

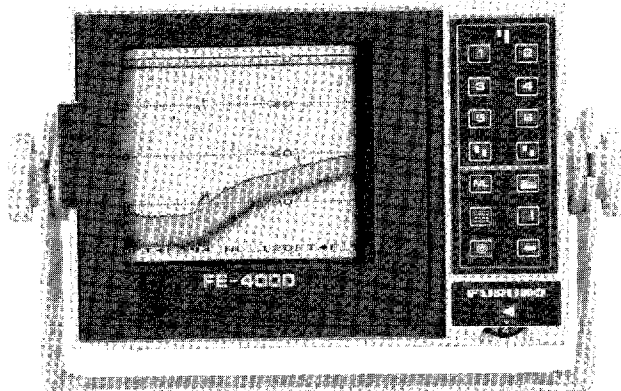
No. : OM-E2297-0C

# FURUNO

## OWNER'S MANUAL

ECHO SOUNDER

MODEL FE-4000



**FURUNO ELECTRIC CO., LTD.**  
NISHINOMIYA, JAPAN

8603500KY (863)  
PRINTED IN JAPAN

## A WORD TO FURUNO FE-4000 OWNERS:

Congratulations on your choice of the FURUNO FE-4000 Echo Sounder! We are confident that you will enjoy many years of operation with this fine piece of equipment.

For over 30 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 FE-4000 Echo Sounder is just one of the many Furuno developments in the field of echosounding. The compact, lightweight but rugged unit is easy to install and operate and is suitable for both fresh and salt water applications.

This unit is designed and constructed to give the user many years of trouble-free operation. However, to obtain optimum performance from this unit, you should carefully read and follow the recommended procedures for installation, operation and maintenance. No machine can perform to the utmost of its ability unless it is installed and maintained properly.

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

Thank you for considering and purchasing Furuno equipment.

## FEATURES

The FE-4000 has a large variety of functions, all contained in a splash-proof rugged aluminium die cast case that is compact to fit almost any size boat.

All keys respond immediately to the operator's command and each time a control touchpad is pressed an audible "beep" sounds to confirm that the command has been received by the unit.

- Shadow Line control makes discrimination of fish close to the bottom and the bottom itself easier.
- Three paper advance speeds for detailed observation of fishing conditions.
- Easy paper loading cassette
- Extremely effective noise limiter eliminates interference with minimal effect on desired echoes.
- Six Basic Ranges, from 0-15Ft., to 0-480Ft. Unit of measurement may be changed from Feet to Fathoms or Meters.
- Phased Range allows start of Basic Range to be set from 0 foot to a maximum of 480 Feet in Basic Range 6.
- Three Pulselengths from 0.2 to 0.8 msec. for excellent short range and deep range performance, with three different Sounding Rates.
- Potent 50W transmitter, with sensitive receiver.
- Universal 11-15VDC power supply, drawing less than 6.5W of power.

# TABLE OF CONTENTS

	<u>Page</u>
<b>SPECIFICATIONS</b> .....	1 to 3
<b>PRINCIPLE OF OPERATION</b> .....	4
<b>INSTALLATION</b> .....	5 to 14
<b>TRANSDUCER INSTALLATION</b> .....	5
Transom Mount .....	6
Suction Cup Mount .....	7
Inside Hull Mount .....	7
Through-Hull Mount .....	8
Transducer Preparation and Painting .....	10
<b>RECORDER UNIT INSTALLATION</b> .....	11
Mounting Recorder Unit .....	11
<b>CABLE CONNECTIONS</b> .....	12
Transducer Cable Connection to Recorder Unit .....	13
Power Cable Connection .....	13
<b>GROUNDING</b> .....	13
<b>LOADING OF RECORDING PAPER</b> .....	14
<b>OPERATIONAL OVERVIEW</b> .....	15 to 20
<b>CONTROLS</b> .....	15
Power Switch/Gain Control .....	15
Range Selection .....	16
Basic Range/Phased Range/Shadow line .....	17
Noise Limiter/Marker Line/Range Marker/Paper Advance .....	18
Paper Illumination .....	19
<b>INDICATORS</b> .....	19
<b>INTERPRETING THE RECORDING</b> .....	21 to 23
DETECTING AREA .....	21
ZERO LINE .....	22
FISH SCHOOL ECHOES .....	22
BOTTOM ECHO .....	22
SURFACE NOISE/AERATION .....	23
<b>MAINTENANCE</b> .....	24 to 25
GENERAL .....	24
STYLUS REPLACEMENT .....	24
FUSE REPLACEMENT .....	25

CLEANING AND LUBRICATION .....	25
MAINTENANCE OF THE TRANSDUCER .....	25
<b>TROUBLESHOOTING</b> .....	26 to 29
BASIC TROUBLESHOOTING FOR USER .....	26
MORE EXTENSIVE TROUBLESHOOTING FOR SERVICE SHOP .....	28
TRANSDUCER CHECK .....	29
<b>HOW TO CHANGE INTERNAL SETTING</b> .....	30
CHANGE OF DEPTH UNIT .....	30
<b>EXPLODED VIEW AND PARTS LIST</b> .....	31
<b>SCHEMATIC DIAGRAMS</b> .....	32

