

FURUNO

OPERATOR'S MANUAL

COLOR SEARCHLIGHT SONAR

MODEL CH-32



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NISHINOMIYA, JAPAN

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-Your Local Agent/Dealer

Initial : AUG 1990
B : DEC. 13, 1996

(ETMI)

PUB. No. OME-12770
CH-32





SAFETY INSTRUCTIONS

"DANGER", "WARNING" and "CAUTION" notices appear throughout this manual. It is the responsibility of the operator of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.

The level of risk appearing in the notices is defined as follows:



DANGER

This notice indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or property damage.

DANGER



Do not open the equipment.

Hazardous voltage which will cause death or serious injury exists inside the equipment. Only qualified personnel should work inside the equipment.

WARNING

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

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

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

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

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

Do not operate the equipment with wet hands.

Electrical shock can result.

Keep heater away from equipment.

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

CAUTION

Use the proper fuse.

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

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

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

Do not place objects on the top of the equipment.

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

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

The transducer may become damaged.

The zinc block attached to or near the transducer must be replaced yearly.

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

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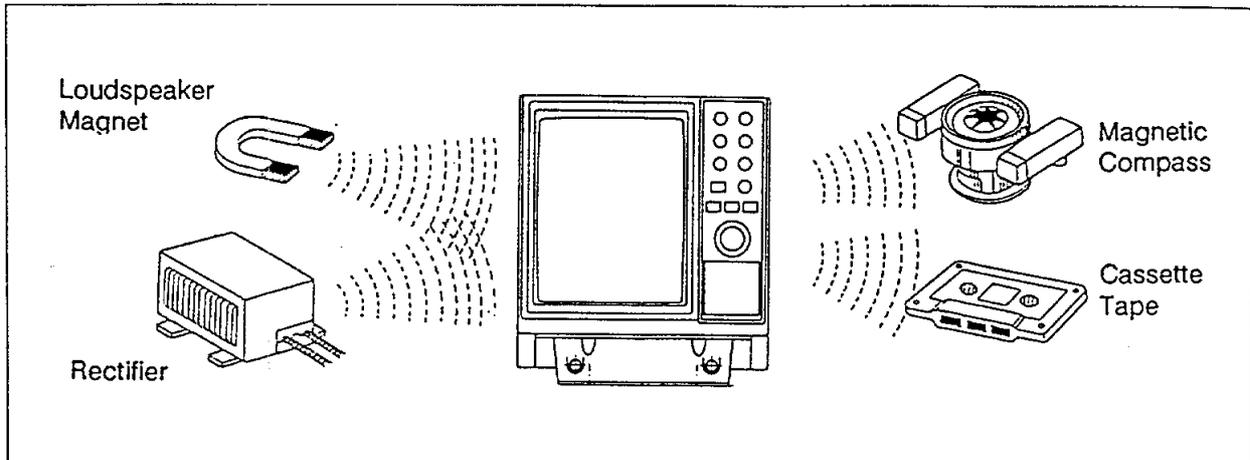
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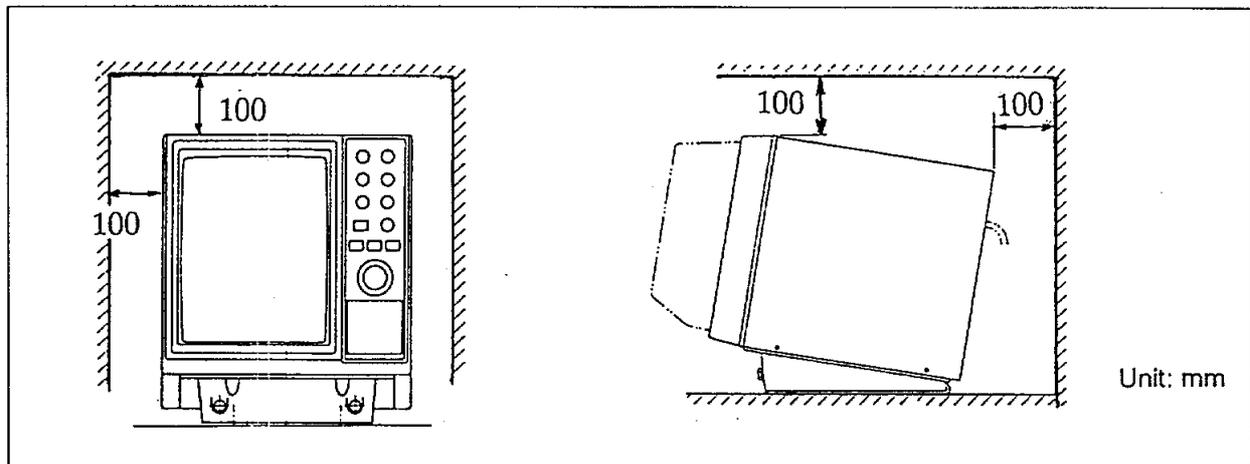
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HANDLING PRECAUTIONS

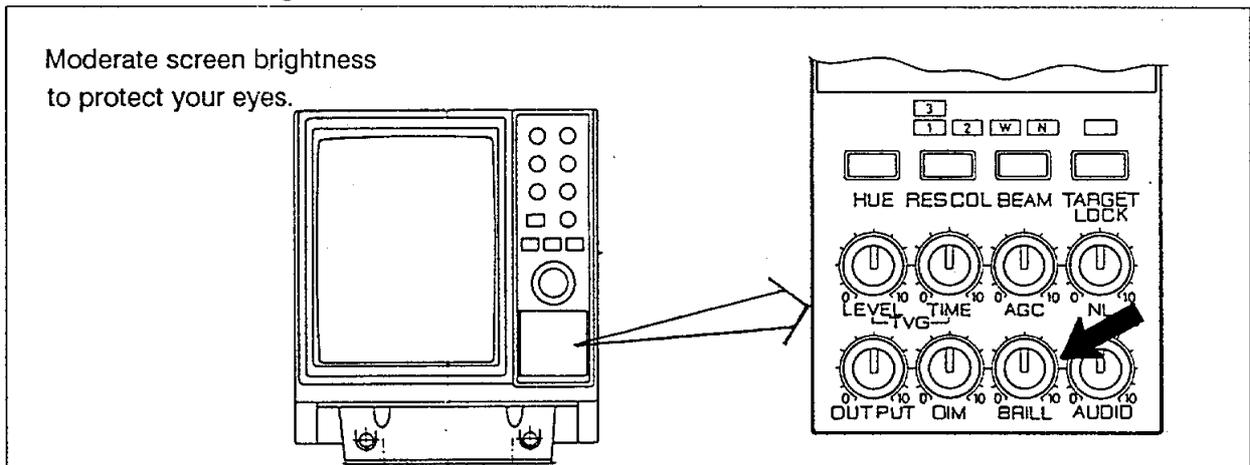
Keep all magnetic materials away.



Allow service/ventilation space.



Do not increase brightness too much.



NOTE: The CH-32 retracts the soundome automatically when the power is turned off, even if the soundome is not retracted. Note however that if you turn off the main power switch first, the soundome cannot be retracted.

1. FOREWORD

Congratulations on your choice of the FURUNO CH-32 Color Searchlight Sonar! We are confident that you will enjoy many years of operation with this fine piece of equipment.

For over 40 years Furuno Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

The CH-32 is the newest addition to Furuno's CH family of sonars. This new sonar is especially designed to provide powerful detection capability at long range and improved operation by the rotary controls and trackball. The display of the sonar is presented in eight colors like other Furuno color sounders and sonars. The excellent combination of a new high-power transmitter and improved receiver AGC brings you a clear and high-quality picture on a 14-inch screen.

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

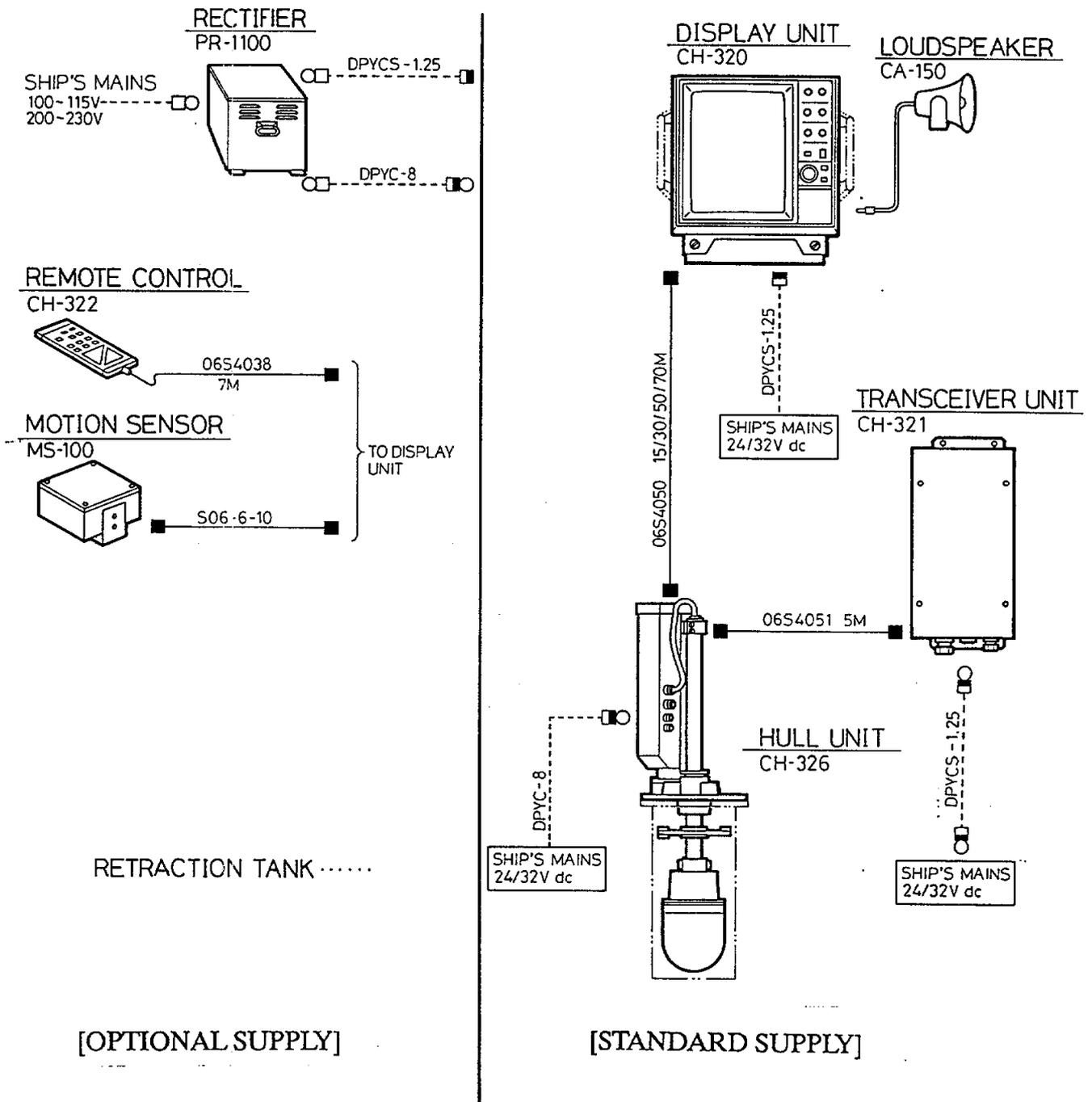
Thank you for considering and purchasing Furuno equipment.

FEATURES

- 1) Displays a bright, non-fading steady picture in 8-color presentation on 14" CRT. Selectable background color lessens eye-fatigue in both daytime and nighttime operations.
- 2) High-power operation — choice of 40kHz/2kW or 60kHz/3kW.
- 3) Trackball offers easy-to-use operation for various marker settings.
- 4) Off-centered or zoomed presentation mode is provided in addition to normal PPI and PPI + Historical presentation.
- 5) Scan reverse key allows you to reverse the direction of training for quick echo tracking.
- 6) Wide vertical beamwidth selection is available at the range scale of 400m or shorter. It reduces the undetected area.

2. SYSTEM CONFIGURATION

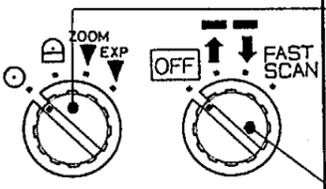
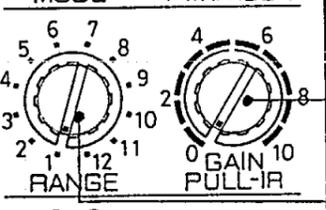
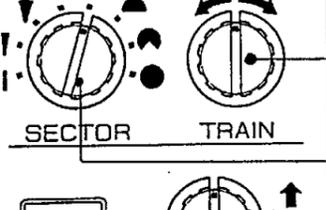
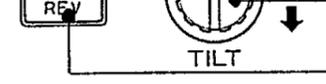
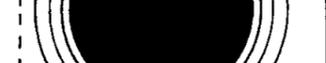
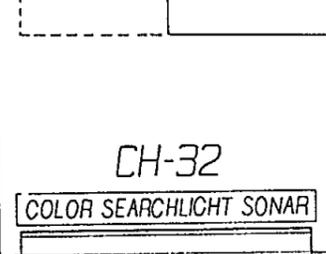
The CH-32 consists of the following units.



- NOTES. 1. ■ : Connector to be fitted at installation
 2. ■ : Connector fitted at factory
 3. ○■ : Crimp-on lug to be fitted at installation
 4. ■○ : Crimp-on lug fitted at factory
 5. ○○ : Crimp-on lug prepared and fitted locally
 6. Cables ————— : Furuno supply
 - - - - - : Prepare locally

3. OPERATING CONTROLS

MAIN PANEL

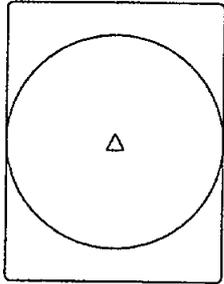
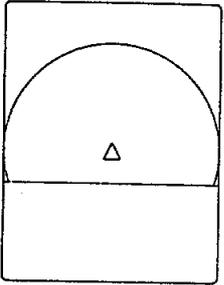
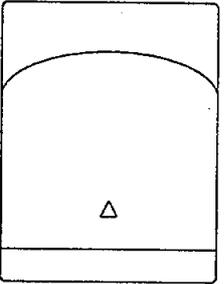
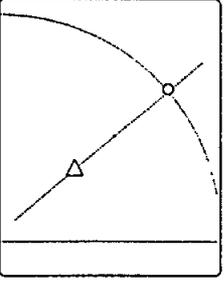
	FUNCTION	DESCRIPTION	For details —
	MODE	selects display mode among the four kinds below. ○ Full circle PPI Sonar Display ⊕ PPI Sonar Display + Historical Display ⊕ ZOOM Expanded PPI Sonar Display (expanded echo size) ⊕ EXP Expanded PPI Sonar Display (expanded detection range)	Page 5
	PWR/XDCR	switches on and off the entire system and controls the transducer. Each position functions as follows. OFF : The equipment is switched off. ↑ : Raising (retracting) the transducer. ↓ : Lowering the transducer. FAST SCAN: Lowering the transducer and High-speed training.	Page 18
	GAIN/IR	adjusts the receiver sensitivity. Turning the control clockwise increases the sensitivity. When changing the range and tilt settings, readjustment of the gain is required. For normal use, it is recommended to set it around the "5" position. When interference can be seen on the screen, pull out the GAIN control to reduce or eliminate it.	Page 34 Page 6
	RANGE	selects the detecting (display) range. The selected range appears at the upper corner of the screen.	Page 6
	TRAIN	determines the center direction of the train sector. In the ZOOM and EXP mode, it controls the direction to be off-centered.	
	SECTOR	selects the width of the transducer training sector among eight (6°, 36°, 60°, 96°, 120°, 180°, 240° and 360°) positions. The direction of training can be made in both directions except at the 360° setting.	
	TILT	controls the tilt angle between +5° and -90°. The setting angle is made in 1-degree steps and displayed at the upper right corner of the screen.	pages 12-17
	SCAN REV	reverses the training direction instantly at every press of the key. This is valuable for quick echo tracking.	Page 18
	OFF-CENTER	shifts the own ship's position to expand the fish size in the ZOOM mode or the detection range in the EXP mode.	page 8
 <p>CH-32 COLOR SEARCHLIGHT SONAR</p>	TRACKBALL R/B ALARM	moves the trackball marker (+). The trackball mark data, i.e., slant range, horizontal range, depth and bearing to the mark, are always indicated on the screen. Additionally, this control is used to position the R/B(Range/Bearing) marker and set the alarm zone with the R/B and the ALARM keys located above the trackball control.	Pages 7 - 8

Sub-PANEL

FUNC-TION	DESCRIPTION	For details
HUE	changes the background color of the display to compensate for lighting conditions. (Deep Blue → Blue → Black)	
RESCOL	Response Color Course 1: LOG enhances weak echo and is normally used. 2: LINEAR downplays the weak echoes comparing with LOG. It is effective to suppress the plankton layer. 3: SQUARE enhances the strong echoes comparing with LINEAR resulting in clear and easy-reading picture.	
BEAM (Vertical)	selects N (narrow) for general use; W (wide) for fish which swims up and down at high speed. W is available at the range scale of 400m or shorter.	Page 13
TARGET LOCK	turns on/off the target lock function.	Pages 9,10
AGC	suppresses the echo tail of strong targets, e.g., the seabed, for easy recognition of fish schools adjacent to the sea bottom. Position "0" is the normal setting.	Page 36
NL	rejects noise which is displayed over the screen in light blue or blue. Position "2" is the normal setting.	Page 37
TVG	LEVEL controls the receiver sensitivity to eliminate surface noise, which may mask shallow targets. TIME determines the TVG effective depth.	Page 35
AUDIO	adjusts the volume of the external loudspeaker for monitoring a target echo.	
BRILL	adjusts brightness of the screen.	
DIM	adjusts panel illumination.	
OUTPUT	adjusts output power, "0" is for minimum power and "10", maximum. Set to "10" for normal use, and use a low power when sea surface reflection or seabed echo obscures fish schools.	Page 36

Presentation Mode

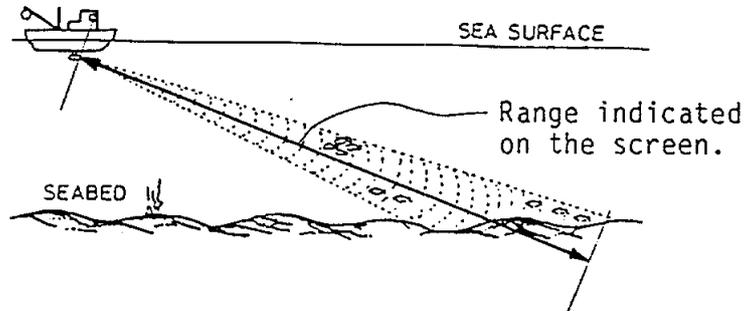
Four presentation modes are available: Full circle PPI, PPI + Historical, Zoomed PPI and EXPanded PPI mode.

		Presentation
		<p>Full circle PPI mode</p> <p>Normal full circle picture is displayed on entire screen.</p>
		<p>PPI + Historical mode</p> <p>Normal circle picture is displayed at the upper portion of the screen and the historical display picture on the lower portion.</p>
<p>ZOOM</p> 		<p>Zoomed PPI mode</p> <p>Zoomed picture is displayed on entire screen. The echo size on the screen is expanded 1.5 times.</p>
<p>EXP</p> 		<p>Expanded PPI mode</p> <p>The detection range in the direction of the sector center is expanded 1.5 times.</p>

NOTE: The length of the picture displayed in the lower part of the historical display is equal to four full circle pictures approximately (Information of 240 transmissions). This enables you to observe the history of a fish movement, which cannot be readily recognized on the instantaneous PPI display. In other words, you may be able to find fish coming up from the bottom echo with a proper setting of TILT and AGC.

Range Selection

The RANGE control selects the detection (display) range. Select the range according to either the fish species being searched for or the depth desired. Normally it is set so that the bottom is traced at the lower part of the screen (like an echo sounder).

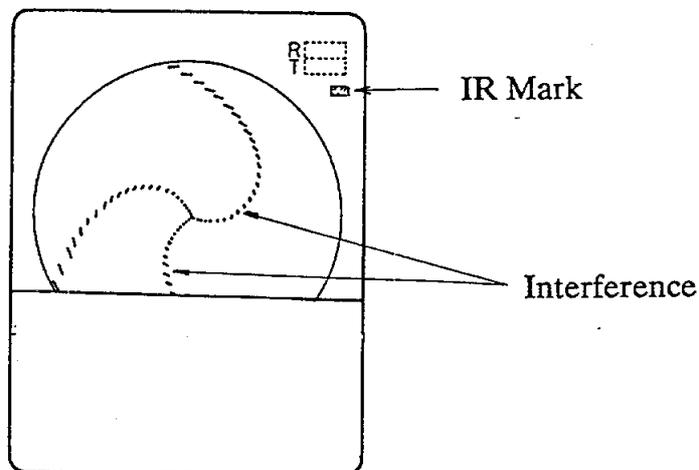


	1	2	3	4	5	6	7	8	9	10	11	12
Range (m)	60	100	150	200	300	400	600	800	1000	1200	1600	2000

NOTE: The unit of measurement can be changed by an internal DIP switch. See pages AP-2 and AP-3.

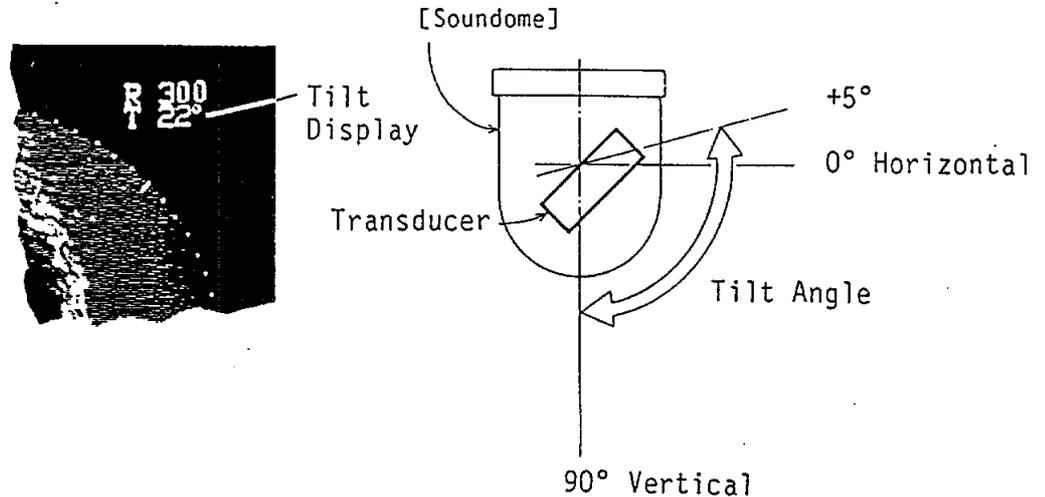
IR (Interference Rejector)

When interference from other echo sounders operating nearby or other electrical noise can be seen on the screen, pull out the IR control to reduce or eliminate the interference. Interference is easily recognizable by its appearance (see figure below). Although the IR is effective in most cases, some forms of interference cannot be reduced or eliminated.



TILT Control

The tilt angle shows the direction to which the sound wave is emitted. When the sound wave is emitted horizontally, it is said to be zero (0) degrees and when emitted vertically, 90 degrees. To set a tilt angle, operate the TILT knob for the desired angle while watching the tilt angle indication at the top right-hand side of the screen. The tilt angle can be set in one-degree steps within the range of +5 to -90 degrees.



TRACKBALL Operation

The trackball has two functions basically.

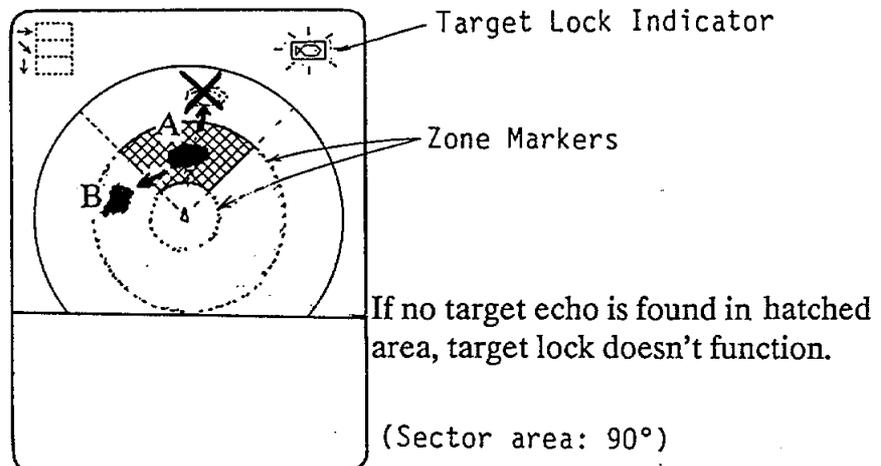
- (1) To obtain the data (slant & horizontal range depth and bearing) from own ship to the specified position on the screen.
- (2) Combined with a R/B and ALARM key directly above it, the R/B marker, alarm zone display is switched on and off.

