   Press the **MENU/ESC** key to show the main menu.

2.   Select [Others] then push the left-click button.

3.   Select [Alarm & Audio] then push the left-click button.

4.   Select [Fish Alarm] then push the left-click button.

5.   Select [ON] then push the left-click button.

6.   Select [Quit] from the setting box then left-click to close the box.

7.   Select [Alarm Zone] then push the left-click button.

8.   Operate the trackball to place the cursor on the starting point of the alarm zone.

9.   Push the left-click button.

10. Rotate the trackball clockwise to select the ending point. The display paints a fan-shaped alarm zone.
     The alarm range appears on the display as shown below.

Fish alarm range
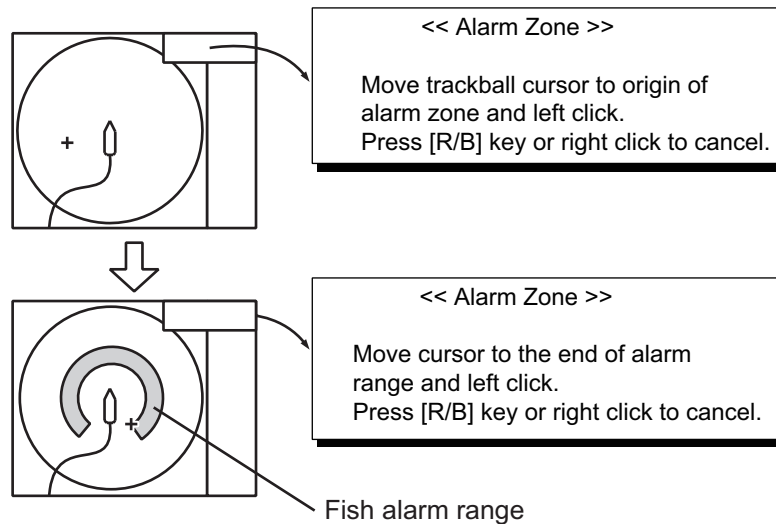
11. Push the left-click button.

12. Long-press the **MENU/ESC** key to close all menus.
     When a fish echo enters the alarm area the buzzer sounds.

Note 1: There must be at least 3° difference between the starting and ending points to get a fan-shaped alarm zone as shown in (a) and (b) below. Otherwise, the unit paints a 360° alarm zone as in (c) where there is less than 3° between the starting and ending points.

(a)   (b)   (c)
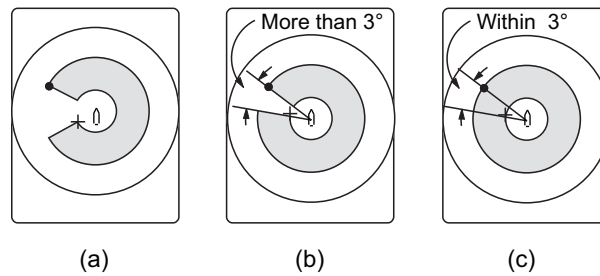
Note 2: The echo strength which triggers the alarm can be set with [Alarm Level] on the [Alarm & Audio] menu. The setting range is 0 to 30. This value corresponds with the 32-echo colors.

To disable the alarm, select [OFF] at the step 5.

2.15   How to Relocate a School of Fish

The offcenter feature relocates a school of fish.

1. Operate the trackball to place the cursor on the position where you want to relo-
    cate the own ship mark.

2. Press the **OFF CENTER** key.

3. To move the own ship mark back to the screen center, press the **OFF CENTER**
    key again.
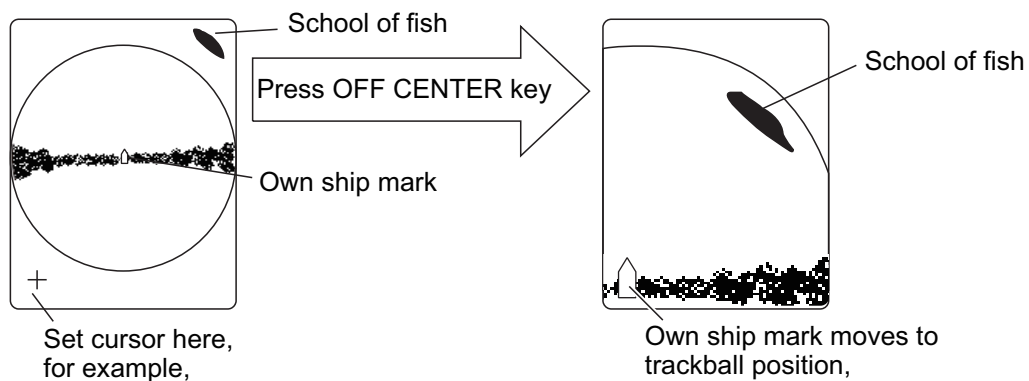
Note 1: The offcenter feature cannot be canceled in the true motion mode. Switch the mode to cancel the offcenter. When the **OFF CENTER** key is pressed, the own ship mark moves to the cursor position.

Note 2: You can also activate the offcenter feature by long-pushing the left button with the cursor in the echo display area. To restore the normal display, long-push the right button.

2.16 How to Compare Concentration of School of Fish

2.16.1 How to compare with the fish estimate mark

You can get an estimate of the volume of two schools of fish by using the two **ESTI-MATE** keys as follows:

1. Operate the trackball to place the cursor on a school of fish, and then press the **ESTIMATE 1** key.
   The estimate mark 1 appears on the school of fish. Relative volume is shown by a figure between 0 and 100, below the estimate mark. When the area inside the mark is filled in reddish brown, volume figure is said to be 100. When the estimate mark is entered, a graph is shown at the histogram on the numeric/ graphic data display.

2. Operate the trackball to place the cursor on another school of fish, and then press the **ESTIMATE 2** key.
    Compare estimate figures for each school of fish by observing estimate mark data and the fish histogram.

3. To turn off the estimate marks press their respective keys.
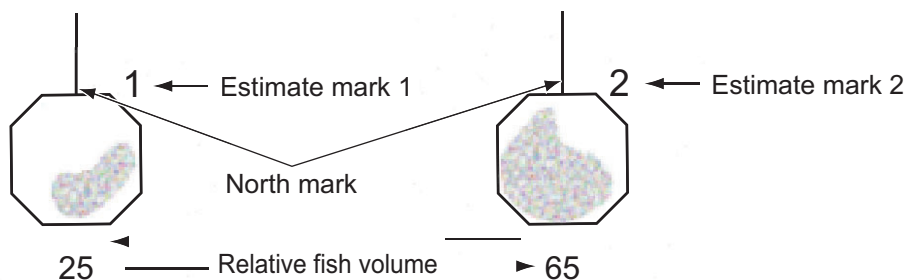
Note: The fish school mark and event mark 1 can be entered with the fish estimate mark. For details, contact your dealer.

<u>**Fish histogram**</u>

The fish histogram shows, in graph form, signal strength distribution for the school(s) of fish marked with an estimate mark on the horizontal displays. The histogram display for each of those displays will be different since the calculation method is different. This data appears only when an estimate mark is active. When two estimate marks are active, histograms are displayed one on top of the other as below.
The horizontal axis shows signal strength in 16 colors, and the vertical axis shows the concentration of a school of fish inside the fish estimate mark. For the fish estimate mark inscribed on the horizontal display the graph shows the average movement in five scans, to increase accuracy.

Fish estimate mark source

2 | Scan1

Fish estimate mark no.

1 | Scan1

Fish estimate mark source

2 | Scan2

Estimate mark 1 or estimate mark 2 displayed

Both estimate marks displayed
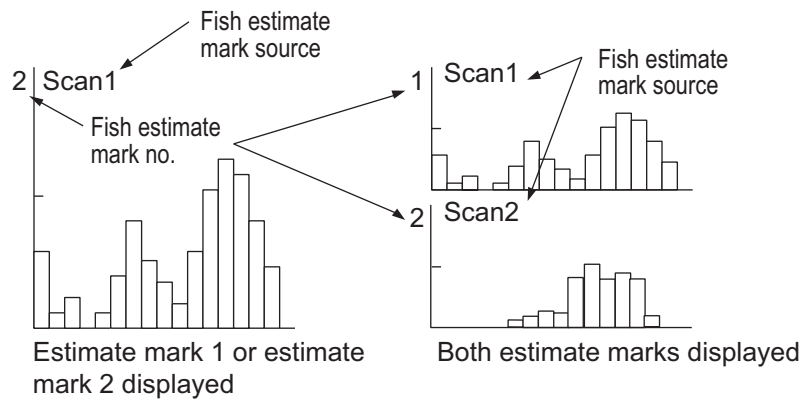
Note: The histogram display is redrawn five transmissions after a fish estimate mark is erased and another mark of the same number is entered soon after.

2.16.2 How to compare with the circle cursor

You can get an estimate of the volume of two schools of fish with the circle cursor as follows:

1. Push the scrollwheel to show the [Select Mark] window.

<< Select Mark >>

Circle cursor

Selected mark name → Event Mark (H, S)

Scan mode in which mark can be entered
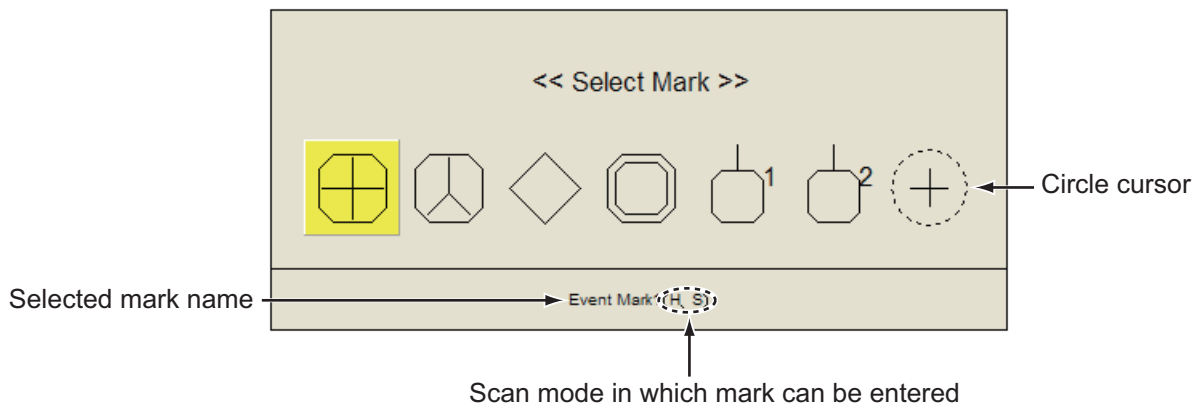
2. Select the circle cursor and push the left-click button. The [Select Mark] window disappears, then the cursor is changed to the circle cursor.

3. Place the circle cursor on a school of fish.

4. Rotate the scrollwheel to adjust the size of the circle cursor. Set the school of fish in the circle cursor to estimate correctly. The diameter of the circle cursor is displayed below the circle cursor.

Diameter of the circle cursor

83m
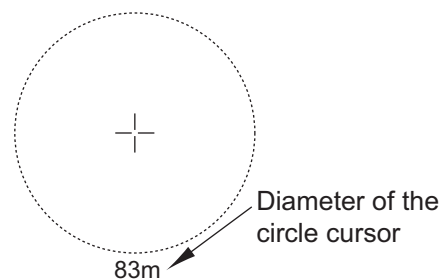
5. Place the circle cursor on another school of fish to estimate the volume. You can compare the volume of two schools of fish with the diameter of the school of fish.

6. Push the right-click to quit the measurement. The circle cursor is changed to the normal cursor.

Note: The event mark 1, event mark 2, fish mark, target lock mark, estimate mark 1, and estimate mark 2 can be entered from the [Select Mark] window. Push the left-click button to enter the mark selected on [Select Mark] window.

2.17 How to Measure the Speed of a School of Fish

To ensure a good haul, it is important to estimate the direction and speed of the school of fish before shooting the net. You can do this with the **FISH** key. With tidal current data and fish speed data, you can determine the timing of the net shooting more efficiently. This function requires speed and heading data.

2.17.1 How to measure the speed of a school of fish

1. Place the cursor on the center of a school of fish then press the **FISH** key or push the left-click button. The latest fish mark (◇) appears on the school of fish.

2. Wait until the target fish moves a reasonable distance from the latest fish mark.

3. Place the cursor on the same school of fish selected in step 1 then press the **FISH** key.
   The latest fish mark appears on the target, the 2nd latest fish mark (◈) appears on the location selected at step 1 and any earlier fish marks are shown with an X. The distance between the two fish marks and speed, course, and bearing of the school of fish appear at the bottom right-hand corner of the horizontal display area.

Latest fish mark

Place the cursor on a school of fish and press [FISH] key.

WAIT A FEW MINUTES

2nd latest fish mark

Latest fish mark

Earlier fish mark (Max. 18)

FISH MOVEMENT DATA
◈−◇ (Distance moved)
➜ 2975m (Horizontal range to fish mark)
⬇ 153m (Depth)
S 12.3kn (Speed)
C 256° (Course)
B 235° (Bearing)

Place the cursor on the school of fish's current location and press [FISH] key again.
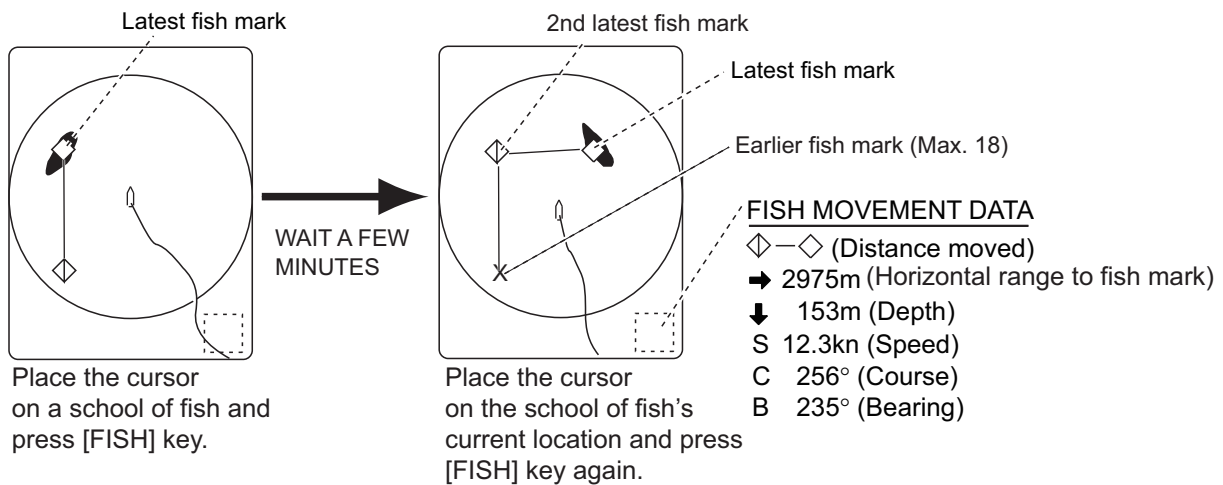
Note 1: The time and distance between each press of the **FISH** key should be as long as possible to increase accuracy of measurement. For best results, repeat the procedure two or three times.

Note 2: Each time the **FISH** key is pressed the latest fish mark and ship's speed mark change in the sequence shown below. A maximum of 20 fish marks can be entered. When you enter more than 20, the earliest fish mark is erased.

This data is the latest fish mark data.

[FISH]   key pressed once

  〃   〃   twice

  〃   〃   three times

  〃   〃   four times
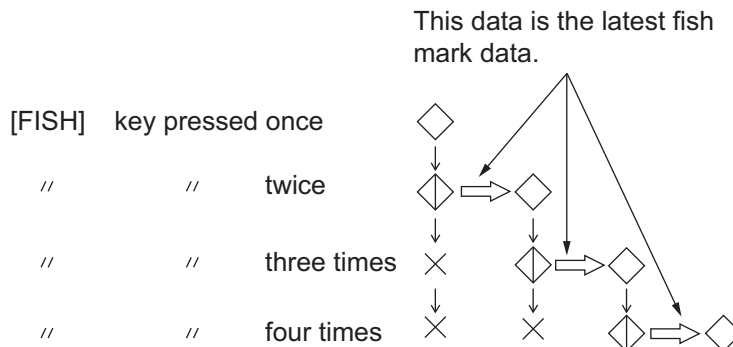
2.17.2 How to delete fish marks

Fish marks can be deleted individually with the **DELETE MARK** key or by earliest entry from the menu.

How to delete fish marks with the DELETE MARK key

Use the trackball to place the cursor on the fish mark you want to erase. The color of the fish mark changes from white to red when the fish mark is correctly selected. Press the **DELETE MARK** key to delete the fish mark.

How to delete fish marks from the menu

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Erase Marks] then push the left-click button.

Erase Marks		Quit
F3 Event Mark1	: Execute	
F4 Event Mark2	: Execute	
F5 Fish Mark	: Execute	
F6 Own Ship Pos Mark	: Execute	
F7 Ship's Track	: Execute	

3. Select [Fish Mark] then push the left-click button. Each push of the left-click button deletes the earliest fish mark.

4. Long-press the **MENU/ESC** key to close all menus.

Note: The default function of the **F5** key deletes the earliest fish mark.

2.18 Event Mark, Own Ship Position Mark

The event mark is useful for finding the horizontal range, depth and bearing to a location some distance from current position. 20 such marks may be inscribed on the horizontal display. This function requires speed and heading data.

There are two types of event marks, latest event mark 1 (⊕) and event mark 2 (⬨). Each time an event mark is entered the latest event mark appears at the cursor position and all other event marks are shown by marks +, ⊥ and numbered in sequential order. When the memory capacity for event marks is reached the earliest event mark is automatically erased to make room for the latest.

2.18.1 How to enter an event mark

1. Set the cursor where you want to enter an event mark.

2. Press an **EVENT** key. The horizontal range, depth and bearing to the event mark appear at the bottom left corner of the horizontal display area. The event mark 1 can be entered by pushing the right-click button.

⊞

➡ 234m: Horizontal range (m) from own ship mark
⬇ 19m: Present depth (m) to mark
   (35m): Depth (m) of mark at moment EVENT key is pressed.
B 265°: Present bearing (degree)

⌐— Bottom left-hand corner of the screen
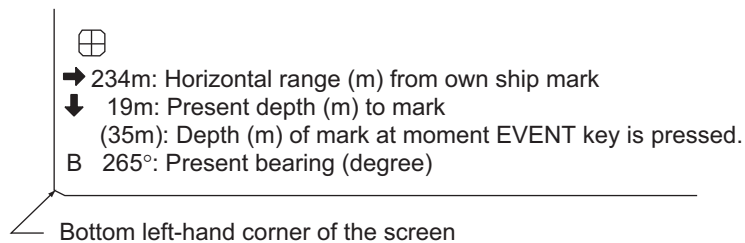
*Ex. Indications when the **EVENT** ⊞ key is pressed*

With speed and heading data the mark follows own ship's movements. In the True Motion mode, the event mark is stationary. When the tilt angle is changed mark position changes with horizontal range. Note however that the mark's position does not change when automatic tilt is active; the tilt center angle is used to position the mark.

Plotting an event mark on the display is equivalent to dropping a buoy with an anchoring chain that extends from surface to bottom. The buoy is fixed at its geographical location, but the marker on the display moves to a point where the present beam plane intersects the anchor chain of the buoy as the ship moves or the tilt angle is changed. This can be said about marks as well such as fish mark and cursor.
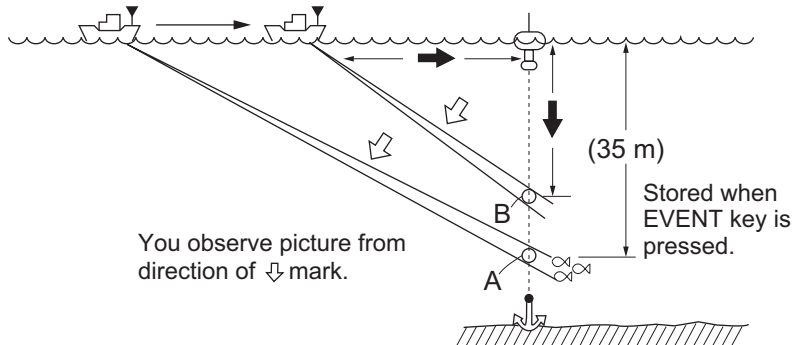
2.18.2   How to enter an own ship position mark

Place the cursor close to the center of the own ship mark (transducer position) and press the **EVENT** key. Ten own ship position marks may be inscribed. When the capacity for own ship position marks is reached the earliest own ship position mark is automatically erased.

Note: The **SHOOT** key can enter the own ship position mark. Set [Event Key] to [Shoot] on the [Mark Display] menu.

2.18.3   How to erase an event mark, own ship position mark

Event marks and own ship position marks can be deleted individually with the **DELETE MARK** key or by earliest entry from the menu.

Delete an event mark, own ship position mark with MARK DELETE key

Use the trackball to place the cursor on the event mark or own ship position mark you want to erase. The color of the mark changes from white to red when the mark is correctly selected. Press the **DELETE MARK** key to delete the mark.

Delete an event mark, own ship position mark from the menu

1.   Push the right-click button on the numeric/graphic data display to show the pop-up menu.
2.   Select [Erase Marks] then push the left-click button.
3.   Select [Event Mark1], [Event Mark2] or [Own Ship Pos Mark] then push the left-click button.
     Each push of the left-click button deletes the oldest event mark or own ship mark.
4.   Long-press the **MENU/ESC** key to close all menus.

Note: The default function of the **F3** (for event mark 1), **F4** (for event mark 2) and **F6** (own ship position) keys delete the oldest event mark or own ship mark.

2.19 Net Course Mark

Before shooting the net, decide the shoot timing considering tide direction, distance to the school of fish and moving direction of the school of fish. Use the net course mark as a guide to decide the timing. This function requires speed and heading data.

How to enter the net course mark

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Others] then push the left-click button.
3. Select the [Display Setting] then push the left-click button.
4. Select the [Net Course Mark] then push the left-click button.

Net course mark

<<Set net course mark>>

Move trackball cursor to net course mark position and left click.
Press R/B key to cancel.
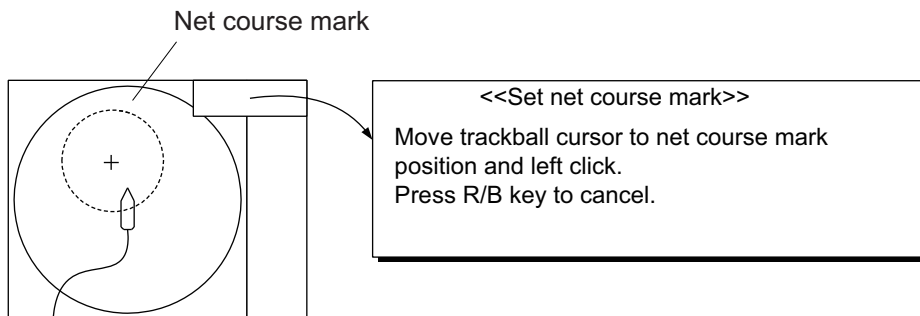
5. Use the trackball to position the net course mark, which is shown by a dashed circle.
6. Push the left-click button to set, and the dashed circle changes to a solid one.
7. Long-press the **MENU/ESC** key to close all menus.

Note 1: To delete the net course mark select [Delete] at step 4.

Note 2: The default function of the **F10** key deletes the oldest net course mark.

2.20 Net Behavior

With connection of a net sonde, you can observe net behavior after the throwing of the net. Accurate depiction of net sonde position depends on proper setting of the distances between net sonde transmitters. You can set those distances on the main menu-[Others] - [Initial Setting] - Change confirmation window - [Net Sonde Setting] menu. This function requires speed and heading data.

Note: To enable this feature, set [Event Key] to [Event] in the [Mark Display] menu, then do the following:

1. Press the **SHOOT** key just upon throwing the net into the water. The following actions occur:

- Net shoot mark (▽) appears at own ship position.
- Net shoot data appears at top of the display.
- Net sonde mark (▽¹,▽²) is inscribed.
- Net depth data is displayed.