# SPECIFICATIONS

\*\*\*\*\*

## 1. Depth Range

		1	2	3	4	5	6
Meters	Basic	0- 5	0- 10	0- 20	0- 40	0- 80	0-160
	Half Phase	3- 8	5- 15	10- 30	20- 60	40-120	80-240
	Full Phase	5- 10	10- 20	20- 40	40- 80	80-160	160-320
Feet	Basic	0- 15	0- 30	0- 60	0-120	0-240	0-480
	Half Phase	8- 23	15- 45	30- 90	60-180	120-360	240-720
	Full Phase	15- 30	30- 60	60-120	120-240	240-480	480-960
Fathoms	Basic	0- 3	0- 5	0- 10	0- 20	0- 40	0- 80
	Half Phase	2- 5	3- 8	5- 15	10- 30	20- 60	40-120
	Full Phase	3- 6	5- 10	10- 20	20- 40	40- 80	80-160

Units are selected with an internal jumper block.

## 2. Recording Paper

PD-1015NW Dry Paper, 10cm x 15m

## 3. Paper Advance

Slow : 6 mm/min.  
 Medium : 12 mm/min.  
 Fast : 24 mm/min.

## 4. Paper Loading

Easy loading cassette

## 5. Pulselength/Sounding Rate

Range	Pulselength	Sounding Rate		
		Basic	Half Phase	Full Phase
1	0.2 ms	300 ppm	300 ppm	300 ppm
2	0.2	300	300	300
3	0.2	300	300	300
4	0.2	300	300	300
5	0.4	300	150	150
6	0.8	150	150	100

Pulselength and Sounding Rate are automatically determined by range and phase.

## 6. Transmitter Power Output

50W

## 7. Frequency

200kHz or 50 kHz

## 8. Echo Intensity

3 different intensities (White, Gray and Black) including background.

## 9. Power Supply

11 - 15 VDC, less than 6.5W

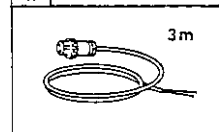
**COMPLETE SET**

	Name	Type	Code No.	Q'ty
1	Recorder Unit		000-013-635* 000-013-636**	1
2	Transducer	NBM40-50-10 TBM50-200-10	000-015-081* 000-015-082**	1
3	Installation Materials	00S0120	000-024-774	1set
4	Accessories	FP02-00500	000-024-927	1set
5	Spare Parts	SP02-01700	000-024-708	1set

\* for 50kHz, \*\* for 200kHz

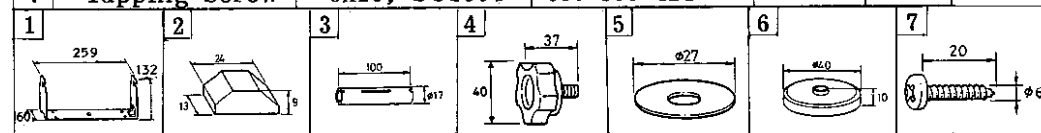
**INSTALLATION MATERIALS**

	Name	Type	Code No.	Q'ty
1	Power Cable Assy	00S0120	000-104-058	1



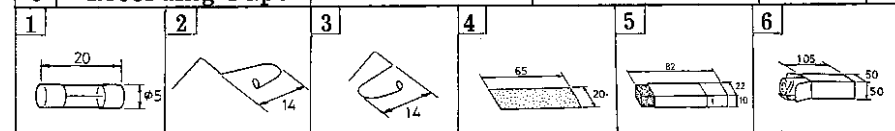
**ACCESSORIES**

	Name	Type	Code No.	Q'ty	Fig.
1	Hanger	02-055-1601-1	100-031-091	1	1
2	Rubber Cushion	02-052-1303	100-022-540	2	2
3	Winding Reel	FGS-210020-2	210-100-212	1	3
4	Knob Bolt	KG-B2, M8x20	000-800-418	2	4
5	Knob Washer	05-012-0125	591-201-251	2	5
6	Rubber Washer	02-052-1302	100-022-531	2	6
7	Tapping Screw	6x20, SUS304	000-800-414	4	7



**SPARE PARTS**

	Name	Type	Code No.	Q'ty	Fig.
1	Fuse	FGMB 2A 125V	000-103-165	2	1
2	Recording Stylus	02-055-1518-1	100-031-071	1	2
3	Collector Stylus	02-055-1519-1	100-031-081	1	3
4	Sandpaper	02-055-1125-0	100-030-710	1	4
5	Sponge Brush	02-055-1115-0	100-030-620	1	5
6	Recording Paper	PD-1015NW	000-878-456	1	6



**OPTION**

	Name	Type	Code No.	Q'ty
1	Transducer	NBM-40-50-11*	000-015-083	1
		50B-5NR*	000-015-028	
		UT200LF-8A**	000-015-036	
		200B-5NR**	000-015-014	
2	Suction Cup and Bracket	OP02-15	000-013-633	1
3	Adhesive		000-013-634	15g

\* for 50kHz \*\* for 200kHz 3

**PRINCIPLE OF OPERATION**

The FE-4000 Echo Sounder determines the distance between its transducer and underwater objects such as fish, lake bottom or seabed and displays the results on a 4" recording paper. It does this by utilizing the fact that an ultrasonic wave transmitted through water travels at a nearly constant speed of 4800 feet (1500m) per second. When a sound wave strikes an underwater object such as fish or sea bottom, part of the sound wave is reflected back toward the source. Thus by calculating the time difference between the transmission of a sound wave and the reception of the reflected sound wave, the depth to the object can be determined. In a sense an echo sounder can be thought of as being an extremely sophisticated and quick timer, since it is capable of resolving time differences shorter than one thousandth of a second.