Procedures/Purpose	
R/B Mark	<p>1) Position the trackball marker on the desired point.</p> <p>2) Press the R/B switch. The range and bearing markers appear and their data are displayed at the bottom left-hand side of the screen.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Trackball Mark Data</p> </div> <div style="text-align: center;"> <p>R/B Mark Data</p> </div> </div> <p>3) To erase the marker, place the trackball mark near the own ship's mark and press the R/B switch.</p>

<p>ALARM Zone</p>	<p>You can set a 360 degree alarm zone (by the ALARM key) to audibly alert you when echoes more than red color enter the preselected zone.</p> <ol style="list-style-type: none"> 1) Press the ALARM key. Two zone markers, set zone message and alarm mark appear on the screen. 2) Move the inner zone marker to the alarm start range by the trackball. 3) Press the ALARM key. The alarm start range is registered and the trackball mark jumps to the outer zone maker. 4) Move the outer zone marker to the alarm end range by the trackball. 5) Press the ALARM key to complete the alarm zone setting. 6) To cancel the alarm function, press the ALARM key again. <div data-bbox="879 801 1276 1176" data-label="Diagram"> <p style="text-align: center;">Zone Setting Screen</p> </div>
<p>Off-center</p>	<p>Off-center function is available for the PPI + Historical, Zoomed and Expanded modes.</p> <p>Press the OFF-CENTER key and the own ship's position is off-centered to the opposite direction against the sector center.</p> <div data-bbox="863 1464 1276 1760" data-label="Diagram"> </div> <p>NOTES:</p> <ol style="list-style-type: none"> 1. For off-centering by the trackball marker location, set the DIP SW S3 #3 to "ON". See page AP-3. 2. Off-center function is not available in the normal PPI mode. 3. In the PPI + Historical mode the off-center function works only in the fore-aft direction.

TARGET LOCK Function

The target lock function tracks a fish school appearing in a predetermined target lock zone. To illustrate how it works, suppose that the hatched area shown in the figure below is the target lock zone and the fish school detected at "A" moves toward "B". With the target lock function ON, the target lock is activated at "A" and the transducer is trained automatically following the movement of the fish toward "B".



Note that the fish school can be tracked only when it moves horizontally. When it moves up and down, it should be tracked by manually changing the tilt. Note also that if the fish school goes out of the zone in the range direction, the tracking is suspended until it or a new fish school comes into the zone.

To activate the target lock function;

1. Select the target lock zone (= alarm zone) using the trackball, TARGET LOCK key and sector switch. See page 8.
2. Press the TARGET LOCK switch on the sub-panel. The target lock indicator () appears on the screen.
3. When a fish school displayed in red or reddish brown is detected in the specified zone, the target lock is activated and the target lock indicator on the screen blinks and the buzzer sounds to call the operator's attention.
4. To turn off the target lock function, press the TARGET LOCK switch again.

NOTE: Set the target lock zone so that bottom echoes are excluded from the zone, otherwise the target lock may be activated with bottom echoes.

Target Lock Mode Selection

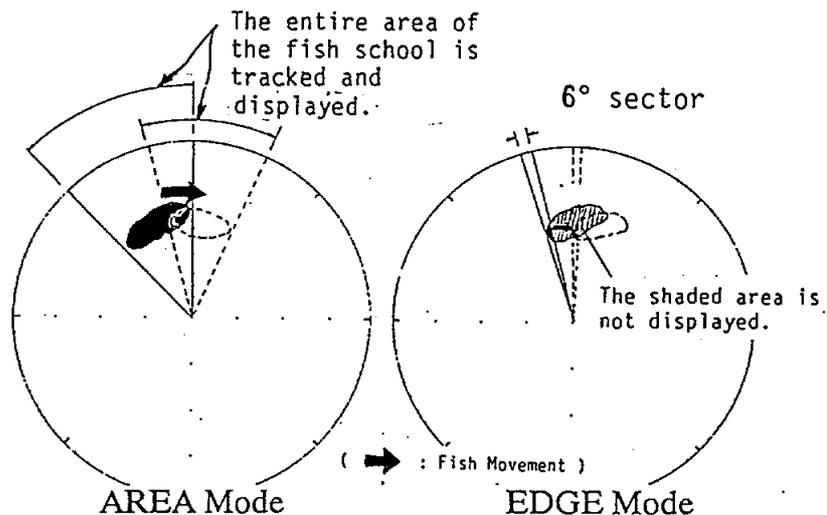
In the target lock function, two types of tracking modes are available, AREA and EDGE. Select either of them with DIP switch S2 #7 (see page AP-3). The switch is factory-set for the AREA mode.

AREA Mode

The sounding beam is scanned from end to end of the fish school. Namely, the transducer training is reversed at each end of the fish school. The advantage of this mode is that you can observe the size of the fish school continually.

EDGE Mode

The sounding beam tracks either end of the fish school without scanning; the transducer stops training whenever an echo above the red level is detected and trains again when it disappears, resulting that the sounding beam follows the movement of the front or back end of the fish school. Note that the display area is 6° only.



Target Lock Sounding Beam Control

In the target lock function, the sounding beam can be controlled by DIP switch S3 #4 setting as follows. See page AP-3.

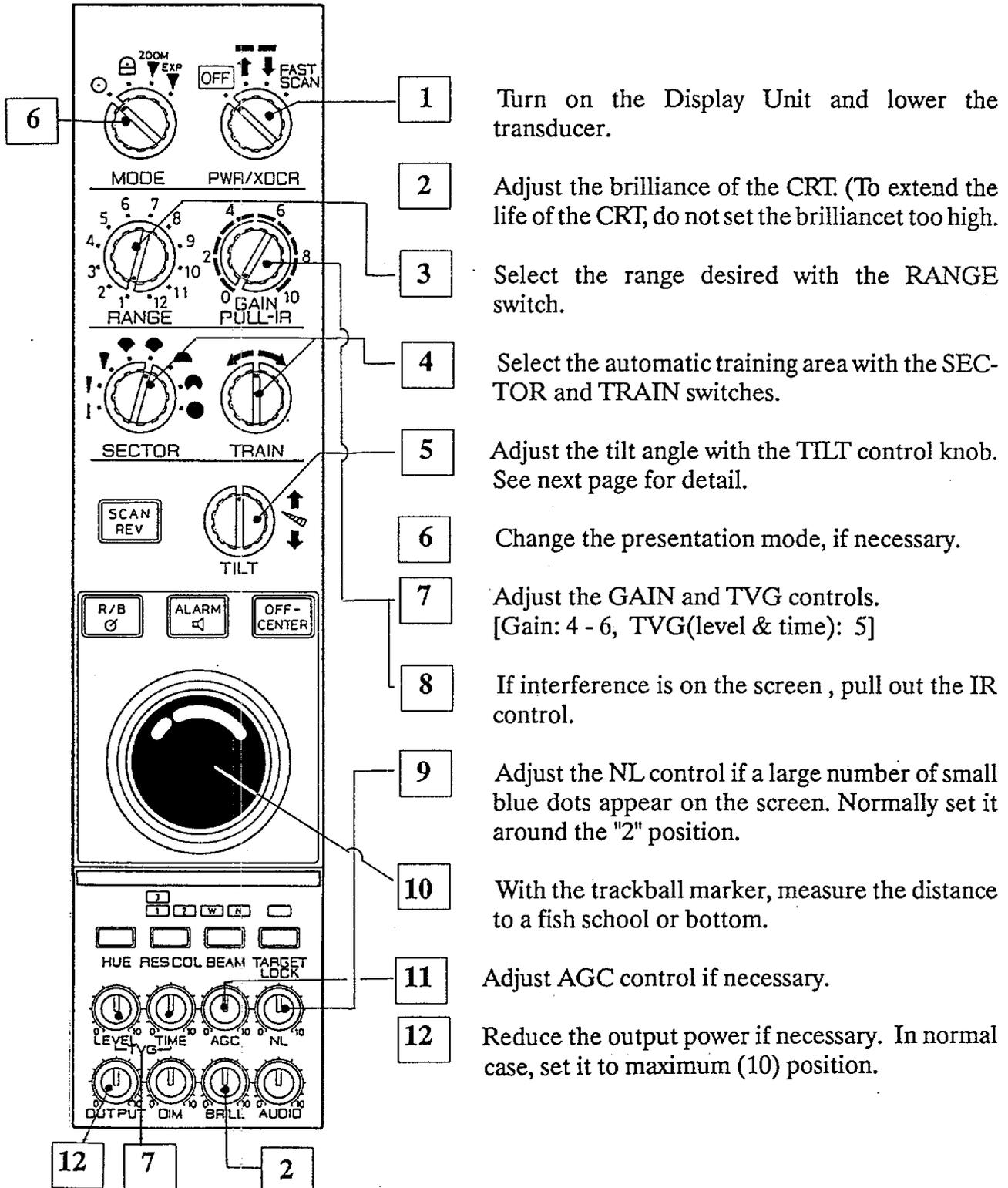
DIP SW Setting		Operation
Target Lock Beamwidth	ON	Automatic Mode: When the echo captured in the target lock function disappears, the sounding beam is automatically changed to wide vertical beam to extend the detecting area. After the echo is recaptured, the beam is switched to narrow.
	OFF	Manual Mode: The sounding beam is switched manually by the switch on the sub-Panel (Factory-set).

Note: This function is available only when the narrow beam is selected.

4. BASIC OPERATION

PROCEDURE

Typical operating procedure of the CH-32 is shown below.



Setting The Tilt Angle

Finding the proper tilt angle is of utmost importance when searching for fish. When selecting a tilt angle, keep the following points in mind.

Seabed Echo vs Tilt Angle

Case 1: Tilt Angle 30 to 40 degrees

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

Case 2: Tilt Angle 10 to 20 degrees

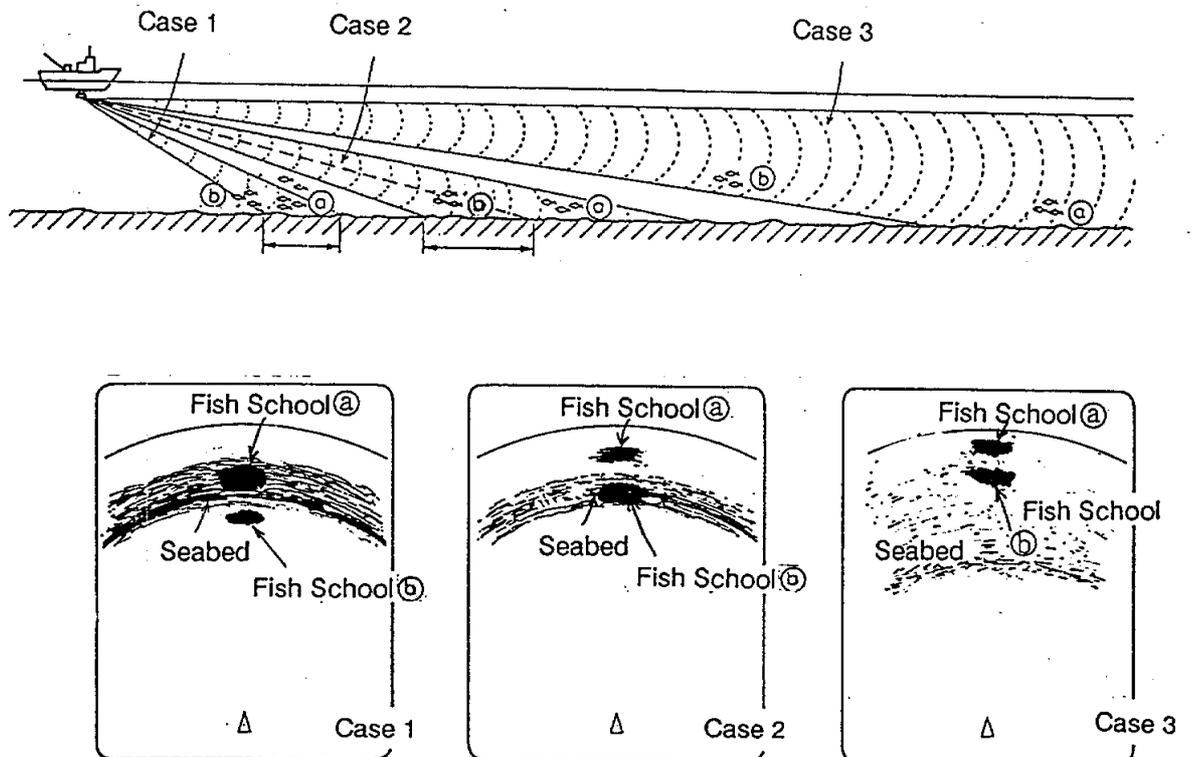
A narrow tilt angle will display only half the seabed since it is captured by only the lower half of the beam.

Case 3: Tilt Angle 0 to 10 degrees

An exceptionally narrow tilt angle may or may not capture the seabed since the returning echo is weak.

Example of How to discriminate Fish Echoes from the Seabed

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



Points to Consider

- As a general rule of thumb, a vertically distributed fish school is a better sonar target than the seabed, since it reflects the transmitted pulse back toward to the source.
- In case 3, both fish schools a and b are presented. Generally speaking, however, midwater fish schools tend to be larger than bottom fish schools and they are often displayed near the seabed on the sonar screen.
- Detection of bottom fish is difficult if they are not distributed vertically.

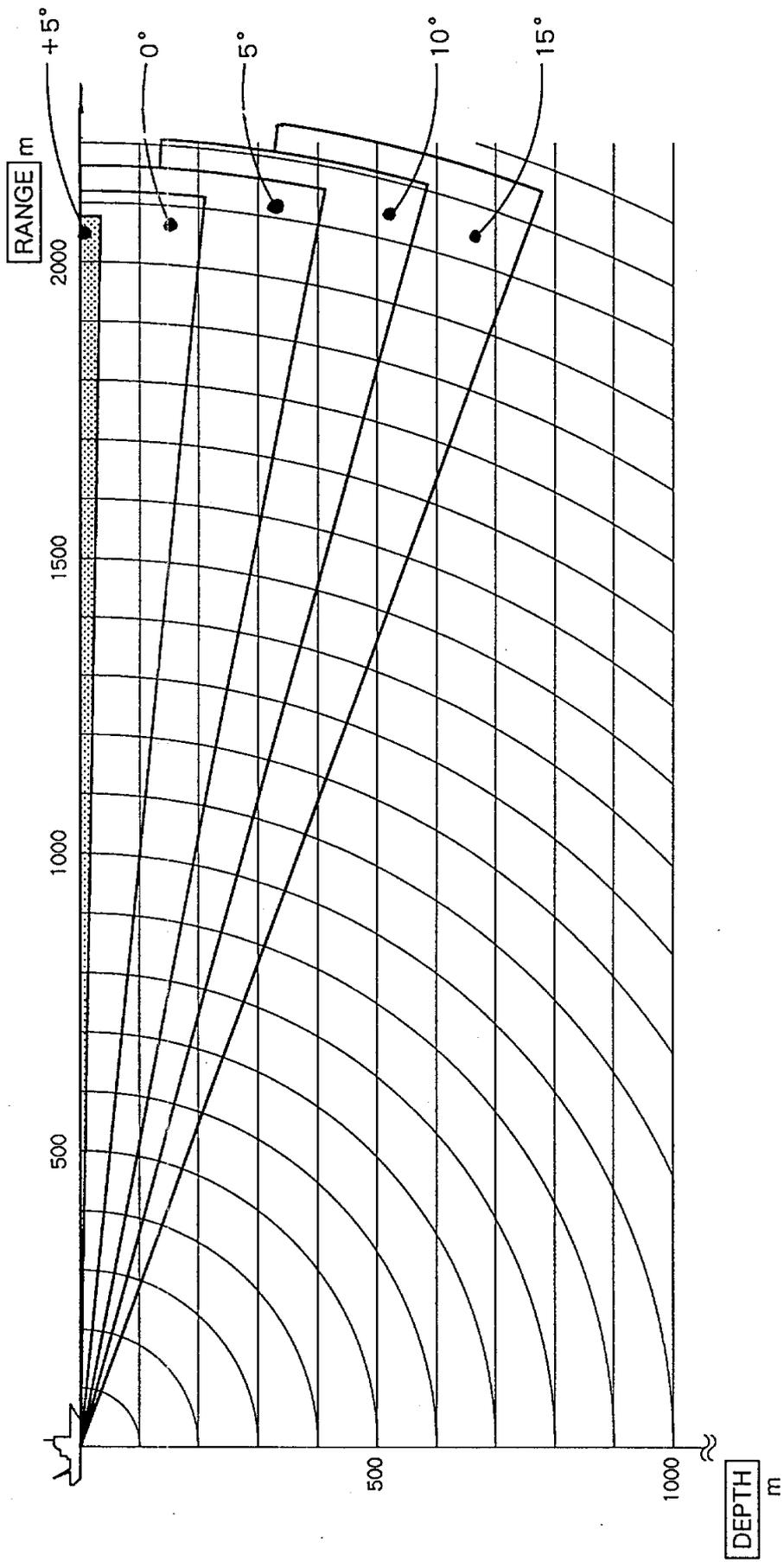
Sounding Beam

The employed beam in the equipment is as shown below.

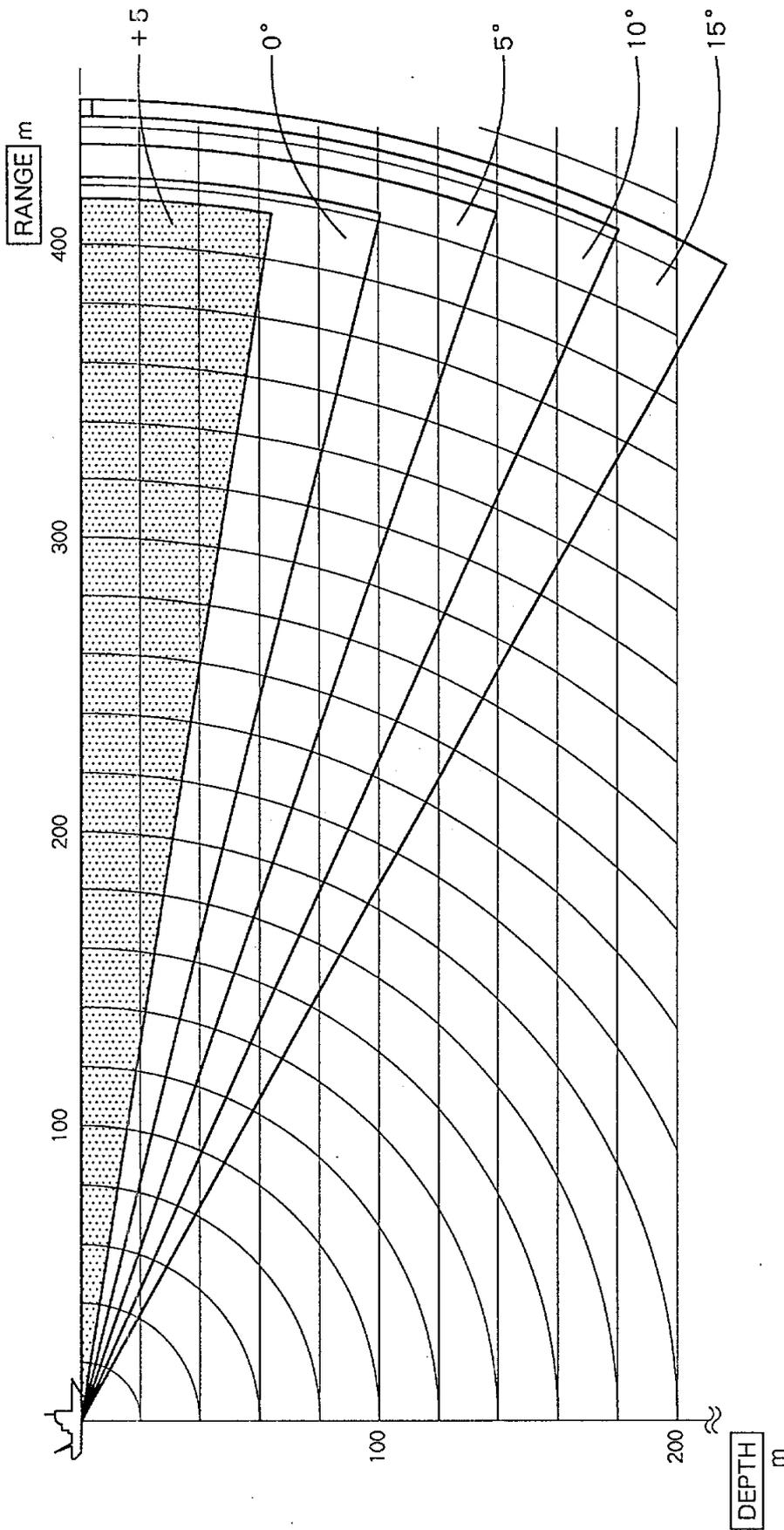
Wide beam is recommended to detect the fish moves up and down rapidly and to reduce the undetected area in short range.

Frequency	BEAM SELECTION	
	Narrow	Wide
40kHz SET		
60kHz SET		

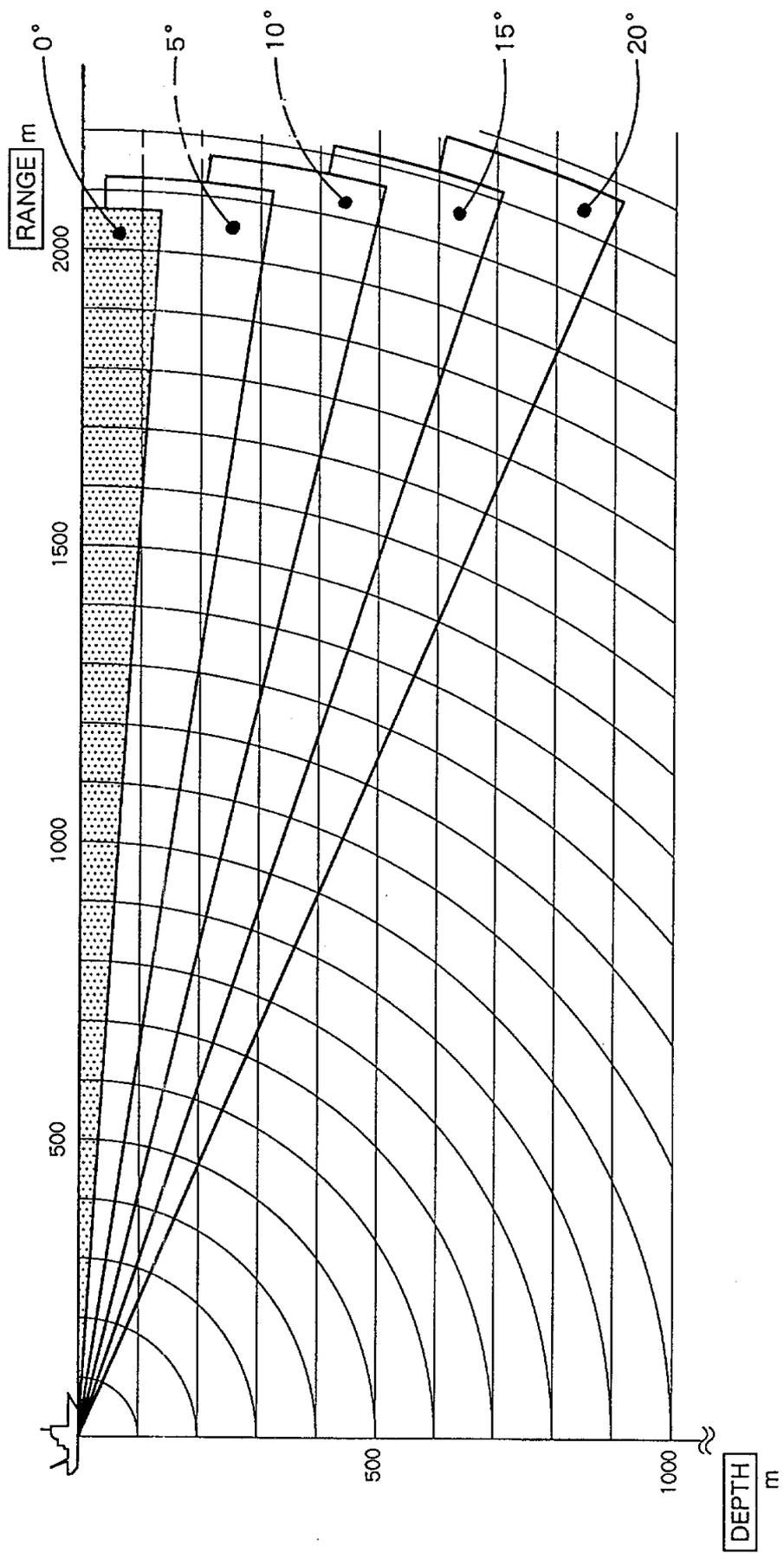
+ Beam Center = Tilt Indication



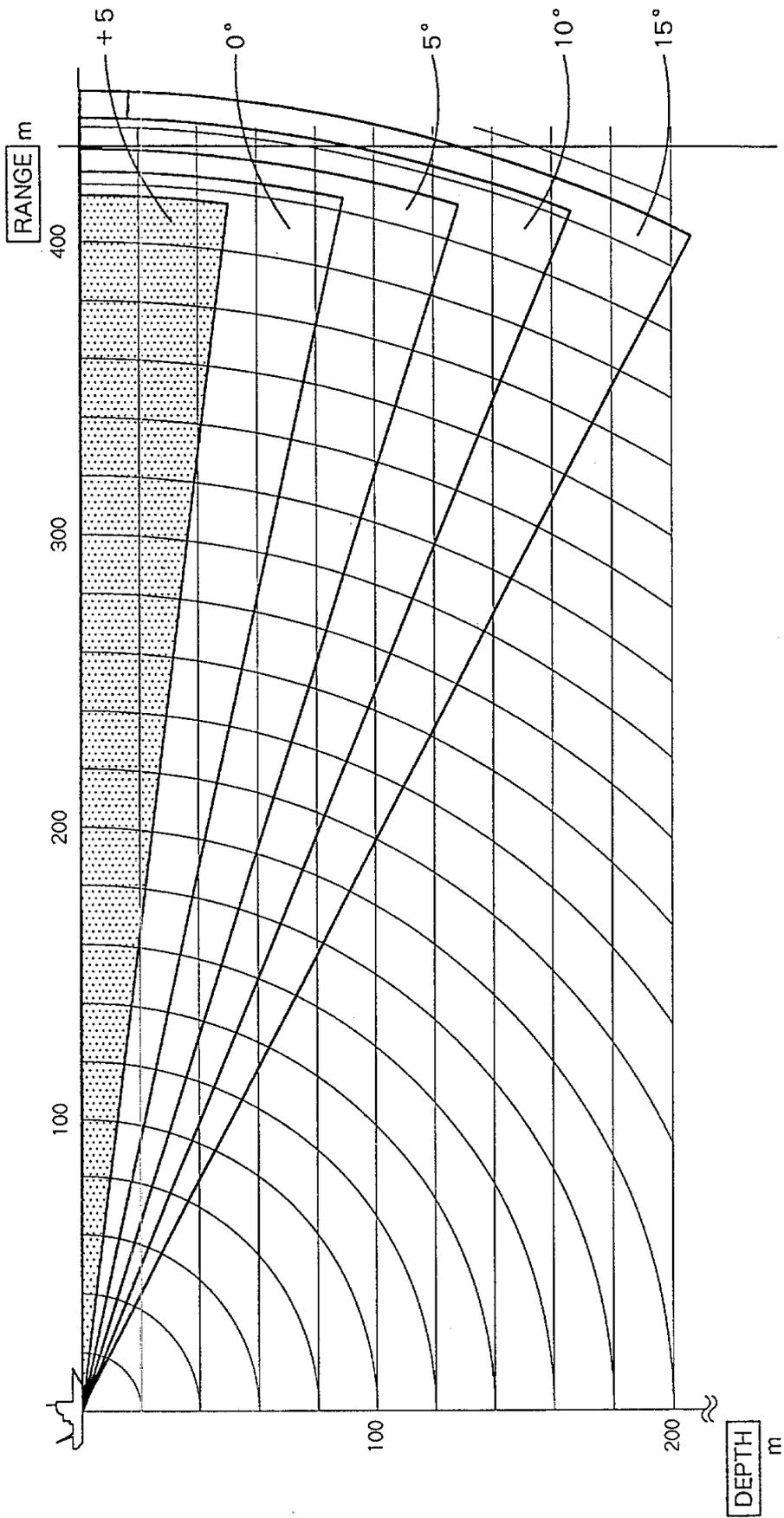
CH - 32 40kHz (Narrow Beam) 12° (H) × 12° (V)