2. To erase the net sonde mark and associated data, press the **SHOOT** key again.
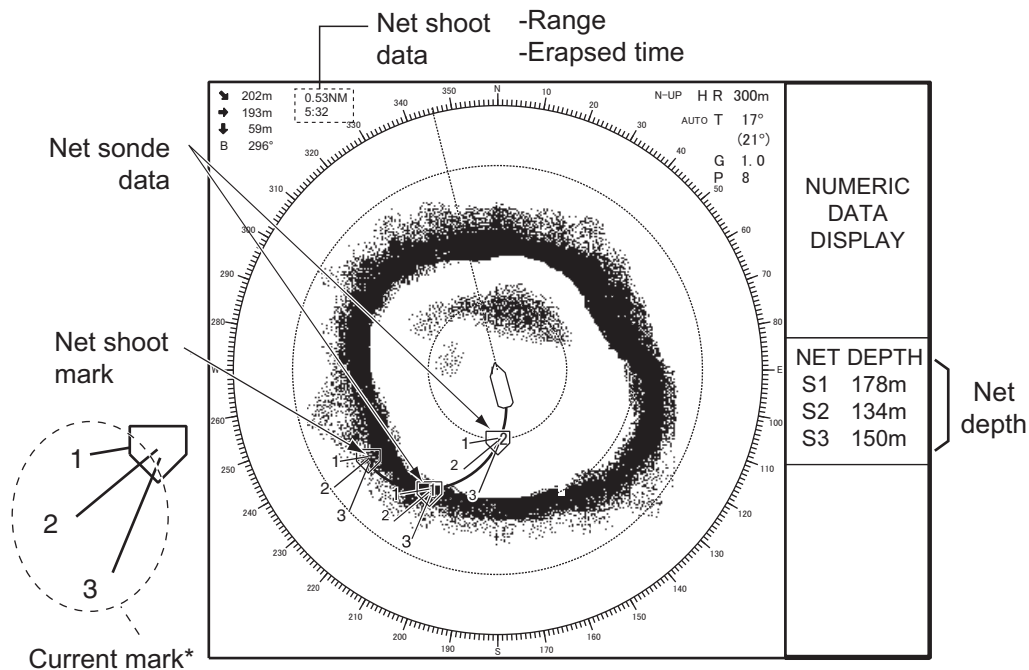
Note: To turn the current mark on/off, see page 6-13.

2.21 Menu Items Descriptions

This section presents an overview of the horizontal display related menus not previously described.

Display Setting menu
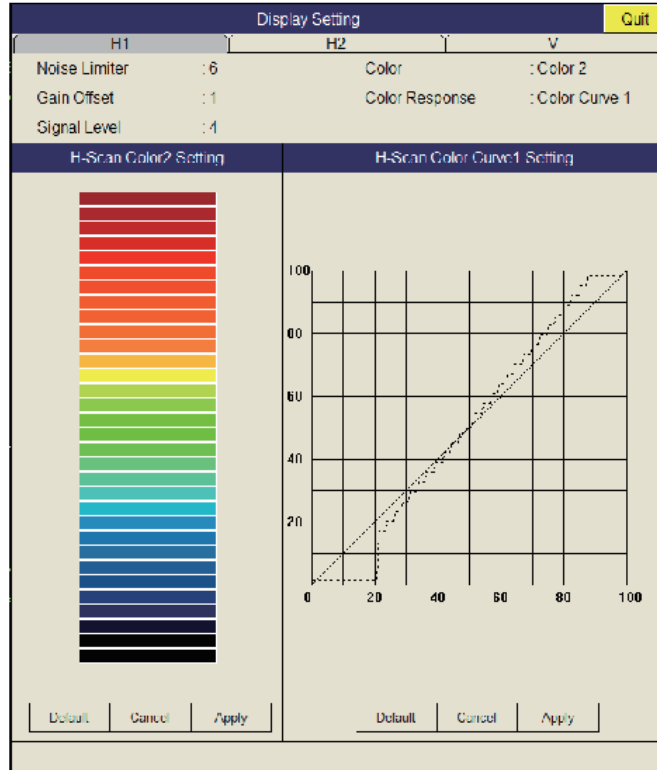
Gain Offset: Adjusts gain level. If the **GAIN** control on the front panel does not provide satisfactory gain adjustment, enter an offset here. The setting range is 0 to 12.

Signal Level: Contaminated water or reflections from plankton may be painted on the screen in green or light-blue. These echoes may be erased in order of strength. The setting range is 0 to 15; 0 corresponds to the weakest color.

Color: Selects color arrangement to use. The default setting is Color 1 to 4.

H-Scan Color1 (or 2 to 4) Setting: Customizes colors. See the procedure on the next page.

1. Operate the trackball to select color then push the left-click button to show the color bar.

H-Scan Color2 Setting

Select color with trackball.

▲	▲	▲	▲	Quit
COL	HUE	SAT	LUM	
9	12	100	58	
▼	▼	▼	▼	Cancel
(1~32)	(0~100)	(0~100)	(0~100)	

COL: Cycles through default colors.
HUE: Adjusts color tint (Setting range: 0-100(%)).
SAT (Saturation): Adjusts color vividness
(Setting range: 0-100(%)).
LUM (Luminescence): Adjusts color brightness
(Setting range: 0-100(%)).

Default | Cancel | Apply
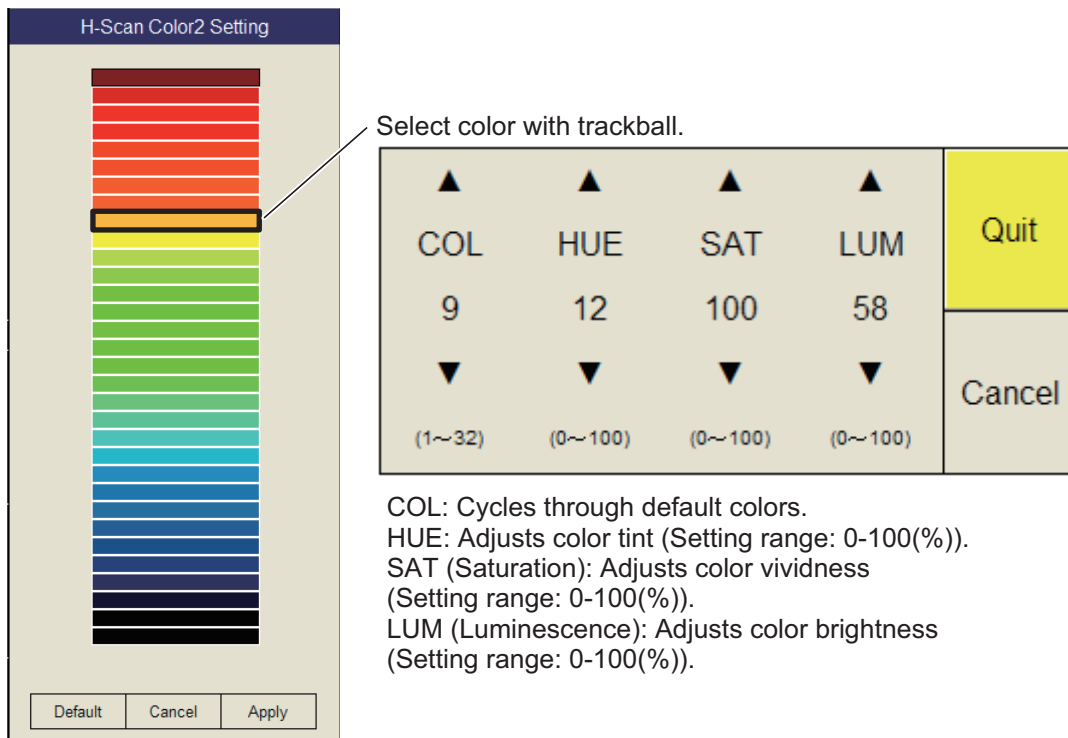
2. Select ▲ or ▼ for COL, HUE, SAT or LUM.

3. Push the left-click button several times to set.

4. Repeat steps 2 and 3 to complete other items.

5. Select [Quit] then push the left-click button.

6. Repeat steps 1 through 5 to set other colors.

7. Select [Apply] then push the left-click button.

Note: To restore default color setting, select [Default] on the window push the left-click button then click the [Apply] button.

H-Scan Color Curve Setting: Adjusts reflected echo strength versus echo color level for currently selected color response number. To adjust the curve, place the trackball at the point desired then push the left-click button. On the horizontal axis input level relative value is shown in the range from 0 to 100%. The setting range for input level is 0-100% in increments of 10% and output level is 0-100% in any value. Select [Apply] then push the left-click button.

H-Scan Color Curve Setting
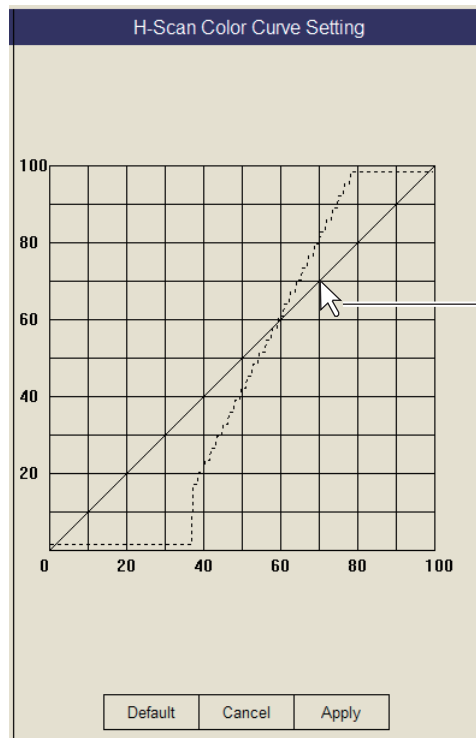
To set input level versus output level, use the trackball to place the cursor on location desired and push the left-click button.

Note: To restore default color setting, select [Default] on the window push the left-click button then click the [Apply] button.

Picture Setting menu

Smooth Echo RNG: Selects echo smoothing level in the range direction. The setting range is 0 to 7. The higher the setting, the greater the smoothing.

Smooth Echo CIR: Selects echo smoothing level in the circular direction. The setting range is 0 to 5. The higher the setting, the greater the smoothing.

2.22 How to Interpret the Horizontal Display

2.22.1 Bottom and school of fish echoes

Bottom echoes

When the tilt angle is changed, the bottom echo illustrated below will appear on the display. When the tilt is decreased (toward 0°), the bottom trace becomes wider and weaker. By observing the bottom condition on the display, the skipper can prevent net damage.

(A) Flat bottom
   Tilt angle: 10° to 15°
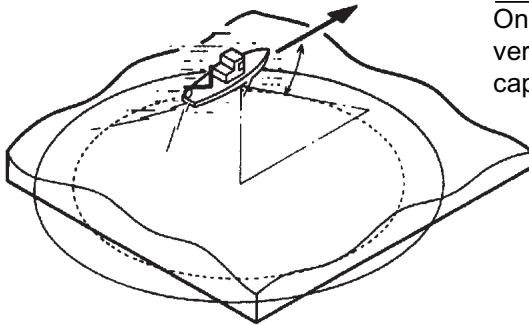
Decreased tilt angle
Only half of vertical beam width captures the bottom.
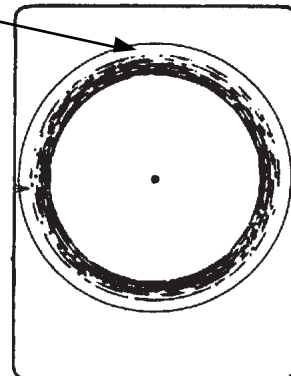
(B) Flat bottom
   Tilt angle: 20° or more
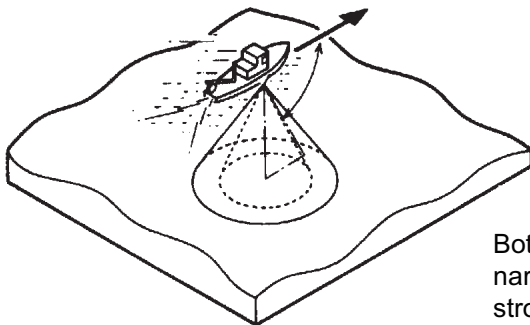
Bottom is displayed narrower and in stronger colors when compared to (A).
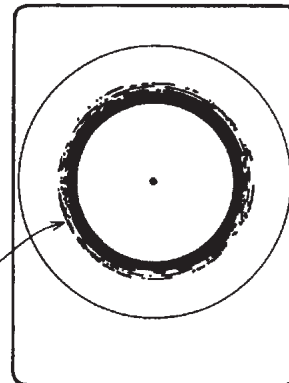
(C) Sloping bottom
   Tilt angle: 20° or more
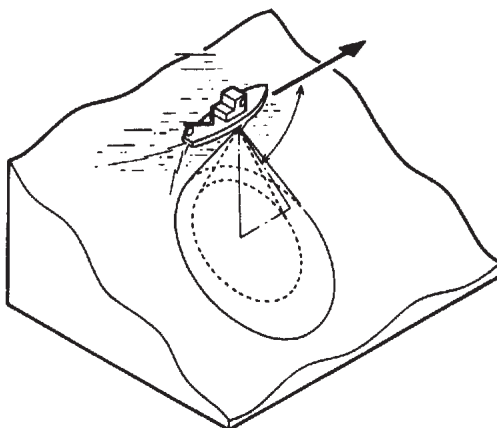
Shallow bottom is displayed in a strong color and with a short tail.

Bottom
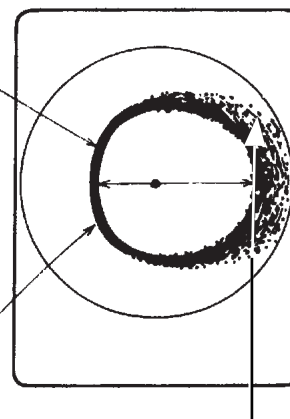
The deeper, sloping bottom echo is displayed in a weak color and with a long tail.

School of fish

A school of fish appear as a mass of echoes on the screen. By this display pattern, the density of the school on the sonar beam can be found. To find distribution and center point of a school of fish, try several different tilt angles.

(A) Sea surface fish
   Tilt angle: 0° to 10°

School of fish

Sea surface reflections
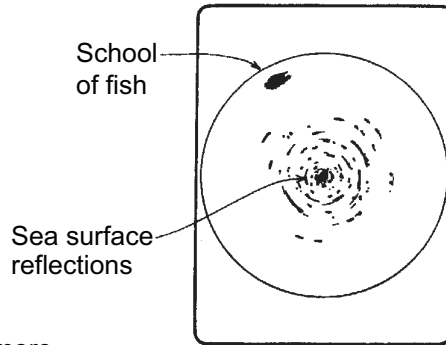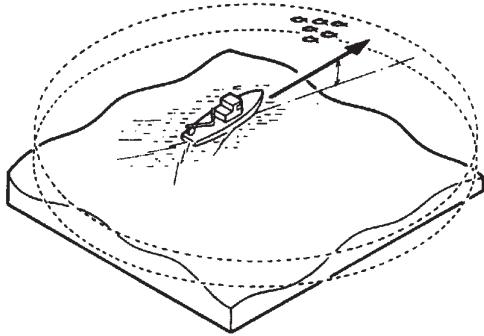
Bottom echo not displayed because of decreased tilt angle. Sea surface reflections are present.

(B) Midwater, bottom fish Tilt angle: 30° or more
   Fish echo which appears before bottom can be detected.

Bottom

School of fish
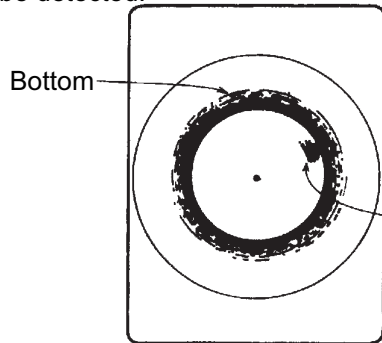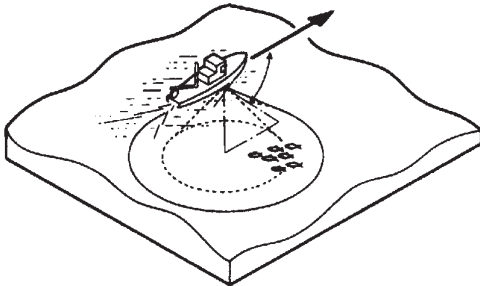
Large midwater fish school is present.

Tilt angle: 0° to 20°
Fish echo which appears together with or after bottom can be detected.

School of fish
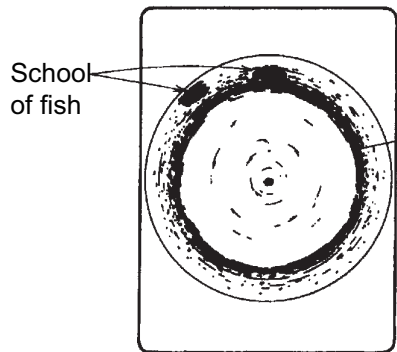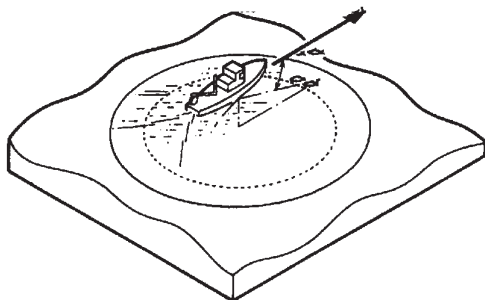
Bottom

When the tilt angle is shallow, the reflection echo from bottom is weak and the fish echo which appears from bottom is easy to find.

2.22.2 Unnecessary echoes

Sea surface reflections

To reduce sea surface reflections, set the tilt angle to 4° or higher, so the upper edge of the sonar beam does not hit the sea surface, or adjust TVG. When a decreased tilt is used, sea surface reflections cover a large area as illustrated below.
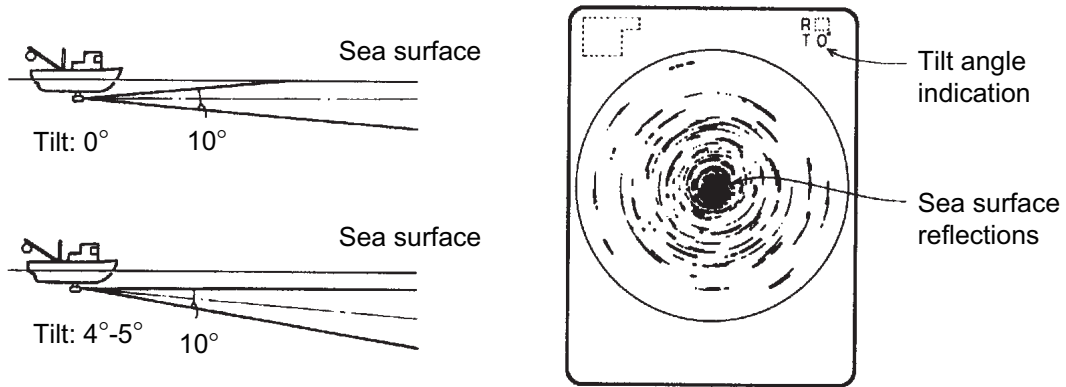
Wake

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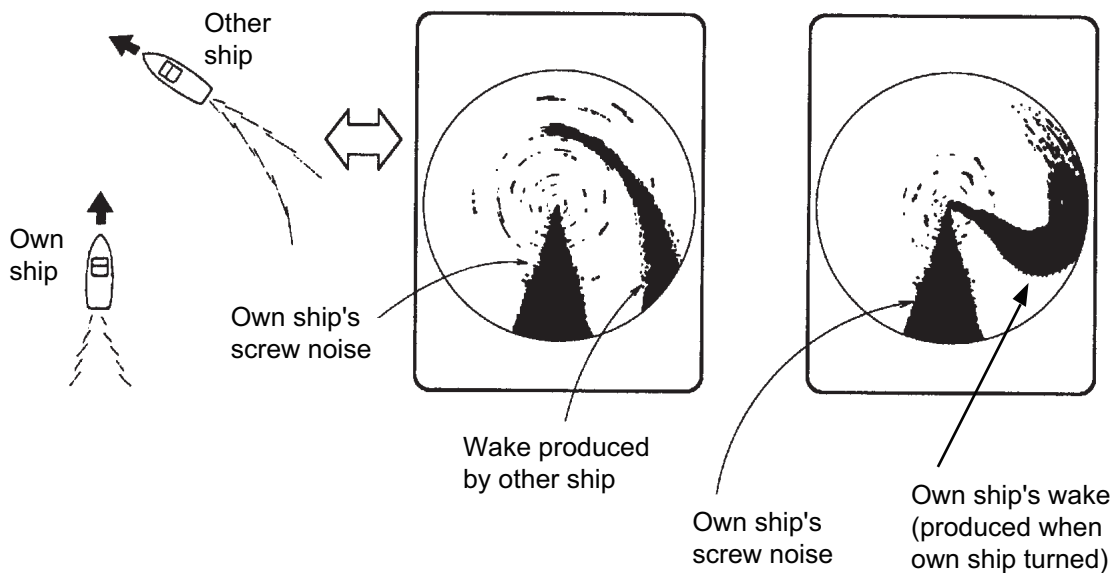
Sidelobe echoes (false echoes

An ultrasonic wave is emitted only in the direction set by the **TILT** control, 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.

Mainlobe echo

Sidelobe echo

The bottom echo detected by sidelobe appears at a certain tilt angle when the sidelobe points vertically. Also, poor soundome projection may result in a similar false echo.

Sidelobe

Mainlobe
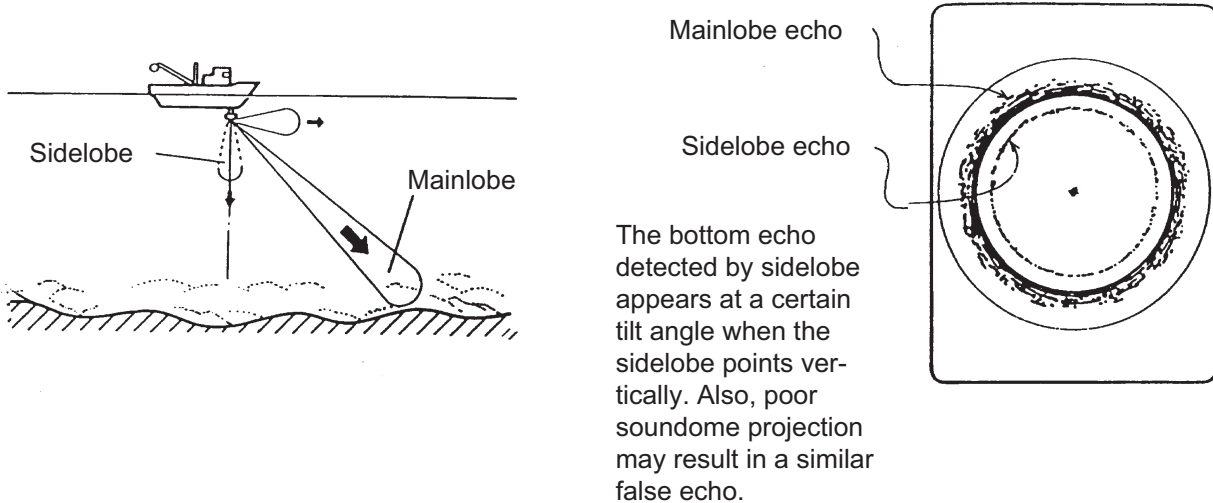
Noise and interference

When the fishing ground is crowded with many fishing boats, the sonar is subject to interference from ultrasonic equipment (echo sounder or sonar) on other boats as well as those on own ship.

For instance, interference from the sonar operated on other boats will show itself on the display as in (A) in the figure below. This interference can be suppressed by changing the TX interval, with [TX Interval] on the [H-Scan Setting] menu. Noise from marine life shows itself on the displays as in (B) in the figure below. This type of noise can be suppressed with the interference rejector on the [Picture Setting] menu.