The entire process begins in the recorder unit. Transmitter power is sent to the transducer as a short pulse of electrical energy. The electrical signal produced by the transmitter is converted into an ultrasonic signal by the transducer and transmitted into the water. Any reflected signals from intervening objects (such as a fish school) are received by the transducer and converted back into an electrical signal. It is then amplified in the amplifier section, and finally, recorded on the paper.

The recording printed by the FE-4000 is made up of a series of vertical scan recording lines for each transmission. Each line represents a "snapshot" of what has occurred beneath the boat. The series of snapshots are accumulated side by side across the paper, and the resulting contours of the bottom and fish between the bottom and surface are recorded. The amount of history of objects that have passed beneath the boat over a series of transmission varies from less than a few minutes to several minutes, depending on how you adjust the unit. For further details, see page 18, Paper Advance Speed key.

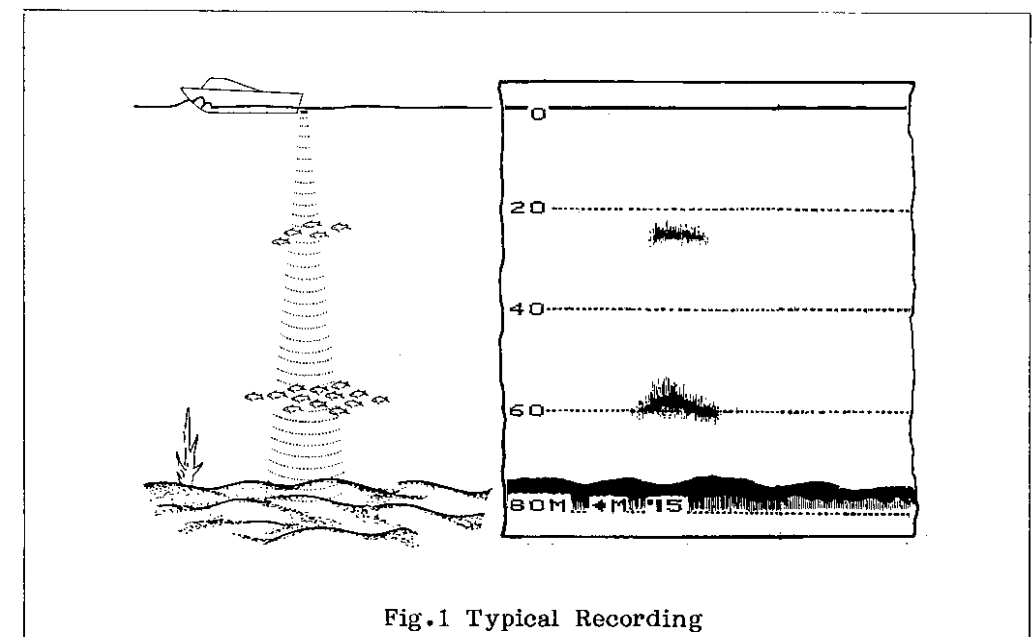


Fig.1 Typical Recording

# INSTALLATION

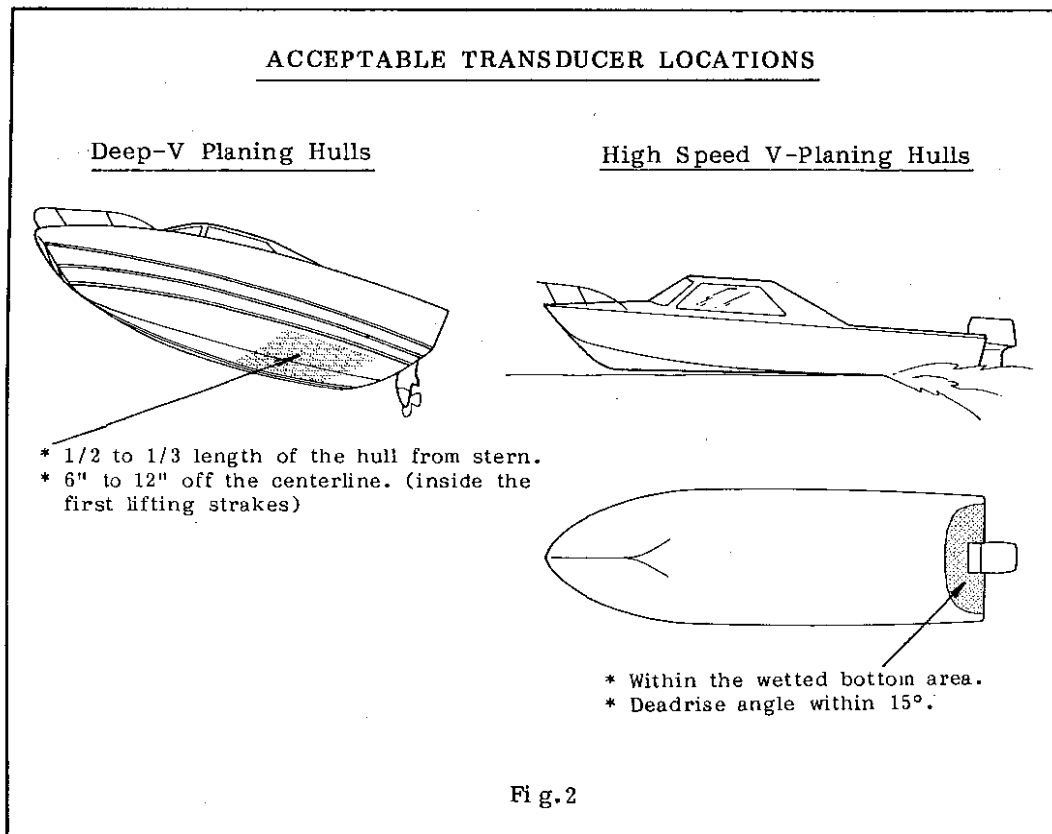
## TRANSDUCER INSTALLATION

The FE-4000 is available with either a transom mount, suction cup mount, inside-hull mount or through-hull mount transducer. This section of the manual shows the installation procedure for each transducer.

The performance of the FE-4000 is directly related to the mounting location of the transducer, especially for high-speed cruising. The installation should be planned in advance, keeping the standard cable length (8m) and the following factors in mind.

- 1) Air bubbles and turbulence caused by movement of the boat seriously degrade the sounding capability of the transducer. The transducer should, therefore, be located in a position where water flow is the smoothest. Noise from the propellers also adversely affects performance and the transducer should not be mounted nearby. The lifting strakes are notorious for creating acoustic noise, and these must be avoided by keeping the transducer inboard of them.