CH - 32 40kHz (Wide Beam) 12° (H) × 29° (V)



CH - 32 60kHz (Narrow Beam) 9° (H) × 8° (V)

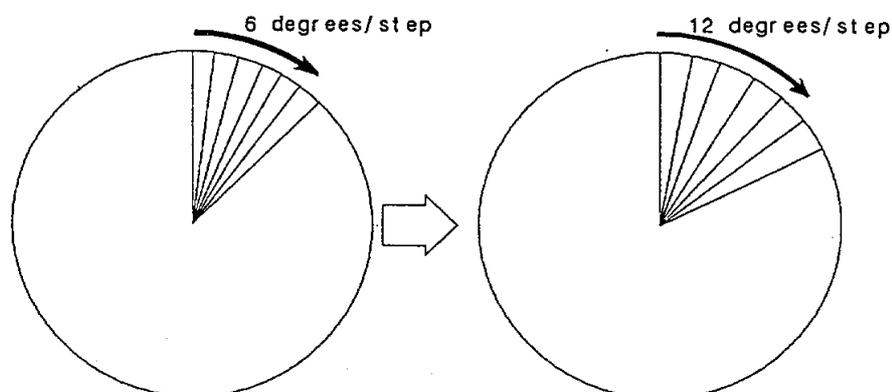


CH - 32 60kHz (Wide Beam) 9° (H) × 25° (V)

5. USEFUL OPERATIONS

Speed up of the Sounding

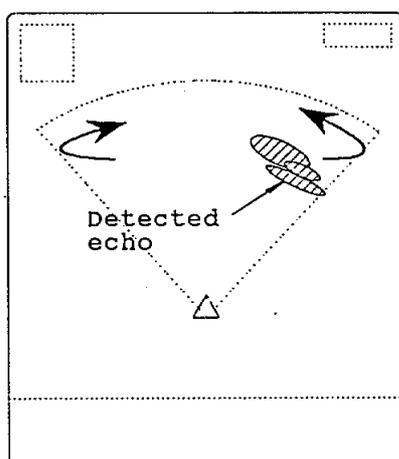
When you prefer fast sounding, turn the [PWR/XDCR] knob to "FAST SCAN" position.



Note: The sounding sector is doubled to speed up sounding. 12° step is available on 300m or long ranges.

Tracking Echoes Quickly

Press the [SCAN REV] key to reverse the training direction for quick tracking. This function is quite useful for quick confirmation of echoes. In a wide sector selection, target echoes may be lost until the sounding beam returns.



Training direction is reversed whenever the SCAN REV key is pressed.

Echoes go out of the Detection Range

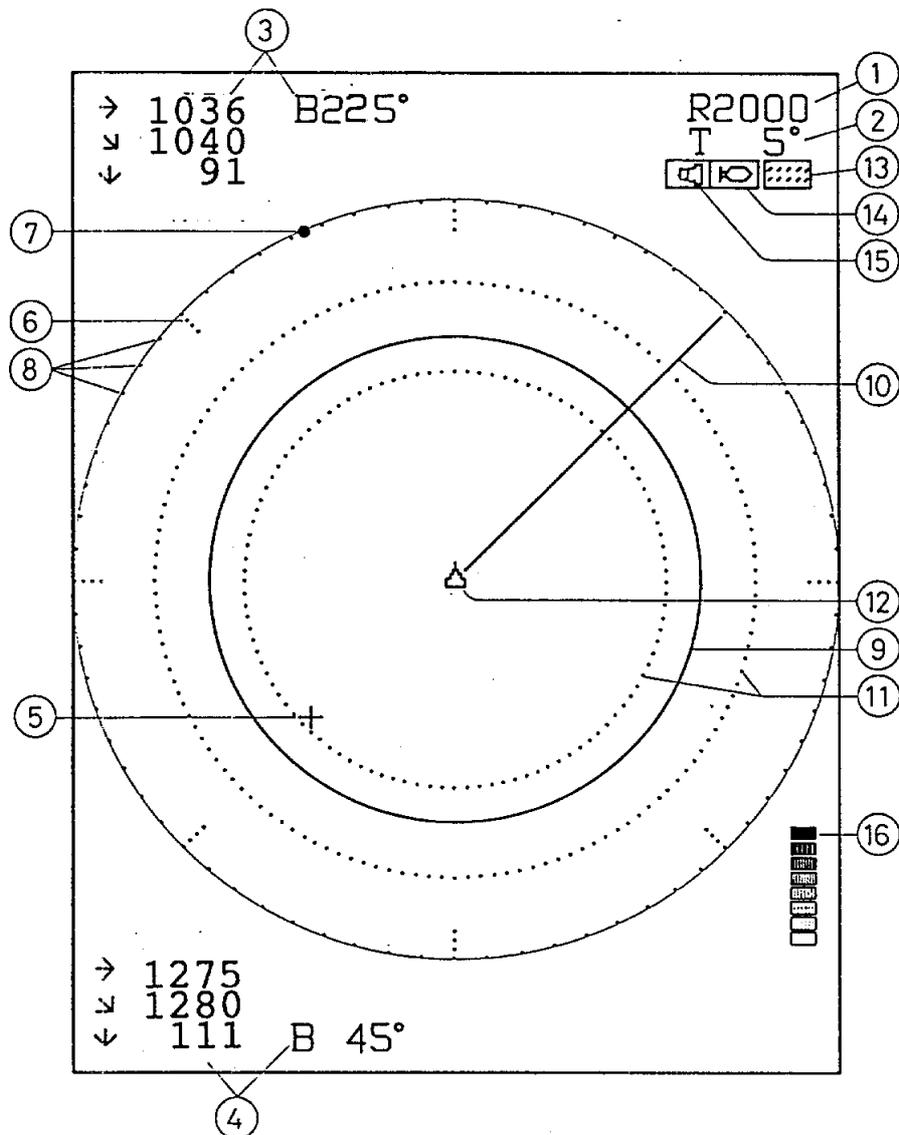
Select "EXP" mode by the MODE knob. The detection range is expanded *1.5 times*.

Observing Echoes in Detail

Select "ZOOM" mode by the Mode knob. The echo size on that display range is expanded *1.5 times*.

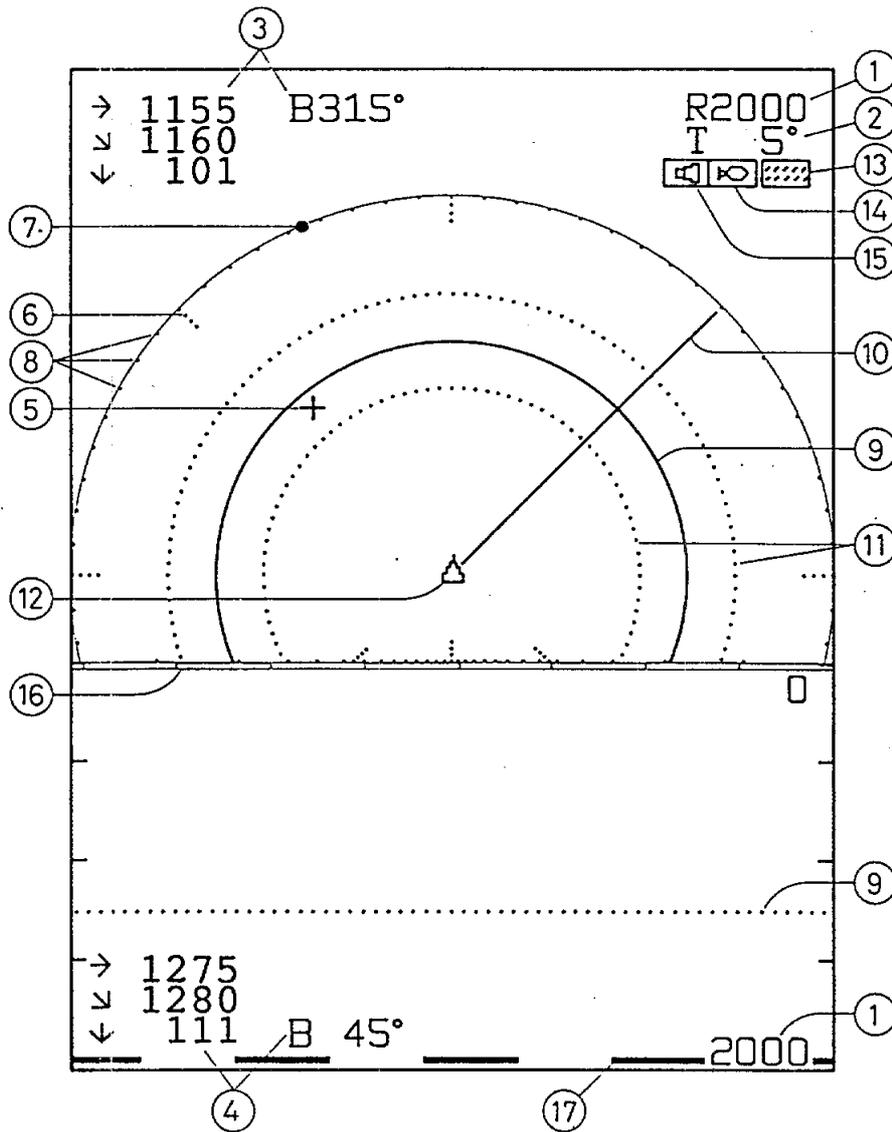
6. INDICATORS ON THE SCREEN

(1) Normal PPI Sonar Display



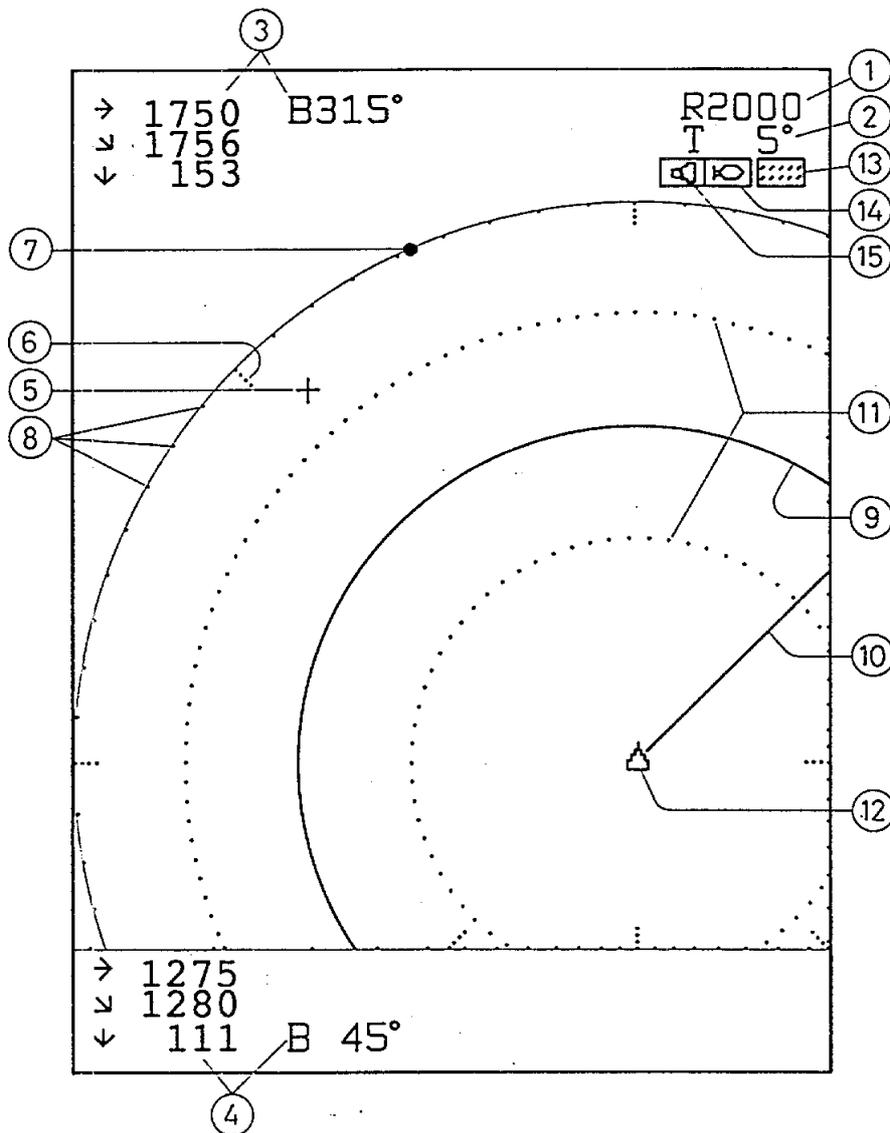
1	RANGE	7	SECTOR CENTER MARK	13	IR MARK
2	TILT	8	SECTOR WIDTH MARK	14	TARGET LOCK INDICATOR
3	TRACKBALL DATA	9	RANGE MARKER	15	ALARM INDICATOR
4	R/B MARK DATA	10	BEARING MARKER	16	COLOR BAR
5	TRACKBALL	11	ALARM ZONE MARKER		
6	CURSOR SCALE	12	OWN SHIP'S MARK		

(2) PPI + Historical Display



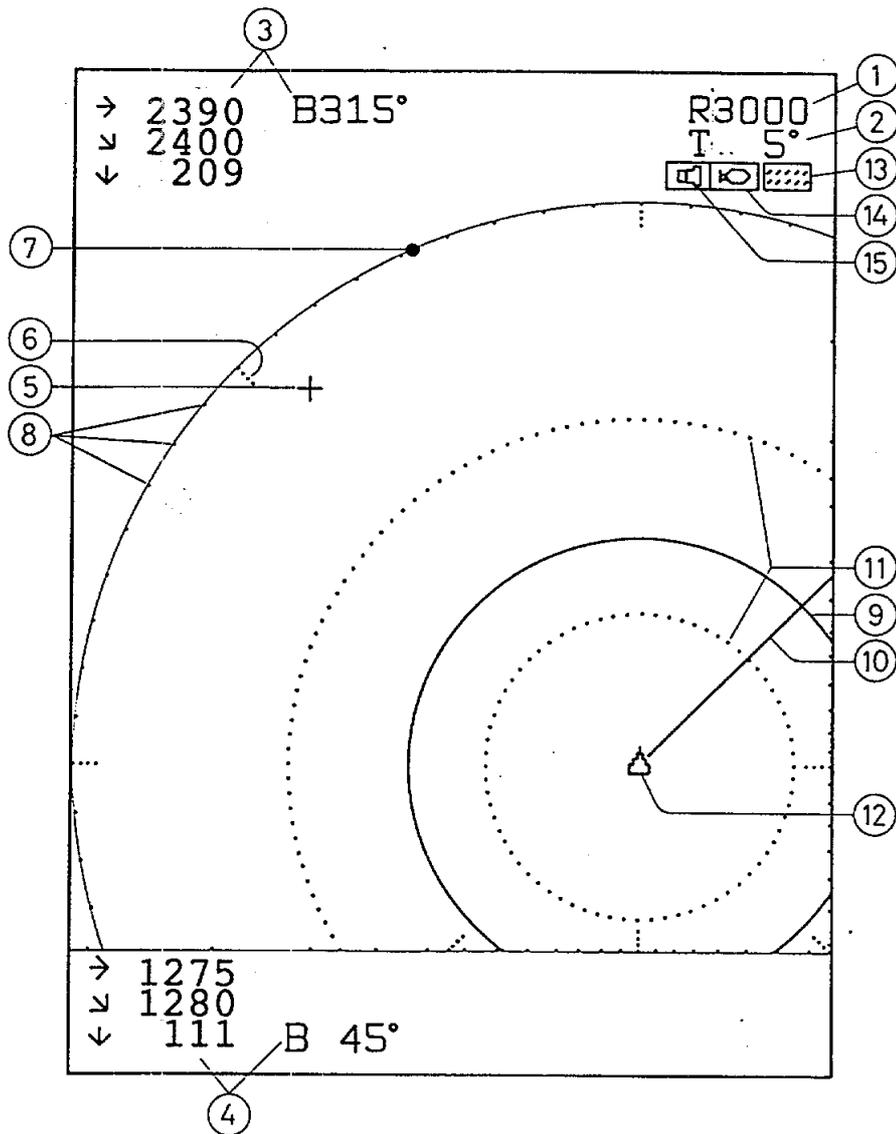
①	RANGE	⑦	SECTOR CENTER MARK	⑬	IR MARK
②	TILT	⑧	SECTOR WIDTH MARK	⑭	TARGET LOCK INDICATOR
③	TRACKBALL DATA	⑨	RANGE MARKER	⑮	ALARM INDICATOR
④	R/B MARK DATA	⑩	BEARING MARKER	⑯	PORT-STARBOARD MARKER
⑤	TRACKBALL	⑪	ALARM ZONE MARKER	⑰	TRAINING DIRECTION MARKER
⑥	CURSOR SCALE	⑫	OWN SHIP'S MARK		

(3) Zoomed PPI Sonar Display (Display Range Expanded)



①	RANGE	⑥	CURSOR SCALE	⑪	ALARM ZONE MARKER
②	TILT	⑦	SECTOR CENTER MARK	⑫	OWN SHIP'S MARK
③	TRACKBALL DATA	⑧	SECTOR WIDTH MARK	⑬	IR MARK
④	R/B MARK DATA	⑨	RANGE MARKER	⑭	TARGET LOCK INDICATOR
⑤	TRACKBALL	⑩	BEARING MARKER	⑮	ALARM INDICATOR

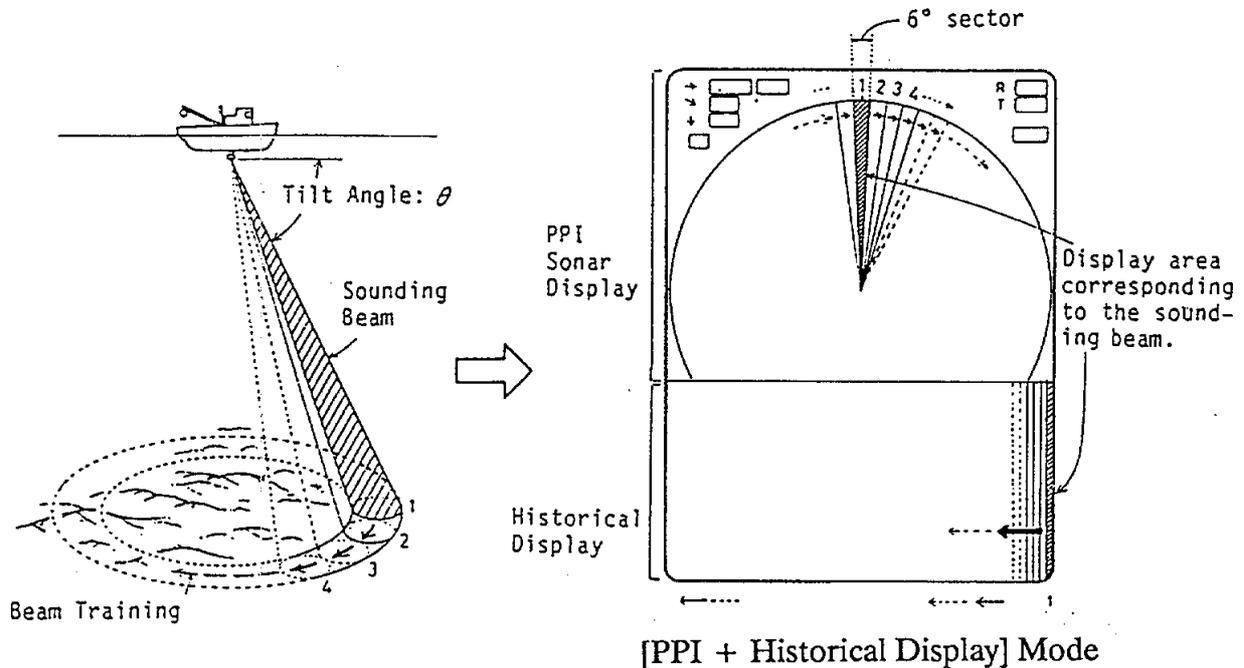
(4) Expanded PPI Sonar Display (Detection Range Expanded)



1	RANGE	6	CURSOR SCALE	11	ALARM ZONE MARKER
2	TILT	7	SECTOR CENTER MARK	12	OWN SHIP'S MARK
3	TRACKBALL DATA	8	SECTOR WIDTH MARK	13	IR MARK
4	R/B MARK DATA	9	RANGE MARKER	14	TARGET LOCK INDICATOR
5	TRACKBALL	10	BEARING MARKER	15	ALARM INDICATOR

7. INTERPRETING THE DISPLAY

How the Picture is Composed on the Screen



As shown above, the sounding beam is emitted from the soundome at a certain tilt angle. The information (target echoes) obtained by this beam is displayed in 6-degree sectors on the PPI sonar screen and by a series of vertical scan lines like a color sounder in the lower part of the screen. See the hatched areas in the figure. The sonar picture is completed with 60 transmissions ($6^\circ \times 60 = 360^\circ$), and the historical display is completed with 240 transmissions. Provided that the training is performed continuously with tilt, it forms a large sounding area (cone shape), resulting in continuous pictures on both parts of the screen.