School of fish

Bottom

Ring of interference

(A) Interference from other sonar (yours or others)

(B) Interference from marine life
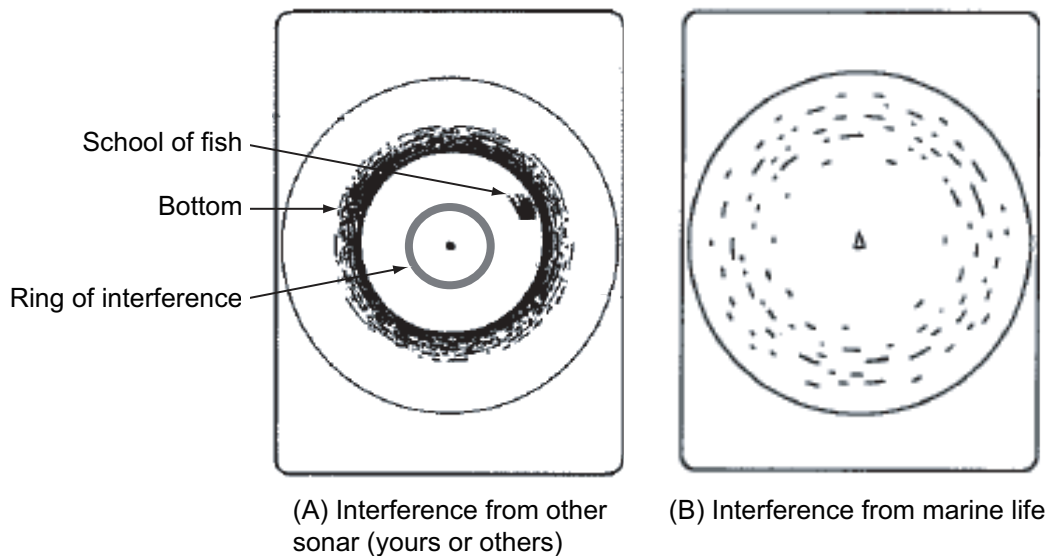
3. VERTICAL MODE

3.1 Basic Operating Procedure

2. Lower transducer.
 ▼: Mid protrusion
 ⬇: Full protrusion

4. Adjust position of vertical bearing mark to display it in vertical display.

5. Press appropriate key.

1. Turn on power.

7. Select range.

6. Press to choose the screen (horizontal or vertical) to adjust gain and range.

8. Adjust gain.

3. Select a vertical display.
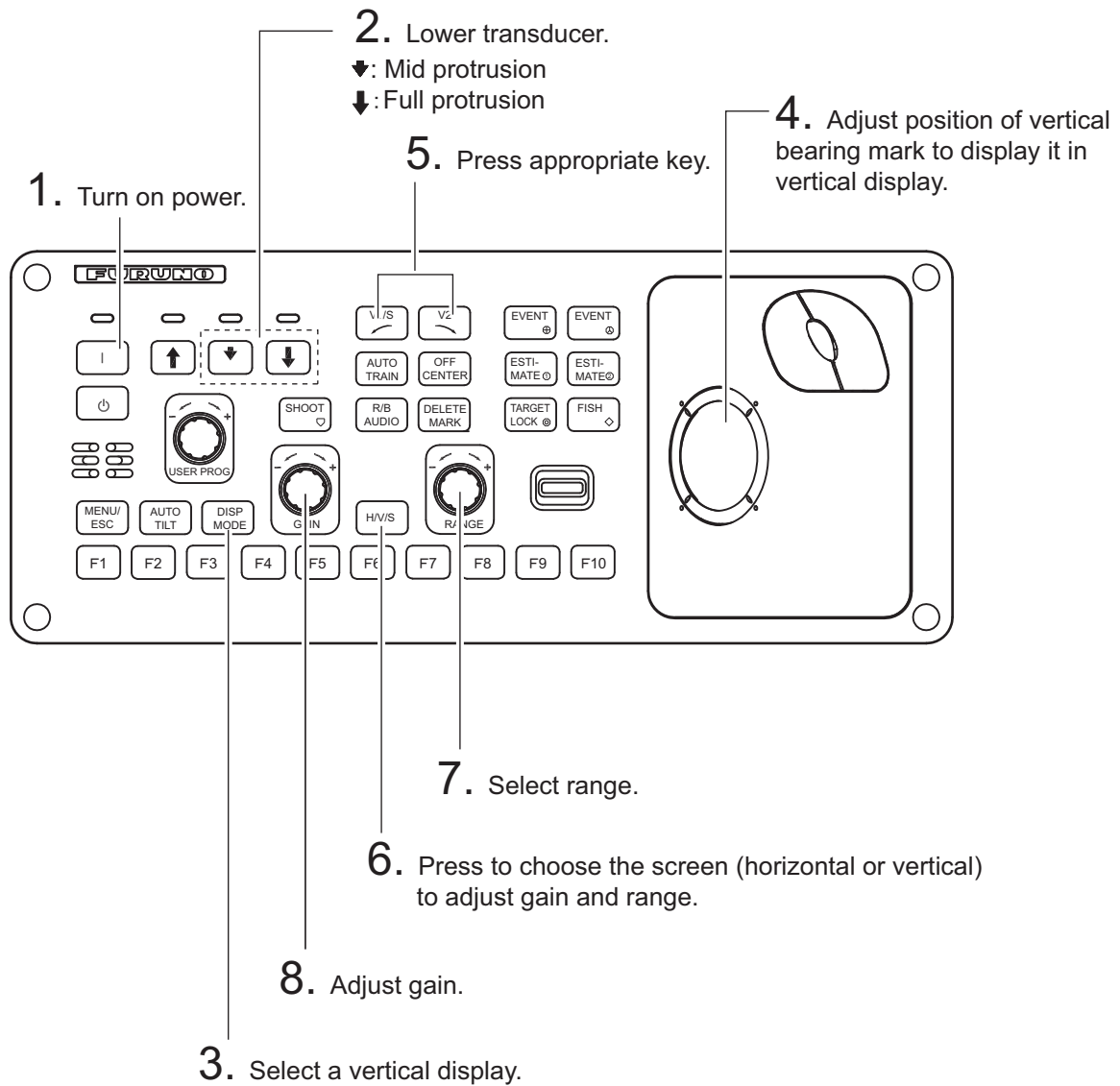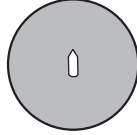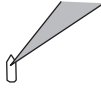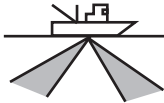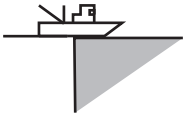
Control panel

3.2 How the Vertical Mode Works

3.2.1 Overview

The vertical mode shows a vertical section of the horizontal display selected with the vertical bearing mark. The figure below illustrates the concept of the vertical mode, in comparison with the horizontal mode. The vertical mode helps you keep fast moving fish such as bonito and tuna within the sonar beam.

	Horizontal Mode	Vertical Mode
Detection aspect, view from top		
Detection aspect, view from side		

3.2.2 How to set the vertical display

1. Press the **MODE** key to select [V1] or [V2].
2. Use the trackball to place the cursor at the desired location in the horizontal display.
3. Press the **V1/S** or **V2** key.

For example, press the **V1/S** key. Then, the Vertical 1 display appears, and the vertical bearing marker is displayed in the horizontal display, with V at the tip of the marker as shown on page 3-3. If both vertical displays are activated 1 or 2 is inscribed at the tip of a vertical bearing marker.

Note: The **TILT** control functions as a bearing setting lever for the vertical display1 in the conditions mentioned below. The bearing of the vertical display1 changes clockwise when the **TILT** control is pressed upward and counterclockwise when pressed downward, changing in increments of two degrees.

• The item [Tilt Lever] in the [Display Setting] menu is set to [TILT & V1].

• When the [V2] display is active, operate the **H/V/S** key to select the vertical display.

3.3 Vertical Indications and Marks

3.3.1 Typical vertical display

The vertical mode provides a vertical section of the horizontal picture. You may show the display on the right or left side of the screen in case of the vertical 1 mode. An expansion mode is available to enlarge the picture. To display the vertical mode, press the **DISP MODE** key and choose V1 or V1 & V2. The example below shows the V1 mode. You can move and change the window size of the vertical display 1 by drag and drop.

Vertical bearing mark

Trackball data
Slant range — 1547m
Horizontal range — 1473m
Vertical range — 473m
Angle to cursor from horizontal — A 33°

NUMERIC/ GRAPHIC DATA DISPLAY

Cursor position reference mark

V 12°   R 2000m   G 8.0   P 1

Vertical display 1

Tilt angle mark
(Detection aspect in vertical direction at horizontal display)

Target lock mark
(Entered on horizontal display.)

Range scale

Trackball mark (+ cursor)

VERTICAL DISPLAY DATA
(from left to right)
Vertical Bearing (V)
Range (R)
Gain (G)
User program number (P)*

V 12°   R 2000m   G 8.0   P 1

*: Shown when [Sel User Prog] is set to [H/V Individual] on the [Register] menu.

Note: When the settings listed below are changed, the setting value is shown at the top of the display for five seconds. The location of the setting value can be changed. Contact your dealer for details.

- Gain (See section 1.6.)
- Vertical bearing (See paragraph 3.2.2.)
- User program (See section 5.3.)
- Display range (See section 3.5.)
- Auto train (See section 3.4.)

3.3.2   Vertical bearing mark, tilt mark

The vertical bearing mark is displayed with solid and dashed lines and it shows the bearing selected on the horizontal display. The circle at the top of the vertical bearing mark has a V inside of it in the vertical 1 mode, or 1 and 2 as appropriate when both the vertical 1 and vertical 2 modes are active. Its bearing may be referenced to North (true) or ship's heading (relative, default setting) on the menu. (See page 6-3.)

The tilt mark is a solid and dashed line which shows in the vertical display the tilt angle set on the horizontal display.

The meaning of the solid and dashed lines are as shown in the table below.

	Solid line	**Dash**
Vertical bearing mark	Range from own ship to vertical scan range	Range further than vertical scan range
Tilt mark	Range from own ship to horizontal scan range	Range further than horizontal scan range

Vertical scan range

Horizontal scan range
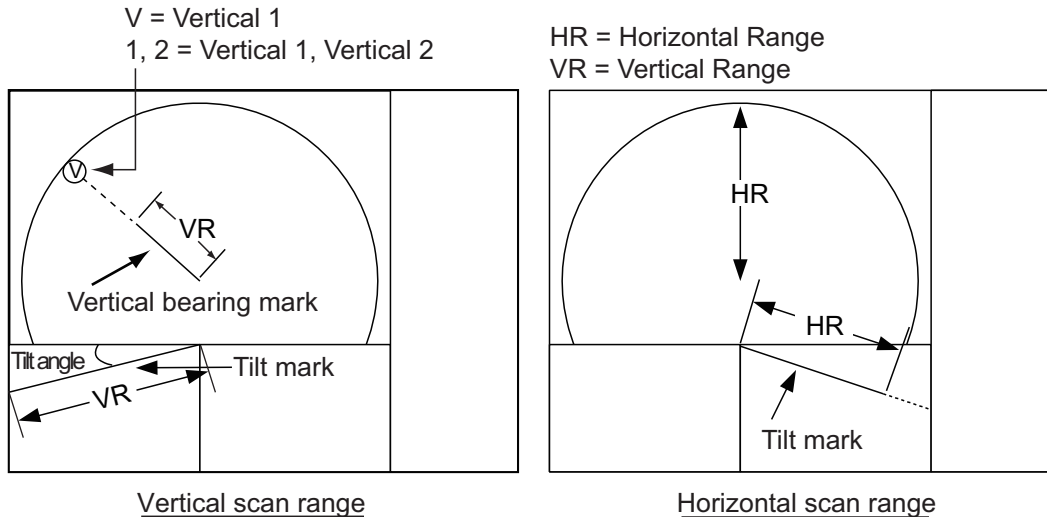
3.3.3 Cursor position reference mark

The cursor position reference mark, a solid circle, is inscribed on the vertical bearing mark when the cursor is placed in the vertical display. Its purpose is to show corresponding cursor position on the horizontal display. It changes position with cursor position, tilt and range, and disappears when its position is no longer within the range of the horizontal display.
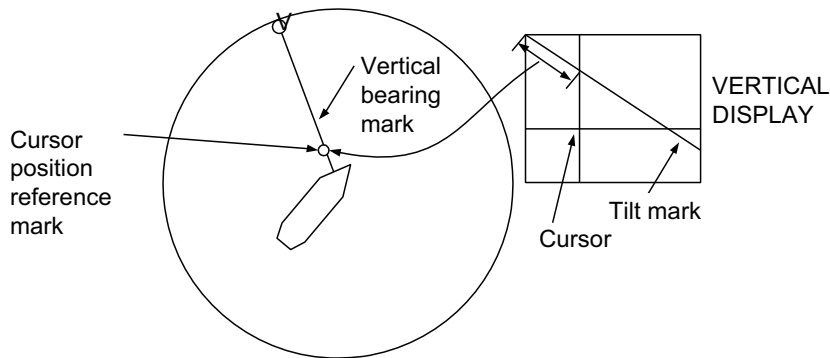
3.4 Auto Train

You may scan the vertical bearing mark in the sector of ±12°, ±24° and ±36°. Press and hold down the **AUTO TRAIN** key while pressing the **V1/S** or **V2** key to select the auto train sector desired. Selected sector appears in large characters for five seconds for your confirmation. To cancel auto train, repeat the above procedure to select [OFF].
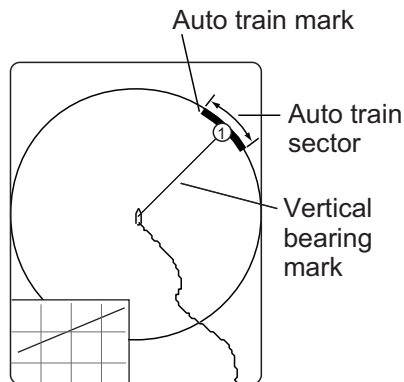
Note: If both the auto train and the target lock are active in a vertical mode, the following restrictions apply:

• V1 mode: Auto train is disabled.

• V2 mode: The auto train for the vertical bearing marker is disabled.

Disable the target lock to restore the auto train.

3.5 Display Range

The **RANGE** control selects the detection range. The range selected is momentarily displayed in large characters at the top of the vertical 1 display. Range is always displayed next to "R" at the lower part of the vertical 1 display.

The default ranges are as shown below. In the vertical 2 combination display, the range for V1 and V2 are same.

Range No.	1	2	3	4	5	6	7	8
Detection range	200	400	600	1000	1600	2000	3000	4000

Note: Ranges can be preset. See page 6-6 for details.

1. Press the **H/V/S** key to show the range and gain indications of the horizontal mode to change the range (and gain). The indication color of the range and gain are changed to orange.

2. Operate the **RANGE** control to select a range.

Note: The range can also adjusted from the range indication. Put the cursor on the range indication to highlight it in yellow then roll the scrollwheel.

3.6 How to Measure the Range, Bearing to a Target

Operate the trackball to place the cursor on the vertical 1 (or vertical 2) display. The range to the location selected is shown at the top left corner.

Cursor data
Slant range — 1547m
Horizontal range — 1473m
Vertical range — 473m
Angle to cursor from horizontal — A 33°

NUMERIC/ GRAPHIC DATA DISPLAY

Cursor   Cursor position
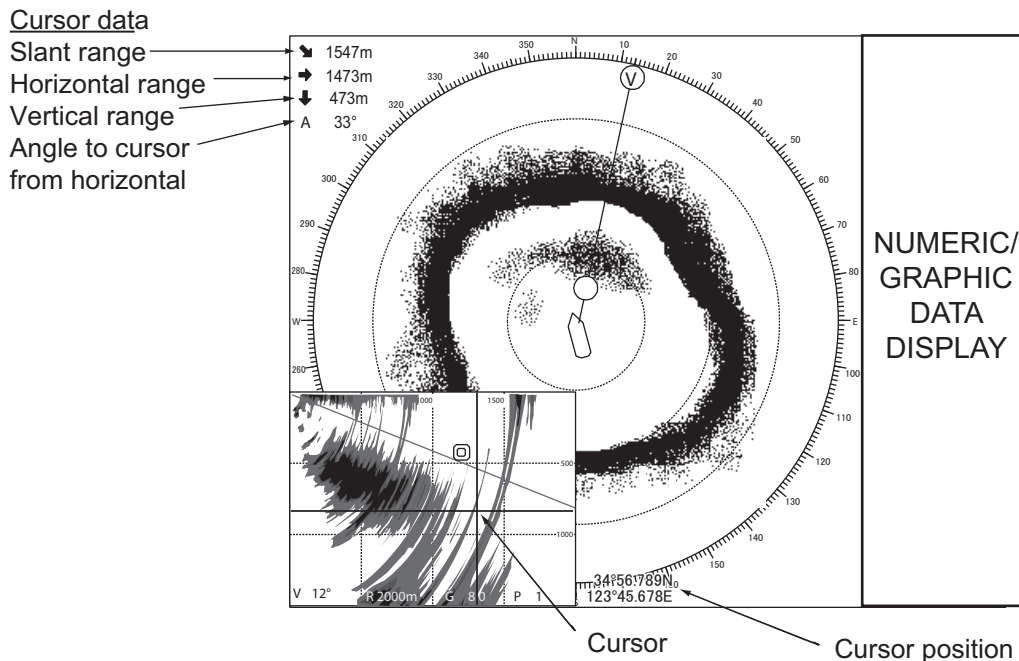
Note: To show the cursor position in L/L, see page 6-12.

3.7 How to Eliminate Weak Echoes

Echoes from targets such as bottom 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 due to little propagation attenuation and little absorption. If these echoes are displayed directly on the screen, the size of the displayed echo from the same school of fish may change with distance, making it difficult to judge the actual size of the school of fish. To overcome this inconvenience use the TVG curve function. 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.

TVG curve

Four TVG curves are available and they vary the gain from large to small.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Gain Setting] then push the left-click button.
3. Press the **H/V/S** key to select [V] tab.

Gain Setting		Quit
H1	H2	V
TVG-Near	: 3	
TVG-Medium	: 0	
TVG-Far	: 0	
TVG Distance…		
Sel. TVG Curve	: TVG 2	
AGC	: 3	
Near AGC…		
2nd AGC…		

4. Select [Sel. TVG Curve] then push the left-click button.

Quit
Cancel
TVG 1
TVG 2
TVG 3
TVG 4

5. Select a curve then push the left-click button. The smaller the number is, the gentler the gain change over distance.
6. Select [Quit] on the setting box then push the left-click button.
7. Long-press the **MENU/ESC** key to close all menus.
   The TVG is also used to suppress unwanted echoes (sea surface reflections, cruising noise, etc.) on near ranges. If the selected curve does not provide satisfactory results, try to adjust TVG-Near, TVG-Medium or TVG-Far, as shown below.

TVG distance and setting

This sonar has three TVG functions, Near, Medium and Far, and they mainly compensate for propagation loss on short, middle and long ranges respectively, centered at the ranges shown below. The higher the TVG setting the greater the amplification of echoes.

1. Press the **MENU/ESC** key to show the main menu.

2. Select [Gain Setting] then push the left-click button.

3. Press the **H/V/S** key to select the [V] tab.

4. Select [TVG Distance] then push the left-click button.

5. Select [Changeable] then push the left-click button.

6. Select ▲ or ▼; for [Near], [Med] or [Far] as appropriate then push the left-click button to change the setting.
   Near: Setting range, 50 to 150 m, 10 m increments. Med: Setting range, 300 to 500 m, 20 m increments Far: Setting range, 600 to 1000 m, 40 m increments

7. Select [Quit] on the setting box then push the left-click button.
   Adjust the TVG level for selected TVG distance as below.

8. Select [TVG-Near], [TVG-Med] or [TVG-Far] as appropriate then push the left-click button.

9. Select ▲ or ▼ as appropriate then push the left-click button to change the setting. The setting range is -5 to 5. The higher the setting, the higher the gain. For strong echoes such as sea surface reflections or plankton layer lower the setting by 1 or 2.

10. Select [Quit] on the setting box then push the left-click button to close the box.

11. Long-press the **MENU/ESC** key to close all menus.

3.8 How to Adjust Strong, Weak Echoes

3.8.1 AGC

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

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Gain Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [V] tab.
4. Select [AGC] then push the left-click button.
5. Select ▲ or ▼ then push the left-click button to change the setting.
    The setting range is 0 to 9. The higher the setting, the higher the degree of suppression.
6. Select [Quit] on the setting box then push the left-click to close the box.
7. Long-press the **MENU/ESC** key to close all menus.

3.8.2 Near AGC

When the water is shallow or heavily sedimented, the reflected echoes from close-in, unwanted echoes may be excessively strong. In this case, a school of fish which is displayed at between 300 and 500 m may disappear gradually when the ship starts approaching the school of fish.

Use the Near AGC feature to suppress this strong echo. Normally set it between 3 and 4, however, this setting depends on the sea area. Do not set it too high; all echoes (including noise) from near distance may be painted in red.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Gain Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [V] tab.
4. Select [Near AGC] then push the left-click button to show the setting dialog box.
5. Select [Near AGC] again then push the left-click button.
6. Select ▲ or ▼ then left-click to change the setting.
    The setting range is -30 to 30. The higher the setting, the stronger the echo level on near range.

7. Select [Quit] on the setting box then push the left-click button to close the box.
8. Long-press the **MENU/ESC** key to close all menus.

Note: Set the effective range of [Near AGC] with [Near AGC Distance]. The setting range is 20 to 500 (or 3000) m, in 20 m increments. The setting range can be changed in the system menu. For details, contact your dealer.

3.8.3 2nd AGC

While it is ideal to suppress bottom echoes with the AGC alone, there are some fishing grounds where this is not possible. (The high power sonar has the advantage of long-range detection but this can also be a disadvantage, since weaker echoes may be hidden in strong, unwanted echoes such as the bottom.) If you can not suppress bottom echoes or sea surface reflections by the AGC function alone, use the 2nd AGC feature. Normally a setting of 1 or 2 is suitable. For especially strong echoes, use a setting of 3 or 4.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Gain Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [V] tab.
4. Select [2nd AGC] then left-click to show the setting box.
5. Select [2nd AGC] again then push the left-click button.
6. Select ▲ or ▼ then push the left-click button to change the setting.
   The setting range is 0 to 12. The higher the setting, the stronger the suppression on long range.

2nd AGC		Quit
2nd AGC	: 2	
Distance	: 0m	
Type	: Normal	

7. Select [Quit] on the setting box then push the left-click button to close the box.
8. Long-press the **MENU/ESC** key to close all menus.

Other AGC-related items on the [2nd AGC] menu

Distance: Set the start range for the 2nd AGC. The setting range is 0 - 2000 m, in 20 m increments. 2nd AGC is inoperative if the display range is lower than the 2nd AGC start range.

Type: Select the TVG type for 2nd AGC. Select [Normal] for everyday use.

3.8.4 How to shorten pulse length

The pulse length 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, the ability to separate several closely located targets. When searching bottom fish, therefore, it is useful to shorten the pulse length in order to separate fish echoes from bottom reflections. Decrease the pulse length setting to shorten the pulse length.

Note: For search of surface and midwater fish in which bottom reflections are not so strong, use the longest pulse length 9.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [TX/RX Setting] then push the left-click button.

3. Press the **H/V/S** key to select the [V] tab.

TX/RX Setting		Quit
H1	H2	V
TX Interval	: 9	
TX Pulse Length	: 9	
TX Power	: 9	
Reverberation	: 0	
Freq Shift	: 7	
Freq/Bearing Set	: 16	
Beam Width...		
Bottom Suppress	: 0	

4. Select [TX Pulse Length] then push the left-click button.

5. Select ▲ or ▼ then push the left-click button to change the setting. The setting range is 0-9. The higher the setting, the longer the pulse length.

6. Select [Quit] on the setting box then push the left-click button to close the box.

7. Long-press the **MENU/ESC** key to close all menus.

3.9 How to Reject 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.

3.9.1 How to identify the noise source

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

1. On the [Test] menu, turn off [TX] to stop transmitting. Turn on all on-board electronic equipment one by one while observing the picture. If noise appears on the sonar display, that equipment is emitting noise. Check the offending equipment's ground and installation.