- 2) The transducer must always remain submerged, even when the boat is rolling, pitching or up on a plane at high speed.

For displacement hulls, using inside-hull and through-hull installations, a practical choice would be somewhere between 1/3 and 1/2 of the boat's length from the stern. For planing hulls, a practical location is generally rather far astern, so that the transducer is always in the water regardless of the planing attitude.



## Transom Mount

This type of mounting is very commonly employed, usually on relatively small I/O or outboard boats. Do not attempt this mounting on an inboard boat due to turbulence created by the propeller ahead of the transducer.

1. Attach the transducer to the bracket as shown in Fig. 3.
2. To determine a suitable transducer mounting location, run the boat at several speed ranges and observe the water flow at the rear and near the transom.

Suitable location is at least 50 cm (18") away from the engine and where the water flow is smooth.

3. On a relatively flat hull, the transducer is mounted flush with the transom, and on a deep "V" hull, it is usually mounted so that the transducer face is parallel with the seabed. A fairing block should be installed ahead of and flush with the transducer to assure clean water flow across the transducer face.

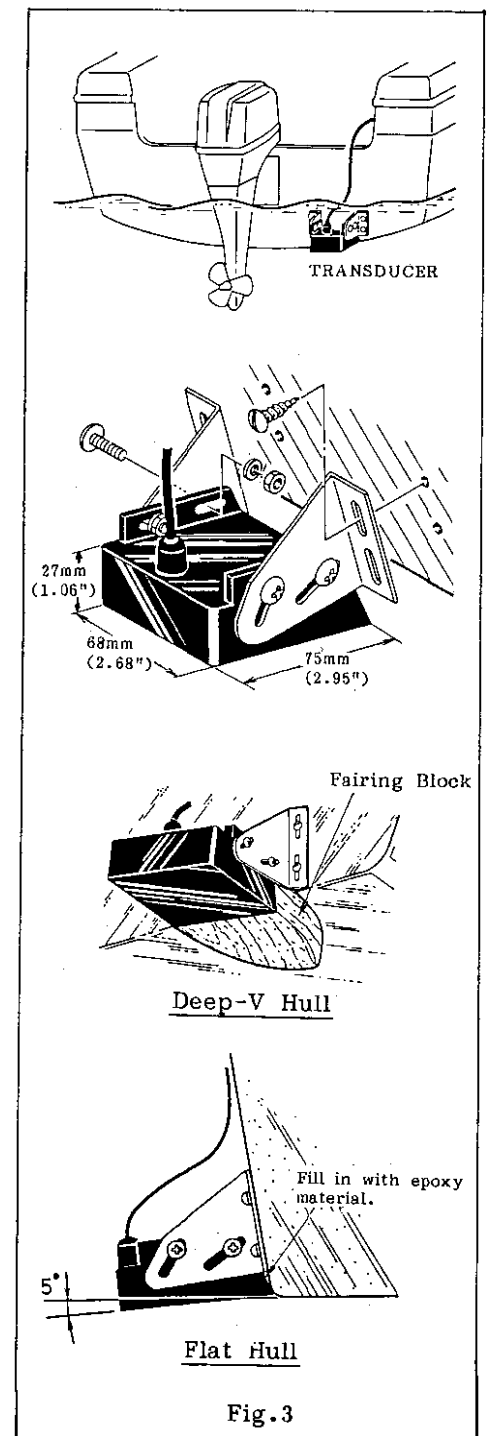
Mark the screw locations by holding the transducer in position on the transom.

4. Drill four pilot holes for the mounting screws.
5. Mount the transducer and secure it with four self-tapping screws. A small amount of sealing compound under the head of each screw will preserve the watertight integrity of the transom.

6. Adjust the transducer position so that either its entire wedge front (for flat hull) or wedge front corner is flush with the transom bottom.