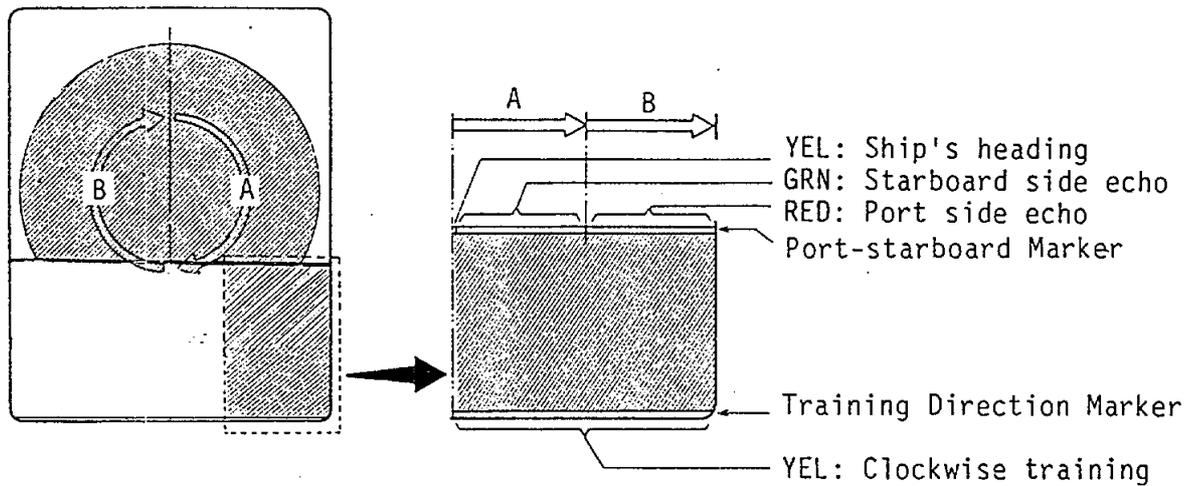
Historical Display Mode

The historical display appears in the lower part of the screen. (This display is quite similar to the recording of a conventional graph recording type sonar.) The features and the expected applications are;

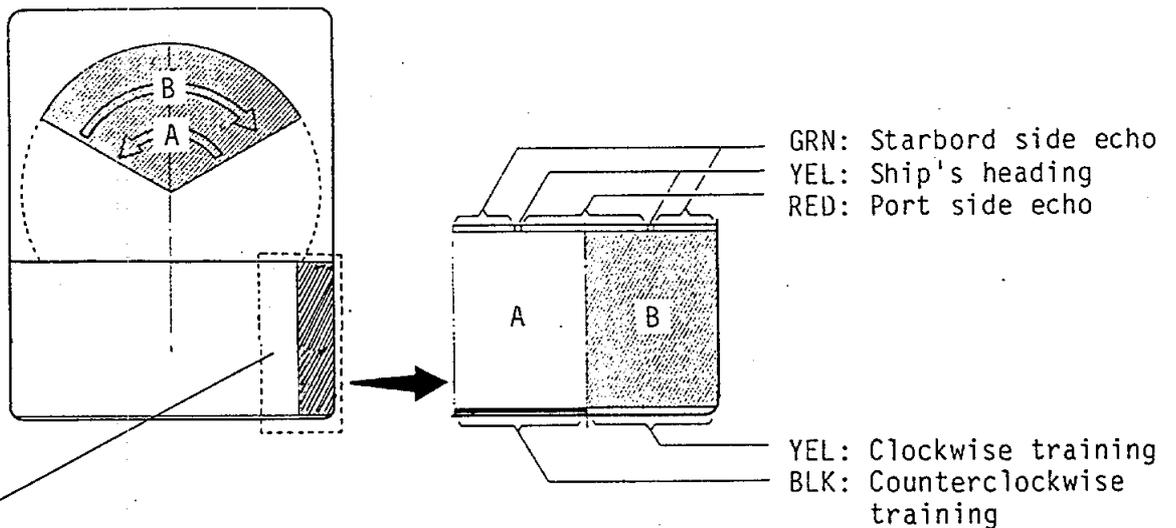
- 1) It can be considered as an echo sounder picture with a tilted transducer.
- 2) It can show as many as the last four complete sonar pictures (360° training of transducer), allowing you to recognize the history of fish school movement/distribution, etc.
- 3) The identification of weak or intermittent targets, which tend to be ignored on the PPI display, may be possible.

When comparing the historical display with the PPI sonar display, the port-starboard/training direction markers help you to recognize the location of the sounding beam and the corresponding area.

Continuous Training Mode; 360° The entire PPI screen corresponds to the hatched area in the historical display. This is recognizable from the color indication of the markers.



Training Area; 120° 120° PPI screen corresponds to the hatched area in the historical display area. This is also recognizable from the color indications.



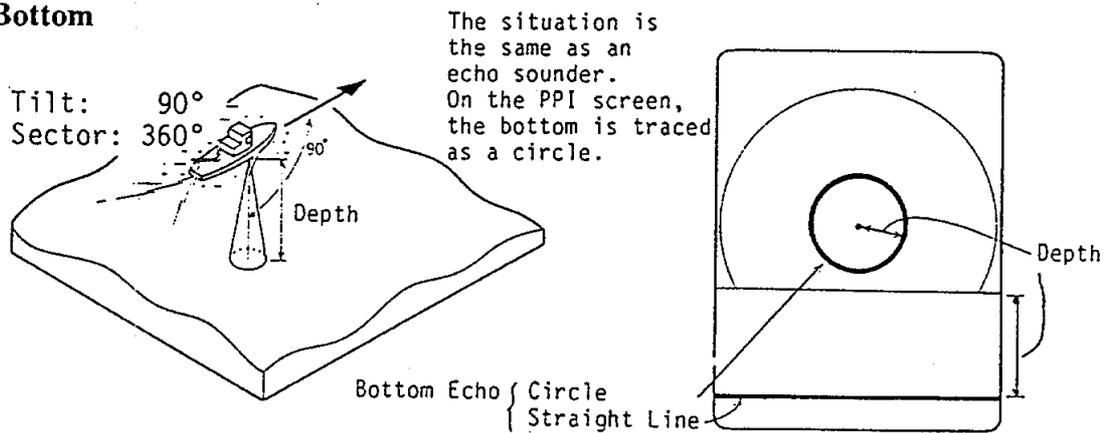
This area is obtained by the previous CCW training and cannot be seen on the PPI screen because it has already been renewed.

Typical Echoes on the Screen

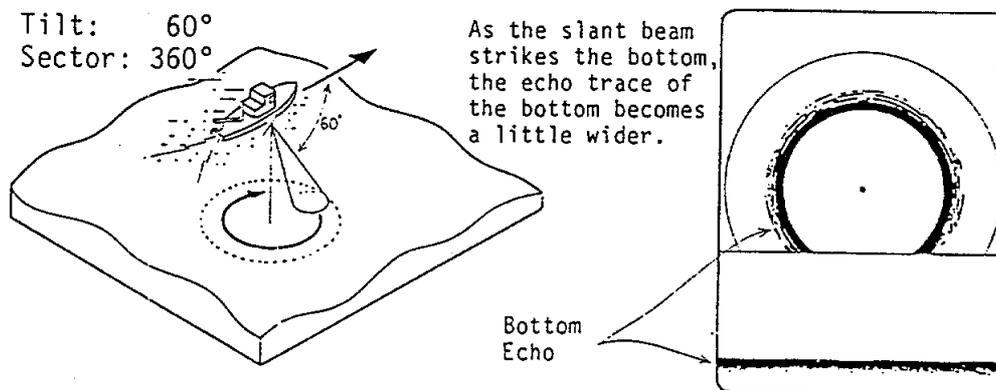
1. Seabed

When the tilt angle is set at some degrees with a full circle training setting, the picture illustrated below will appear on the screen. The seabed echo is presented on the screen as a thick line which realistically shows the bottom contour. When the tilt angle is decreased, the seabed trace becomes wider and weaker. By observing the seabed condition on the screen, the skipper can prevent the net from being damaged by a reef or a shipwreck.

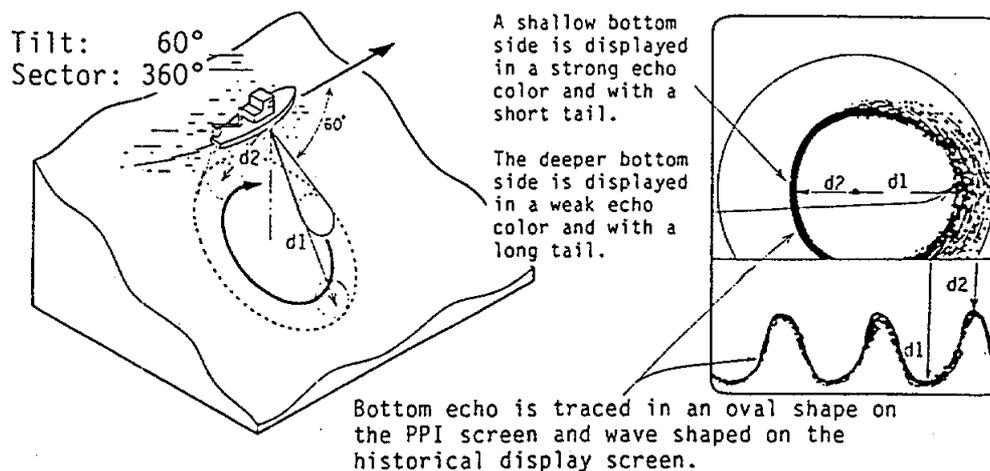
(a) Flat Bottom



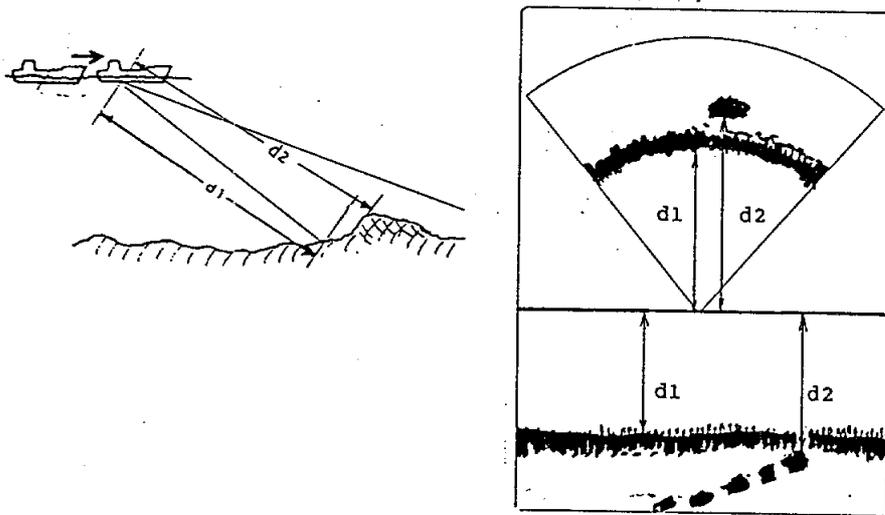
(b) Flat Bottom



(c) Slant Bottom



(d) Reef or Wreck



A reef or wreck is traced on the PPI screen as indicated left. (Auto train mode)

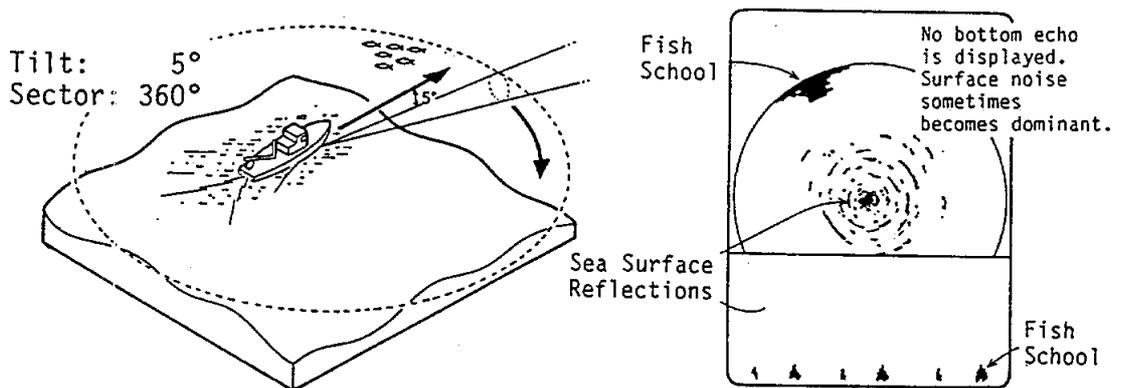
A reef or wreck on the historical display appears as indicated left. It provides better discrimination than the sonar screen.

NOTE: Use the AGC function for clear echo display.

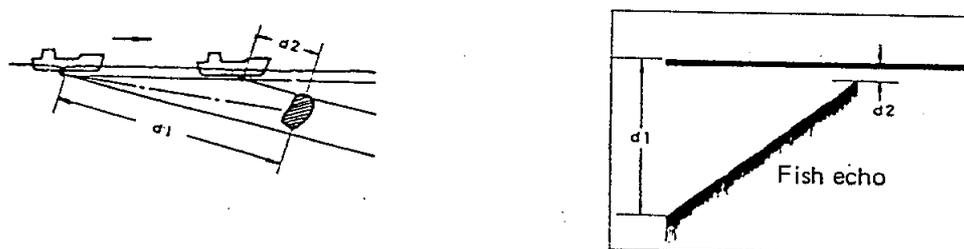
2. Fish School

A fish school appears on the screen as a mass of echoes. The color of the mass shows the density of the schools, and the size of the mass shows how it is distributed. The operator can recognize the horizontal distribution of the fish school from the school's appearance on the screen.

(a) Surface Fish School

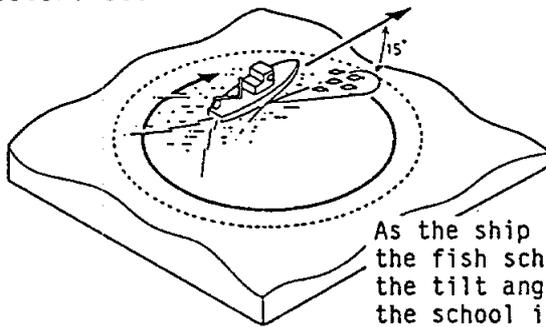


A surface fish school is sounded with a shallow tilt angle setting. If the tilt is settled with the training stopped, after detecting the fish school, and the ship is approaching the school, the fish school is traced on the historical display area as follows.

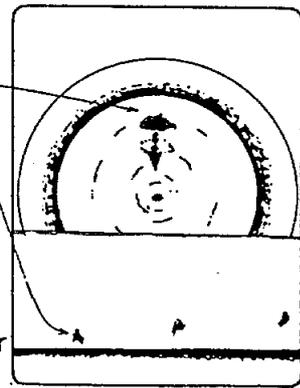


(b) Midwater Fish School

Tilt: 15°
Sector: 360°

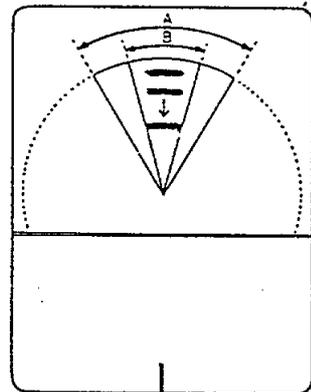
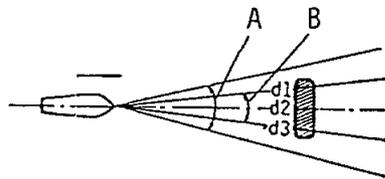


Fish School

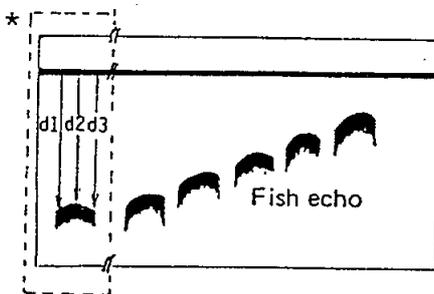


As the ship approaches the fish school, adjust the tilt angle to keep the school in the center of the sonar beam. This brings the echo closer to the screen center.

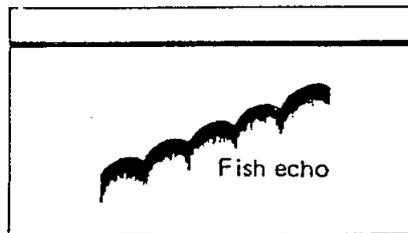
* Historical display when the ship approaches a fish school.



Wide Sector (A)



Narrow Sector (B)



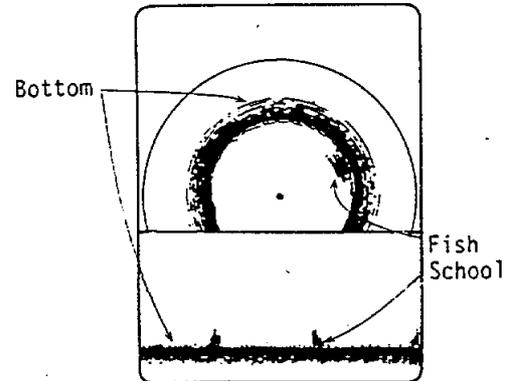
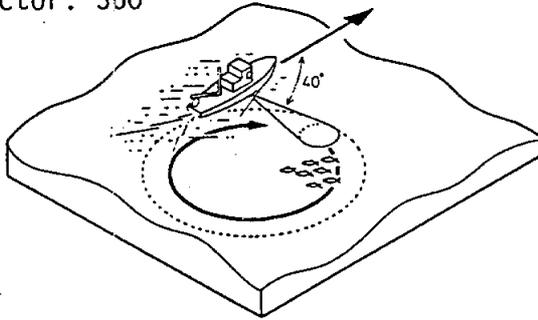
Depending on the training sector, a fish school is traced in a discontinuous or continuous wave shape. It is created by the difference of the depth from the soundome to the center and both edges of the fish school.

* Typical echo trace when ship is stopped.

(c) Bottom Fish School

* When it appears before the bottom echo.

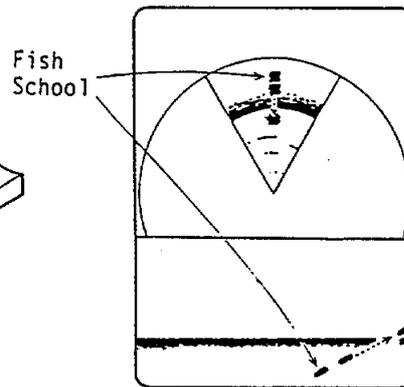
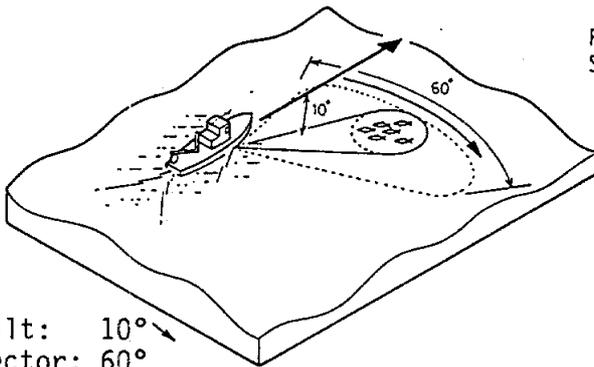
Tilt: 40°
Sector: 350°



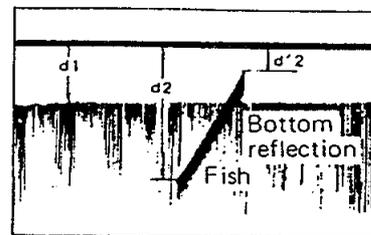
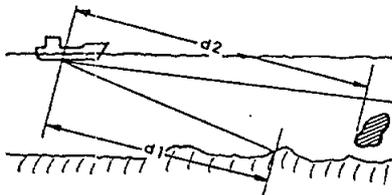
In this case it is sometimes difficult to see the fish school unless the bottom contour line is recognized clearly (or the operator knows the bottom shape from experience.)

* When it appears further than or together with the bottom echo. (shallow water detection)

Tilt: 10°
Sector: 60°
AGC: ON



Fish school appearing together with the bottom echo can be recognized by turning on the AGC



Example of fish echo trace in manual training mode.

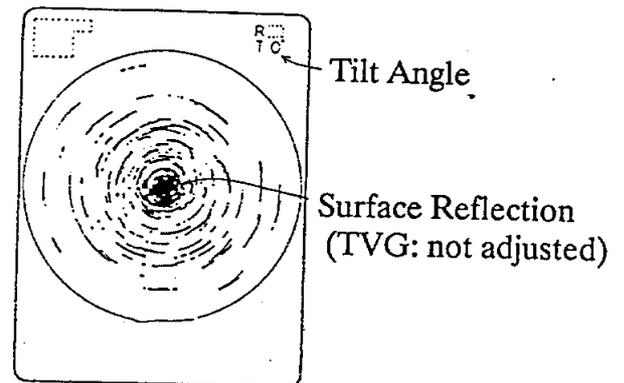
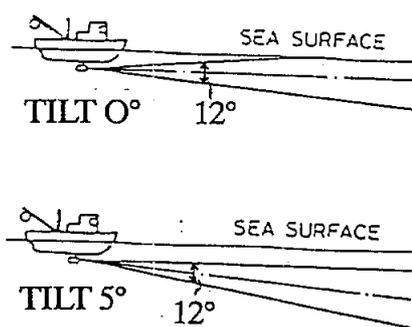
3. Unwanted Echo/Noise/Interference

Sea Surface Reflections

Sound emitted from the sonar transducer forms a circle-shaped beam with a width of approximately 12° degrees* in the vertical direction (vertical beam width). The tilt angle is indicated by the angle between the center line of the beam and the horizontal plane. Then, if the tilt angle is set to 0 degrees, the center line is parallel with the sea surface and one half of the emitted sound goes upward toward the sea surface.

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

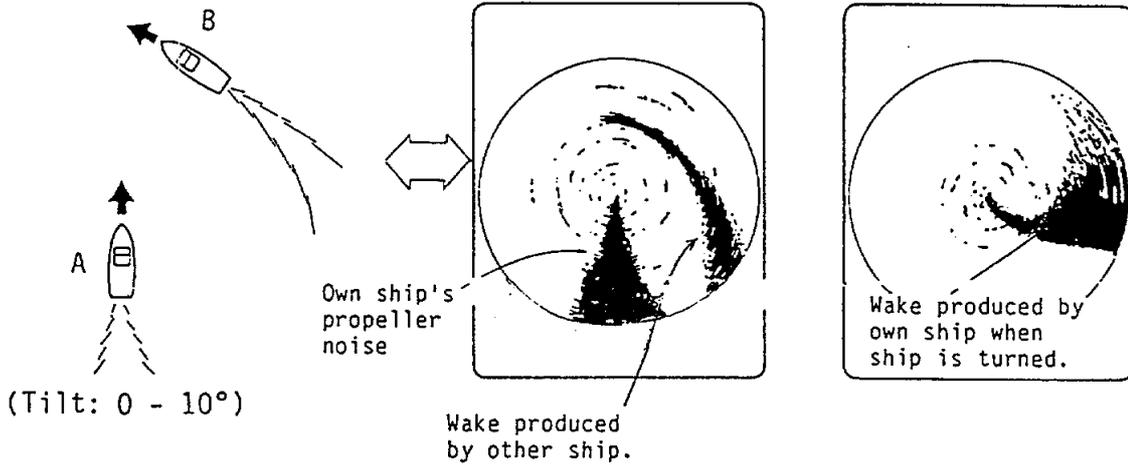
However if the sea is rough, sea surface reflections will become dominant and interfere with observation of wanted echoes. To minimize these sea surface reflections and to search surface fish schools effectively, the tilt angle is usually set to 5-6 degrees so that the upper portion of the beam becomes almost parallel with the sea surface. When the sea is rough, it is often set to a slightly higher.



(* For 40kHz set and narrow beam selection)

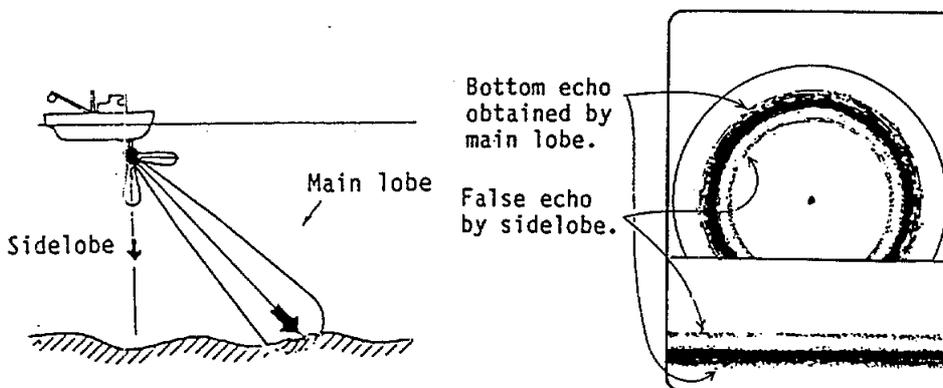
Wake (When setting the TILT to 0 - 10°)

A wake produced by own ship or another ship can be a strong reflecting object. As the wake appears on the screen as a thick continuous line, it can easily be distinguished from a fish school. On the other hand, the wake contains a lot of air bubbles which attenuate ultrasonic energy, making it often difficult to sound beyond the wake.



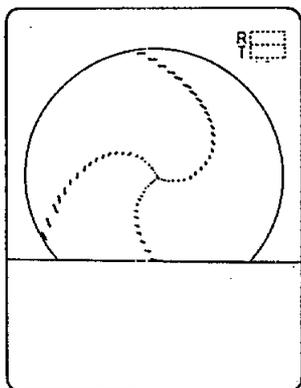
False Echo by Sidelobe

As noted before, an ultrasonic wave is emitted only in the direction set by the TILT switch. In practice, however, there are some emissions outside the main beam that are called "sidelobes". The energy of the sidelobe is fairly weak but when the sonar is used in comparatively shallow water with a high gain setting, strong target echoes are detected by the sidelobe in addition to the detection by the main lobe. These are represented on the screen as a false echo as shown below.

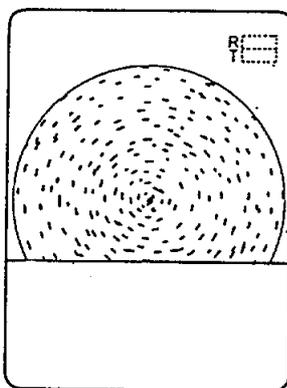


Noise and Interference

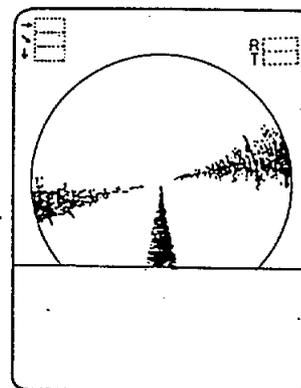
When the fishing ground is crowded with many fishing boats, the sonar may pick up interference from ultrasonic equipment such as an echo sounder, sonar, etc. on board other boats as well as those on board own ship.



Interference Noise from sonar.