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 one of the following:

3.9.2 Interference rejector

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.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Picture Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [V] tab.
4. Select [Int Reject] then push the left-click button.
5. Select ▲ or ▼ then push the left-click button to change the setting The setting range is 0 to 3. The higher the setting, the greater the degree of interference rejection.
6. Select [Quit] on the setting box to close the box.
7. Long-press the **MENU/ESC** key to close all menus.

Picture Setting		Quit
H1	H2	V
Echo Average	: 1	
Int Reject	: 0	
Smooth Echo RNG	: 1	
Smooth Echo CIR	: 0	

3.9.3 Shift TX frequency

If the interference can not be suppressed by the interference rejector or change in TX interval, shift the Tx frequency with the [Frequency] menu.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [TX/RX Setting] then push the left-click button.
3. Press the **H/V/S** key to select the [V] tab.
4. Select [Freq Shift1] then push the left-click button.
5. Select ▲ or ▼ then push the left-click button to change the setting. The setting range is -30 to 30.
6. Select [Quit] on the setting box then push the left-click button.
7. Long-press the **MENU/ESC** key to close all menus.

Note: In some cases the frequency can not be changed because of operating bandwidth. In this case the frequency setting is grayed.

3.9.4 Noise limiter

Weak, unwanted reflections, colored light-blue or green, appear when the water is dirty, plankton layers exists, or due to ship's noise. The noise limiter can reduce the effects of these unwanted reflections. Raising the setting causes unwanted reflections to be displayed in colors of blue to background color.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Display Setting] then push the left-click button.

3. Press the **H/V/S** key to select the [V] tab.

4. Select [Noise Limiter] then push the left-click button.

5. Select ▲ or ▼ then push the left-click button to set the value (setting range: 0 to 15).

6. Select [Quit] on the setting box then push the left-click button to close the box.

7. Long-press the **MENU/ESC** key to close all menus.

3.9.5   Reverberation

You may select the length of reverberation for the echo signal, with [Reverberation] in the [TX/RX Setting] menu on the [V] tab. The larger the setting, the lower the reverberation effect, which makes it easier to see the echo signal. The setting range is 0 to 5.

3.9.6   Echo average

[Echo Average] on the [Picture Setting] menu in the [V] tab adjusts echo afterglow - the amount of time an echo signal remains on the screen. This feature can be useful for watching echo movement. The setting range is 0 to 11. **Setting between 1 and 7**: Echoes are gradually displayed and afterglow remains on the screen longer as the setting is increased.**Setting between 8 and 11**: Echoes are quickly displayed and afterglow remains on the screen longer as the setting is increased.

3.9.7   How to suppress the bottom echo

[Bottom Suppress] on the [TX/RX Setting] menu in the [V] tab suppress the stable echoes such as bottom echo, plankton echo. Moving echoes such as fish school are not effected by this setting. The setting range is 0 to 10. The higher the setting, the lower the stable echo.

Note: Do not over suppress the bottom echo; a slow moving school of fish may also be suppressed.

3.10 How to Adjust Beam Width

The width of the horizontal beam can be adjusted from the [Beam Width] menu.

1. Press the **MENU/ESC** key to show the main menu.

2. Select [TX/RX Setting] then push the left-click button.

3. Press the **H/V/S** key to select the [V] tab.

4. Select [Beam Width] then push the left-click button.

Beam Width	Quit
Beam : 5	

5. Select [Beam] then push the left-click button.

6. Select [▲] (raise setting) or [▼] (lower setting) to adjust the beamwidth. The setting range is 0 to 5.

7. Select [Quit] on the setting box then push the left-click button to close the box.

8. Long-press the **MENU/ESC** key to close all menus.

3.11   Other Menu Items

This section describes menu items which have not been explained yet.

Display Setting menu
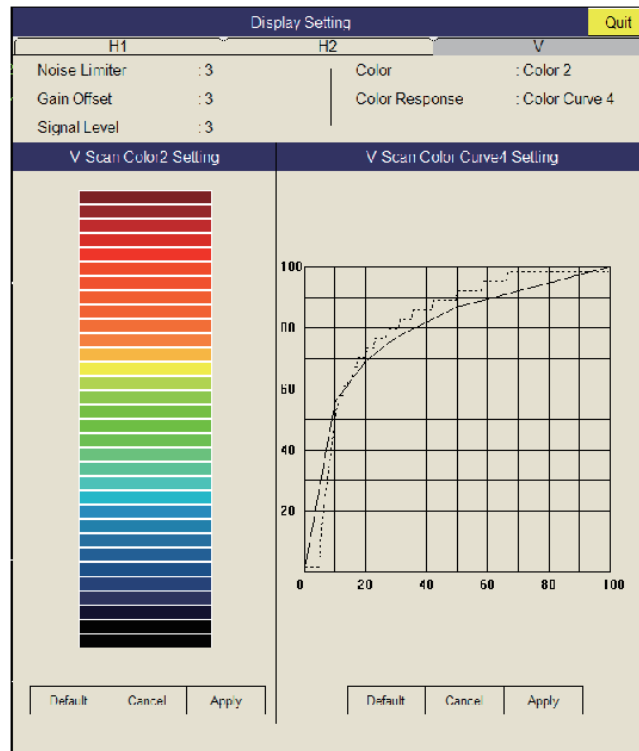
Gain Offset: Adjusts gain level. If the **GAIN** control on the front panel does not provide satisfactory gain adjustment, enter an offset here. The setting range is 0 to 12.

Signal Level: Contaminated water or reflections from plankton may be painted on the screen in green or light-blue. These echoes may be erased in order of strength. The setting range is 0-15; 0 corresponds to the weakest color.

Color: Select color arrangement to use.

V-Scan Color 1 (2 to 4) Setting: Customizes colors. For details, see page 2-36.

V-Scan Color Curve Setting: Adjusts reflected echo strength versus echo color level for currently selected color response number. To adjust the curve, see page 2-36.

Picture Setting menu
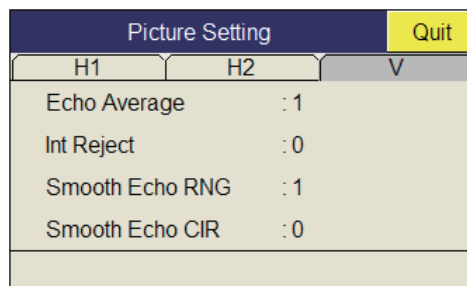
Smooth Echo RNG: Selects echo smoothing level in the range direction. The setting range is 0 to 7. The higher the setting, the greater the smoothing.

Smooth Echo CIR: Selects echo smoothing level in the circular direction. The setting range is 0 to 5. The higher the setting, the greater the smoothing.

3.12 Application to Bonito and Tuna Fishing

Tracking of bonito and tuna presents a special challenge to the sonar operator: He must try to keep them within the sonar beam, a formidable task considering their high speed and penchant for leaping and diving. However, the vertical display, with its wide range in the vertical direction, makes this task easier.

3.12.1 Searching

Neither the naked eye nor binoculars can continually track schools of fish which make lightning quick runs between the surface and midwater. A sonar, however, provides a continuous view of several hundred meters of sea area around the boat, both at the surface and below it.

3.12.2 Tracking

If you are visually tracking a school of fish which characteristically leaps and dives regularly, or a school with a flock of birds hovering over it, the school will scatter once the vessel approaches, thus you will lose sight of the school. This sonar provides continuous pictures of underwater conditions, so you can always know where a school of fish is. For tracking the schools which leap and dive often the vertical mode is especially effective.
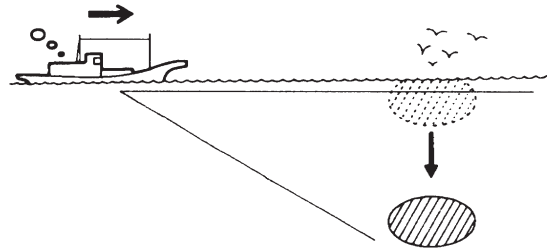
3.12.3 Approaching

The sonar lets you view the movement of a school of fish continuously, thus you can approach a school confident of a good catch.

While a flock of birds hovering over the sea surface is usually a good indication of the presence of a school of fish, the sonar can better verify the size of a school of fish.
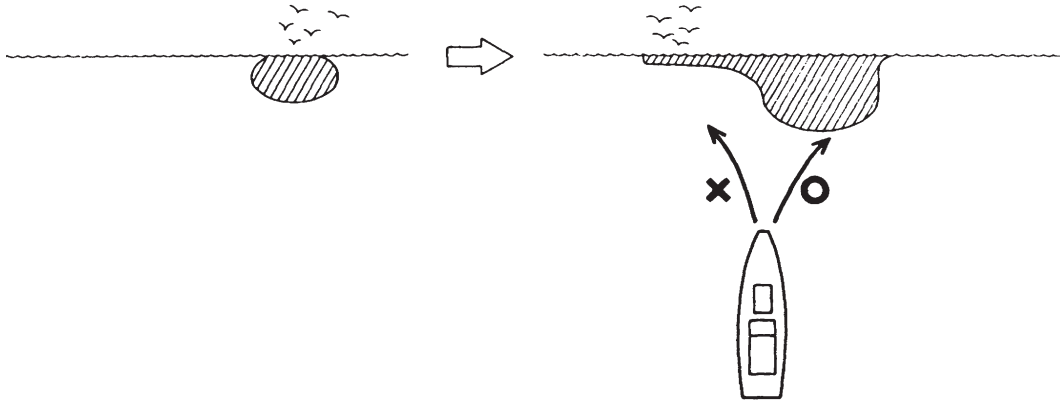
3.12.4 Catching

While the sonar operator monitors the sonar for other schools of fish, the crew can scatter bait and water to attract fish to the boat.
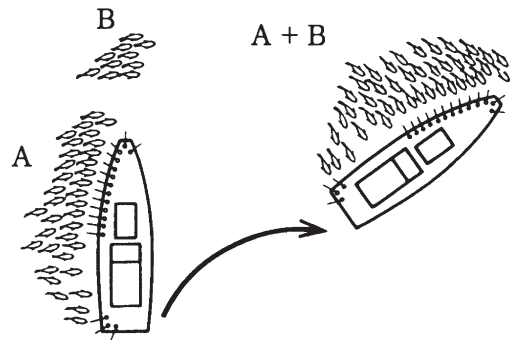
4. NUMERIC/GRAPHIC DATA DISPLAY

4.1 Numeric/Graphic Data Display

This display provides comprehensive numeric/graphic data and appears with the horizontal and vertical displays, at the right side of the display.

HEADING	321°	— Heading*
SHIP COURSE	335°	— Course*
SHIP SPEED	12.5kn	— Speed*

LAT/LON[DGPS]

— Position format
— Navigator type (in brackets)*
DGPS: Differrential GPS
KGPS: Kinematic GPS
FGPS: Floating GPS
GPS: GPS
LC: Loran C
DR: Dead Reckoniong
***: Position error

32°52.150N
132°12.150E

DEPTH   321m ———————
WATER CURRENT
   C1   1.2kn   342°
   C2   0.8kn   298°
   C3   0.4kn   256°

— Depth
Water current speed
and direction for three
layers*

NET DEPTH
   S1   134m
   S2   178m
   S3   213m

Net sonde depth
data*

FISH HISTOGRAM ——————
1 | SCAN1

Fish histogram
(See page 2-29.)

WATER TEMP   10.35°C ——
20MIN   10   0
12
10
8

Water temperature*,
Water temperature
graph*

TARGET LOCK ON
(Mark Interlock:
Est & Fish Info
at Target Lock menu)
TARGET LOCK OFF

SCHOOL OF FISH INFO	
LENGTH	51 m
WIDTH	47 m
HEIGHT	24 m
DIMENSIONS	2564 m^2
VOLUME	45805 m^3
WEIGHT	59 t

* Requires appropriate sensor.

4.2 Numeric, Graphic Data Description

When a data is lost its last-entered value is shown in red. Data displays can be turned on or off through the [DATA DISPLAY] menu.

Numeric/ Graphic item	Description	Display range	Available formats	Where to change format
Heading	Shows heading input from heading sensor.	32 comp. pts, 0° to 359° 0° to 359° 1° to 179° P/S, 0°, 180°	32 comp. pts. 360° True 360° Rel 180° Rel	[Data Display] menu
Course	Shows ship course fed from numeric/graphic indication.			
Speed	Shows ship speed fed from a Numeric/graphic indication.	0 to 40 kn	Fixed at knots	
Position of the ship	Ship position in latitude and longitude. If position data is lost the last-entered position is shown in red.	Lat: 90°00.000S to 90°00.000N Lon: 179°59.999W to 179°59.999E, 180°00.00, 0°00.000	Lat/Lon	
Position sensor	The position sensor type is displayed in brackets ("[]"). When the position sensor is not connected, the brackets are left blank.	DGPS, KGPS, FGPS, GPS, LC, DR, *** **Note:** "***" is displayed when the positioning error occurs.	GPS Loran-C DR AUTO	System menu
Depth	Shows depth from transducer to bottom.	0 to 9999 m	Meters	
Current	Shows tide speed and direction for three layers or tide and speed for two layers against a reference layer fed from a current indication.	Cur. Speed: 0 to 9.9 kn Direction: 0° to 359°	Direction shown as flow from or flow to	[Current Vec & Wind] menu
Net depth	Depth of net sonde transmitter. Shown only at shooting of net.	0 to 999 m	Depth of up to 3 pts can be displayed.	[Net Sonde Setting] menu

Numeric/ Graphic item	Description	Display range	Available formats	Where to change format
Fish histo-gram	Shows signal strength con-centration of fish estimate mark inscribed on hor-izontal display.	Two marks	On/Off on the [Mark Display]- [Histo-gram Disp.] menu	
Water temp.	Shows water temperature in-put from a tem-perature sensor.	-10.00°C to +40.00°C, 14.00°F to 104.00°F	°C, °F	[Data Display] menu
Water temp. graph	Shows water temperature over time. Hori-zontal axis: time, Vertical axis: °C(°F)	Horizontal axis: Time 20 min./1h/6h/12h/ 24h, Vertical axis: Temp. 4°C, 8°F, fixed width, auto shift)	°C, °F	[Data Display] menu
Info on school of fish	Shows informa-tion about school of fish during target lock operation.	**Length**: Distance to school of fish in range direction **Width**: Distance to school of fish in bearing direction **Height**: Vertical distance **Dimensions**: Horizontal dimension of school of fish **Volume**: Estimated volume of school of fish **Weight**: Estimated tonnage of school of fish, calculated from di-mension or volume above		

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5. HOW TO CUSTOMIZE THE EQUIPMENT

5.1 User Menu

You may program 20 often-used menu items to the user menu area in the menu. The default user menu contains, pulse length, TX power, TVG near, TVG medium, TVG far, AGC, 2nd AGC, color, response color and echo average for the horizontal display.

Menu	Quit
TX/RX Setting...	
Gain Setting...	
Display Setting...	
Picture Setting...	
Others...	
▼ Shortcut Menu	

Push the left-click button. →

Menu	Quit
TX/RX Setting...	
Gain Setting...	
Display Setting...	
Picture Setting...	
Others...	
▼ Shortcut Menu	
TX Pulse Length-H1	: 7
TX Power-H1	: 7
TVG-Near-H1	: 5
TVG-Medium-H1	: 2
TVG-Far-H1	: 2
AGC-H1	: 2
2nd AGC-H1	: 7
Color-H1	: Color 2
Color Response-H1	: Color Curve 1
Echo Average-H1	1 *

User menu items

*: This means this item is programmed to H1 menu.

5.1.1 How to program the user menu

The procedure below shows you how to add the menu item [V Mode] (on the Wheel Setting menu) to the user menu. Some menu items can not be programmed to the user menu. See the menu tree on page AP-1 to AP-5 for items which can be programmed.

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Wheel Setting] then push the left-click button.

Wheel Setting	Quit
H Mode	: Tilt Angle
V Mode	: Bearing

3. Select [V Mode] then push the left-click button more than one second. The message "User Menu Registration Selected item will be registered in main menu." appears.

4. Select [Register] then push the left-click button.
    The selected item is registered, and shown at the bottom of the menu. The order of items in the [USER] menu can be changed by drag and drop.
    Note: If 20 items are already registered to the user menu the following message appears. Delete unnecessary items from the user menu and then repeat this procedure to register different item. Press the **MENU/ESC** key to close this message.

```
──────── Caution ────────
No free space in user program.
Delete unnecessary items.
Confirm and press [MENU/ESC] key.
```
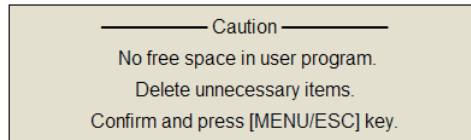
5. Long-press the **MENU/ESC** key to close all menus.

5.1.2 How to delete items from the user menu

To delete a menu item from the user menu which you do not require, do as follows.

1. Press the **MENU/ESC** key to open the main menu.

2. Select [▼ Shortcut Menu] then push the left-click button.

3. Select the item to delete then push the left-click button more than three seconds. The message "Delete Registration Selected item will be removed from main menu. Are you sure?" appears.

4. Select [Remove] then push the left-click button to delete.

5. Long-press the **MENU/ESC** key to close all menus.

5.2 Function Keys (F1 to F10)

The function keys provide one-touch display of desired menu item or entire menu. The default function key settings are as below. Not all menu items and menus may be programmed to the function keys. See the menu tree on page AP-1 to AP-5 for items which may be programmed.

Function key	Default setting	Function
F1	Record Still Image	Save the still image
F2	Recall Still Image	Open the [Still Image] window
F3	Event Mark 1	Erase event mark 1
F4	Event Mark 2	Erase event mark 2
F5	Fish Mark	Erase fish mark
F6	Own Ship Pos Mark	Erase own ship position mark
F7	Ship's Track	Erase approx. 10% of the ship's track
F8	Dimmer	Adjust panel dimmer
F9	Stabilization	Activate or deactivate the stabilization
F10	Net Course Mark	Enter or erase the net course mark

5.2.1   How to execute a program

1. Press desired function key to show the applicable dialog box.

```
<<Dimmer>>

     7
```

When the F8 key is pressed

2. Press the same function key again within five seconds to execute the function. The dialog box automatically disappears in five seconds. You can also close the dialog box manually by pressing any function key other than the one pressed at step 1.

5.2.2   How to program the function keys

You can change the default setting of a function key as shown below. Note that some menu items can not be programmed to the function keys. See the menu tree on page AP-1 to AP-5 for items which can be programmed for function keys.

1. Press the **MENU/ESC** key to open the menu.

2. Press desired function key for more than one second. The message shown below appears for five seconds.

```
<< Function Key Registration >>

Replace the function to new setting.

Press the key again to proceed.
```
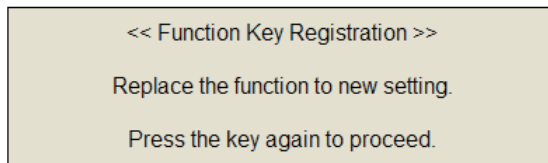
3. Press the same function key again, and the message shown below appears.

```
<< Function Key Registration >>

Registration completed.
```
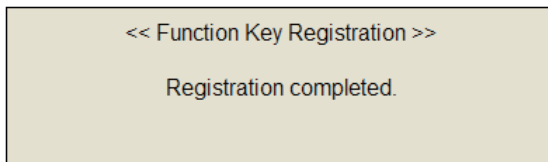
5.2.3 How to erase programs

1. Press the **MENU/ESC** key to open the main menu.

2. Select [Others] then push the left-click button.

3. Select [Register] then push the left-click button.

Register	Quit
Display Mode…	
Sel User Prog	: H/V Individual
Assign User Prog	
Assign User Prog-H	
Assign User Prog-V	
F-KEY List…	
Clear F-KEYSetting…	
H-Scan Range	
V-Scan Range	
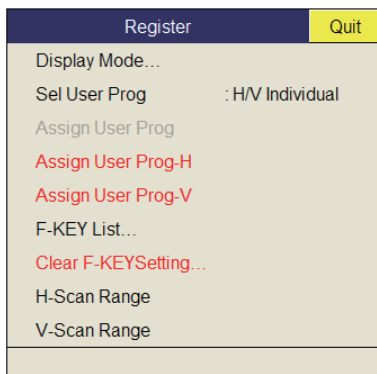
4. Select [Clear F-KEY Setting] then push the left-click button.

5. Select [Changeable] then push the left-click button.

6. Select the function key for which you want to erase its program then push the left-click button. Repeat this step for other function keys.

7. Select [Quit] on the setting box then push the left-click button.

8. Long-press the **MENU/ESC** key to close all menus.

Quit
Cancel
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
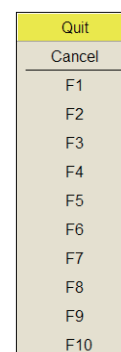
5.2.4 How to program the function keys of remote controller

You can program the function keys (**F1**-**F4**) on the remote controller (option) to provide one-touch access to the functions of the keys on the control unit.

The function of the following control unit keys can be assigned to the function keys on the remote controller.

- **V1/S** key
- **V2** key
- **EVENT** ⊕ (or ⊘) key
- **OFF CENTER** key
- **ESTIMATE 1** (or **2**) key
- **SHOOT** key
- **R/B AUDIO** key

- **DELETE MARK** key
- **TARGET LOCK** key
- **FISH** key
- **AUTO TRAIN** key
- **DISP MODE** key
- **H/V/S** key
- **F1** to **F4** key

The default setting of the **F1** to **F4** key is the same as those on the control unit. To change a setting, do as follows:

1. Press the **F8**, **F9**, and **F10** keys in order while pressing the **MENU/ESC** key to activate the program registration mode on the remote controller.

2. Press the **MENU/ESC** key to close the menu.

3. Press and hold down the applicable key on the control unit and then press a function key on the remote controller.
   When the registration is completed the audio alarm sounds.

4. Operate the function key programmed to confirm functionality.

5. Repeat steps 1 to 4 to program another function key.

5.3   USER PROG Control

The **USER PROG** control provides for instant setup of the equipment according to fishing ground or target fish. Ten programs may be set up, and vertical and horizontal display settings may be programmed together or individually. (The default settings programs them together. For how to program them individually see section 5.3.2.)

5.3.1   How to select a user program

Rotate the **USER PROG** control clockwise or counterclockwise to select the program no. desired. The program no. selected appears at the top right-hand corner of the screen to the right of "P". If the equipment is turned off with a user program active, it starts up with those settings at the next power on.

Note: The user program no. can also be adjusted from the user program no. indication. Put the cursor on the user program no. indication to highlight it in yellow then roll the scrollwheel.

5.3.2   How to program the USER PROG control

1. Set the display appropriately.
   When a combination mode is shown, press **H/V/S** key to select the display to program.
2. Press the **MENU/ESC** key to show the main menu.
3. Select [Others] then push the left-click button.
4. Select [Register] then push the left-click button.

Register	Quit
Display Mode…	
Sel User Prog	: H/V Interlock
Assign User Prog	
Assign User Prog-H	
Assign User Prog-V	
F-KEY List…	
Clear F-KEYSetting…	
H-Scan Range	
V-Scan Range	

Register	Quit
Display Mode…	
Sel User Prog	: H/V Individual
Assign User Prog	
Assign User Prog-H	
Assign User Prog-V	
F-KEY List…	
Clear F-KEYSetting…	
H-Scan Range	
V-Scan Range	

[Sel User Prog] = [H/V Interlock]   [Sel User Prog] = [H/V Individual]

*: H/V Interlock: Effective on both H and V displays.
   H/V Individual: Select the display to use with the **H/V/S** key.

5. Do one of the following then push the left-click button.
   • For H/V Interlock: Select [Assign User Prog].
   • For H/V Individual: Select Assign [User Prog-H/S] or [Assign User Prog-V].

6. Select [Changeable] then push the left-click button. One of the following displays appears depending on your selection.