7. If necessary, to improve water flow and minimize air bubbles staying on the transducer face, incline the transducer about 5° at the rear. This may require a certain amount of experimentation for fine-tuning at high cruising speeds.

8. Fill the gap between the wedge front of the transducer and transom with epoxy material to eliminate any air spaces.



### Suction Cup Mount

This temporary type of mounting is usually employed when the FE-4000 is to be used with the boat's engine stopped and therefore it is not necessary to be overly concerned with a mounting location for minimum turbulence. Select an appropriate place on the transom.

1. Assemble the transducer, brackets and suction cup as shown.
2. Determine the transducer location and clean the transom surface. Do not select a location where the surface is rough.
3. Mount the transducer on the transom; the transducer should be lowered down to nearly the same level as the hull bottom. Employ a safety cord to prevent the transducer from accidentally falling off.
4. Adjust the transducer angle so that its working face is parallel with the waterline.
5. To remove the transducer from the transom, hold the nipple of the suction cup and pull forward.

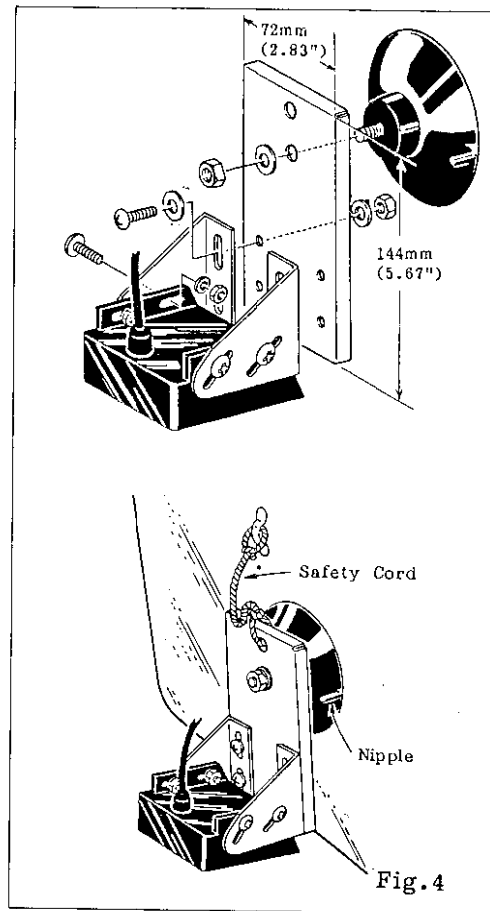


Fig.4

### Inside-Hull Mount

While this is by no means an optimum mounting scheme for deep-water sounding, this type of mounting can sometimes be used on fiberglass boats. A transducer can be likened to an antenna used with a TV set. Mounting an antenna inside your attic is like mounting an echo sounder transducer inside the hull. Both will work well enough, but are hardly optimum for either TV or echo sounder operation. In addition to the general considerations described on page 5, it is important to ensure that the transducer be placed in an area that has a single-hull thickness and is void of air or flotation materials other than solid fiberglass between the transducer face and the water. Also, the transducer face should not be placed over hull struts or ribs which generally run under the hull. Further, a location where the rising angle of the hull exceeds 15° should be avoided to minimize the effect of the boat's rolling.

It is advisable that the mounting location be finalized through a little trial and error after all other installation works have been completed. Temporarily put some silicone grease (not the type that sets up after drying!) inside the hull. Push the transducer down to squeeze out any air bubbles. Turn on the FE-4000 echo sounder. Run the boat at various speeds and move the transducer to different locations to select the position where the best recording is obtained. Once a good location is found, you

may permanently mount the transducer.

The inside-hull mounting is accomplished as follows. Note that only transducers UT-200LF-8A and NMB40-50-11 allow this type of mounting. See Fig.7 for outline drawings.

1. Lightly roughen the transducer face with fine #10 sandpaper and degrease it with a solvent (thinner or alcohol). Also, roughen and degrease the inside of the hull where the transducer is to be mounted.
2. Allow both to dry completely, then coat the transducer face and hull with the adhesive supplied. In a cold environment, you should warm the adhesive to approximately 40°C before usage to soften it.
3. Press the transducer firmly down on the hull and gently twist it back and forth to remove any air which may be trapped in the adhesive. Allow sufficient time for the adhesive to dry.

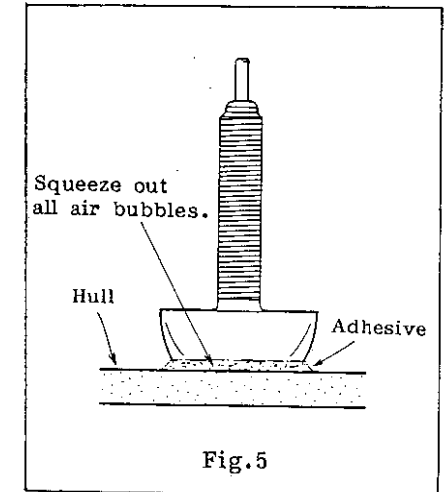


Fig.5

### Through-Hull Mount

This type of mounting provides the best performance of all, since the transducer protrudes from the hull and the effect of air bubbles and turbulence near the hull skin is reduced. To determine the transducer location, keep in mind the general considerations described on page 5. Also, when the boat has a keel, the transducer should be at least 30 cm (1 foot) away from it. Typical through-hull mountings are illustrated in Fig.6.