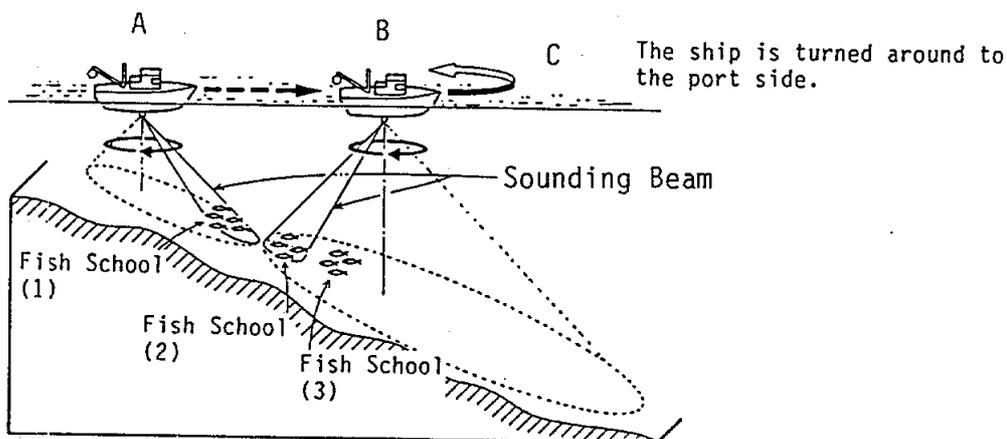
Interference Noise by other electric gears.



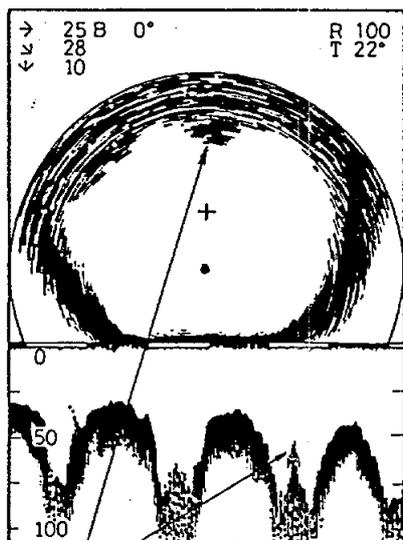
Noise by other boat's propeller.

8. EXAMPLE OF ACTUAL PICTURES

The followings are illustrations based on the actual pictures from a fishing ground. Illustrations 1 thru 3 show the situations below the surface at points A, B and C respectively.



Point A

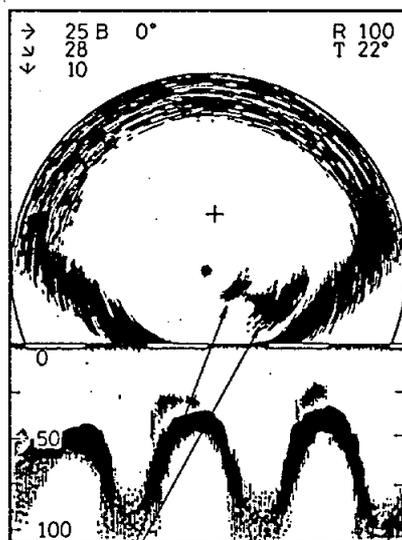


Fish school (1) located on the bottom is detectable in the fore direction of the ship.

From the above picture, the fore direction of the bottom is displayed in a weak echo color and longer tail and the aft direction is in a strong echo color with short echo tail. also the bottom contour is oval shaped.

This kind of display tells you that the bottom is slanting deeper in the fore direction.

Point B

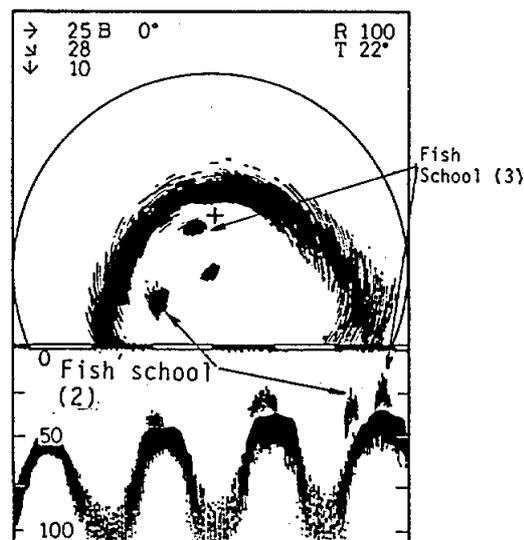


Fish school (2) & (3)

This is the picture when the boat is moving to point B. As before, the forward area is deeper than the aft but the fish school is displayed in the aft at this time.

From the lower picture you can know the fish schools are beginning to gather by observing previous pictures.

Point C

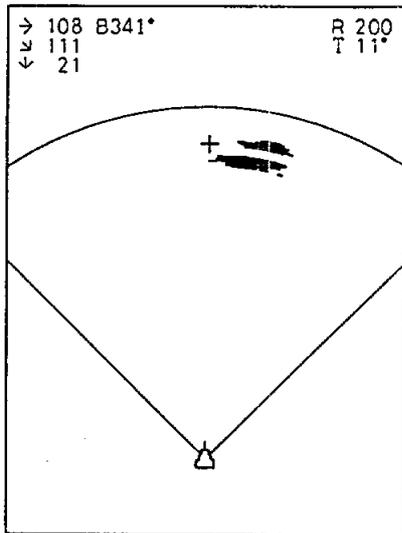


This is the picture when the ship is turned around to the port side. Accordingly the bottom contour shows that it is slanting shallower in the fore direction.

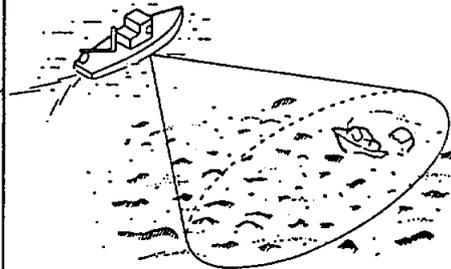
In this stage, the fish schools have separated into two schools.

The separation is clearly observed in the lower picture.

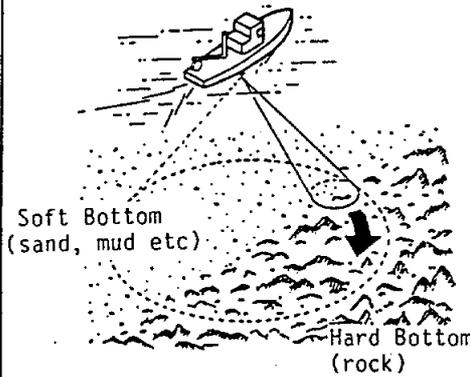
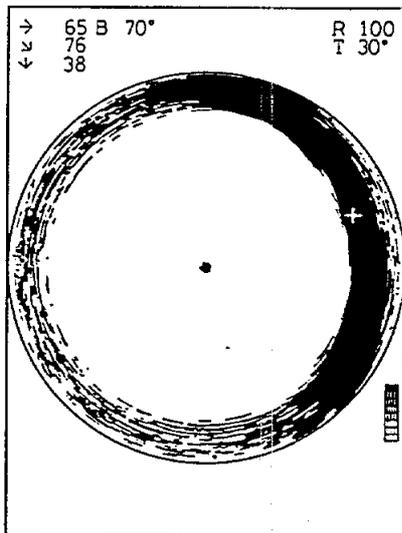
Other Typical Pictures



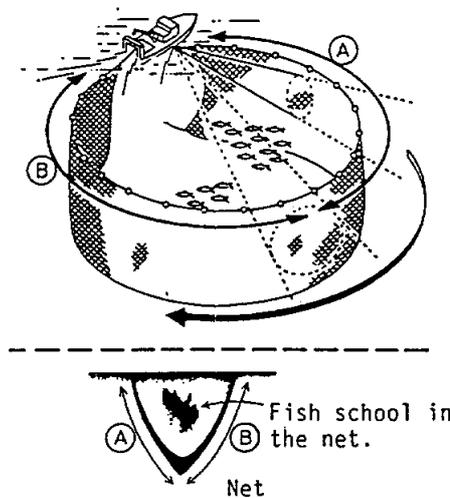
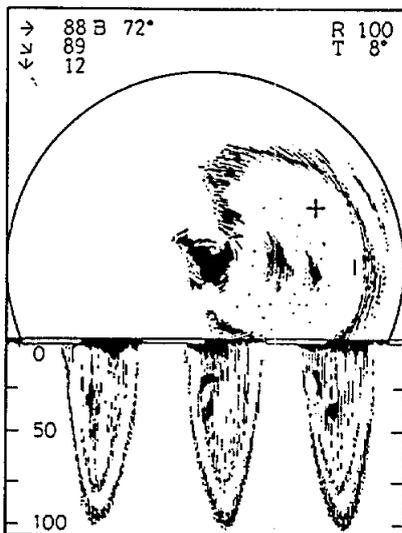
A typical picture of a wreck.



A ship separated in two is clearly discriminated and displayed from the bottom echo.
(40kHz AGC used.)



The seabed is even but the material is quite different between the starboard and port side. This is known from the color display of the bottom (hard bottom; reddish brown & red, soft bottom; yellow & green, etc.)

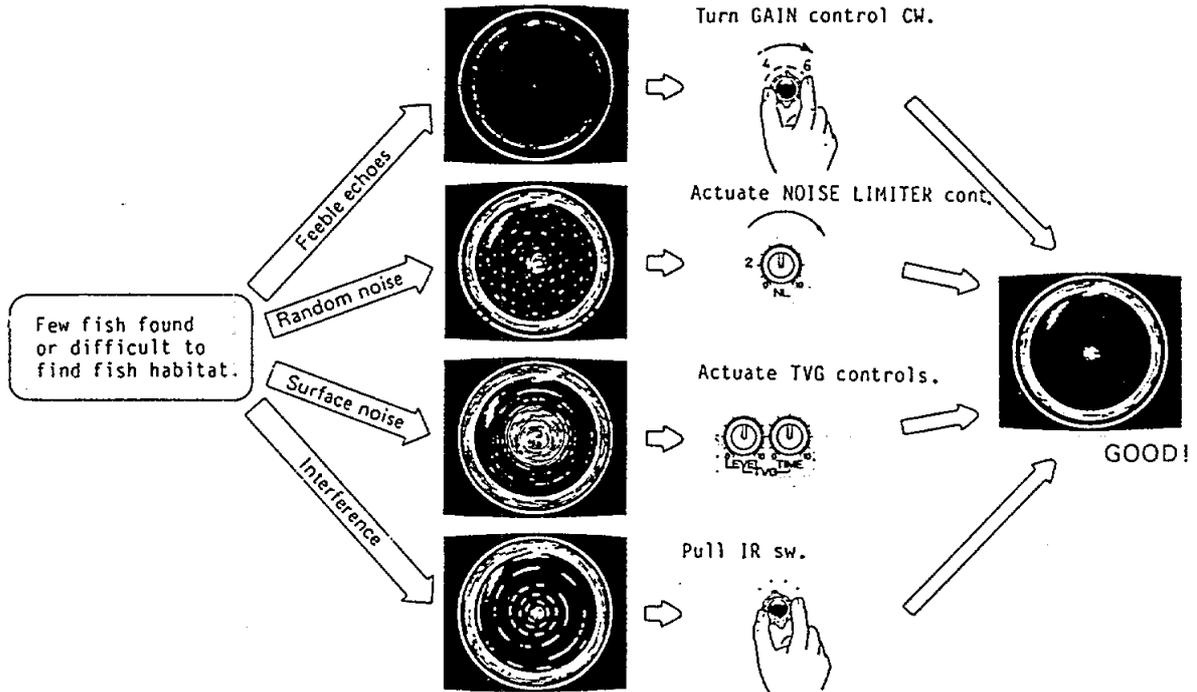


This picture shows the operation of a purse seiner at the fishing ground. The net and the fish school in it can be observed. (If you adjust the tilt angle, the situation on the surface, mid-water and bottom of the net also can be seen.)

9. HOW TO OBTAIN QUALITY PICTURES

1. Gain Setting

Most equipment malfunctioning claims result from improper setting of switches and controls. For example, fish, fish habitat or outcrop can not be readily detected by merely increasing the gain. Initially set the gain around the "5" position. Then fine tune depending on the condition of the fishing ground, frequency used, etc.



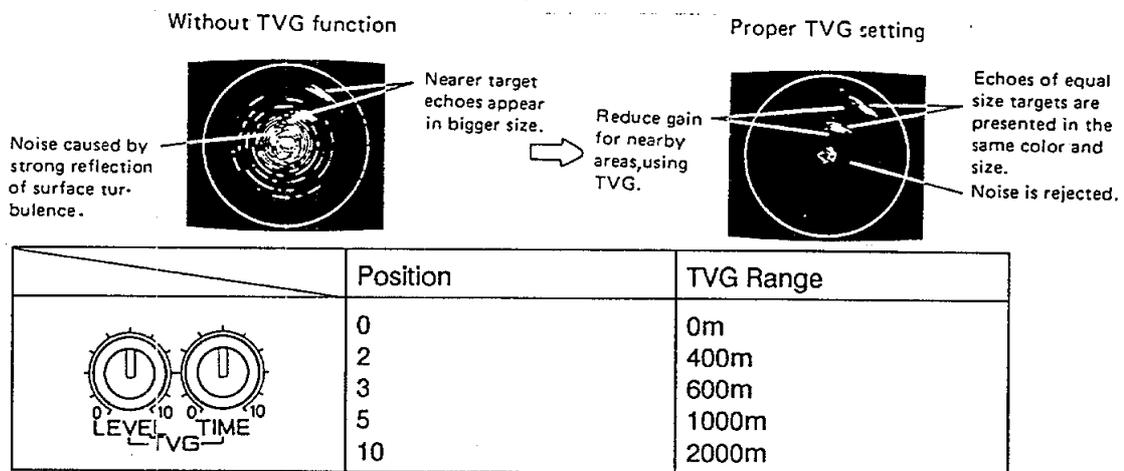
Standard Setting -----

Gain:	"5" ("4" to "6")
Noise Limiter:	"2"
TVG:	Level --- "5"
	Time --- "5"

2. Eliminating Unwanted Feeble Echoes (Applying Proper TVG)

Echoes from targets (such as a seabed or a fish) return to the transducer in order of the distance to them, and when their intensities are compared at the transducer face, those from nearer targets are generally stronger when their reflecting properties are nearly equal. The sonar operator will be quite inconvenienced if these echoes are directly displayed on the screen, since he won't be able to judge the actual size of the target from the size of echoes displayed on the screen. To overcome this inconvenience, use the TVG 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 similar intensities irrespective of the ranges to them.

In the CH-32, the TVG level and time controls compensate for propagation loss. The effective distance is up to 2000m approximately.



The TVG also functions to suppress unwanted echoes and noise which appear in a certain range area on the screen as shown in the figure above. To obtain the proper TVG setting, follow the procedure below.

(Procedure)

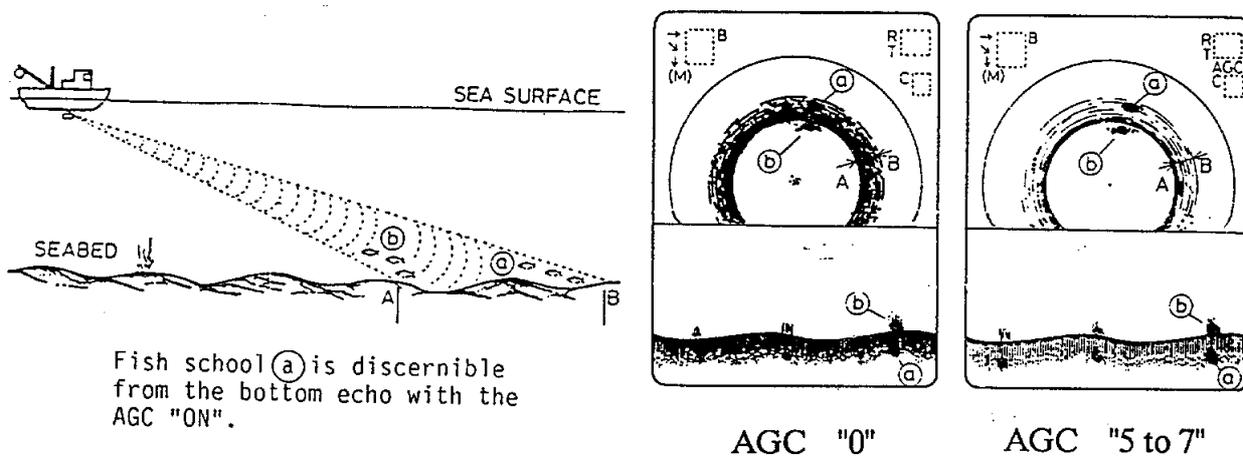
1. Set TVG time for the "5" position (approx. 1000m). This is the standard setting and you can maintain this setting in most cases.
2. When sea surface reflections or plankton layers disturb the picture, set the TVG level knob around "5" to eliminate them.
3. Locate a fish school on a long range setting and watch it while it approaches. Adjust the tilt so that the fish school is always placed in the center of the sonar beam. Check that the fish echo is displayed in the same color while it approaches. If the color changes suddenly to weaker colors as the fish echo nears area, the TVG is improperly set. Adjust the TVG level to correct it. If sea surface reflections and noise remain, try to remove them with the AGC and NOISE LIM controls as described on pages 36 and 37.

3. Suppressing Seabed Tail (Displaying Bottom Fish Clearly)

As described earlier, fish schools located near the seabed are sometimes difficult to detect because you have to discriminate fish echoes in the seabed reflections. The AGC switch decreases the tail of seabed reflection, making it easier to discriminate bottom fish.

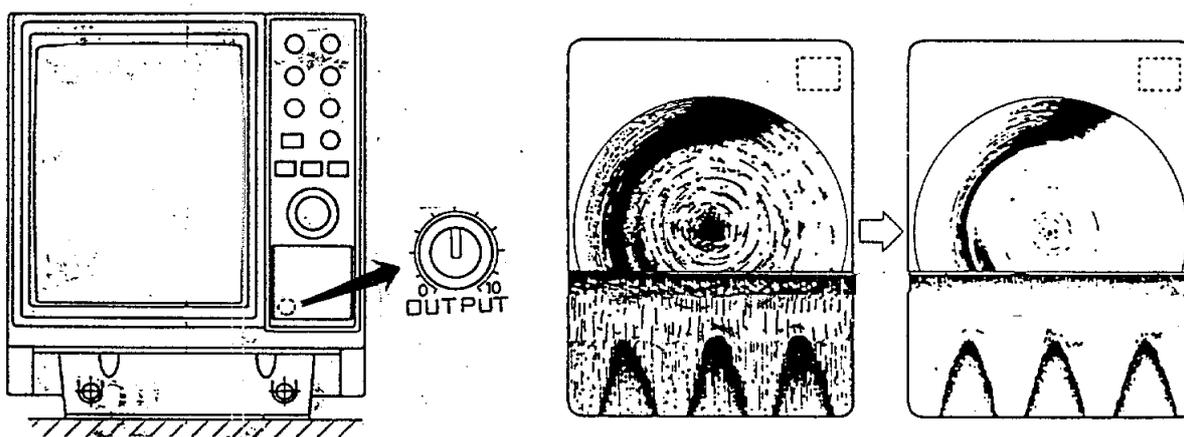
AGC Control

The AGC functions to automatically reduce the receiver gain only against strong echoes such as the seabed or a large school of fish. Since weak echoes remain unaffected, a small school of fish becomes easier to detect.



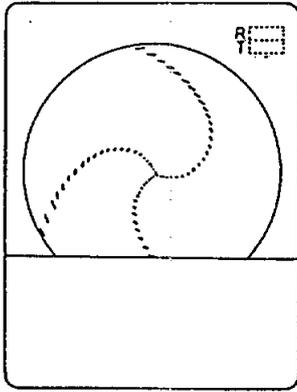
4. Suppressing Seabed and Sea Surface Reflections in Shallow Fishing Grounds (Reducing output power)

In shallow fishing grounds, excessive sea surface and seabed reflections often interfere with wanted fish echoes and they can not be eliminated sufficiently with the aforementioned TVG and AGC controls. In such cases, try to reduce the output power by pushing the "OUTPUT" switch, without turning down the gain. The picture becomes more clearer when output power is reduced rather than when the gain is decreased as illustrated below.

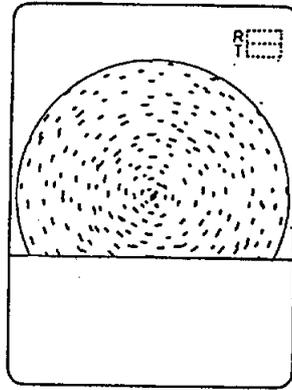


5. Rejecting Sonar Interference and Noise (Turning on the NOISE LIM/IR switches)

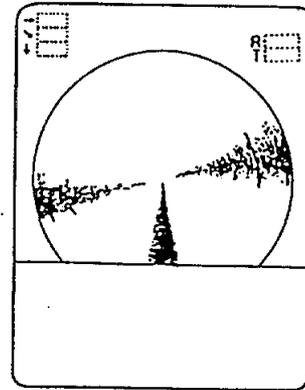
You may encounter occasional or intermittent noise and interference as shown below. These are mostly caused by on-board electronic equipment, engine, or propeller noise or electrical noise from other sonars being operated nearby.



Interference Noise
from sonar.



Interference Noise
by other electric
gears.



Noise by other
boat's propeller.

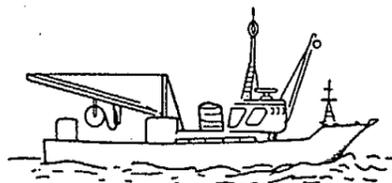
To eliminate noise effectively, you should first identify the noise source.

- * Turn on and operate all on-board equipment one by one while watching the picture.
- * Run the boat at various speeds to check if the noise is speed dependent.

If neither of the above two steps has no effect on the picture, adjust the NOISE LIM/IR controls.

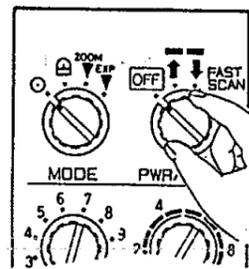
10. HINTS FOR FISHING

PURSE SEINING

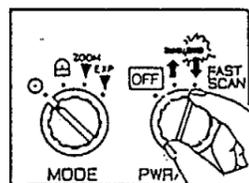


These examples give some helpful hints on how to use your sonar. Don't be afraid to experiment with control settings to optimize your results.

1 Power "ON".

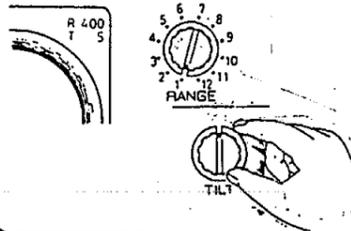


2 Lower soundome.



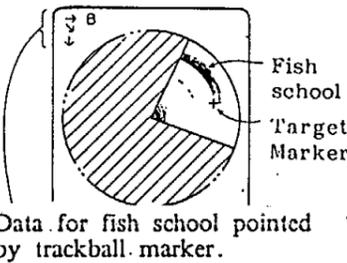
After blinking, remains lit.

3 Search for fish school by RANGE and TILT sw. using.



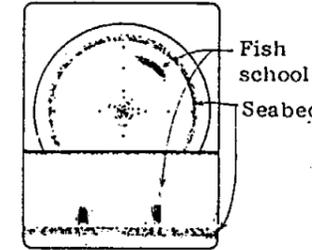
Here comes fish school!

4 Narrow the train area, and track fish school.

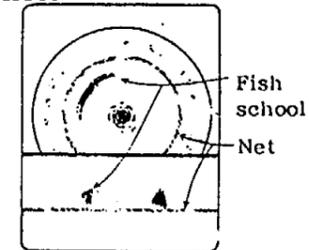


Data for fish school pointed by trackball marker.

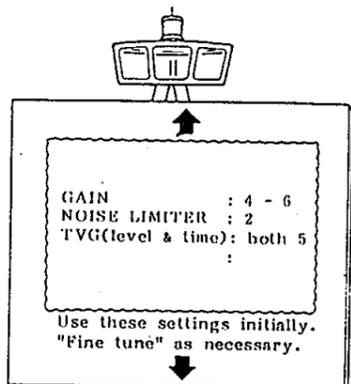
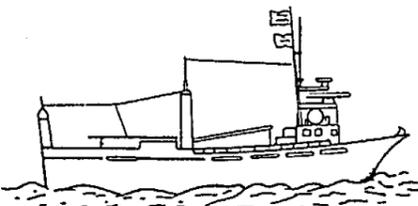
5 Change tilt angle for strongest fish school echo.



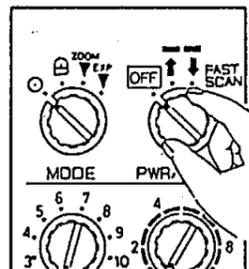
6 Monitor situation of both fish school and net.



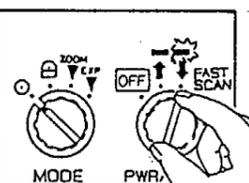
BOTTOM TRAWLING



1 Power "ON".

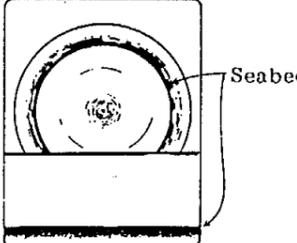


2 Lower soundome.



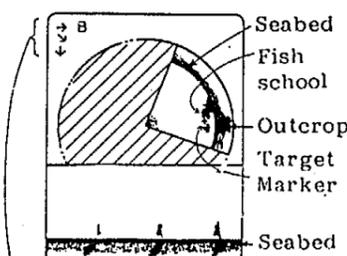
After blinking, remains lit.

3 Observe seabed on the screen.



Select the proper range and tilt angle.