Quit
Cancel
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10

"Assign User Prog"

Quit
Cancel
P1-H
P2-H
P3-H
P4-H
P5-H
P6-H
P7-H
P8-H
P9-H
P10-H

"User Prog-H"

Quit
Cancel
P1-V
P2-V
P3-V
P4-V
P5-V
P6-V
P7-V
P8-V
P9-V
P10-V

"User Prog-V"

7. Select a program no. then push the left-click button.

8. Select [Quit] on the setting box then push the left-click button.

9. Long-press the **MENU/ESC** key to close all menus.

6. OTHERS MENU

This chapter provides descriptions for the [Others] menu. To display the [Others] menu, press the **MENU/ESC** key, select [Others] then push the left-click button.

Others	Quit
Edit User Program…	
ES Setting…	
2D-Map Disp Setting…	
Erase Marks…	
Wheel Setting…	
Display Setting…	
Alarm & Audio…	
Register…	
Record/Recall…	
Initial Setting…	
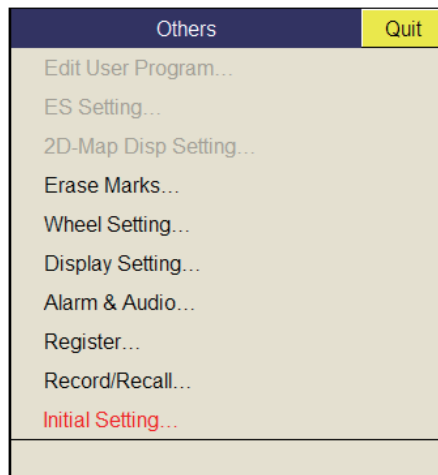
The [Record/Recall] menu is described in chapter 7. Also, menu items shown in gray can not be accessed.

6.1 Erase Marks Menu

The [Erase Marks] menu lets you delete selected marks and track.

1. Select [Erase Marks] on the [Others] menu then push the left-click button. This menu can be also opened from the right-click pop up menu.

Erase Marks	Quit
F3 Event Mark1	: Execute
F4 Event Mark2	: Execute
F5 Fish Mark	: Execute
F6 Own Ship Pos Mark	: Execute
F7 Ship's Track	: Execute
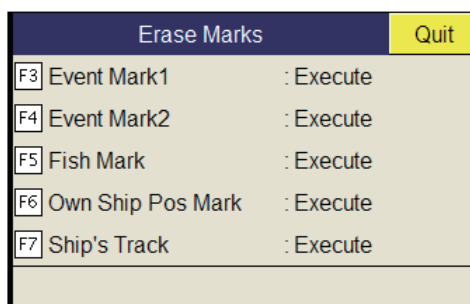
2. Select the mark (or track) you want to delete then push the left-click button. The earliest mark is deleted. For ship's track, approximately 10% of the track is erased with each push of the left-click button.

3. To continue erasing marks, push the left-click button.

4. Long-press the **MENU/ESC** key to close all menus.

Note: The default function of the **F3** (for event mark 1), **F4** (for event mark 2), **F5** (fish mark) and **F6** (for own ship position) keys delete the oldest event mark, fish mark, own ship mark. The default function of the **F7** key erases approximately 10% of the track.

6.2 Wheel Setting Menu

One of the following functions can be assigned to the scrollwheel.

- Tilt angle (Horizontal display only)
- Gain
- Range
- Bearing (Vertical display only)

1. Select [Wheel Setting] on the [Other] menu then push the left-click button. This menu can be also opened from the pop-up menu.

Wheel Setting		Quit
H Mode	: Tilt Angle	
V Mode	: Bearing	

2. Select [H Mode] or [V Mode] then push the left-click button.

Quit	Quit
Cancel	Cancel
Tilt Angle	Range
Range	Gain
Gain	Bearing

  H Mode   V Mode

3. Select the function to assign to the scrollwheel then push the left-click button.
4. Select [Quit] on the setting box then push the left-click button to close the box.
5. Long-press the **MENU/ESC** key to close all menus.

6.3 Display Setting Menu

The [Display Setting] menu sets various display-related items according to operator's preference. To display the menu, open the main menu then select the [Others] and [Display Setting] menus.

Display Setting	Quit
Mode Selection	: Mode Key
Echo Disp Area	: Within Range
H2 DISPLAY	: Landscape
2D-Map Display	: Landscape
2nd Monitor Setting	: Portrait
V-Scan Aspect Ratio	: Fixed
V-Scan Dpt Rng	: 100
Presentation Mode	: Head Up
2D-Map Up	: North Up
TM Disp Range	: 1.6R
Full Screen Area	: 1.6R
Bearing Ref	: Ship Heading
TILT lever	: Tilt
Auto Tilt	: Narrow
F10 Net Course Mark	: Execute
F8 Dimmer	: 7
Key Beep Volume	: 0
TimerDisplay	: OFF

Mode Selection: Determines how display modes are chosen: **MODE** key or pull-down menu.

Echo Disp Area: Selects the echo display mode for the horizontal display, [Within Range] or [Full Screen]. See page 1-7.

H2 Display: Selects the combination mode of two horizontal displays: Landscape, Portrait, or Inset.

2nd Monitor Setting: When two monitors are connected, select the combination mode for the sub-display; Landscape or Portrait. This function is available only when [Dual Display] is selected at [2nd Monitor Setting] on [Others]-[Initial Setting].

V-Scan Aspect Ratio: Selects the type of the horizontal to vertical ratio to use on the V-display; Fixed or Flexible.

V-Scan Dpt Rng: Sets the ratio (%) to reduce the display range of the depth direction in the vertical display. The setting range is 20-100. Adjustment is disabled (grayed out in menu) when [V-Scan Aspect Ratio] is set to [Fixed].

Presentation Mode: Selects presentation mode. Head-up, North-up, Course-up and true motion (requires ship's speed and heading data) are available.

TM Disp Range: Selects how many times to expand the display range in the true motion mode. 1.3R (R=Range) and 1.6R are available.

Note: When you set [TM Disp Range] to 1.3R and [Full Screen Area] to 1.6R, the full screen area for the TM mode becomes 1.6R.

Full Screen Area: Selects a configuration for the full screen display, 1.3R or 1.6R.

Bearing Ref: Selects how to reference bearing for the vertical bearing marker. The choices are ship's heading and North.

TILT lever: Selects function of the **TILT** control. [Tilt] sets the tilt only. [Tilt & V1] sets the bearing of the vertical 1 display in the vertical display and sets the tilt in the horizontal display./

Auto Tilt: Selects the auto tilt angle, Wide (±2° to 10°, ±4° to 16°, ±6° to 20°) or Narrow (±1° to 4°, ±2° to 6°, ±3° to 8°).

Net Course Mark: Inscribes/deletes the net course mark. For details, see section 2.19.

Key Beep Volume: Sets the volume of the beep which sounds for key operation. The setting range is 0 to 7. "0" turns off the key beep.

Timer Display: Set [ON] to show the timer window at the bottom left of the display. The timer window can be moved by drag and drop operation. Operate the timer window as shown below.

1. Select [▶] on the timer window and push the left-click button to start the timer. The icon [▶] on the timer window changes to 〔●〕.

2. Select 〔●〕 on the timer window and push the left-click button to stop the timer. The icon 〔●〕 on the timer window changes to [▶].

3. Select [|◀] on the timer window and push the left-click button to reset the timer.

6.4 Alarm & Audio Menu

The [Alarm & Audio] menu sets the fish alarm and the audio bearing mark sector. To show this menu, open the main menu, then open the [Others] and [Alarm & Audio] menus.

Alarm & Audio	Quit
Fish Alarm	: OFF
Alarm Level	: 16
Alarm Zone…	
Ship SPD Alarm	: ON
Audio	: ON
Audio Volume	
Audio Sector	: 30°
Reverberation	: 0

Fish Alarm: Turns the fish alarm function on or off. The default setting is [OFF].

Alarm Level: Sets the minimum echo color which triggers the fish alarm. The setting range is 0 to 30.

Alarm Zone: Sets fish alarm zone. For details, see section 2.14.

Ship SPD Alarm: The default setting is ON. The alarm is released if ship's speed exceeds the following limits: Lowering transducer: 18 knots (1200 mm stroke) or 15 knots (1600 mm stroke) Raising transducer: 15 knots (1200 mm stroke) or 12 knots (1600 mm stroke)

Audio: Turns the audio function on/off.

Audio Alarm: Adjusts the volume of the audio alarm.

Audio Sector: Selects the audio sector width for use with audio function.

Reverberation: Selects the length of reverberation for audio signal. The setting range is 0 to 9. 0 is no reverberation. The larger the setting, the longer the reverberation.

6.5 Register Menu

The [Register] menu provides various programming functions. To show this menu, select [Register] on [Others] menu then push the left-click button.

Register	Quit
Display Mode…	
Sel User Prog	: H/V Individual
Assign User Prog	
Assign User Prog-H	
Assign User Prog-V	
F-KEY List…	
Clear F-KEYSetting…	
H-Scan Range	
V-Scan Range	
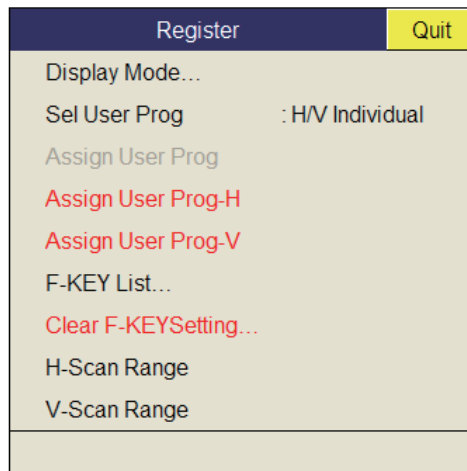
[Sel User Prog] = [H/V Interlock]

Sel User Prog/Assign User Prog/Auto User Prog Sel: Programs the **USER PROG** control. For further details see section 5.3.

Display Mode: Selects the display mode to use.

F-KEY List: Shows the functions assigned to each function key.

F1 Record Still Image	F2 Recall Still Image	
F3 Event Mark1	F4 Event Mark2	
F5 Fish Mark	F6 Own Ship Pos Mark	Confirm
F7 Ship's Track	F8 Dimmer	
F9 Stabilization	F10 Net Course Mark	

Clear F-KEY Setting: Erases program assigned to a function key.

H-Scan Range: Presets the horizontal mode ranges as selected with the **RANGE** control. The setting range is 60 to 5000 m.

V-Scan Range: Presets the vertical scan ranges as selected with the **RANGE** control. The setting range is the same as that for [H-Scan Range].

6.6   Initial Setting Menu

The [Initial Setting] menu sets up mark size, current vector, net sonde, target lock, etc.

1. Press the **MENU/ESC** key to show the main menu.
2. Select [Others] then push the left-click button.
3. Select [Initial Setting] then push the left-click button.
4. Select [Changeable] then push the left-click button.

Initial Setting	Quit
Language	: English
Remote BOX LED	: ON
Menu Box Transp.	: OFF
TVG Monitor Transp.	: OFF
Monitor Setting...	
Data Display...	
Mark Display...	
Mark Size...	
Data Display...	
Current Vec & Wind...	
Net SONDE Setting...	
Net Shoot Setting...	
Target Lock...	
Auto Fish Mark...	
Stabilization...	
Test...	
Initialization...	

For serviceman
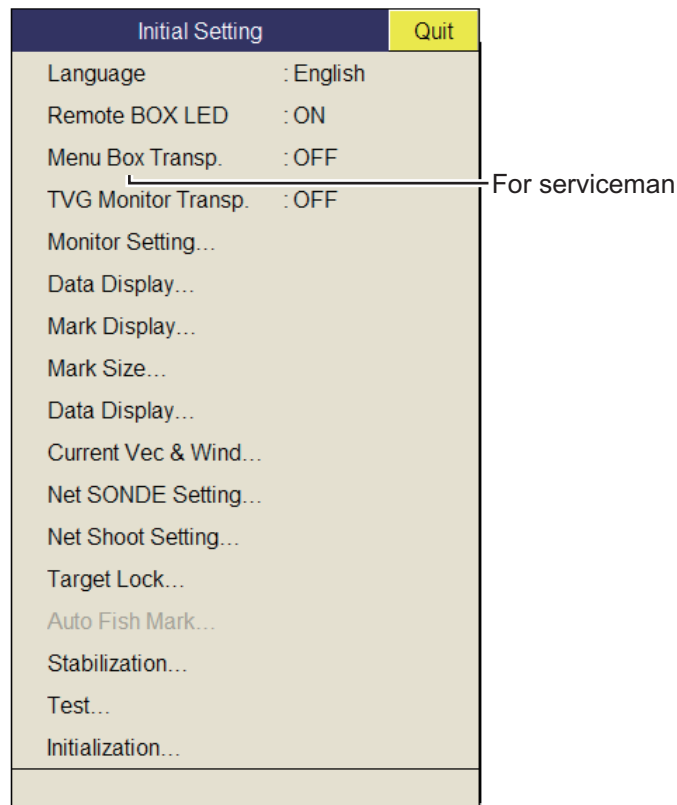
For [Target Lock] and [Test], see page 2-20 and page 8-8, respectively.

Remote BOX LED: Turns ON/OFF the LED of the remote controller (option).

Menu Box Transp.: Selects the degree of transparency for the menu display. (Setting range: OFF, 1 to 5) Alpha blending technology is used for transparency effects.

Monitor Setting menu

The [Monitor Setting] menu sets the function of dual monitors. Select [Monitor Setting] on the [Initial Setting] menu then push the left-click button.

Monitor Setting	Quit
Monitor Orientation	: Horizontal
2nd Monitor Setting	: Dual Display

2nd Monitor Setting: Selects the display format for the sub monitor (Off, Dual Display, Sub Display).

Note: When the above setting is changed the default display arrangement is restored.

- OFF: Select if a single monitor is connected.
- Dual Display: Main and sub monitors show different pictures in the combination display mode.
- Sub Display: Main and sub monitors show the same picture in the combination display mode.

Display mode	Dual Display		Sub Display	
	Main monitor	Sub monitor	Main monitor	Sub monitor
H2	H1	H2	H1/H2	H1/H2
V1	H	V1	H/V1	H/V1
V2	H	V1/V2	H/V1/V2	H/V1/V2

Note: Turn the power off and on again after you change this setting.

Data Display menu

The [Data Display] menu sets the readout format for the marks on the display. Select [Data Display] on the [Initial Setting] menu then push the left-click button. This menu is also shown on the pop-up menu.
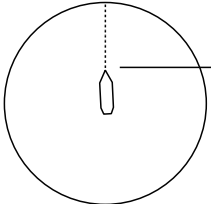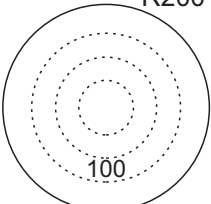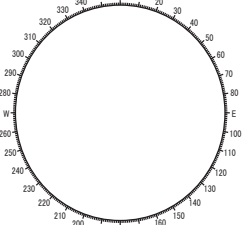
Data Display	Quit
Data Display	: ON
Data Box POS	: Fixed
Data Box Transp.	: OFF
Data Box Size	: Small
Auto Tile Window	: Execute

Data Display: Turns the numeric/graphic data display on/off.

6-8
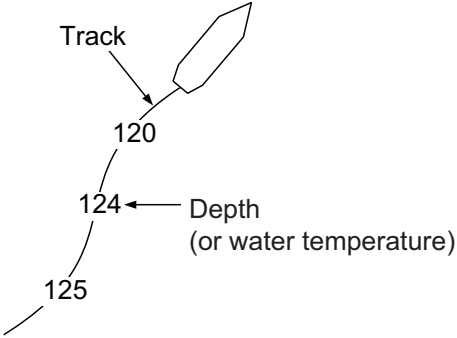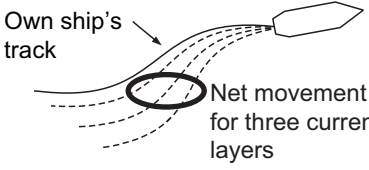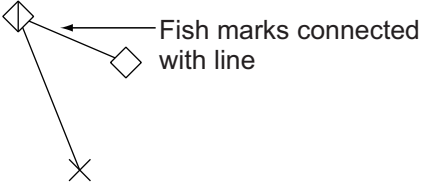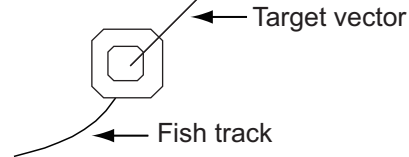
Mark Display menu

The [Mark Display] menu turns on/off marks. Select [Mark Display] on the [Initial Setting] menu then push the left-click button.

Mark Display	Quit
Heading Mark	: ON
Range Rings	: ON
Bearing Scale	: ON
Azimuth Compass	: ON
Lat/Lon Lines	: ON
Own Ship's Track Plot	: ON
Data On Track	: OFF
Net Move Plot	: ON
Fish Mark Connect	: ON
Target Vector	: ON
Fish Track Plot	: ON
EVENT Key	: Event
Histogram Disp.	: ON
Mark Color	: White

Heading Mark: The heading mark is a dashed line which indicates the heading in all presentation modes. It extends from own ship position to the outer edge of the display and appears at zero degrees in the head-up mode. It changes the orientation depending on ship's orientation in the north-up, course-up and true motion modes.	Heading mark
Range Rings: The range rings are the dotted line circles about own ship, and they provide an estimate of the range to a target. Rings appear every distance of 1/2 or 1/4 of the range depending on menu setting.	R200 100
Bearing Scale: The bearing scale is the concentric solid circle at the edge of the display. It provides an estimate of the bearing to a target.	
Own Ship's Track Plot: Traces ship's movement with a solid line. When the capacity of the track memory is exceeded the earliest track is automatically erased to trace new track. Requires speed and course data.	

Data On Track: Shows depth or water temperature on the ship's track.	Track 120 124 ← Depth (or water temperature) 125
Net Move Plot: Shows predicted net movement against three current layers over time. Automatically turned on or off with the net shoot mark. Requires the current data.	Own ship's track Net movement plot for three current layers
Fish Mark Connect: You may connect fish marks with a line to show the order in which they were entered.	Fish marks connected with line
Target Vector: This is a line extending from the target lock mark, and it shows speed and direction of tracked school of fish. See the illustration below for appearance.	
Fish Track Plot: Traces target movement in target lock. Requires speed and course data.	Target vector Fish track
EVENT Key: Selects the key to enter the own ship's position mark (Event key, Shoot key).	
Histogram Disp.: Shows signal strength distribution for the school(s) of fish marked with an estimate mark on the horizontal display.	
Mark Color: Selects the color of the event, fish school, and fish estimate marks. (Setting range: White, Light blue, Blue, Yellow, Purple, Green) The mark color can not be set individually.	

Mark Size menu

The [Mark Size] menu lets you select the size and shape of the marks. Select [Mark Size] on the [Initial Setting] menu then push the left-click button.

Mark Size	Quit
Trackball Mark	: + Small
Target Lock Mark	: Normal
Auto Fish Mark	: Small
Target Vector	: Small
Event Mark	: Large
Fish Mark	: Large
Own Ship Pos Mark	: Normal
Own Ship Mark	: Actual
Net Shoot Mark	: Normal
Estimate On Scan	: Large
Current Vector	: Small
Range Ring Interval	: 1/4R
Bearing Scale	: Small
Own Ship's Track Plot	: 5R

Trackball Mark: Selects size and appearance of cursor. The choices are large and small "+" mark, and large and small "■" mark.

Target Lock Mark: The target lock mark size is available in normal, large, or small.

Target Vector: You may display the target vector in short, normal or long lengths. Set "long" for slow moving target; "short" for faster moving target.

Event Mark: Selects event mark size; normal, large, or small.

Fish Mark: Displays the fish mark in normal, large, or small size.

Own Ship Pos Mark: Shows the own ship position mark in normal, large, or small size.

Own Ship Mark: Selects size of own ship mark to standard, large, or actual.

Net Shoot Mark: You may show the net shoot mark in normal, large, or small size.

Estimate On Scan: Selects the size of the fish estimate mark on the horizontal display for normal or large.

Current Vector: The length of the current vector may be set to short, long, short/thick, or long/thick.

Range Ring Interval: Selects the range ring interval; 1/4R or 1/2R (R=Range).

Bearing Scale: Selects the size of the bearing scale for normal or large size.

Own Ship's Track Plot: Selects the amount of track to display; 5R, 10R, 20R, 40R (R=Range).

Data Display menu

This menu turns on/off alphanumeric data. Select [Data Display] on the [Initial Setting] menu then push the left-click button.

Data Display	Quit
Range&Bearing	: ON
Fishing Area	: OFF
Cursor Position	: OFF
Course	: 32 CMPS
Current Data	: 360°True
Event Mark	: 32 CMPS
Other Marks	: ±180°
Distance For Shoot	: NM
Water Temp	: ℃
Water Temp Range	: 20 Minute

Range/Bearing: Turns on/off the range and bearing data which appears when the range/bearing marks are turned on.

Fishing Area: Not used.

Cursor Position: Turns on/off the cursor position (latitude and longitude) display. (Requires navigation data.)

Note: When [EXT Data] on [Setting]-[Lat/Lon] on system menu is set to [Disable], the cursor position is not displayed even if the [Cursor Position] on [Initial Setting]-[Data Display] is set to [ON]. For the System menu, contact your dealer.

Course: Selects how to display course; [32 CMPS] (32 compass points), [360°True] (true bearing), [360°] (360° Relative), [±180°] (180° Relative). [±180°] shows xxxS in case of starboard direction; xxxP in case of port direction (xxx: 1 to 180). Heading sensor is required to set to [360°True]. [32 CMPS] shows bearing with alphabet indication, for example, "N", "N/E", "NNE", "NE/N", etc.

Current Data: Selects how to display tidal current data; [32 CMPS] (32 compass points), [360°True] (true bearing), [360°] (360° Relative), [±180°] (180° Relative).

Event Mark: Selects how to display event mark data; [32 CMPS] (32 compass points), [360°True] (true bearing), [360°] (360° Relative), [±180°] (180° Relative).

Other Marks: Selects how to display other mark data; [32 CMPS] (32 compass points), [360°True] (true bearing), [360°] (360° Relative), [±180°] (180° Relative).

Distance For Shoot: Selects the distance run unit to show the distance run after shooting the net. The options are miles, meters and feet.

Water Temp: Selects water temperature unit; in °C (Celsius) or °F (Fahrenheit).

Water Temp Range: Selects the time range to show water temperature, 20 Minute, 1 Hour, 6 Hours, 12 Hours or 24 Hours.

Current Vec & Wind menu

The [Current Vec & Wind] menu sets up tidal current and wind data. Select [Current/Wind] on [Initial Setting] menu then push the left-click button.

Current Vec & Wind	Quit
Current Data	: Water Current
On Own Ship Mark	: ON
On Ship Pos Mark	: ON
On Net Shoot Mark	: ON
Current Flow Dir	: To
Wind	: OFF

Current Data: Selects how to display current data; absolute or in relation to layer 1, layer 2 or layer 3.

On Own Ship Mark: Shows or hides the current mark on the own ship mark.

On Ship Pos Mark: Shows or hides the current mark on the own ship position mark.

On Net Shoot Mark: Shows or hides the current mark on the net shoot mark.

Current Flow Dir: Selects how to display current data. [FROM] shows from what direction the current is flowing; [TO] shows the direction the current is heading. Requires connection of a current indicator.
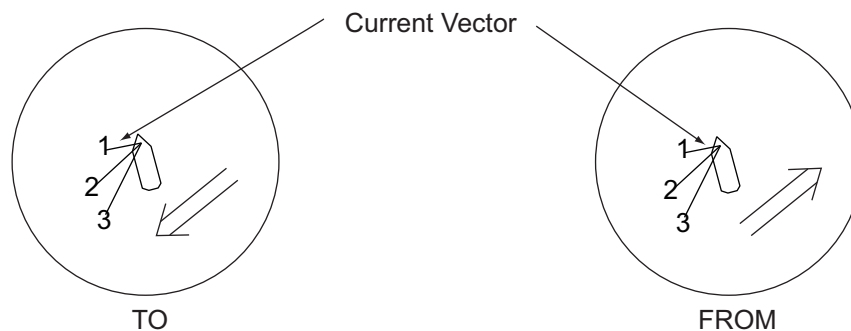
Wind: Selects wind display; OFF, relative wind data or true wind data.