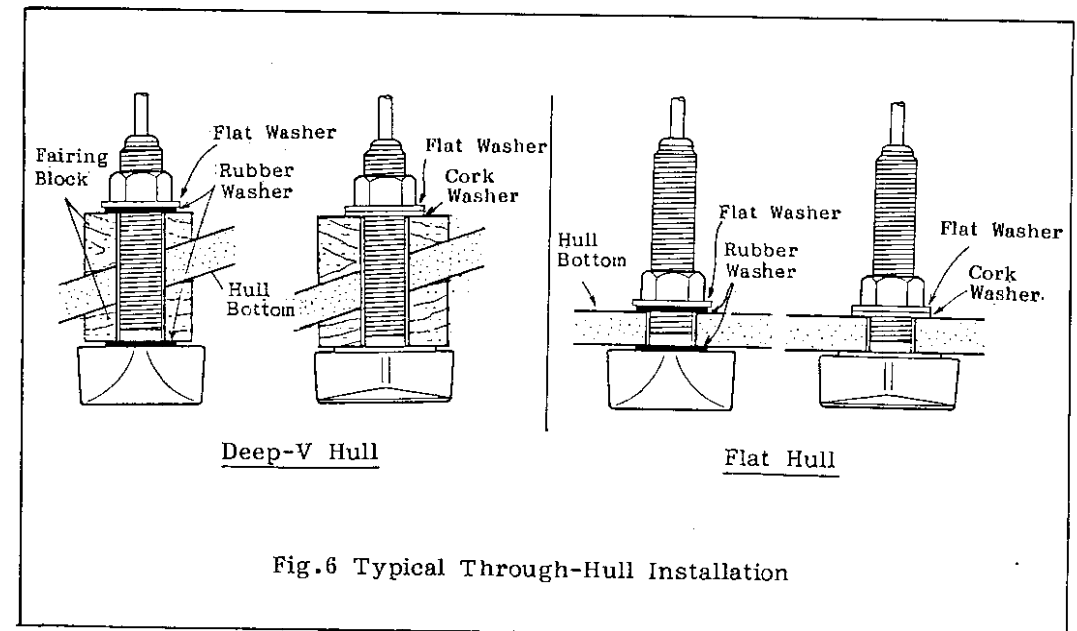


Fig.6 Typical Through-Hull Installation

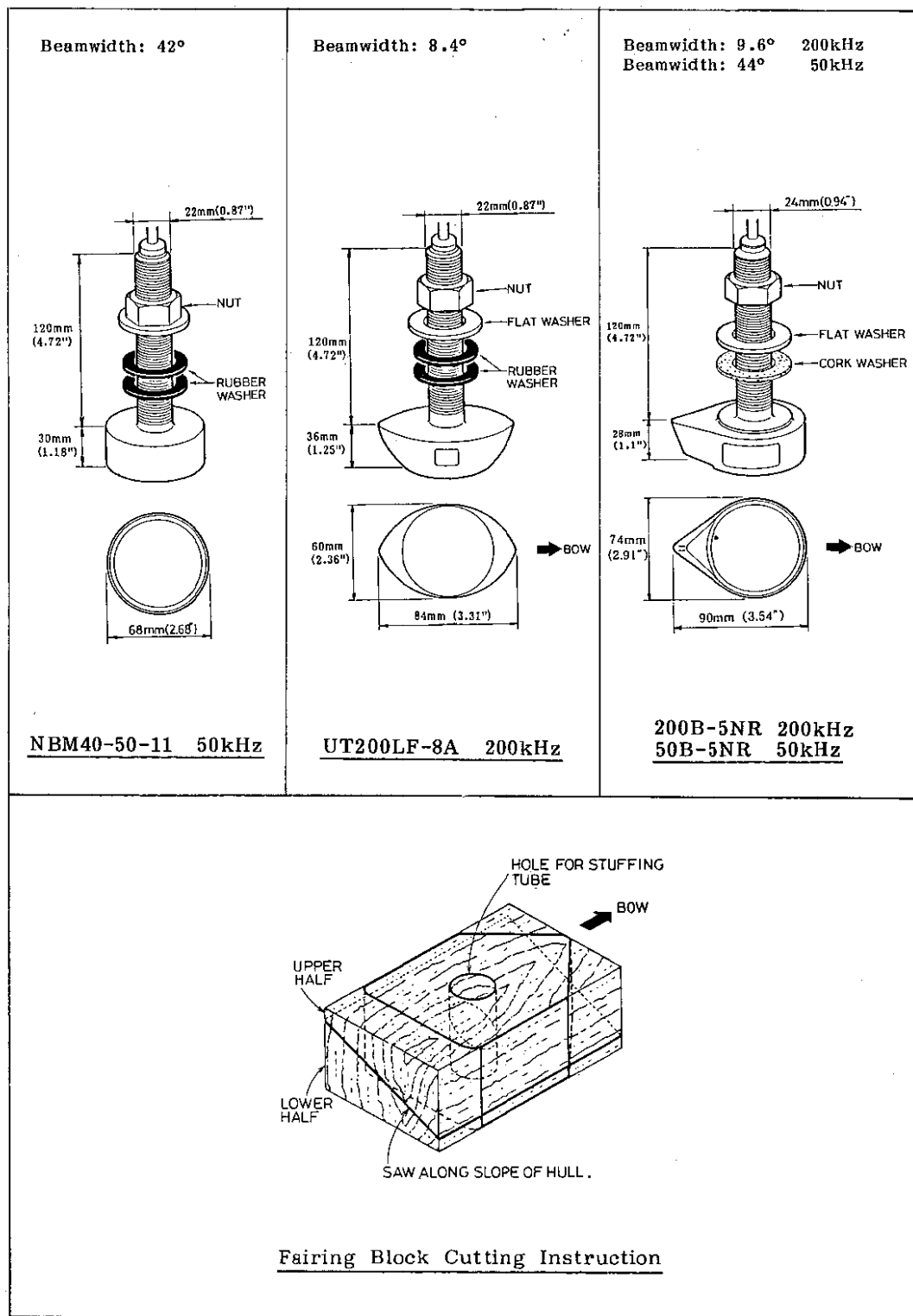


Fig.7 Inside-Hull and Through-Hull Transducer Outline Drawings/Fairing Block Cutting Instruction.

Through-hull mounting is accomplished as follows.

1. With the boat hauled out of the water, mark the location selected for mounting the transducer on the bottom of the hull.
2. If the hull is not level within 15 degrees in any direction, fairing blocks made out of teak should be used between the transducer and hull, both inside and outside, to keep the transducer face parallel with the water line. Fabricate the fairing block as shown in Fig.7 and make the entire surface as smooth as possible to provide an undisturbed flow of water around the transducer. The fairing block should be smaller than the transducer itself to provide a channel to divert turbulent water around the sides of the transducer rather than over its face.
3. Drill a hole just large enough to pass the threaded stuffing tube of the transducer through the hull, making sure it is drilled vertically.
4. Apply a sufficient amount of high quality caulking compound to the top surface of the transducer, around the threads of the stuffing tube and inside the mounting hole (and fairing blocks if used) to ensure watertight mounting.
5. Mount the transducer and fairing blocks and tighten the locking nuts. Be sure that the transducer is properly oriented and its working face is parallel to the waterline. Do not over-stress the stuffing tube and locking nuts through excessive tightening, since the wood block will swell when the boat is placed in the water. It is suggested that the nut be tightened lightly at installation and retightened several days after the boat has been launched.

**CAUTION**

The tightening torque should not exceed 400kg-cm. Excessive stress will cause damage to the threads of the plastic stuffing tube.

**Transducer Preparation and Painting**

Just prior to putting your boat into the water, the face of the transducer should be thoroughly wiped with a detergent liquid soap. This will lessen the time necessary for the transducer to establish good contact with the water. Eliminating this will lengthen the time required for complete "saturation" and will reduce the performance of the unit.