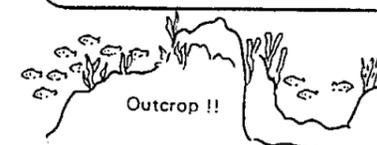
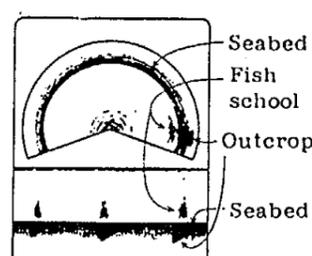
4 Narrow the train area, and track fish school.



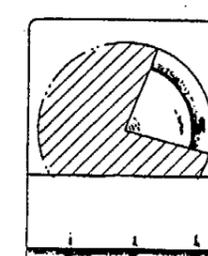
Data of fish school, seabed or outcrop pointed by trackball marker.

Here comes fish school!

5 Observe seabed condition.



6 Change tilt angle, and tow net.



For bottom trawling, sonar is usually used to detect net "hangs" ahead rather than to detect fish close to the bottom, since seabed returns usually mask the weaker fish targets close to the seabed. If the fish school is dense enough and off the seabed they can be detected by sonar.

DO NOT FORGET TO RETRACT THE SOUNDOME BEFORE TURNING OFF THE POWER !!

11. MAINTENANCE AND GENERAL NOTES

Good performance depends on regular maintenance. Following the guidelines below will keep the unit operating in top condition.

DISPLAY UNIT

1. Handle with care. Corrosion may start even from a scratch.
2. Don't check inside the unit because of high tension voltage which exists there.
3. Allow space around the unit for ventilation.
4. Keep it away from equipment with magnets (such as a speaker, large capacity transformer) and also magnetic sensitive units such as gyrocompass or cassette tape.
5. Clean the filter and screen with a wet or dry soft cloth. Don't use thinner or benzine.
6. Put on the cover after operation.

TRANSCEIVER UNIT

Wipe off dust or oil with a cloth dampened in a mild detergent. Keep the unit clean, especially the cable entrance.

HULL UNIT

1. Lubrication

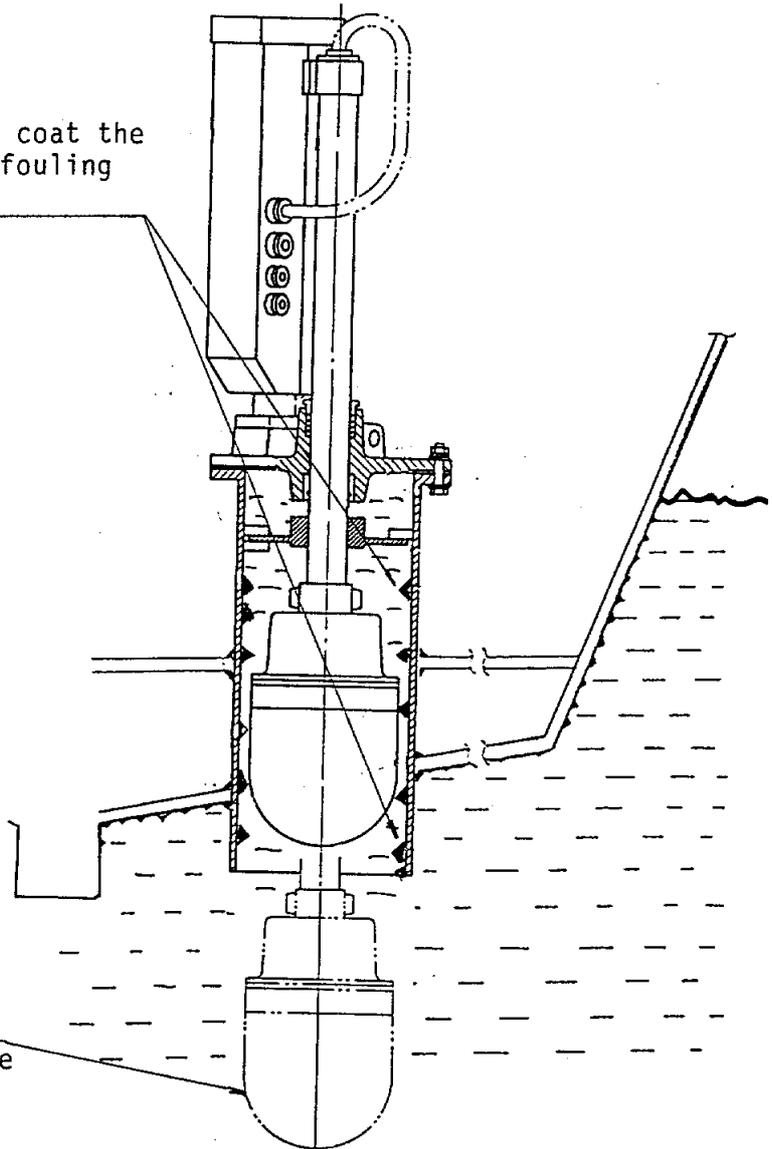
Remove the cover for the raise/lower drive assembly by loosening the fixing screws. Then apply grease to the raise/lower screw shaft once a year. Also put grease on the raise/lower main shaft (upper part of the grease cotton retainer) twice a year.

2. Cleaning Retraction Tank (Removal of Marine Growth)

If marine growth (barnacle, oyster, etc.) breeds inside the retraction tank, the raise/lower operation will be obstructed. In the worst case, the raise/lower motor may burn out. Therefore, it is necessary to remove marine growth at least once a year or when the ship is hauled on the slip or in the dry dock.

If the sonar is left inoperative for a considerably long period, scrape off marine growth inside the tank before operation.

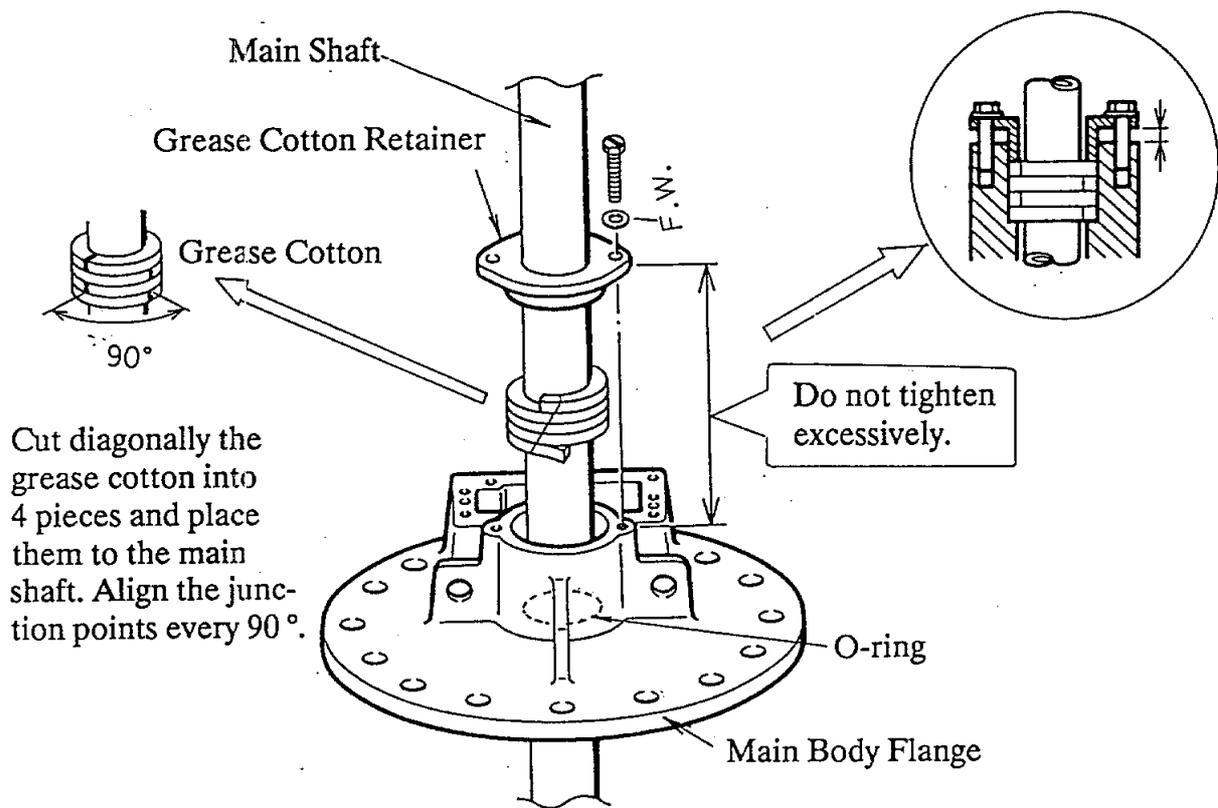
Scrape off marine growth and coat the inside of the tank with antifouling paint.



Soundome
Do not clean the dome surface with thinner or alcohol and never paint it.

3. Replacement of the Grease Cotton Rings

Replacement of the grease cotton rings is required every two years or when water penetrates along the main shaft. For a ship whose waterline is higher than the flange level, though water penetration into the ship is prevented by the O-ring fitted at the bottom of the main body flange, it is recommended to replace the grease cotton rings with the ship hauled up.



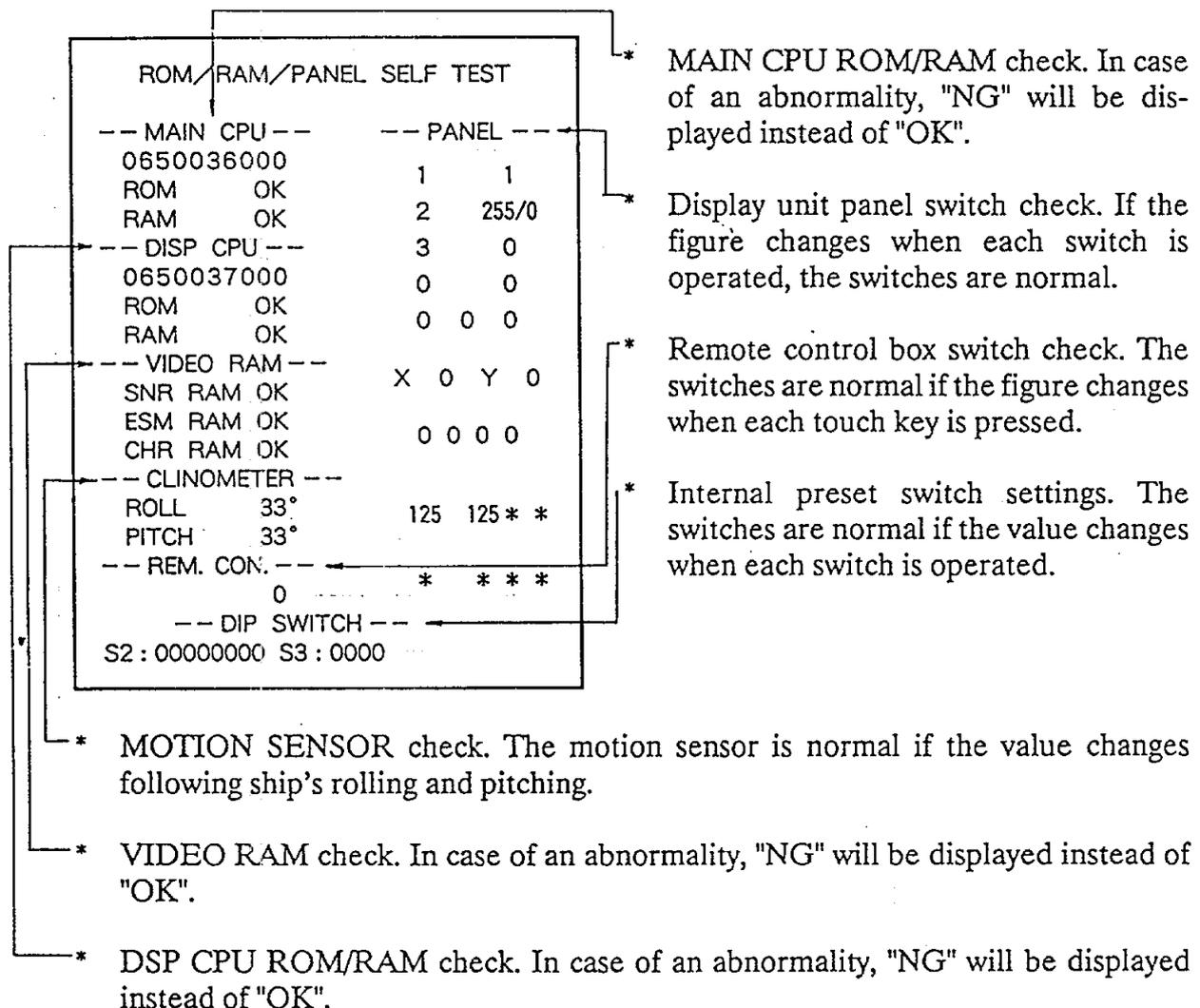
12. DIAGNOSTIC SELF-CHECK

The CH-32 incorporates the following check functions:

No.	Item	Operating Method
1	Display Unit Check (1)	While pressing [R/B] key, turn on power.
2	Hull Unit Check	While pressing [ALARM] key, turn on power.
3	Display Unit Check (2)	While pressing [SCAN REV] key, turn on power.

Display Unit Check (1)

The CPU checks memory ICs, peripheral ICs, operation panel and internal setting switches, and displays the results as follows:



Hull Unit Check

This checks that the transducer is trained/tilted correctly with a specified number of pulses.

TRAIN/TILT SELF TEST					
-- PHOTO SENSOR --					
DEG	TRAIN		DEG	TILT	
0°	80 OK		+5°	-- OK	
90°	72 OK		30°	78 OK	
270°	86 OK		90°	-- OK	
-- TRAIN --			COUNT = 8		
DEG	CW	NG	CCW	NG	
0°	1808	0	1812	0	
90°	3592	0	3592	0	
270°	1796	0	1788	0	
0°					
-- TILT --			COUNT = 7		
DEG	↓	NG	↑	NG	
+5°	1289	0	*1219	0	
30°					
90°	1797	0	1867	0	

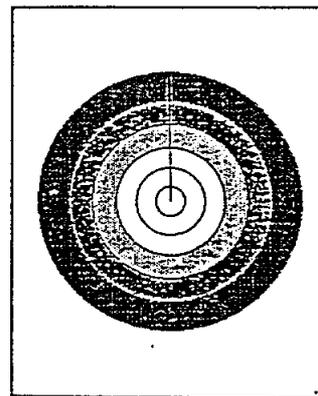
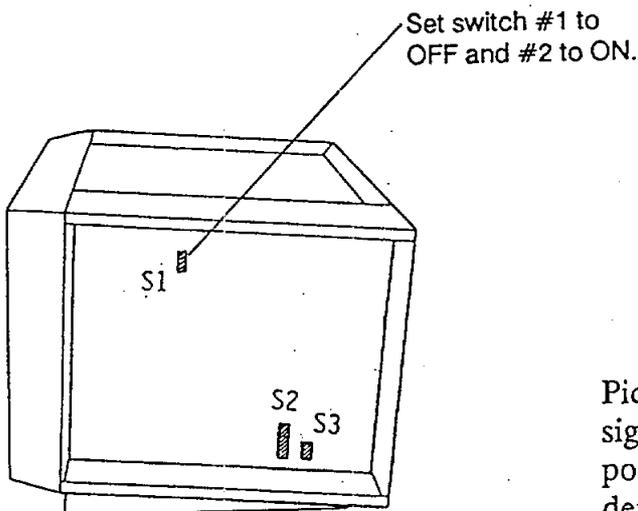
* PHOTO SENSOR Check
Six "OKs" should be displayed.

* TRAIN Check
The number of "NG" increases when the number of pulses used to train the transducer is abnormal. When it increases frequently, the set is faulty.

* TILT Check
The number of "NG" increases when the number of pulses used to tilt the transducer is abnormal. When it increases frequently, the set is faulty.

Display Unit Check (2)

This mode is used to check the display unit by using internally generated reference signals. The check can be performed without hull and transceiver units (though it is all right even if they are connected) and the check result shows, if normal, the signals are correctly processed in the display unit.



Picture shows concentric circles in which signal strength increases from the center position outwards. The picture will differ depending on the setting of the TVG, GAIN and NOISE LIM. controls.

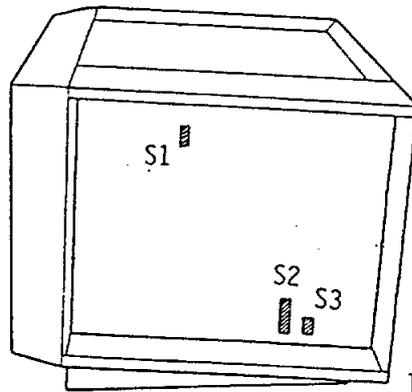
APPENDIX

CHANGING SPECIFICATIONS.....	AP-2
CHARACTERISTICS OF THE ULTRASONIC WAVE IN WATER	AP-4
SPECIFICATIONS.....	AP-10
OUTLINE DRAWINGS	AP-13

CHANGING SPECIFICATIONS

Changing Operating Specifications

According to user requirements, and in order to render use even easier, the operating specifications can be changed to those shown in the following table. The switches used to change the specifications are located on the DSP board in the display unit. Change settings to fit user's particular requirements.



Display Unit Right Side View

Switch S1

Function	No.	Descriptions			
Input Signal	1	ON	Echo (Factory setting)	OFF	Test signal
	2	OFF		ON	

Refer to "Display Unit Check (2) on page 43 for the test signal.					
Strongest Echo Color	3	ON: Magenta, OFF: Reddish brown (Factory setting)			
Echo Emphasis (Range)	4	ON: On, OFF: Off (Factory setting)			

It increases reddish brown part of echoes in radial direction.					
Echo Emphasis (Width)	5	ON: On, OFF: Off (Factory setting)			

It increases reddish brown part of echoes in circular direction.					
Audio Frequency	6	ON: 1000Hz (Factory setting), OFF: 900Hz			
	7	Unused			
	8				

Switch S2

Function	No.	Descriptions							
Unit	1	OFF	Meter (Factory setting)		ON	Feet	OFF	Fathom	
	2	OFF			OFF		ON		
Maximum Range Scale	3	ON: 2400m, OFF: 2000m (Factory setting)							
Training Speed	4	ON: Low, OFF: Standard (Factory setting)							
TVG Compensation	5	OFF	0	ON	1	OFF	2	ON	3
	6	OFF		OFF	(40kHz)	ON	(60kHz)	ON	
		It compensates for absorption attenuation of acoustic signal in water. Use larger number setting when long range sensitivity is too low compared to short range and can not be corrected with the TVG LEVEL and TIME controls.							
Target Lock Mode	7	ON: Edge, OFF: Area (Factory setting)							
Stabilizer	8	ON: Yes (Factory setting), OFF: No							

Switch S3

Function	No.	Descriptions	
	1	Unused	
	2		
Off-center	3	ON: Trackball mark, OFF: Sector center (Factory setting)	
		Trackball Mark: Own ship mark is off-centered to the trackball mark position. Sector Center: Own ship mark is off-centered in the direction opposite to the sector center.	
Target Lock Beamwidth	4	ON: Automatic OFF: Manual (Factory setting)	
		Refer to the operator's manual for detail.	

CHARACTERISTICS OF THE ULTRASONIC WAVE IN WATER

The purpose of this chapter is to provide an overview of the characteristics of the ultrasonic wave in water.

Sound Velocity

It is generally known that an ultrasonic wave travels 1500 meters per second in sea water, but in practice, some amount of variation arises depending on the season and area from differences in the following three factors:

Water temperature θ [°C]
 Salinity density S [%]
 Water pressure (water depth) h [m]

Therefore, for propagation in surface water the velocity changes not only by area but also by direction of the wave propagation. The equation obtained thru numerous measurements is;

$$C = 1410 + 4.21\theta - 0.037\theta^2 + 1.145S + 0.0168h \text{ [m/s]}$$

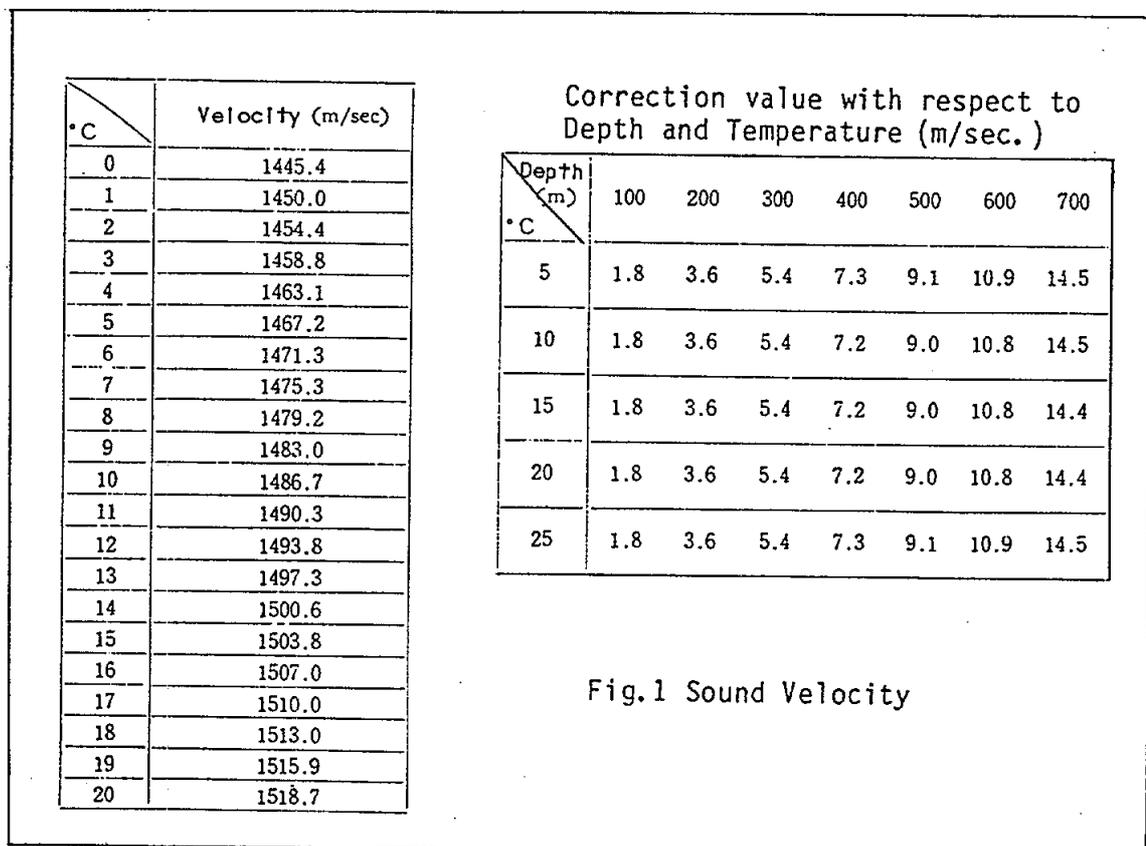


Fig.1 Sound Velocity

Research in the waters throughout the world has revealed that there is a difference of approximately 100[m/s] between the areas where the velocity is maximum and minimum.

Generally, the velocity increases as follows, provided that salinity density is constant:

- 3m/sec for every 1 degree rise of water temperature.
- 1.7m/sec for every 100m increase of water depth.

Absorption And Attenuation

An ultrasonic wave emitted into water becomes weaker in intensity as it goes away from the emitting source. Principle causes of attenuation are:

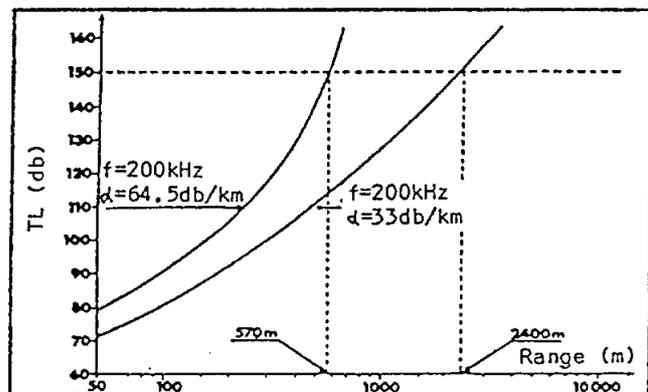
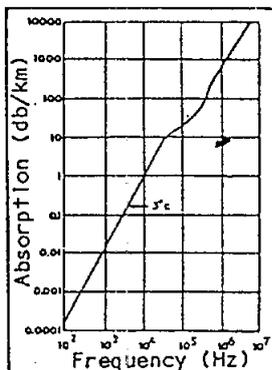
1. Acoustic energy of the ultrasonic wave decreases gradually through reflection, refraction and diffusion in water.
2. Acoustic energy is absorbed by the viscosity of the medium (water) and converted into other forms of energy.