Net SONDE Setting menu

The [Net SONDE Setting] menu sets up the net sonde. Select [Net SONDE Setting] on [Initial Setting] then push the left-click button.

Net SONDE Setting	Quit
Number Of XMTR *	: 3
XMTR Distance...*	
Net Length	: 1800m
Depth Display...	
Display Style	: Numeric
Depth Graph Range	: 100m

*Setting cannot be adjusted after the net is thrown.

Number Of XMTR: Sets number of transmitter units used, from 0 to 10. When the total value of [XMTR Distance] is smaller than the setting value of [Net Length], max. 10 transmitter units can be used.

XMTR Distance: Sets the distance between transmitters. Select this item then push the left-click button to set the distances.

XMTR Distance	Quit
End Of Net To S1	: 400m
S1->S2	: 400m
S2->S3	: 400m
S3->S4	: 400m
S4->S5	: 400m
S5->S6	: 400m
S6->S7	: 400m
S7->S8	: 400m
S8->S9	: 400m
S9->S10	: 400m

Net Length: Sets net length in increments of 100 m. Setting range is 500* m to 3000 m.
*Minimum length depends on the settings of [Number of XMTR] and [XMTR Distance].

Depth Display: Selects which sonde depth data to show. Select this item and push the left-click button to select net sondes. The check mark shows current selection (Max. 3).

Display Style: Selects the display format of the net depth, Numeric or Graph.

Depth Graph Range: Sets the depth range of the SONDE graph. The setting range is 50 m, 100 m, 150 m, 200 m.

Quit
Cancel
√ S1
√ S2
√ S3
S4
S5
S6
S7
S8
S9
S10

Net Shooting Setting menu

The [Net Shooting Setting] menu sets up net shoot parameters. Selects [Net Shooting Setting] on [Initial Setting] then push the left-click button.

Net Shoot Setting	Quit
Net Diameter	: 500m
Tilt Interlock	: ON
Net Plot Corr-LYR1	: 50%
Net Plot Corr-LYR2	: 50%
Net Plot Corr-LYR3	: 50%

Net Diameter: Sets net diameter in increments of 10 meters. Setting range is 200 m to 1000 m.

Tilt Interlock: Turns on/off interlocking of diameter of net course mark with tilt angle.

Net Plot Corr-LYR1, 2, 3: The movement of the net during net shooting is plotted using water current speed and direction fed from a current indicator. The current indicator feeds that data for three depths (layers), thus net movement will be different at each layer. Determine degree of difference among layers considering net, sea conditions, etc. If 50% is set, for example, the net movement plot mark moves at speed of 50% of water current speed.

Stabilization menu

The [Stabilization] menu compensates for the affects of pitching and rolling. Select [Stabilization] on Initial [Setting menu] then push the left-click button. Requires a inertial measurement unit.

Stabilization	Quit
F9 Stabilization	: ON
Pitch Angle Cor	: 0.0
Roll Angle Cor	: 0.0

Stabilization: Turns stabilization on/off.

Note: The default function of the **F9** key turns stabilization on/off.

Pitch Angle Cor: Offsets the pitch angle error generated by the inertial measurement unit.

Roll Angle Cor: Offsets the roll angle error generated by the inertial measurement unit.

Initialization menu

Select [Initialization] on [Initial Setting] menu then push the left-click button to show the [Initialization] menu.
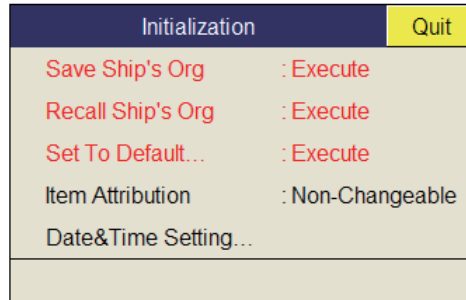
Save Ship/Org: All menu settings are saved.

Recall Ship/Org: Recalls the saved menu settings. Default settings are memorized in the internal memory. Use this item to recall the setting then rotate the **USER PROG** control.

Set To Default: Restores all default menu settings.

Item Attribution: Locks/unlocks protected menu settings. Asterisk-marked items on this page and [Ship Speed] in the [Alarm & Audio] menu cannot be adjusted by the user.

Date&Time Setting: Sets date, time, and time zone.
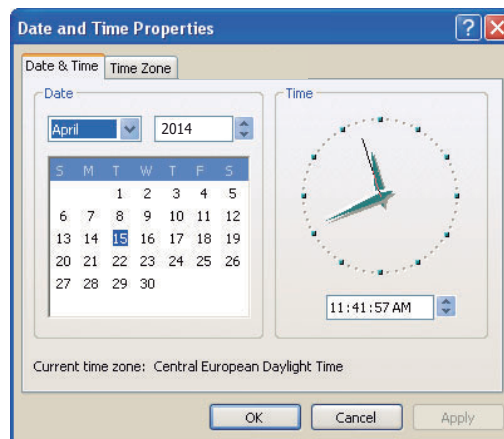
7. RECORD/RECALL OPERATION

You can take still images of the display and store them internally.

7.1 How to Specify Where to Save Still Images

You can specify where to save still images as follows:

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Record/Recall] then push the left-click button.

Record/Recall	Quit
Still Image…	
Motion Image…	
Setting File…	
2D-Map Data…	
Delete Data…	
Destination To Save…	
F1 Record Still Image	: Execute
F2 Recall Still Image	: Display
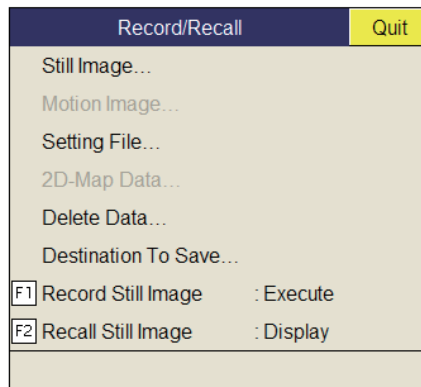
3. Select [Destination To Save] then push the left-click button.

Destination D:\Backup Reference

OK   Cancel
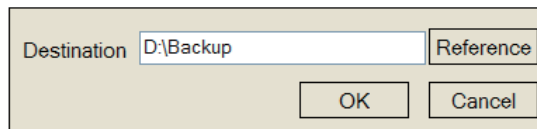
4. Select [Reference] on the Destination To Save window then push the left-click button.

Change Destination

Local Disc (D:)   Disk Info

Left-click

Destination list

Destination D:\Backup

OK   Cancel

Disk Info   Quit

Local Disk(D:)

Used Space : 374 MB

Free Space : 61047 MB

Disk Information window

Note: The capacity of the D drive may be changed.

5. Specify the location where to save the still image from the pull-down menu.
"D" drive saves a still image to a folder whose name is automatically given the current data (yyyy.mm.dd).

6.   Select [OK] then push the left-click button.

7.   Long-press the **MENU/ESC** key to close all menus.

7.2   How to Save Still Images

You can save the picture on the display as a still image.

Single display

1.   Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2.   Select [Record/Recall] then push the left-click button.

3.   Select [Record Still Image] then push the left-click button.
The picture at the moment the button is pushed is shown on the display for approx. four seconds. The still image data is saved at the location selected at section 7.1. Date and time are used for the name of the data automatically.

   •   Still image: "yyyy_mm_dd_hh_mm_ss.jpg"

   •   Setting: "RECORD_yyyy_mm_dd_hh_mm_ss.dat"

Note: The default function of the **F1** key saves the still image window.

Dual display

Select the monitor on which to capture the still image, 1: main monitor, 2: sub monitor.

1.   Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2.   Select [Record/Recall] then push the left-click button.

3.   Select [Still Image] then push the left-click button.

File name list   Monitor list
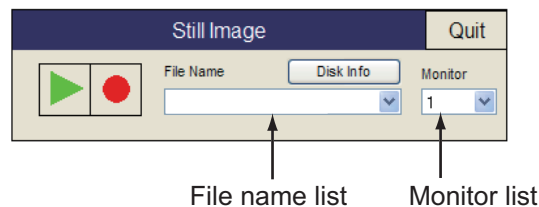
4.   Select the monitor on which to capture the still image from the monitor list.
1: main monitor, 2: sub monitor.

5.   Select [●] and push the left-click button to save the still image.

6.   Select [Quit] on the window then push the left-click button to close the window.

7.3   How to Display Saved Still Images

There are two ways to display saved still images.

   •   Display the latest still image

   •   Display a still image from the file name list

How to display the latest still image

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Record/Recall] then push the left-click button.

3. Select [Recall Still Image] then push the left-click button.
    The latest still image is shown on the display.
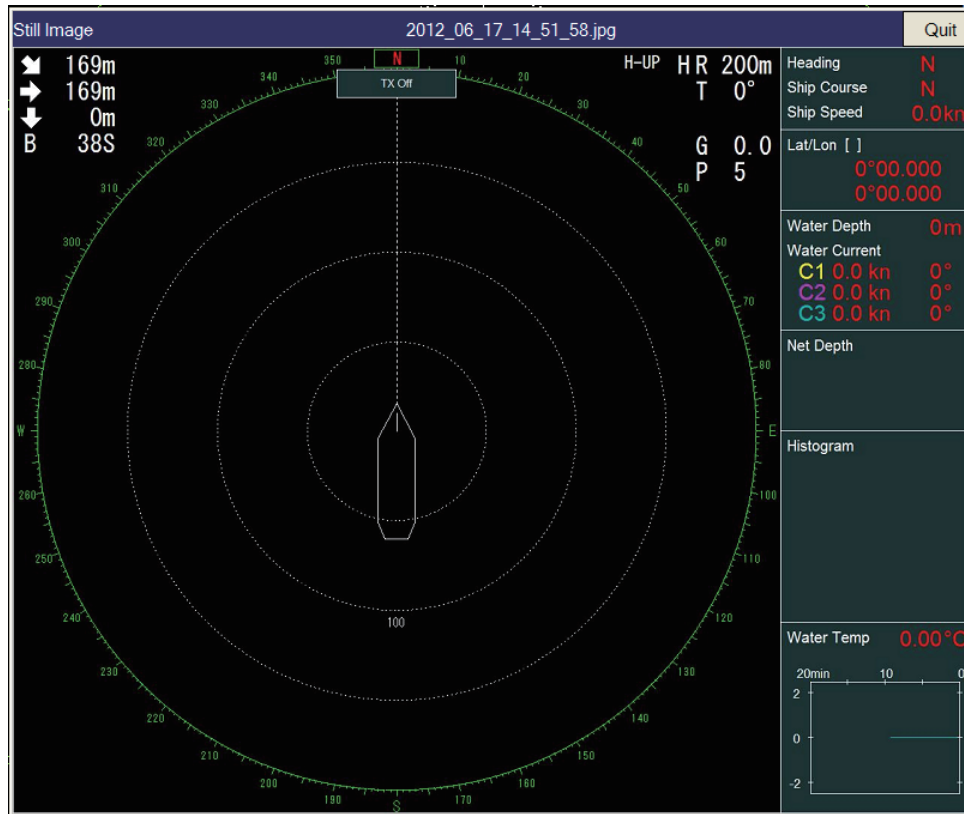
Note: The window can be resized, and moved by drag and drop. Also, you can zoom in/out with the scrollwheel.

4. Select [Quit] on the still image window then push the left-click button to close the window.

Note: The default function of the **F2** key displays the recalled still image window.

How to display a still image from the file list

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Record/Recall] then push the left-click button.

3. Select [Still Image] then push the left-click button.

4. Select a file from the file list.

5. Select the play button (green triangle) on the window then push the left-click button to recall the still image window. A maximum of eight windows can be shown on the display.

6. Select [Quit] on the recalled image window then push the left-click button to close the window.

7. Select [Quit] on the still image window then push the left-click button to close the window.

7-3

7.4 How to Save Settings

The FSV-35 can store the setting information (P1-P10) as shown below. Note however that setting data cannot be changed if the user program setting has changed. For how to program the user prog control, see section 5.3.2.

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Record/Recall] then push the left-click button.

3. Select [Setting File] then push the left-click button.
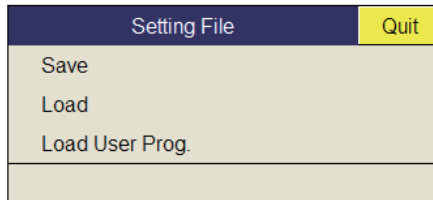
4. Select [Save] then push the left-click button.
   The file is given a name (FSV35_yyyy_mm_dd_hh_mm_ss.ini) then shown in the box.
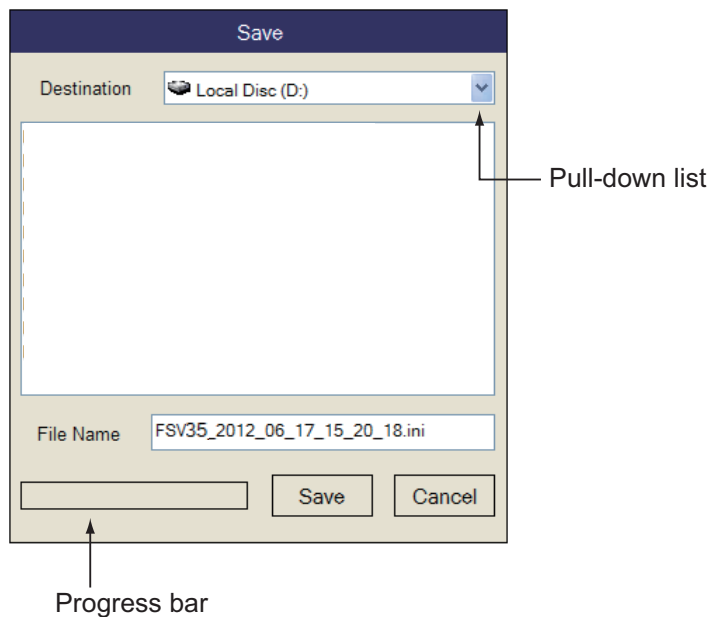
5. Select a destination to save from the pull-down list.

6. Select [Save] then push the left-click button.
   The progress bar at the bottom of the box shows the saving progress. The [Setting File] menu appears when the saving is completed.

7. Long-press the **MENU/ESC** key to close all menus.

Note: If the capacity at the destination is approaching maximum, the message "Disk capacity is approaching maximum. Delete unnecessary data." appears. In this case, select [Delete Data] then push the left-click button to delete unnecessary data.

7.5 How to Load Files

7.5.1 How to load the setting information

This section shows you how to load the setting information saved at section 7.4.

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Record/Recall] then push the left-click button.

3. Select [Setting File] then push the left-click button.

4. Select [Load] then push the left-click button.
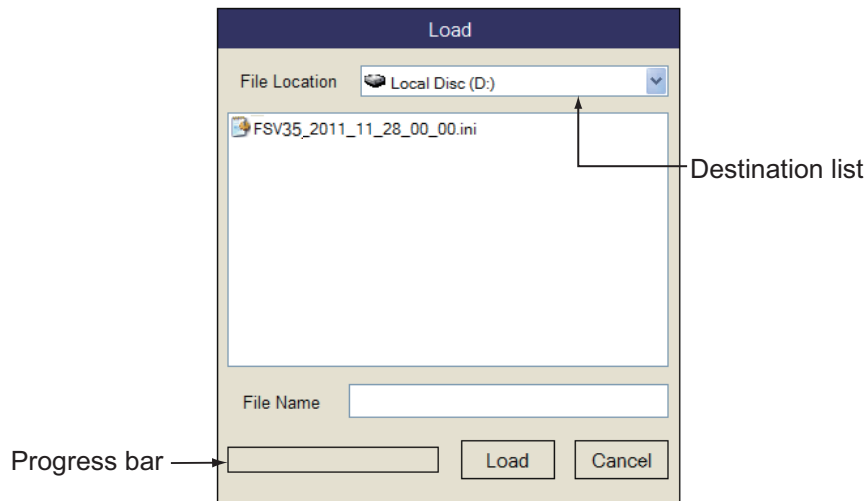
5. Select the file to load.

6. Select [Load] then push the left-click button.
   The progress bar at the bottom of the box shows the loading progress. The [Setting File] menu appears when the saving is completed.

7. Long-press the **MENU/ESC** key to close all menus.

7.5.2 How to replay setting information

You may want to replay setting information to set up the equipment according to target fish or fishing ground.

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Record/Recall] then push the left-click button.

3. Select [Setting File] then push the left-click button.

4. Select [Load User Prog] then push the left-click button.
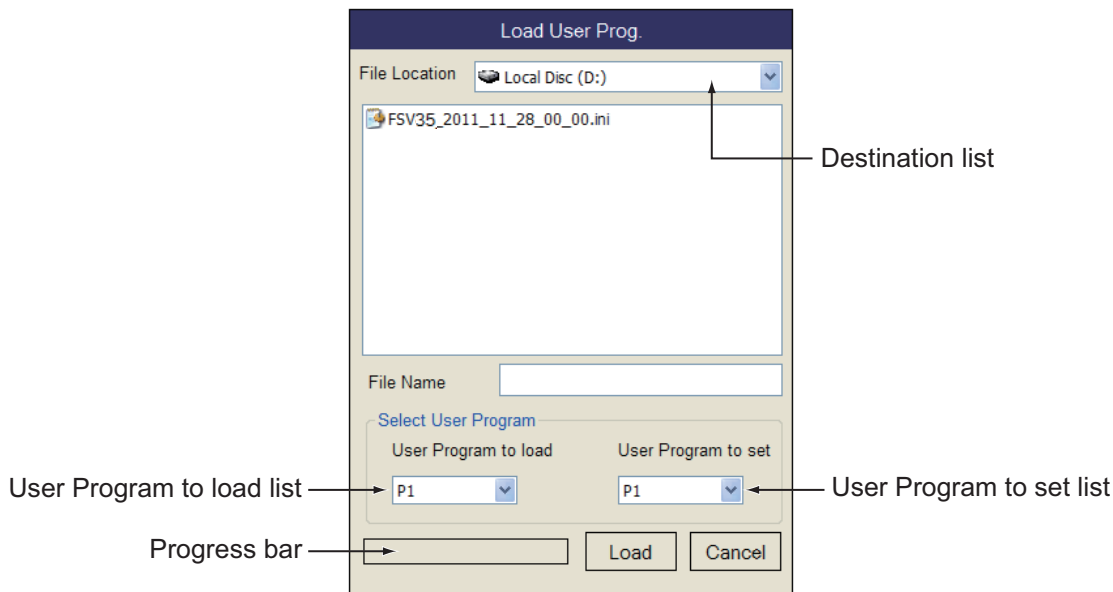
5. Select a file to load from the destination list.

6. Select the setting number from the [User Program to load] list then push the left-click button.

7. Select the setting number to load from the [User Program to set] list then push the left-click button.

8. Select [Load] then push the left-click button.
   The progress bar at the bottom of the box shows the loading progress. The [Setting File] menu appears when the saving is completed.

9. Long-press the **MENU/ESC** key to close all menus.

7.6 How to Delete Files
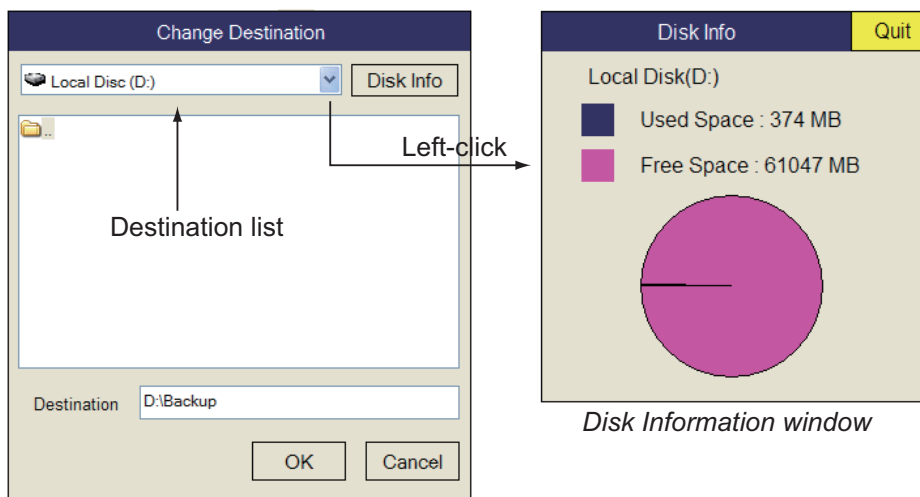
You can delete unnecessary files as shown below.

1. Push the right-click button on the numeric/graphic data display to show the pop-up menu.

2. Select [Record/Recall] then push the left-click button.

3. Select [Delete Data] then push the left-click button.

Destination list
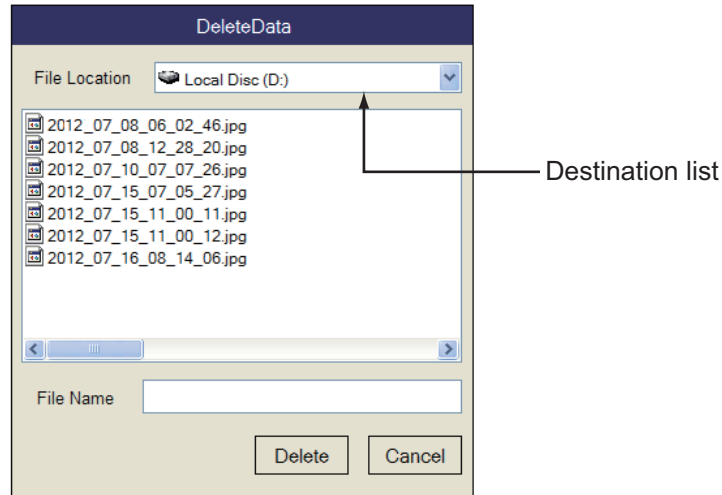
4. Select the file to delete.

5. Select [Delete] then push the left-click button. The massage "Are you sure to delete?" appears.

6. Select [OK] then push the left-click button.
   The file selected at step 4 is deleted.

7. Long-press the **MENU/ESC** key to close all menus.

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8. MAINTENANCE, TROUBLE-SHOOTING

This chapter provides maintenance and troubleshooting procedures for the operator.

⚠ WARNING	NOTICE
ELECTRICAL SHOCK HAZARD **Do not open the equipment.** This equipment uses high voltage that can cause electrical shock. 0nly qualified persons can work inside the equipment.	**Do not apply paint, anti-corrosive sealant or contact spray to plastic parts or equipment coating.** Those items contain products that can damage plastic parts and equipment coating.

8.1 Preventive Maintenance

Regular maintenance is important for keeping the equipment in good working order. Check the following points monthly.

- Check all cables. If damaged, replace.
- Check connectors at each unit. If loosened, reconnect.
- Check the ground terminal of each unit. Clean if necessary.

Cleaning the equipment

Remove the dust or dirt from the equipment with a soft, dry cloth. Do not use chemical cleaners to clean the equipment because they can remove paint and markings.

8.2   Hull Unit Maintenance

Care for the hull unit by following the procedures shown below.

Apply MOLYTONE grease #2 every six months.

Raise transducer and coat main shaft with Daphne Grease MP No.2 (IDEMITSU KOSAN CO.,LTD.*1) every six months.