To maintain the sensitivity of the transducer, do not coat the face with heavy pigmented antifouling paints, i.e., cuprous oxide types. Use only a light, thin coat of a vinyl based antifouling paint, like International Paint's TRI-LUX No.67 or No.68.



## RECORDER UNIT INSTALLATION

### Mounting Location

The recorder unit is carefully constructed to be able to withstand the humidity and corrosive atmosphere common in the marine environment, but it is not designed to be used outside, directly exposed to that environment. Salt water spray will most assuredly cause damage to the sensitive components inside. Keep these and the following factors in mind when planning the installation of the recorder unit.

#### CAUTION

Furuno will assume no responsibility for the damage caused by exposure to either fresh or salt water.

1. The recorder unit consumes very little power, so there is no need of forced air ventilation. However it is necessary to provide at least some circulation of cooling air by allowing sufficient space around the unit.
2. Many owners will undoubtedly use the FE-4000 on small boats, many with center consoles. The recorder unit must be mounted inside an enclosed cabinet, completely shielded from salt water spray, and from fresh water spray if the boat is usually hosed down after a day's outing. Most small center console boats are equipped with such an enclosed cabinet behind the wheel, and most have clear doors so that equipment may be seen behind them.
3. It is recommended to keep the recorder unit out of direct sunlight or at least shaded because of heat that can build up inside the cabinet.
4. Consideration should be made to provide space for access to the mounting hardware on the side and connectors behind the recorder unit. Also allow at least a foot or so of "service loop" in the cables to allow the unit to be pulled forward for servicing or internal adjustment.
5. The recorder unit can be mounted on either a table-top, bulkhead or overhead. Make sure that the selected location is strong enough to support the unit under the conditions of continued vibration or shock which will be normally encountered on the boat. If necessary, appropriate reinforcement measures should be taken in the mounting area.

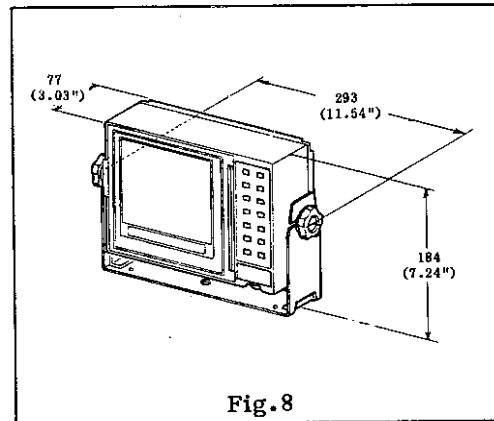


Fig. 8

3. Install the mounting hanger using the screws supplied.
4. Fit knobs, rubber washers and knob washers to the recorder unit.
5. Install the recorder unit in the mounting hanger. Tighten the knobs securely.