The higher the frequency, the greater the absorption and attenuation of the ultrasonic wave as shown below. In other words, the absorption coefficient is a function of the frequency. Generally, total energy loss encountered on the way to and from a target is expressed

$$TL [dB] = 40\log R + 2\alpha R$$

where R ----- Range to a target

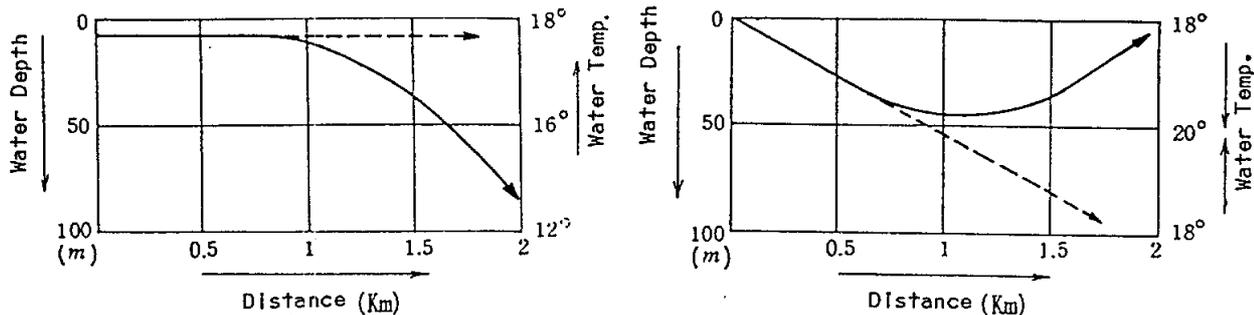
α ----- Absorption coefficient



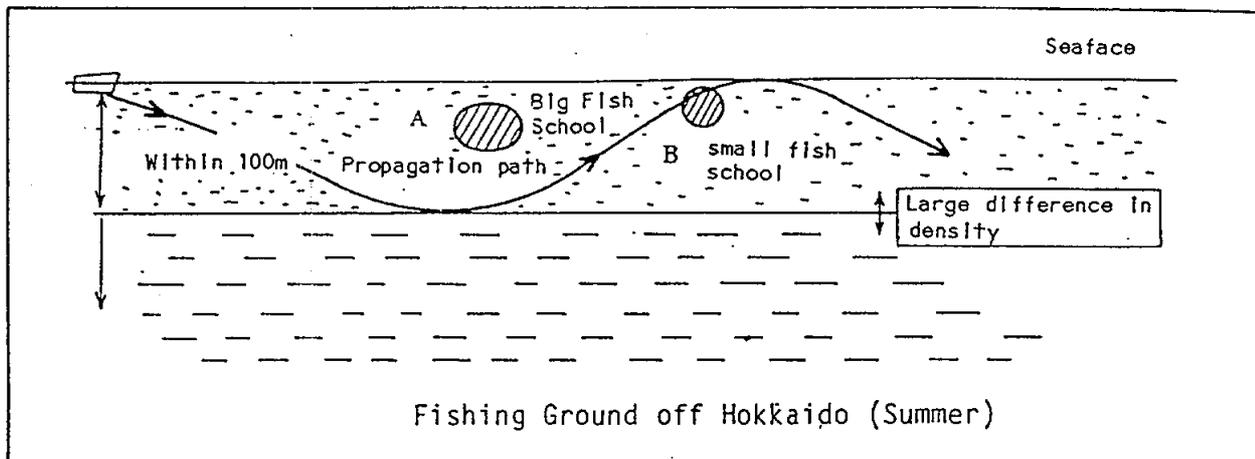
Refraction

An ultrasonic wave transmitted in water does not travel straight but is more or less refracted. This refraction is caused by the variation of propagation velocity in water. If the velocity decreases (temperature decreases) with depth, the top part of the wave front moves faster than its bottom part, and gradually the front bends downwards. In the same way, it bends upwards if the sound velocity increases (temperature rises) with depth.

In other words, the ultrasonic wave refracts toward colder water.



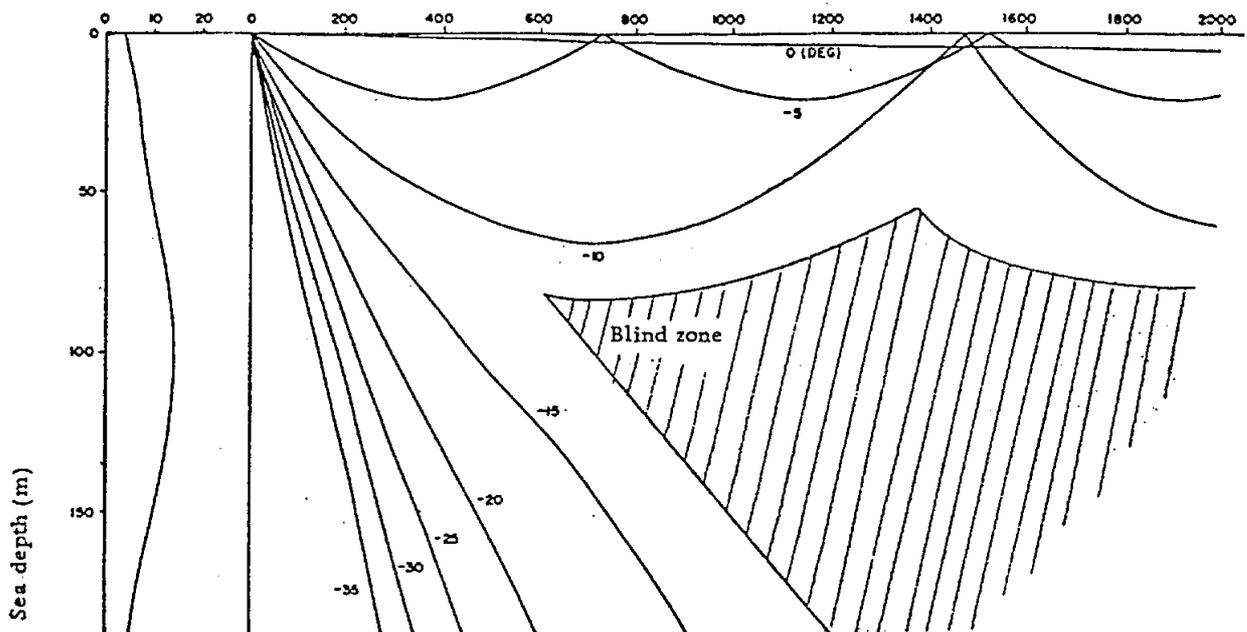
Here, a fishing ground off Hokkaido island in Japan is taken as an example.



In summer, there is a large difference in salinity density below and above the 100m deep point. An ultrasonic wave emitted almost in the horizontal direction propagates within 100m deep water in the same way as a radio wave in a waveguide. As a result, even a small fish school is sometimes detected at an unexpected long range or on the contrary, detection of a large fish school does not extend to a relatively long range. These phenomena are encountered when two fish schools lie in positions "A" and "B" of the illustration.

The drawing below shows how temperature variation affects sound propagation with respect to different emitting directions (tilt angles).

Beams tilted five and ten degrees bend upward at 400m and 600m points respectively. Beams tilted down more than 15 degrees travel in almost straight lines. Between the two beams, a blind zone is created beyond the 600m point. In this zone nothing can be detected. The shown drawing is only an example calculated by a computer, based on the temperature with depth as shown in the left column of the figure. In actual fishing grounds, the temperature distribution and subsequently the behavior of the sound beam is much more complicated. It is, therefore, for effective use of sonar, necessary to know at least roughly how the temperature is distributed in various waters.



Adverse Effect Of Air Bubbles

Even infinitesimal air bubbles in sea water (liquid medium) affect propagation of ultrasonic sound. This is because the cubic elasticity of gas is extremely small when compared with that of liquid; the air bubbles violently vibrate (contract and expand) by the action of sound pressure, diffusing the ultrasonic wave and dispersing part of the acoustic energy. In a liquid which contains a large amount of air bubbles, attenuation of an ultrasonic wave increases and the wave is reflected at the boundary of waters which contain and do not contain air bubbles.

From the above it can be said that reflection occurs in the boundary where the density (P) of the material (medium) that is, the velocity of the ultrasonic wave changes. The velocity of an ultrasonic wave with respect to its medium is 200 thru 400m/s in gas, except for hydrogen and helium; 900 thru 2000m/s in liquid (several times higher than in air) and 2000 thru 6400m/s in ordinary metal.

The product of the density (P) and the velocity (C) is called intrinsic acoustic impedance and in the boundary between two media which has extremely different C from each other, most of the acoustic power is reflected and only a small portion penetrates. (In the boundary between water and air, the acoustic energy penetrates with a loss of approximately 30dB, that is approximately 0.1% of the energy penetrates from one medium to the other.)

Reflection from water which contains air bubbles is caused by the fact that the cubic elasticity decreases in aerated water, causing the intrinsic acoustic impedance to change.

In the actual sonar operation, adverse effect of air bubbles is shown by interrupted display of target echoes which occurs while crossing over the wake of another boat or when the sonar transducer passes above the air bubbles generated by own ship.

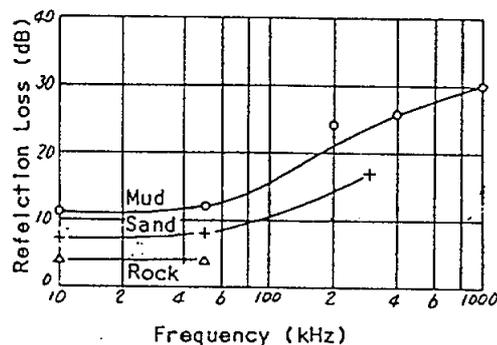
Air bubbles in water have a resonant frequency of 15kHz thru 100kHz and hence the ultrasonic wave in this frequency range is most strongly affected.

Reflection At Seabed And Fish School

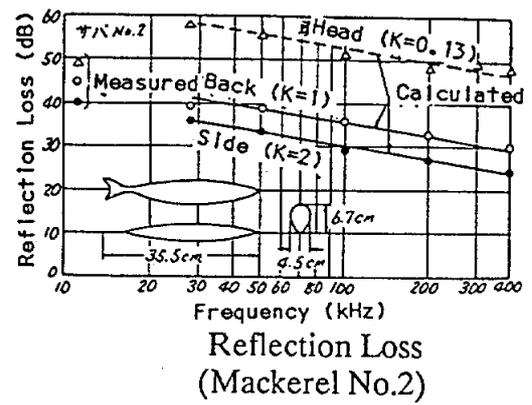
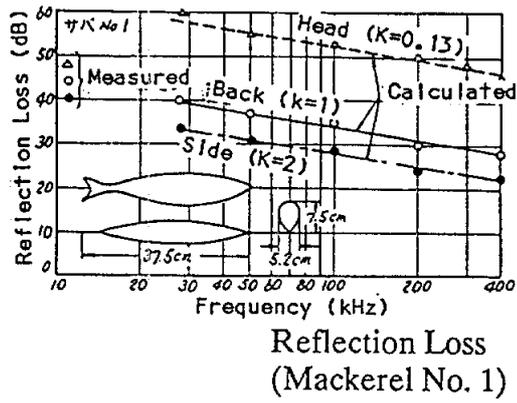
The nature of the seabed is roughly classified into the following four kinds: crag, sand, mud and seaweeds. In addition, shells and carcass of animals (especially coral) imbedded in the seabed cause reflection loss.

$$\text{Reflection Loss } L_b = 20 \log \frac{\text{Incident sound pressure}}{\text{Reflection sound pressure}} \quad (\text{db})$$

The actual reflection loss in the sea is shown below. The reflection loss remains almost constant up to 50kHz and then gradually increases.

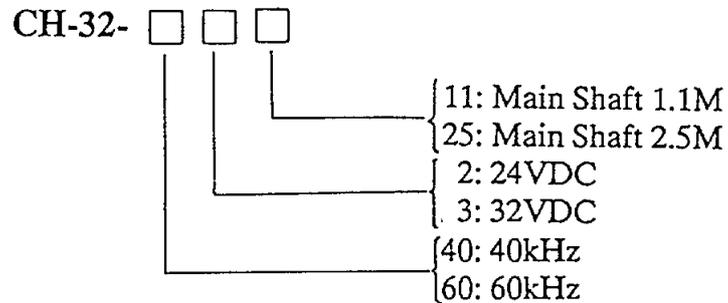


The relation of frequency vs reflection loss for mackerel is shown below. The calculated value and actually measured value nearly coincide. And also, on the contrary to the seabed reflection, the reflection loss decreases as the frequency increases. The "K" in the figure is the coefficient of fish shape, where its larger value introduces smaller reflection loss.



Species	Incident Direction of Ultrasonic Wave		
	Back	Side	Head
Sardine	1	2	0.13
Bonito	1	2	0.5
Horse Mackerel	0.8-1.2	1.4-2.2	0.4-0.6
Sea Bream	0.9	3	0.45
Turbot		2	
Average	1	2	0.4

SPECIFICATIONS



1. Display System PPI and historical displays on 14" color CRT
2. Picture Color 8 colors depending on signal strength
3. Display Mode
- 1) Full circle PPI
 - 2) PPI + historical presentation
 - 3) Zoomed PPI
 - 4) Expanded PPI
4. Range/Pulselength/
Train Speed

No.	Range			Pulselength ms	Train Spd (Sec.)*	
	Meter	Feet	Fathom		"L" **	"S" **
1	60	200	40	0.8	9	9
2	100	400	80	1.3	9	9
3	150	600	120	2.0	13	13
4	200	800	160	2.3	17	17
5	300	1000	200	4.0	25	19
6	400	1500	300	5.3	33	23
7	600	2000	400	8.0	56	31
8	800	2500	500	10.6	72	39
9	1000	3000	600	13.3	88	47
10	1200	4000	700	16.0	104	55
11	1600	5000	800	21.3	136	71
12*	2000 or 2400	6000 or 6400	1000 or 1200	26.6 or 32.0	168 or 200	87 or 103

* Selected internally

** "L"; Low, "S"; Standard

5. Audio Monitor

900 or 1000Hz selected by internal switch, 4W.

6. Transceiver

Freq.	Output Power	Beamwidth at -3dB		
		Hor.	Vert.	
			Nar.	Wide
40kHz	2kW	12°	12°	29°
60kHz	3kW	9°	8°	25°

Wide beam available on 400m or shorter ranges.

7. Training

Manual or automatic training in 6° or 12° steps.
(12° step is available on 300m or longer ranges.)

Train sector selected from 6°, 36°, 60°, 96°, 120°, 180°, 240° and 360° (Train center can be set in any direction in 6° steps.)

Train direction can be reversed at any time.

8. Tilt

+5° to -90°/4 seconds approx., 1°/step

**9. Transducer
Raise/Lower**

Transducer travel: 600mm

Raise time: approximately 21 seconds

Lower time: approximately 17 seconds

**10. Allowable
Ship's Speed**

18 knots (15 knots during raise/lower operation)

11. Other Functions

Target Lock: Locks on and tracks fish target above a specified level in the automatic training sector.

Monitor Sensor: Stabilizes sounding beam against rolling and pitching of up to ±20°
(Option)

12. Power Supply

24/32VDC, 200W (500W during transducer raise/lower)
100/110/200/220VAC, 50/60Hz with rectifier PR-1100

13. Ambient Condition

Temperature: 0°C to 45°C
Humidity: less than 95%

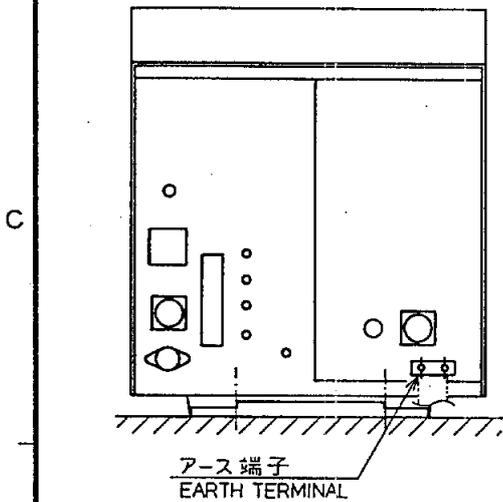
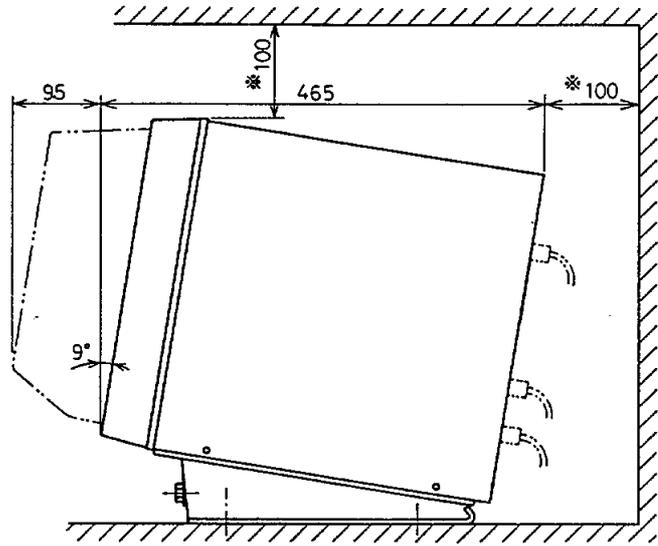
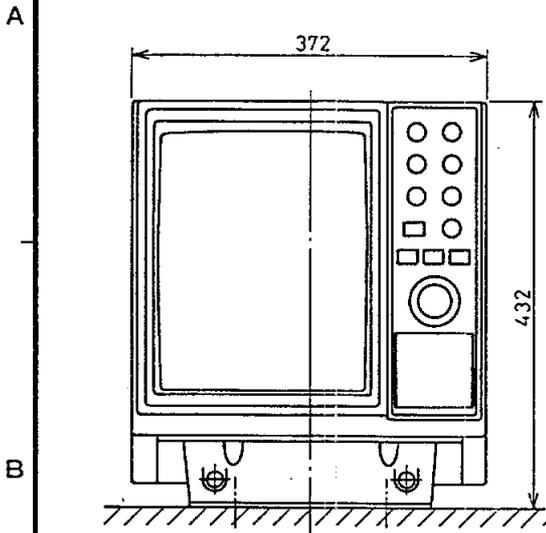
COMPLETE SET

STANDARD SUPPLY

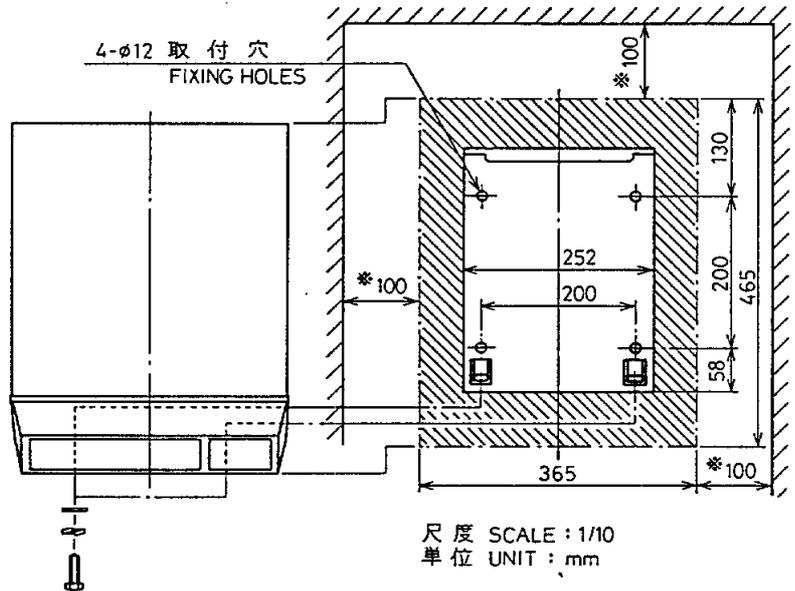
No.	Name	Type	Code No.	Remarks
1	Display Unit	CH-320	000-069-247	
2	Transceiver Unit	CH-321-40 CH-321-60	000-069-248 000-069-249	40kHz 60kHz
3	Hull Unit	CH-326-40-2-11 CH-326-40-2-25 CH-326-40-3-11 CH-326-40-3-25 CH-326-60-2-11 CH-326-60-2-25 CH-326-60-3-11 CH-326-60-3-25	000-069-257 000-069-301 000-069-258 000-069-302 000-069-259 000-069-303 000-069-260 000-069-304	40: 40kHz 60: 60kHz 2: 24VDC 3: 32VDC 11: 1.1m shaft 25: 2.5m shaft
4	Accessories	FP06-00800	000-069-254	
5	Installation Materials	CP06-00620 (15M) CP06-00630 (30M) CP06-00640 (40M) CP06-00650 (70M)	000-069-250 000-069-251 000-069-252 000-069-253	With 15m cable With 30m cable With 50m cable With 70m cable
6	Spare Parts	SP06-00610	006-535-010	

OPTION

No.	Name	Type	Code No.	Remarks
1	Motion Sensor	MS-100		
2	Remote Control	CH-322		
3	Rectifier	PR-1100-61 PR-1100-72	000-069-262 000-069-263	For 110VAC For 220VAC
4	Retraction Tank	06-014-2511-1 06-014-2512-0	100-129-151 100-136-640	For 1.1m shaft For 2.5m shaft
5	Handle	FP10-00210	006-957-300	
6	Video Interface	OP06-1	000-065-818	
7	Stay Angle	OP06-10	006-537-120	



後面図 REAR VIEW



尺度 SCALE : 1/10
単位 UNIT : mm

取付寸法 MOUNTING DIMENSION

*: 推奨サービス空間
RECOMMENDED SERVICE SPACE

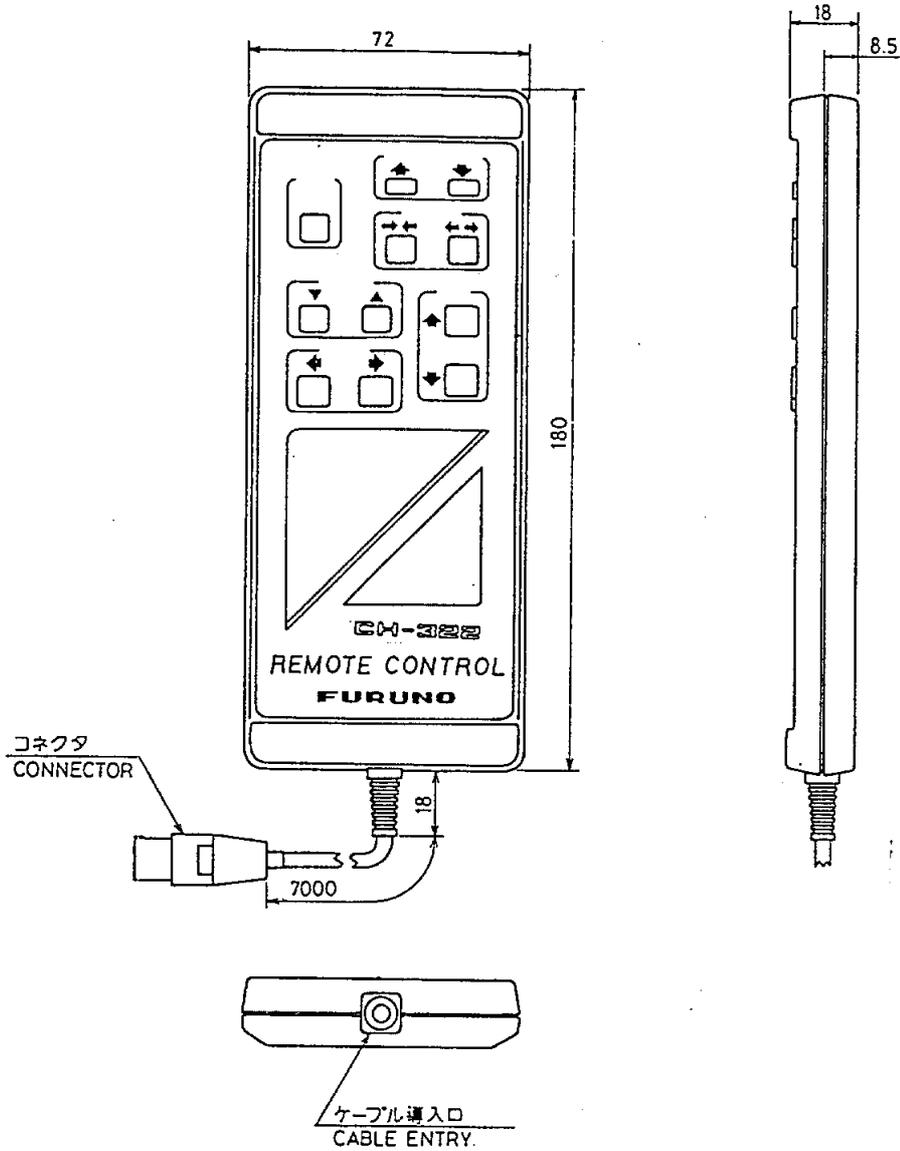
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	AUG. 28. '90 T. NAKAWO	三角法 THIRD ANGLE PROJECTION			指示装置 DISPLAY UNIT
検図 CHECKED	AUG. 28. '90 T. MIYOSHI	尺度 SCALE	1/8	名称 TITLE	
製図 DRAWN	AUG. 28. '90 M. USUDA	重量 WEIGHT	20 kg	図番 DWG.NO.	C1277-G05-A