Dry dock ship and clean transducer face yearly. Apply single coat of "SEATENDER 20" anti-foulant to transducer face to keep marine life off the transducer. Do not paint metallic parts such as the transducer flange.
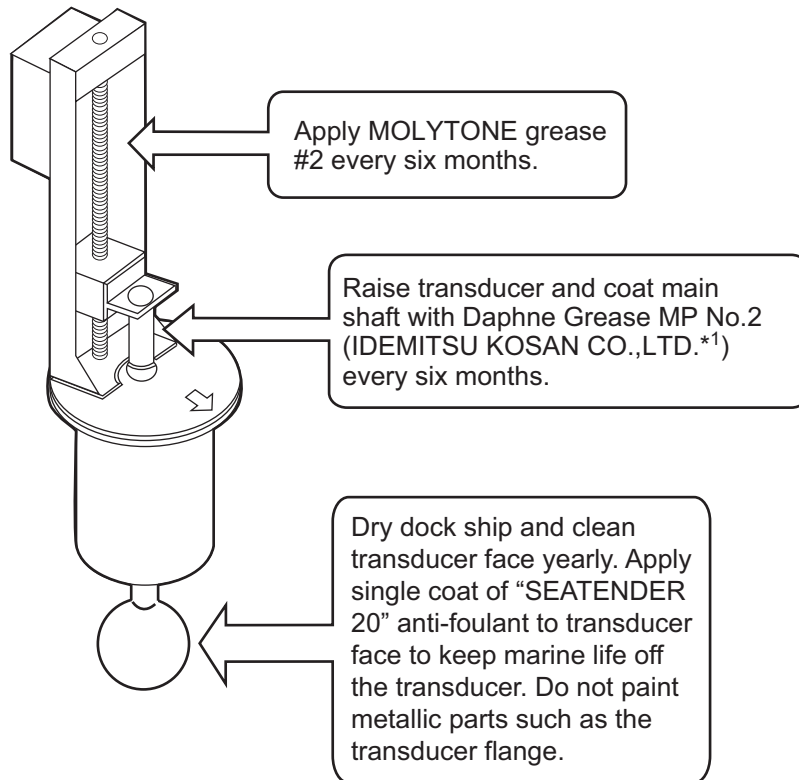
*1 Equivalent greases:
   SHOWA SHELL OIL: Shell Albania Grease S No.2
   EXXON MOBIL: Mobilux EP No.2
   NIPPON OIL CORPORATION: Multinox Grease No. 2

⚠ CAUTION

Replace anticorrosion zinc plate yearly.

Corrosion between the main shaft and transducer may result, allowing water leakage and/or loss of transducer.

8.3   How to Replace Fuses

The fuses in the processor unit, transceiver unit and hull unit protect them from over-current and equipment fault. If the power cannot be applied, first check the fuse in the processor unit and transceiver unit. If the power still cannot be turned on, have a qualified technician check the fuses in other units.

Unit	Type	Code No.	Remarks
Processor unit	FGB01 250V 20A	000-155-775-10	For 12 VDC
	FGB01 250V 10A PBF	000-155-787-10	For 24 VDC
Transceiver unit	FGBO 250V 20A	000-155-786-10	For 100/110/115 VAC (2 pcs.)
	FGBO 250V 10A PBF	000-155-839-10	For 220/230 VAC (2 pcs.)
Transceiver unit (B voltage power section)*	FGBO 250 V 15A PBF	000-157-874-10	2 pcs.
Transceiver unit (DC power section)*	FGMB 250V 5A PBF	000-157-570-10	2 pcs.
Hull unit*	FGMB 250V 2A PBF	000-157-497-10	

* For the replacement of the fuse, request service.

⚠ WARNING

Use the proper fuse.

Use of a wrong fuse can cause fire or damage the equipment.

8.4   Battery on the Mother Board

The battery on the Mother Board in the processor unit backs up data when the power is turned off. Have a qualified technician replace the battery when the applicable symptom below occurs.

Procesor Unit Program No. 105-0840-xx.xx: The date indication is incorrect when a GPS navigator is not connected.
Procesor Unit Program No. 105-0809-xx.xx: The battery voltage shown on the Board Test is 2.6 V or less. When this occurs, the error code 322 appears at the bottom of the display. Additionally, the processor unit does not start up.

Name	Type	Code No.	Life	Processor Unit Program No.
Lithium battery	ER3 WKP	000-177-013-10	7 years	105-0840-xx.xx
Lithium battery	CR-2032L/BK	000-159-662-11	3 years	105-0809-xx.xx

Note: Dispose of the battery in accordance with local regulations. Tape the + and - terminals of the battery before disposal to prevent fire, caused by short circuit.

8.5 How to Clean the Filter in the Processor Unit

Clean the filter in the Processor Unit when the filter becomes dusty. Remove the filter and clean it with water and a mild detergent. Let the filter dry then set it to the Processor Unit.

Processor unit

Filter
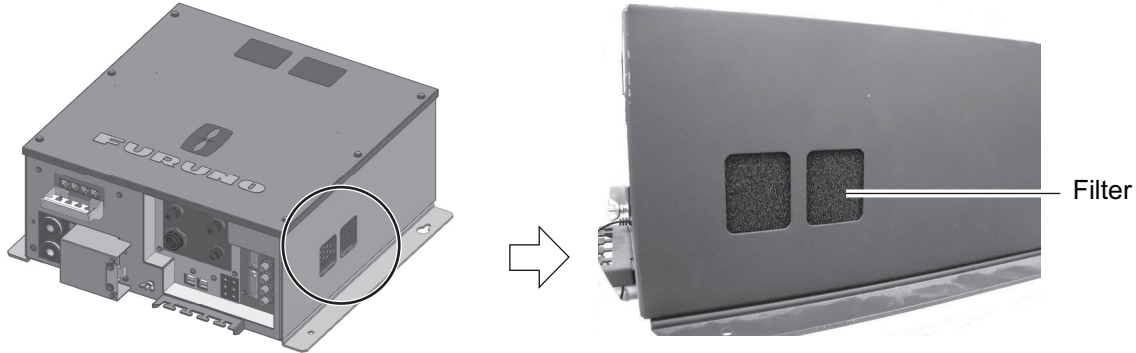
8.6 How to Clean the Trackball on the Control Units

If the trackball does not roll smoothly it may require cleaning. Do the following to clean the trackball.

1. Turn the ring on the trackball 45°.
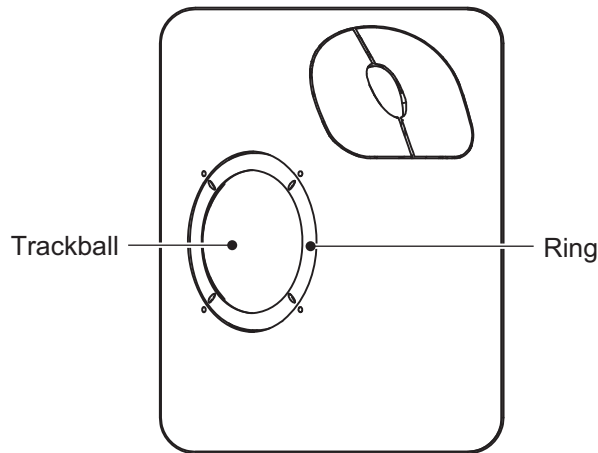
Trackball

Ring

Trackball unit

2. Remove the retaining ring and ball.

3. Clean the ball with a soft lint-free cloth.

4. Blow carefully into the ball-cage to dislodge dust and lint. Look for a build-up of dirt on the metal rollers. If dirty, clean the rollers using a cotton swab moistened lightly with isopropyl-rubbing alcohol.

5. Make sure that fluff from the swab is not left on the rollers.

6. Replace the ball and retainer ring. Be sure the retainer ring is not inserted reversely.

8.7   Troubleshooting

The table below provides common symptoms of equipment troubles and the means to rectify them.

Troubleshooting

Symptom	Check, remedy
Cannot turn on power.	• Check cables between transceiver unit, processor unit and monitor unit. • Check ship's mains. • Have a qualified technician check the fuses inside the transceiver unit.
Bottom echo becomes irregular.	• Rough seas. Distance to the bottom changes due to rolling and pitching. • Long range selected. Transmission period is longer so ship's pitching and rolling are apt to affect detection of echo.
Weak echoes	• Output power set to minimum. Set [TX Power] to maximum, on the [TX/RX Setting] menu. • Excessive TVG. Readjust TVG on the [Gain Setting] menu. **Note:** Readjustment of TVG is necessary after the gain is adjusted.
Somewhat strange color	Brilliance setting too low. Increase brightness of the monitor.
Picture contains noise.	• Equipment not grounded properly. Check equipment ground. • Power cable is too close to the signal cable. Relocate power cable or signal cable. • Debris may be on sea surface. Reject unwanted noise with the interference rejector on the [Picture Setting] menu or gain offset on the [Display Setting] menu.

8.8   Warning Messages

The table below shows the warning messages which may appear on the display. All warning messages are accompanied by an audio alarm, which you may silence with the **R/B AUDIO** key.

Warning messages

Message	Meaning, Remedy
Power supply	
<<OVERVOLTAGE!! >> RETRACT TRANS-DUCER AND TURN OFF POWER. CHECK SHIP'S MAINS VOLTAGE. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center and the buzzer sounds when the voltage supplied to the transceiver unit is excessive. Transmission is stopped if the equipment is transmitting, to protect the transducer and transmitter power section from damage. →Silence the buzzer with the **R/B AUDIO** key, retract the transducer and turn off the power. Have a qualified technician check input voltage.
Transceiver unit	
<<NO RESPONSE FROM TRANSCEIVER UNIT!! >> TURN OFF AND ON POWER AGAIN, OR CHECK POWER LINE TO TRANSCEIVER UNIT. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center and the buzzer sounds when there is no reply from the transceiver unit. →Press the **R/B AUDIO** key to turn off the buzzer. Have a qualified technician check the set.
<<ELECTRIC CHARGE!! >>RETRACT TRANS-DUCER AND TURN OFF POWER. CHECK SHIP'S MAINS VOLTAGE. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center and the buzzer sounds if the +B voltage of capacitors in the transceiver unit can not be charged to predetermined voltage within the specified time. →Press the **R/B AUDIO** key to silence the buzzer. Have a qualified technician check the set.
<<OVER TEMPERATURE!! >> RETRACT TRANSDUCER AND TURN OFF POWER. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center and the buzzer sounds when the temperature in the power supply block has exceeded 85°C;. →Press the **R/B AUDIO** key to silence the buzzer. Turn off the system and have a qualified technician check the system.
Hull unit, transceiver unit	
<<TRANSDUCER NOT RETRACTED!! >>CUT OFF POWER LINE TO MONITOR UNIT AND HULL UNIT. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center, the buzzer sounds and the LEDs above keys blink if the transducer is not raised within 30 seconds (1200 mm stroke) or 40 seconds (1600 mm stroke) after pressing the ↑ key. →Press the **R/B AUDIO** key to silence the buzzer. The reason may be the transducer is tangled in the net or its shaft is bent. Try raising it from the hull unit as shown in section 8.12.
<<WARNING!!>> TRANSDUCER IS KEPT AT WRONG POSITION. SET BACK TRANSDUCER POSITION TO NORMAL BY USING ↑ OR ↓ KEY. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center and the buzzer sounds when the transducer is knocked out of position. →Try to return the transducer to its normal position by operating the ↑ or ↓ key and silence the buzzer with the **R/B AUDIO** key.

Message	Meaning, Remedy
<<WARNING!!>> TRANSDUCER IS KEPT EX-TENDED. MAX ALLOWABLE SPEED FOR EX-TENDED TRANSDUCER IS 18 KT. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center and the buzzer sounds when the transducer is extended and ship's speed, input by external equipment, exceeds 18 knots (1200 mm stroke) or 15 knots (1600 mm stroke). →Silence the buzzer with the **R/B AUDIO** key and lower ship's speed.
<<WARNING!!>> MAX ALLOWABLE SPEED DURING RAISING/LOWERING TRANSDUCER IS 15 KT. PRESS R/B KEY TO TURN OFF ALARM.	This message blinks at the screen center and the buzzer sounds when the transducer is raised/lowered and ship's speed, input by external equipment, exceeds 15 knots (1200 mm stroke) or 12 knots (1600 mm stroke). →Silence the buzzer with the **R/B AUDIO** key and lower ship's speed.

When multiple warnings occur at the same time, the warning with the highest priority is displayed. The order of priority is as follows:

Priority	Message	Remarks
1	TRANSDUCER NOT RETRACTED*	Message remains on screen until problem is cleared.
2	OVERVOLTAGE	
3	OVER TEMPERATURE*	Message remains on screen until problem is cleared.
5	ELECTRIC CHARGE*	Message remains on screen until problem is cleared.
6	NO RESPONSE FROM TRANS-CEIVER UNIT.	

*: These messages are not erased even if a message of higher priority arrives.

8.9   Error Codes

The equipment displays a (blinking) three-digit error code at the bottom of the display when it detects internal trouble. In case of multiple error, error codes appear in numerical order and the maximum number of error codes is five. The codes remain on the screen until the corresponding trouble is fixed, and a buzzer sounds each time a new error code is added to the on-screen error code display. For any error code, report error code number to your dealer.

* * * Error Code * * *   #003, #006, #108

8.10 Status Messages

Status messages appear at the screen center to alert the operator. These are as below.

Status messages and their meanings

Status message	Meaning
TX OFF	Transmission turned off from the menu.
RAISE/LOWER TEST*	Raise/lower command received from the control unit in normal operation, to manually test raise/lower switch in hull unit. Raise/lower keys on the control unit are inoperative during the hull unit test.

*Not displayed when TX is OFF.

8.11 Tests

A comprehensive diagnostic facility is provided for testing the equipment. If NG (No Good) or abnormal display appears in the test results for any test, contact your dealer.

8.11.1 Test menu

1. Press the **MENU/ESC** key to show the main menu.

2. Select [Others] then push the left-click button.

3. Select [Initial Setting] then push the left-click button.

4. Select [Changeable] then push the left-click button.

5. Select [Test] then push the left-click button.

: For technician.

Note: The menu item [TX] turns transmission on/off. Turn off transmission to specify the source of noise, for example.

8.11.2 Board test

The board test checks all the circuit boards in the system. Select [Board Test] from the [Test] menu to do this test.

```
─────────────────────────────── BOARD TEST ───────────────────────────────

MPU-001-FSV35    105-0924-XX.XX ←──── (1)        TRCPU-0    105-0835-XX.XX   S2 00000000(40)
                 (or 105-0840-XX.XX)                        105-0837-XX.XX   S3 00010000(10)
                 (or 105-0809-XX.XX)
                   RAM   = OK                                 ROM   = OK
                   EWF   = Enable                             RAM   = OK
                   CAN Unique No. =                           TDS   = OK
                   USB   =
                   USB   =                           TRX     0000000000
                   Monitor1  = 1280x1024
                   Monitor2  =
                   LAN MAC address  = **-**-**-**-**-**    BMF-0    DATA  = OK
                                                                    RDS   = OK    S1 00000000(00)
                   HDD   = *****                                    FDS   = OK    S2 00000000(00)
                   PCI   = *****

                   CPU Temperature   = 32.0 ˚C
          (2)      BOARD Temperature = 20.0 ˚C       PWR      3.3V  = 3.3V
            ╲      CPU Fan Speed    = 4800rpm                 5V    = 5.0V
             ╲→    BATTRY  = 3.2V                             +B    = 168.0V ←──── (4)

 FSV-8502    105-0818-XX.XX   S1 00000000(00)       INC      TEST  = OK
             105-0817-XX.XX   S2 00000000(00)                PITCH = +12.3
             105-0816-XX.XX                          ↑       ROLL  = - 2.5
               ROM   = OK ←──── (3)                 (5)
               RAM   = OK
               LAN MAC address  = **-**-**-**-**-**

 FSV-8501    105-0811-XX.XX   S1 0000(0)            FSV-8501  105-0811-XX.XX   S1 0001(0)
             105-0812-XX.XX                          ↑        105-0812-XX.XX
             105-0815-XX.XX                         (6)       105-0815-XX.XX

               ROM   = OK                                       ROM   = OK
               RAM   = OK                                       RAM   = OK

               LAN MAC address  = **-**-**-**-**-**             LAN MAC address  = **-**-**-**-**-**

                              Press MENU/ESC key to cancel.
```

OK: Normal, NG: Error
XX: Version No.

For any NG, contact your dealer for advice.

How to read the test results

(1)	Program no. (displayed in white). Abnormal number shown in red.
(2)	Voltage of backup battery in the processor unit
(3)	Memory read/write test results are shown as OK (white) or NG (red).
(4)	+B voltage
(5)	Inertial measurement unit test results.
(6)	No.2 control unit check.

8.11.3   Panel test

The panel test checks the keys, controls and trackball of the control unit. Select [Panel Test] from the [Test] menu to do this test.
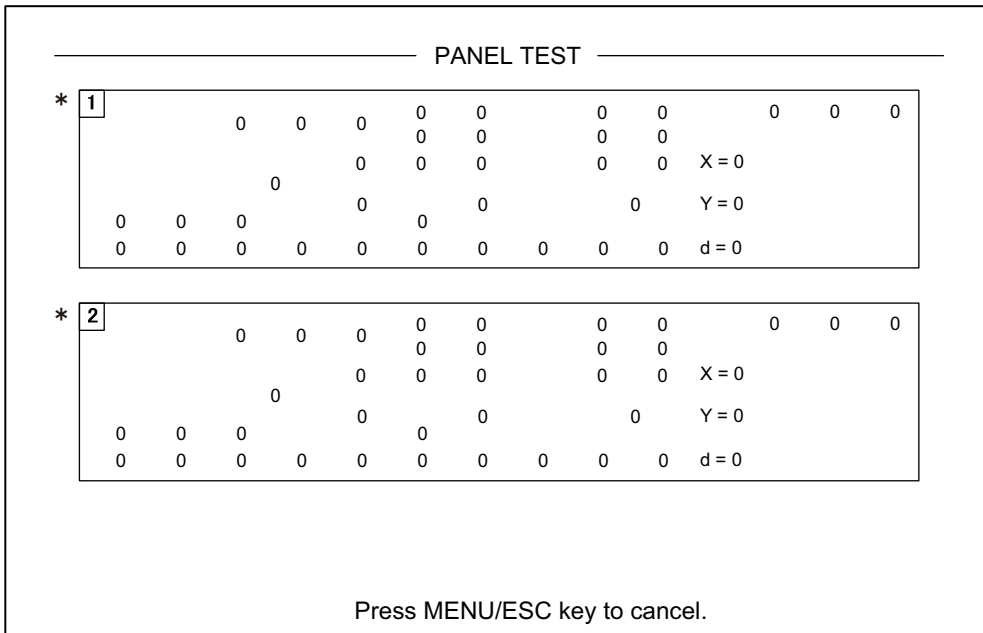
*When two control units are connected, 1 is for main control unit and 2 is for sub control unit.

Key check: Press each key one by one. A key is normal if its corresponding on-screen location shows 1 while the key is pressed and 0 when the key is released. The power keys (ON and OFF) can not be checked.

Control check: Operate each control one by one. A control is normal if;
Clockwise rotation: Positive value
Counterclockwise rotation: Negative value
No rotation: "0"

Lever check: Press the lever upward or downward. Normal conditions are 1 for upward and 2 for downward.

Trackball check: Operate the trackball. X-Y coordinates of trackball position are displayed. Normal conditions are as follows.
Rightward: X positive, Leftward: X negative
Upward: Y positive, Downward: Y negative

8.11.4 Test pattern

The test pattern test checks for proper display of colors. Select [Test Pattern] from the [Test] menu to do this test. Use the **MODE** key to change the test pattern.

PRESS MENU KEY TO QUIT TEST MODE.
PRESS MODE KEY TO CHANGE TEST PATTERN.

WHITE / Black → BLACK → RED → GREEN → BLUE
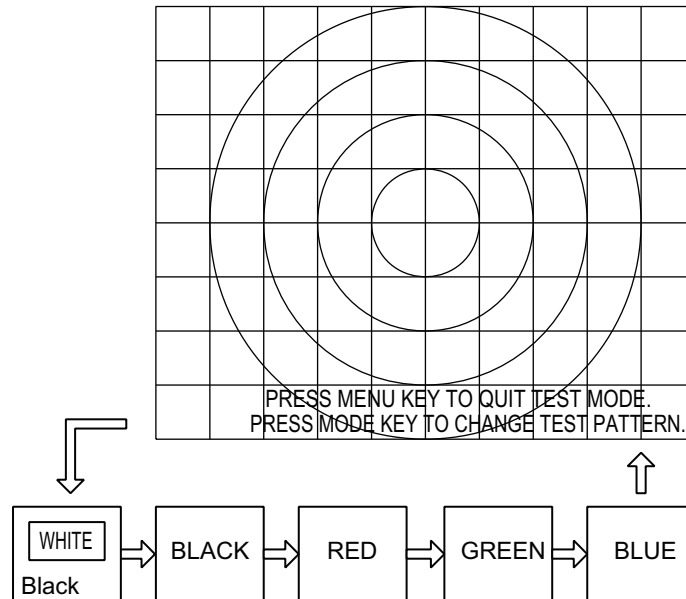
8.12 How to Raise the Transducer from the Hull Unit

If the transducer cannot be raised with the switches on the control unit, because it is tangled in the net or its shaft is bent, try to raise it from the hull unit, automatically or manually, whichever works.

⚠ **DANGER**

Keep away from raise/ower shaft in hull unit when it is moving.

Gears in hull unit will cause serious injury.

8.12.1   How to raise the transducer automatically

1. Turn off the switchboard, transceiver unit and hull unit from the ship's mains breaker.

    You can force-quit the system by long-pressing the POWER OFF (⏻) switch for approx. 10 seconds.

2. Check if the net or other object is caught in the transducer.

3. Look through the lid on the raise/lower control box in the hull unit to check if the motor breaker is OFF. If it is midway between ON and OFF, open the lid and turn it off and then on.

4. Unfasten six screws to remove the cover of the raise/lower control box.

5. Push the RESET button (blue) on the raise/lower control box.

6. Close the cover.

7. Turn on the breaker at the ship's mains.
    If you force-quitted the system at step 1, go to the step 8.

8. Turn on the system from the control unit.

9. Press the ⬆ key on the control unit to raise the transducer.

If the transducer cannot be raised, the shaft may be bent. In this case raise it manually with the hand crank, following the instructions in the next section.
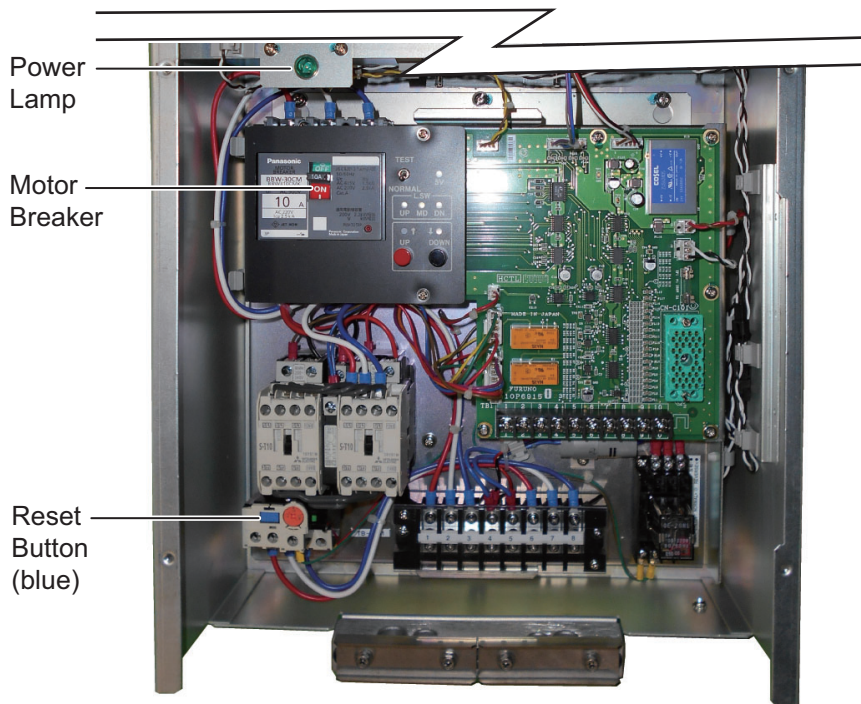
8.12.2 How to raise the transducer manually

1. Open the lid on the raise/lower control box of the hull unit and turn off the motor breaker. Confirm that the power lamp is off. (See the illustration on the preceding page for the location of the motor breaker and power lamp.)