A

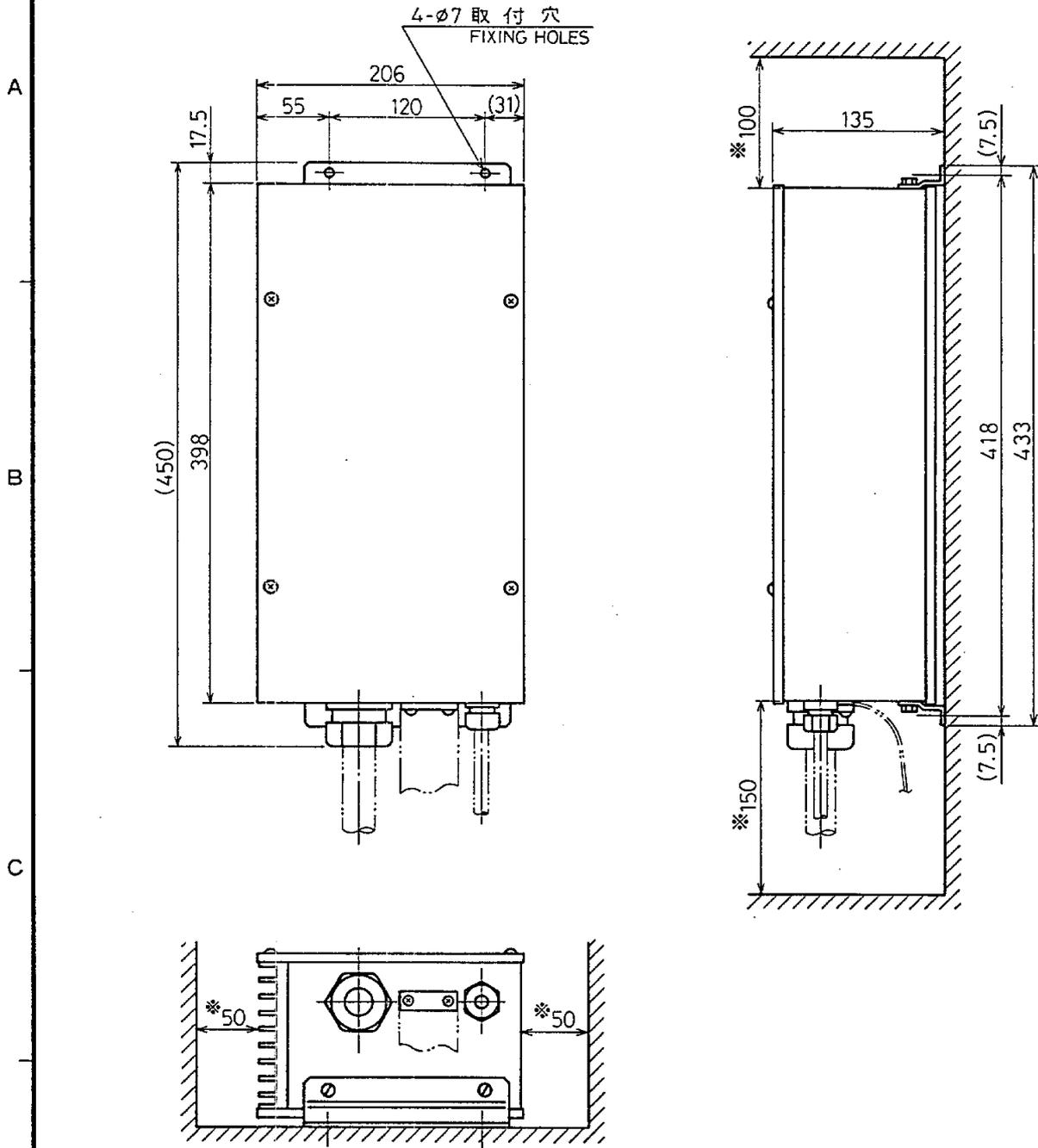
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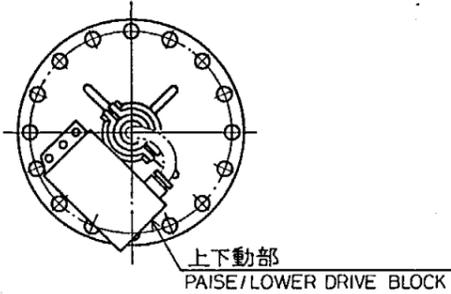


品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	三角法 THIRD ANGLE PROJECTION	名称 TITLE			
検図 CHECKED	尺度 SCALE	CH-322 リモートコントロール REMOTE CONTROL			
製図 DRAWN	重量 WEIGHT	kg	図番 DWG.NO. C1277-G07-A		

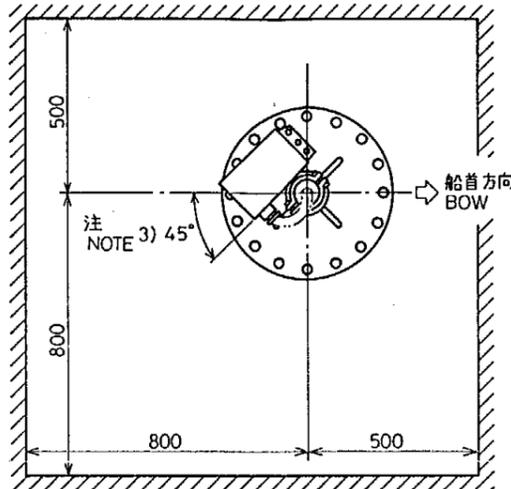


*:推奨サービス空間
RECOMMENDED SERVICE SPACE

承認 APPROVED	品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
AUG. 28 '90 T. NAKAWO		三角法 THIRD ANGLE PROJECTION				名称 TITLE 送受信装置
検図 CHECKED	AUG. 28 '90 T. MIYOSHI	尺度 SCALE		1/5		CH-321 TRANSCEIVER UNIT
製図 DRAWN	AUG. 28 '90 M. USUDA	重量 WEIGHT		5.5 kg	図番 DWG.NO.	C1277-G03-A

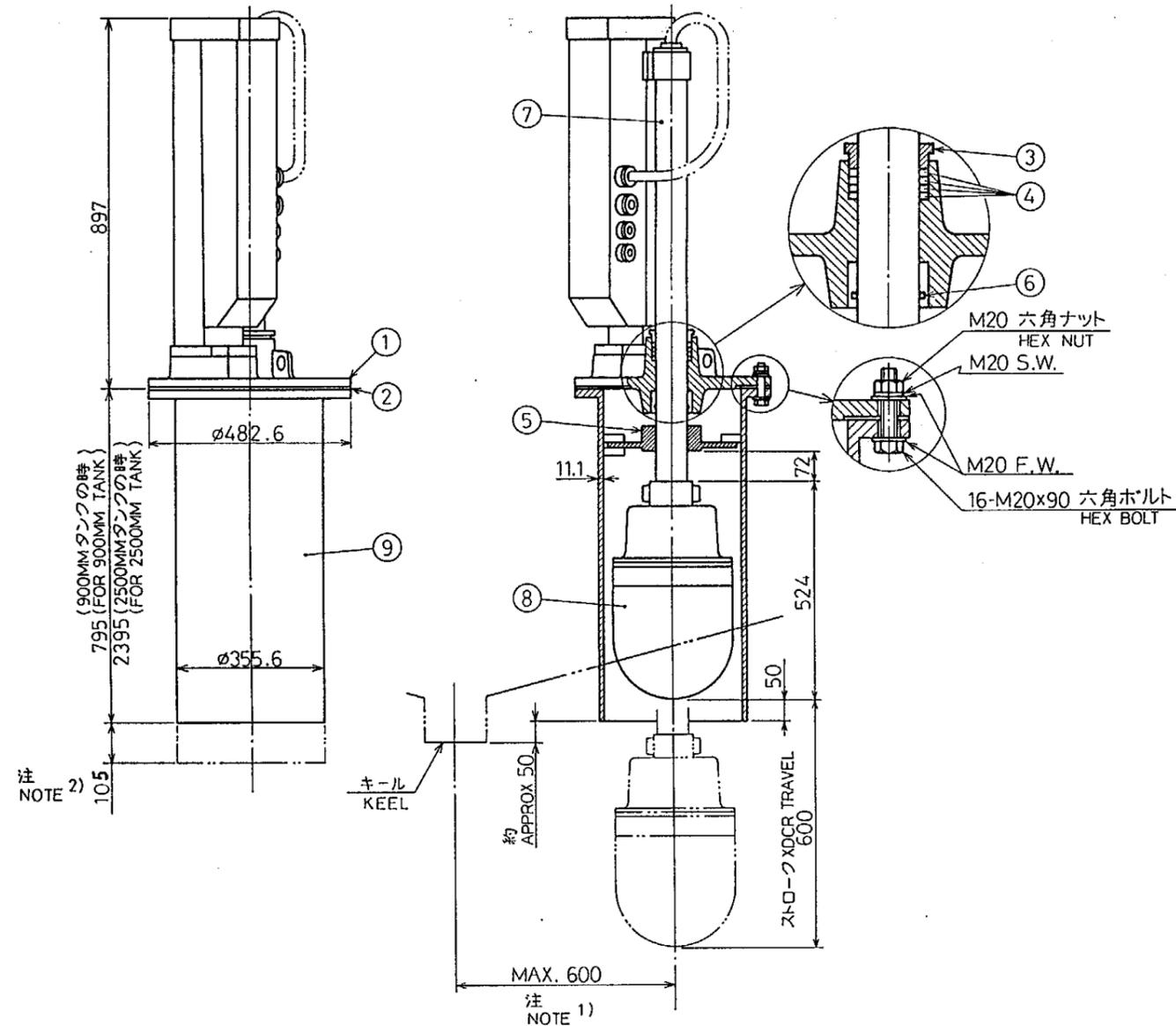


推奨保守点検用スペース(尺度 1/20)
RECOMMENDED SERVICE SPACE (SCALE 1/20)



- 注 1) 装備位置は船首から1/3 (小型船では1/2) 程度で、キールから600mm以内とする。
 2) 格納タンクは、装備位置に応じて105mm以内で切断する。
 3) 左図の如く、船首-船尾ラインと上下動部の角度が約45° となるよう装備する。
 図では上下動部は左舷船尾側に位置しているが、右舷船尾側、左舷船首側又は、右舷船首側でもよい。
 4) 装備後は装備要領書を参照し、船首線調整を行うこと。
 5) エンジルーム付近など振動が伝わりやすい場所に装備する場合は、装備要領書の通り本体上部にステー取付金具 (オプション) を取り付け、さらに防振用ステーを船体まで張って下さい。
 6) 保守点検の為、上下装置上部には (タンク長+50mm) のスペースを設けるか、障害となる天井等に角600×600mm程度の角穴を設ける。

- NOTE 1) THE HULL UNIT IS GENERALLY PLACED ABOUT 1/3 (1/2 IN CASE OF SMALL BOAT) OF THE SHIP'S LENGTH FROM THE BOW ON THE FORE - AFT LINE AND BESIDE THE KEEL LINE (LESS THAN 600mm FROM KEEL LINE).
 2) CUT THE TANK WITHIN 105MM IN LENGTH ACCORDING TO INSTALLATION METHOD.
 3) THE HULL UNIT SHOULD BE ORIENTED SO THAT THE SHIP'S FORE - AFT LINE CROSSES THE RAISE LOWER DRIVE BLOCK AT AN ANGLE OF APPROXIMATELY 45° AS SHOWN AT LEFT. NOTE THAT POSITIONS WHICH ARE ROTATED IN 90° STEPS FROM THE SHOWN POSITION ARE ALSO ALLOWED.
 4) HEADING ADJUSTMENT SHOULD BE PERFORMED AFTER INSTALLATION, REFERRING TO THE INSTALLATION MANUAL.
 5) WHEN THE UNIT IS INSTALLED IN THE ENGINE ROOM WHERE INTENSE VIBRATION IS EXPECTED, INSTALL THE VIBRATION - ISOLATING STAY FROM TOP OF THE UNIT TO SHIP'S HULL BY USING THE STAY ANGLE (OPTION). REFER TO INSTALLATION MANUAL FOR DETAIL.
 6) SECURE SERVICE SPACE (TANK LENGTH + 50MM) ABOVE THE UNIT OR MAKE A SQUARE HOLE OF 600 × 600MM ON THE CEILING.



9	格納タンク RETRACTION TANK		(1)		オプション OPTION
8	旋回部 SOUNDOME ASSEMBLY		1		
7	上下シャフト MAIN SHAFT		1		1.1m OR 2.7m
6	Oリング O-RING		1		
5	タンクガイド TANK GUIDE		1		
4	グリスコットン GREASE COTTON		4		
3	グリスコットン押え台 GREASE COTTON RETAINER		1		
2	フランジパッキン GASKET		1		
1	架台載台 MAIN BODY FLANGE		1		
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

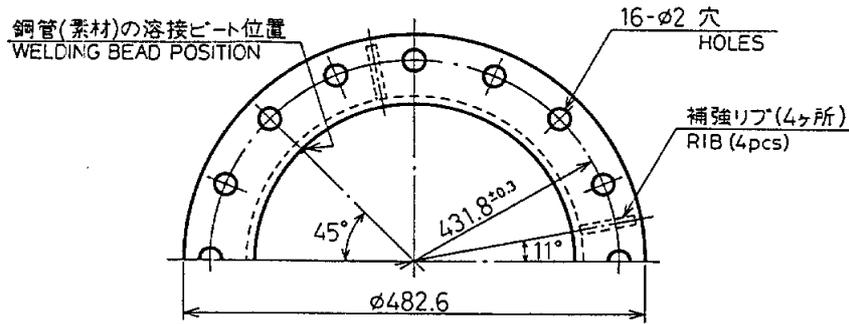
承認 APPROVED	AUG. 9. 90 T. UAKANO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	上下装置外寸図 HULL UNIT
検図 CHECKED	AUG. 8. 90 T. MIYOSHI	尺度 SCALE	1/15	CH-326	(ストローク XDCR TRAVEL 600mm)
製図 DRAWN	AUG. 8. 90 M. USUDA	重量 WEIGHT	160 kg	図番 DWG.NO.	C1277-G01-A

1

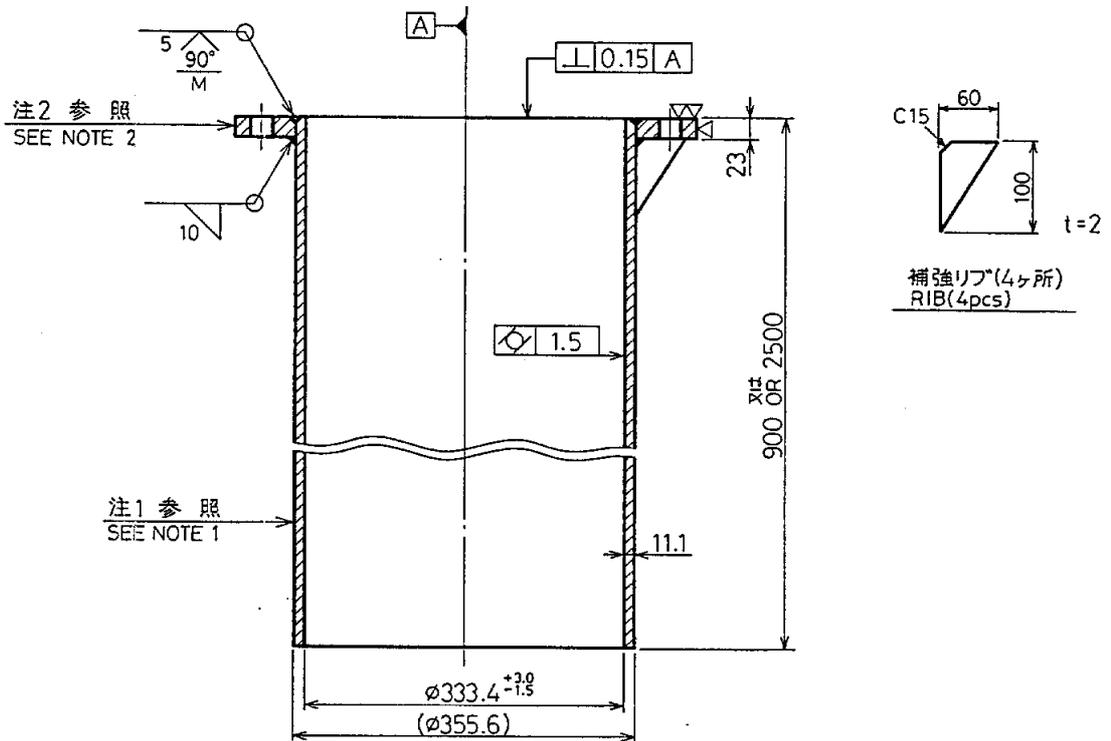
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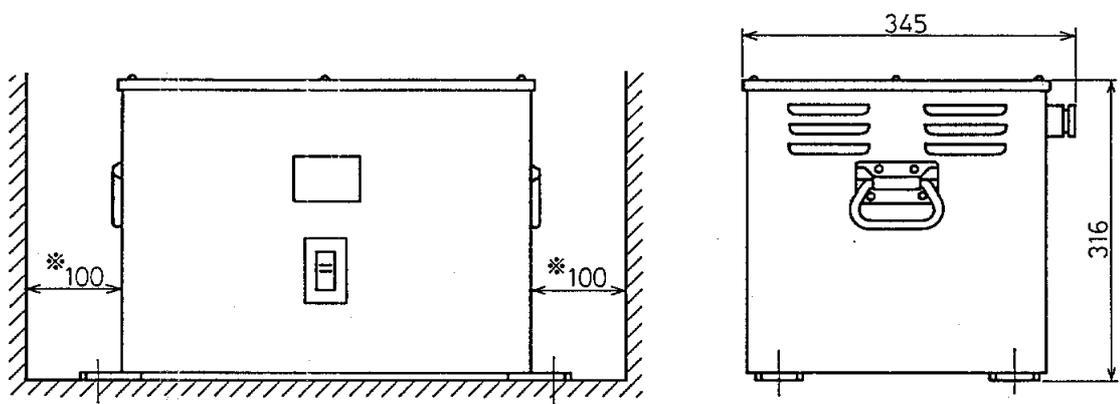
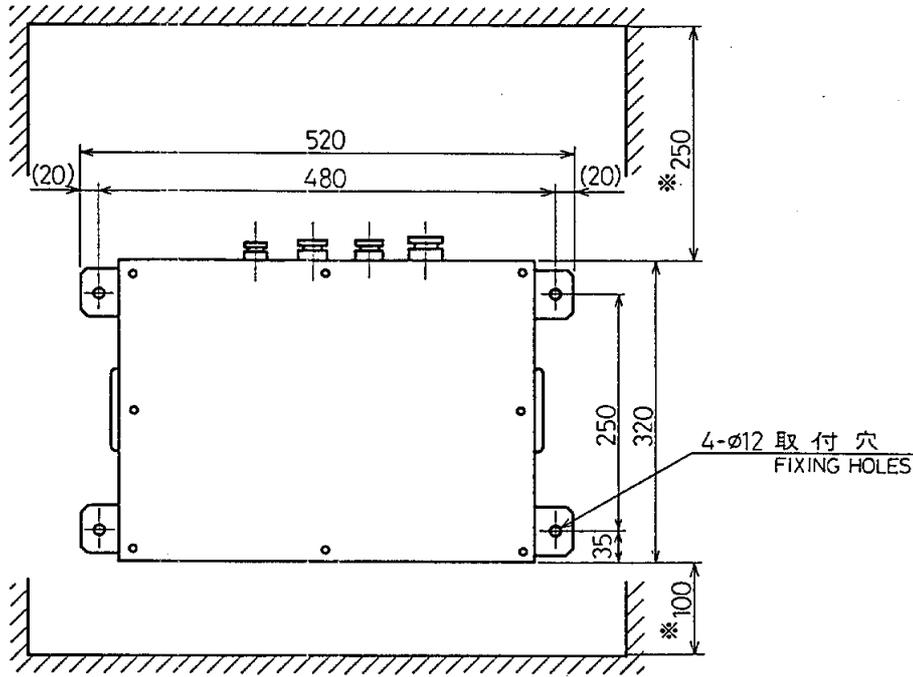
- 注) 1. タンク材料はSTPG38-E-C (圧力配管用炭素鋼管 冷間仕上電気抵抗溶接鋼管 呼び径350スケジュール40を使用のこと。
 2. 補強リブおよびフランジ材料はSS41を使用のこと。
 3. タンク内面はタールエポキシ塗装の後、防汚塗料を塗布のこと。
 4. タンク上面は塗装しないこと。

- NOTE 1. USE STPG-38-E-C (14" SCHEDULE 40 COLD FINISH CARBON STEEL PIPE FOR PRESSURE SERVICE).
 2. USE SS-41 (ROLLED STEEL FOR GENERAL STRUCTURE) FOR RIB AND FLANGE.
 3. GIVE EPOXY PAINT AND ANTI FOULING PAINT ON INSIDE OF TANK.
 4. DO NOT PAINT UPPER SURFACE OF FLANGE.

D

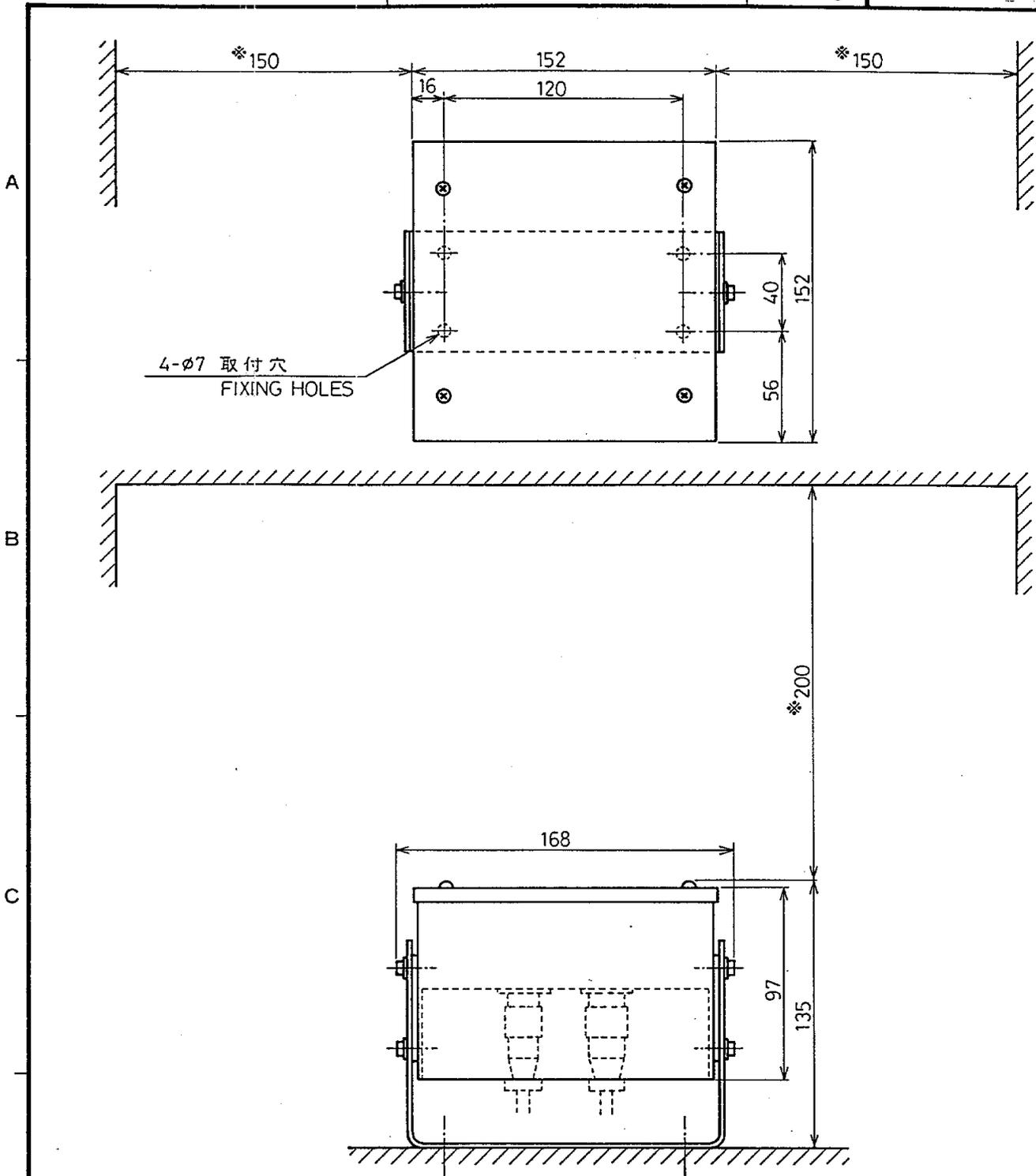
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	AUG.28.'90 T.NAKANO	三角法 THIRD ANGLE PROJECTION	名称 TITLE	鉄製格納タンク外観図 STEEL RETRACTION TANK OUTLINE DRAWING	
検図 CHECKED	AUG.28.'90 T.MIYOSHI	尺 度 SCALE	1 / 8		
製図 DRAWN	AUG.28.'90 M.USUDA	重 量 WEIGHT	kg	図 番 DWG.NO.	C1277-G06-A

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※:推奨サービス空間
RECOMMENDED SERVICE SPACE

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	AUG.28.90 T. NAKAJO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	整流器 RECTIFIER
検図 CHECKED	AUG.28.90 T. MIYOSHI	尺度 SCALE	1/8	PR-1100	
製図 DRAWN	AUG.28.90 H. USUDA	重量 WEIGHT	53 kg	図番 DWG.NO.	C5003-G01-A



- NOTE 1. 保守点検及び放熱用として ※印のスペースをとること。
 DIMENSIONS MARKED "※" SHOW RECOMMENDED MAINTENANCE AND VENTILATION SPACE.
2. 船首マーク [FORE] を船首方向に向けて、筐体が水平になるように取り付けること。
 ORIENT THE [FORE] MARK ON THE UNIT TOWARD SHIP'S BOW AND MOUNT THE UNIT LEVEL.

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	JUL. 20. '90 T. NAKANO	三角法 THIRD ANGLE PROJECTION	名称 TITLE	動揺検出器	
検図 CHECKED	JUL. 20. '90 T. KOBAYASHI	尺度 SCALE	1/3	MS-100	MOTION SENSOR
製図 DRAWN	JUL. 20. '90 M. USUDA	重量 WEIGHT	2 kg	図番 DWG.NO.	C1278-G01-A