2. Unscrew two screws (see the figure at step 3.) to remove the cover.

3. Attach the crank to the motor shaft, referring to the illustration below.

Screw

Crank

Cover

Motor
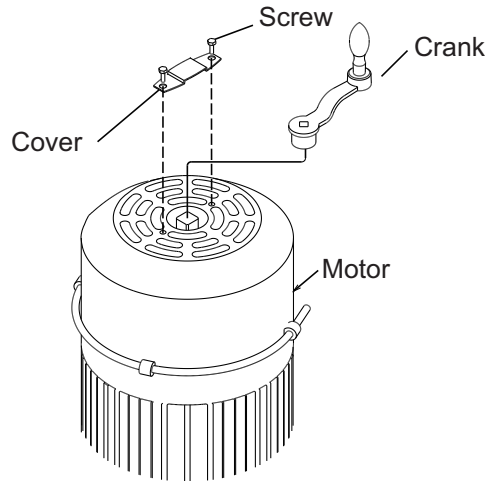
4. While holding the crank, pull the release lever toward you and upward to release the brake.
Note: Hold the crank when releasing the brake, to prevent the transducer from falling out.

Release lever

Holder

8-13
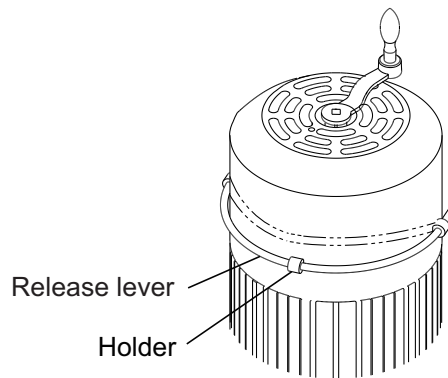
5. Turn the crank clockwise to raise the transducer. Also, you can raise the transducer with a socket wrench or impact wrench, using the socket near the crank. If an impact wrench is used the torque should be 14.5 Nm (1.48 kgfm)

6. After retracting the transducer into the tank, set the release lever to the holder as shown below.

APPENDIX 1 MENU TREE

[MENU/ESC] key

```
┌─ TX/RX Setting ──┬─ TX Interval (0 to 9; 9) [H1/H2], U: Yes/F: Yes
│  U: No /F: Yes   ├─ TX Pulse Length (0 to 9; 7 [H1], 9 [H2/V]), U: Yes/F: Yes
│                  ├─ TX Power (0 to 9; 7 [H1], 9 [H2/V]), U: Yes/F: Yes
│                  ├─ Reverberation (0 to 5; 0), [H1/H2/V], U: Yes/F: Yes
│                  ├─ Freq Shift (-30 to 30; 0 [H1], 7 [H2/V]), U: YesF: Yes
│                  ├─ Freq/Bearing Set (0 to 31; 16), [H1/H2], U: Yes/F: Yes
│                  ├─ Beam Width, U: No/F: Yes
│                  │     └─ Beam (AR, -4 to 30; 5 [H1], 4 [H2]), (0 to 5; 5) [V], U: Yes/F: Yes
│                  └─ Bottom Suppress (0 to 10; 0), [H1/H2/V], U: Yes/F: Yes
│
├─ Gain Setting ──┬─ TVG-Near (-5 to 5; 5 [H1], 2 [H2], 3 [V]), U: Yes/F: Yes
│  U: No/F: Yes   ├─ TVG-Medium (-5 to 5; 2 [H1], 3, [H2], 0 [V]), U: Yes/F: Yes
│                 ├─ TVG-Far (-5 to 5; 2 [H1], 4 [H2], 0 [V]), U: Yes/F: Yes
│                 ├─ TVG Distance [H1/H2/V], U: No/F: No
│                 │     ├─ Near (50 to 100; 50 [H1/H2/V]
│                 │     ├─ Medium (300 to 500; 400 [H2/V]
│                 │     └─ Far (600 to 1000; 800 [H2/V]
│                 ├─ Sel. TVG Curve (TVG 1, TVG 2, TVG 3, TVG 4) [H1/H2/V], U: Yes/F: Yes
│                 ├─ AGC (0 to 9; 2 [H1/H2], 3 [V]), U: Yes/F: Yes
│                 ├─ Near AGC, U: No/F: Yes
│                 │     ├─ Near AGC (-30 to 30; 0 [H1/V], 3 [H2]), U: Yes/F: Yes
│                 │     └─ Near AGC Distance (20 to 500 (or 3000)* m; 200m [H1/V], 300m [H2]) ,
│                 │          U: Yes/F: No
│                 └─ 2nd AGC, U: No/F: Yes
│                       ├─ 2nd AGC (0 to 12; 7 [H1], 5 [H2], 0 [V]), U: Yes/F: Yes
│                       ├─ Distance (0 to 2000 m; 0m) [H1/H2/V], U: Yes/F: No
│                       └─ Type (Normal, Pre Only, Post Only) [H1/H2/V], U: Yes/F: N
│
├─ Display Setting ─┬─ Noise Limiter (0 to 15; 6 [H1/H2], 3 [V]), U: Yes/F: Yes
│  U: No/F: Yes    ├─ Gain Offset (0 to 12; 1 [H1/H2], 3 [V]), U: Yes/F: Yes
│                  ├─ Signal Level (0 to 15; 4 [H1/H2], 3 [V]), U: Yes/F: Yes
│                  ├─ Color (Color 1, Color 2, Color 3, Color 4) [H1/H2/V], U: Yes/F: Yes
│                  ├─ Color Response (Corlor Curve 1, Color Curve 2, Color Curve 3, Color Curve 4;
│                  │   Color Curve 1 [H1/H2], Color Curve 4 [V]), U: Yes/F: Yes
│                  ├─ H-Scan Color Setting [H1/H2/V], U: No/F: No
│                  └─ H-Scan Color Curve Setting [H1/H2/V], U: No/F: No
│
├─ Picture Setting ─┬─ Echo Average (0 to 11; 1 [H1/V], 2 [H2]), U: Yes/F: Yes
│  U: No/F: Yes    ├─ Int Reject (0 to 3; 2 [H1], 0 [H2/V]), U: Yes/F: Yes
│                  ├─ Smooth Echo RNG (0 to 7; 3 [H1], 2 [H2], 1 [V]), U: Yes/F: Yes
│                  └─ Smooth Echo CIR (0 to 5; 0) [H1/H2/V], U: Yes/F: Yes
│
├─ Others ──────┬─ Erase Marks ──┬─ Event Mark1 (Execute), U: Yes/F: Yes
│  U: No/F: Yes │  U: No/F: Yes  ├─ Event Mark2 (Execute), U: Yes/F: Yes
│               │                ├─ Fish Mark (Execute), U: Yes/F: Yes
│               │                ├─ Own Ship Pos Mark (Execute), U: Yes/F: Yes
│               │                └─ Ship's Track (Execute), U: Yes/F: Yes
①               ②  Wheel Setting ──┬─ H Mode (Tilt Angle, Range, Gain), U: Yes/F: Yes
                   U: No/F: Yes   └─ V Mode (Range, Gain, Bearing), U: Yes/F: Yes
```

```
┌──────────────────────────────────┐
│ U: Items which can be            │
│ programmed to the user menu.     │
│ F: Items which can be            │
│ programmed to a function key.    │
│                                  │
│ Defaut settings in bold italic.  │
└──────────────────────────────────┘
```

*: Setting range can be changed on the system menu. For details, contact your dealer.

① — Others ——— ② Display Setting ——— Mode Selection (*Mode Key*, Pull-Down Menu), U: No/F: No
U: No/F: Yes
├─ Echo Disp Area (*Within Range*, Full Screen), U: Yes/F: Yes
├─ H2 Display (*Landscape*, Portrait,Inset), U: Yes/F: Yes
├─ 2nd Monitor Setting (*Portrait*, Landscape), U: Yes/F: Yes
├─ V-Scan Aspect Ratio (*Fixed*, Flexible), U: Yes/F: Yes
├─ V-Scan Dpt Rng (20, 40, 60, 80, *100*), U: Yes/F: Yes
├─ Presentation Mode (*Head Up*, North Up, Course Up, True Motion), U: Yes/F: Yes
├─ TM Disp Range (1.3R, *1.6R*), U: No/F: No
├─ Full Screen Area (1.3R, *1.6R*), U: No/F: No
├─ Bearing Ref (*Ship Heading*, North), U: No/F: Yes
├─ TILT lever (*Tilt*, Tilt & V1), U: No/F: No
├─ Auto Tilt (Wide, *Narrow*), U: No/F: No
├─ Net Course Mark (*Execute*, Delete), U: No/F: Yes
├─ Dimmer (0 to 7; *7*), U: Yes/F: Yes
├─ Key Beep Volume (0 to 7; *5*), U: No/F: No
└─ Timer Display (*OFF*, ON), U: No/F: No

Alarm & Audio ——— Fish Alarm (OFF, *ON*), U: No/F: No
U: No/F: Yes
├─ Alarm Level (0 to 30; *16*), U: No/F: No
├─ Alarm Zone, U: No/F: No
├─ Ship SPD Alarm (OFF, *ON*), U: No/F: No
├─ Audio (OFF, *ON*), U: No/F: No
├─ Audio Volume, U: No/F: No
├─ Audio Sector (*30°*, 60°, 90°, 180°, 330°), U: No/F: No
└─ Reverberation (0 to 9; *0*), U: No/F: No

Register ——— Display Mode (*H1*, *H1&H2*, *V1*, *V1&V2)*, U: No/F: No
├─ Sel User Prog (*H/V Interlock*, H/V Individual), U: No/F: No
├─ Assign User Prog (P1 to P10), U: No/F: No
├─ Assign User Prog-H (P1-H to P10-H), U: No/F: No
├─ Assign User Prog-V (P1-V to P10-V), U: No/F: No
├─ F-KEY List, U: No/F: No
├─ Clear F-KEYSetting (F1 to F10), U: No, F: No
├─ H-Scan Range (60 to 5000 m; *200 m, 400 m, 600 m, 1000 m, 1600 m, 2000 m, 3000 m, 4000 m*), U: No/F: No
└─ V-Scan Range (60 to 5000 m; *200 m, 400 m, 600 m, 1000 m, 1600 m, 2000 m, 3000 m, 4000 m*), U: No/F: No

Record/Recall ——— Still Image, U: Yes/F: Yes
U: No/F: Yes
├─ Setting File, U: No/F: Yes
│   ├─ Save, U: No/F: No
│   ├─ Load, U: No/F: No
│   └─ Load User Prog., U: No/F: No
├─ Delete Data, U: No/F: No
├─ Destination To Save, U: No/F: No
├─ Record Still Image (Execute), U: No/F: Yes
└─ Recall Still Image (Display), U: No/F: Yes

Initial Setting ——— Language (日本語 , English), U: No/F: No
U: No/F: Yes
├─ Remote BOX LED (*ON*, OFF), U: Yes/F: No
├─ Menu Box Transp. (1 to 5, *OFF*), U: Yes/F: Yes
├─ TVG Monitor Transp. (*OFF*, ON), U: Yes/F: Yes
└─ Monitor Setting, U: No/F: Yes
      └─ 2nd Monitor Setting (OFF, *Dual Display*, Sub Display), U: Yes/F: Yes

③   ④

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③ — Others ———— Initial Setting ——— ④ Data Display, U: No/F: Yes
      ├ Data Display (**ON**, OFF), U: Yes/F: Yes
      └ Data Box Transp.* (ON, **OFF**), U: Yes/F: Yes
  ├ Mark Display, U: No/F: Yes   *: No use.
     ├ Heading Mark (OFF, **ON**), U: No/F: No
     ├ Range Rings (OFF, **ON**), U: No/F: No
     ├ Bearing Scale (OFF, **ON**), U: No, F: No
     ├ Own Ship's Track Plot (OFF, **ON**), U: No/F: No
     ├ Data On Track (**OFF**, Water Temp, Water Depth),
             U: No/F: No
     ├ Net Move Plot (OFF, **ON**), U: No/F: No
     ├ Fish Mark Connect (OFF, **ON**), U: No/F: No
     ├ Target Vector (OFF, **ON**), U: No/F: No
     ├ Fish Track Plot (OFF, **ON**), U: No/F: No
     ├ EVENT Key (**Event**, Shoot), U: No/F: No
     ├ Histogram Disp. (OFF, **ON**), U: No/F: No
     └ Mark Color (**White**, Baby Blue, Blue, Yellow, Purple, Green), U: No/F: No
  ├ Mark Size, U: No/F: Yes
     ├ Trackball Mark (**+Small**, +Large, ■Small, ■Large),
            U: No/F: No
     ├ Target Lock Mark (**Normal**, Small, Large), U: No/F: No
     ├ Target Vector (Short, **Normal**, Long), U: No/F: No
     ├ Event Mark (Normal, **Large**, Small), U: No/F: No
     ├ Fish Mark (Normal, **Large**, Small), U: No/F: No
     ├ Own Ship Pos Mark (**Normal**, Large, Small), U: No/F: No
     ├ Own Ship Mark (Standard, Large, **Actual**), U: No/F: No
     ├ Net Shoot Mark (**Normal**, Large, Small), U: No/F: No
     ├ Estimate On Scan (Small, **Large**), U: No/F: No
     ├ Current Vector (**Small**, Long, Short/Thick, Long/Thick)
             U: No/F: No
     ├ Range Ring Interval (1/2R, **1/4R**), U: No/F: No
     ├ Bearing Scale (**Small**, Large), U: No/F: No
     └ Own Ship's Track Plot (**5R**, 10R, 20R, 40R), U: No/F: No
  ├ Data Display, U: No/F: Yes
     ├ Range&Bearing (OFF, **ON**), U: No/F: No
     ├ Fishing Area (**OFF**, ON), U: No/F: No
     ├ Cursor Position (**OFF**, ON), U: No/F: No
     ├ Course (**32 CMPS**, 360°True, 360°, ±180°), U: No/F: No
     ├ Current Data (32 CMPS, 360°**True**, 360°, ±180°), U: No/F: No
     ├ Event Mark (**32 CMPS**, 360°**True**, 360°, ±180°), U: No/F: No
     ├ Other Marks (32 CMPS, 360°**True**, 360°, ±180°), U: No/F: No
     ├ Distance For Shoot (**NM**, Meter, Feet), U: No/F: No
     ├ Water Temp (°**C**, °F), U: No/F: No
     └ Water Temp Range (**20 Minute**, 1 Hour, 6 Hours, 12 Hours,
             24 Hours), U: No/F: No
  └ Current Vec & Wind, U: No/F: Yes
     ├ Current Data (**Water Current**, Rel to Layer1, Rel to Layer2,
             Rel to Layer3), U: No/F: Yes
     ├ On Own Ship Mark (OFF, **ON**), U: No/F: No
     ├ On Ship Pos Mark (OFF, **ON**), U: No/F: No
     ├ On Net Shoot Mark (OFF, **ON**), U: No/F: No
     ├ Current Flow Dir (**To**, From), U: No/F: No
     └ Wind (**OFF**, Relative, Absolute)
       U: No/F: Yes

⑤   ⑥

⑤

— Others ———————— Initial Setting

⑥

— Net SONDE Setting, U: No/F: Yes
— Number Of XMTR (0 to 10; **3**), U: No/F: No
— XMTR Distance, U: No/F: No
— End Of Net To S1 (0 to 1000 m; **400 m**), U: No/F: No
— S1->S2 (0 to 1000 m; **400 m**, U: No/F: No
— S2->S3 (0 to 1000 m; **400 m**), U: No/F: No
— S3->S4 (0 to 1000 m; **400 m**), U: No/F: No
— S4->S5 (0 to 1000 m; **400 m**), U: No/F: No
— S5->S6 (0 to 1000 m; **400 m**), U: No/F: No
— S6->S7 (0 to 1000 m; **400 m**), U: No/F: No
— S7->S8 (0 to 1000 m; **400 m**), U: No/F: No
— S8->S9 (0 to 1000m; **400 m**), U: No/F: No
— S9->S10 (0 to 1000 m; **400 m**), U: No/F: No
— Net Length* (500 to 3000 m; **1800 m**), U: No/F: No
— Depth Display (S1 to S10; **S1 to S3**), U: No/F: No
— Display Style (**Numeric**, Graph), U: No/F: No
— Depth Graph Range (50 m, **100 m**, 150 m, 200 m), U: No/F: No
— Net Shoot Setting, U: No/F: Yes
— Net Diameter (20 to 1000 m, **500 m**), U: No/F: No
— Tilt Interlock (OFF, **ON**), U: No/F: No
— Net Plot Corr-LYR1 (0 to 100%; **50%**), U: No/F: No
— Net Plot Corr-LYR2 (0 to 100%; **50%**), U: No/F: No
— Net Plot Corr-LYR3 (0 to 100%; **50%**), U: No/F: No
— Target Lock, U: No/F: Yes
— Tracking Method (Target Mark, **Fish**), U: Yes/F: Yes
— Tilt Interlock (OFF, Tilt, **Tilt&Range**), U: No/F: No
— Mark Interlock (OFF, **Estimate Mark**, Est&Fish Info), U: No/F: No
— Tracking Data (Horizontal, **H&V**), U: No/F: No
— Threshold (1 to 30; **16**), U: No/F: No
— Bottom Threshold (0 to 5; **3**), U: No/F: No
— Target Speed Limit (1 to 15 kn; **5 kn**), U: No/F: No
— Smoothing (0.0 to 1.0; **0.5**), U: No/F: No
— Target SPD Update (15Sec, 30Sec, 45Sec, **60Sec**), U: No/F: No
— Target Lock Window (**Small**, Large, Largest), U: No/F: No
— Dimension Setup (0 to 100t/1000 m^2; **25t/1000 m$^{2)}$**), U: No/F: No
— Volume Setup (0 to 100t/1000 m^3; **25t/1000 m$^{3)}$**), U: Yes/F: No
— Stabilization, U: No/F: Yes
— Stabilization (OFF, **ON**), U: No/F: Yes
— Pitch Angle Cor (-10.0 to +10.0; **0.0**), U: No/F: No
— Roll Angle Cor (-10.0 to +10.0; **0.0**), U: No/F: No
— Test, U: No/F: Yes
— Board Test (Execute), U: No, F: No
— Panel Test (Execute), U: No, F: No
— Test Pattern (Execute), U: No, F: No
— RX Test (Execute), U: No, F: No
— Noise Test (Execute), U: No, F: No
— TX (**OFF**, ON), U: Yes/F: Yes

*Minimum value depends on setting for Number of XMTR, XMTR Distance.

⑦

⑧

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⑦ Others ———— Initial Setting ———— ⑧ Initialization, U: No/F: Yes
- Save Ship's Org (Execute), U: No, F: No
- Recall Ship's Org (Execute), U: No/F: No
- Set To Default (Execute), U: No, F: No
- Item Attribution (**Non-Changeable**, Changeable), U: No/F: No
- Date&Time Setting, U: No, F: No

Shortcut Menu
- *TX Pulse Length* -H1
- *TX Power* -H1
- *TVG-Near* -H1
- *TVG-Medium* -H1
- *TVG-Far* -H1
- *AGC* -H1
- *2nd AGC* -H1
- *Color* -H1
- *Color Response*-H1
- *Echo Average* -H1

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SPECIFICATIONS OF COLOR SCANNING SONAR
FSV-35

1   GENERAL

1.1   Scanning method   Full digital beam forming

1.2   Frequency   24.0 kHz

1.3   Range and Pulse-length

Basic range (m)	Range (m)		Basic range (m)	Range (m)	
	Off-center 'OFF'	Off-center 'ON'		Off-center 'OFF'	Off-center 'ON'
60	0-60	0-96	1000	0-1000	0-1600
100	0-100	0-160	1200	0-1200	0-1920
150	0-150	0-240	1600	0-1600	0-2560
200	0-200	0-320	2000	0-2000	0-3200
300	0-300	0-480	2500	0-2500	0-4000
400	0-400	0-640	3000	0-3000	0-4800
500	0-500	0-800	3500	0-3500	0-5000
600	0-600	0-960	4000	0-4000	0-5000
800	0-800	0-1280	5000	0-5000	0-5000

1.4   Audio search   30°, 60°, 90°, 180°, 330° selectable

1.5   Audio output   Audio terminal (requires speaker with amplifier)

2   PROCESSOR UNIT

2.1   Picture colors   32 colors (sonar picture), 6 colors (marks)

2.2   Pixel number   SXGA (1280 x 1024) or more required

2.3   Orientation   Head-up, North-up*, Course-up* and True-motion*

                                (*: sensor required)

2.4   Presentation mode   Horizontal, Horizontal combination, Vertical 1 combination,

                                Vertical 2 combination

2.5   Features   Custom mode, Interference rejecter, After-glow, Noise limiter,

                                Signal level, Auto-tilt, Automatic target tracking (target lock),

                                Fish alarm, Over-voltage warning, Unretracted transducer warning

3   TRANSCEIVER UNIT

3.1   Transmitter   PDM half-bridge

3.2   Receiving method   Straight amplifier, full digital beam forming

3.3   H-mode beam-width   TX: 360° x 18°, RX: 18° x 18° (-6 dB full width)

3.4   V-mode beam-width   TX: 18° x 105°, RX: 18° x 18°(-6 dB full width)

3.5   Tilt angle   -5° to 90° (downward)

3.6   Vertical search range   0° to 90° (downward)

4   HULL UNIT

Travel (mm)	TYPE	Raise/lower time (sec)	Ship's speed allowance at R/L operation
800/1200	FSV-303	22	18 kn (15 kn)
1200/1600	FSV-304	29	15 kn (12 kn)

5   INTERFACE

5.1   NMEA0183   Ver1.5/2.0/3.0

Input sentences   CUR, DBS, DBT, DPT, GGA, GLL, GNS, HDG, HDM, HDT, MDA,
MTW, MWV, RMA, RMC, VBW*[1], VDR, VHW, VTG, VWR, VWT,
ZDA

Output sentence   TLL

*[1]: Fore-aft and port-stbd speeds required.

5.2   CIF input sentences   System clock, Position, Bearing, First layer current data,
Water depth/temperature, Sonde depth, Ship's speed/course data,
Multi-layer current data, Net depth, Sonde number
Wind speed/direction

6   POWER SUPPLY

6.1   Processor unit   12-24 VDC: 8.7-4.4 A (I/F unit included)

6.2   Interface unit   48 VDC: 2.7 A or less

6.3   Transceiver unit   100/110/115/220/230 VAC: 15 A, 1 phase, 50-60 Hz

6.4   Hull unit   220 VAC: 12 A, 3 phase, 50-60 Hz

6.5   Rectifier (option)
RU-1746B-2   100/110/115/220/230 VAC, 1 phase, 50/60 Hz

6.6   AC/DC power supply unit (option)
PR-241   100-230 VAC, 1 phase, 50-60 Hz

7   ENVIRONMENTAL CONDITION

7.1   Ambient temperature
Processor unit   0°C to +45°C
Transducer   -5°C to +35°C
Others   0°C to +50°C

7.2   Relative humidity   93% max. at 40°C

7.3   Degree of protection
Control unit   IP22 (panel), IP20 (chassis)
Processor unit   IP20
Transceiver unit   IPX0
Interface unit   IP20
Hull unit   IPX2
Transducer   IPX8

7.4   Vibration   IEC 60945 Ed.4

8   COATING COLOR

8.1   Processor unit   N2.5

8.2   Control/Interface unit   N2.5

8.3   Transceiver/Hull unit   2.5G7/2

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FURUNO

FURUNO ELECTRIC CO., LTD.
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EC Declaration of Conformity

CE

We   FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

COLOR SCANNING SONAR FSV-35 and FSV-35S

(Model name, type number)

to which this declaration relates is in conformity with the following standard(s) or other normative document(s)

IEC 60945 Ed.4.0: 2002, clauses 9.2, 9.3, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8 and 10.9
IEC 60945 Ed.3.0: 1996, clauses 10.2 and 10.3

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

• EMC Test Report FLI 12-11-109, November 8, 2011 prepared by Furuno Labotech International
  Co., Ltd.

This declaration is issued according to the Directive 2014/30/EU of the European Parliament and of
the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to
electromagnetic compatibility.

On behalf of Furuno Electric Co., Ltd.

Yoshitaka Shogaki
Department General Manager
Nishinomiya City, Japan   Quality Assurance Department
April 20, 2016
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(Place and date of issue)   (name and signature or equivalent marking of authorized person)