#### CAUTION

If the hanger vibrates too much from side to side, use the supplied rubber cushions to absorb the vibrations.

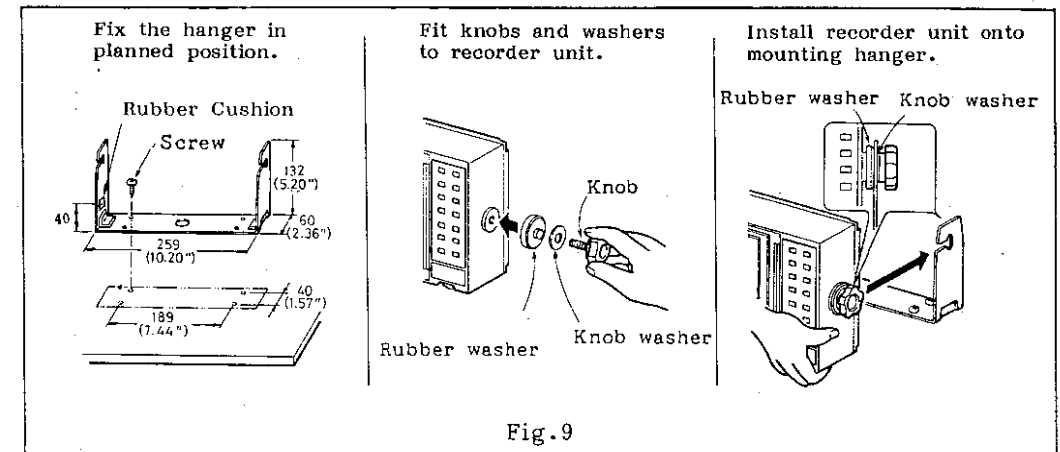


Fig. 9

### CABLE CONNECTIONS

Cable connections to the FE-4000 recorder unit are made at the connectors located at the rear of the unit. Fig. 10 shows the wiring instructions.

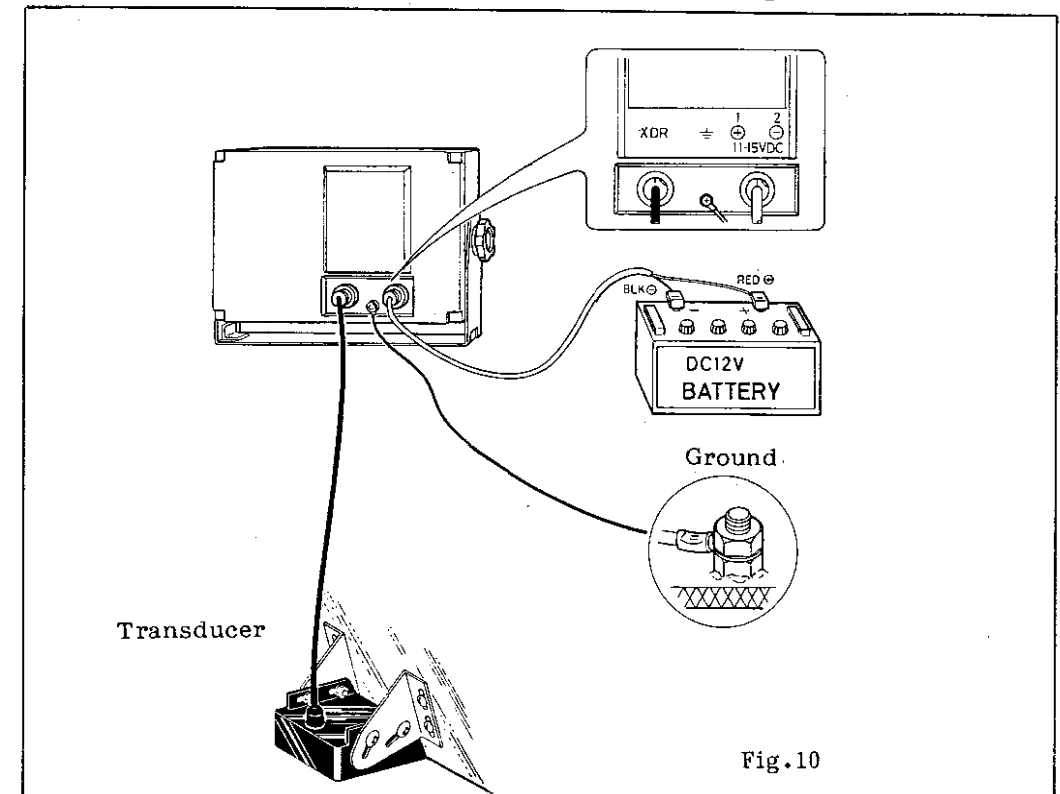


Fig. 10

### Transducer Cable Connection to Recorder Unit

In order to minimize the chance of picking up electrical interference, avoid where possible routing the transducer cable near other on-board electrical equipment. Also avoid running the cable in parallel with power cables.

### Power Cable Connection

The FE-4000 is designed to operate normally at any voltage between 11 and 15Vdc. The power should be directly taken from the distribution board or breaker panel.

Connect the red lead of the cable to the positive (+) terminal of the battery and the black lead to the negative (-) terminal.

### CAUTION

REVERSING THE POLARITY WILL RESULT IN BLOWING THE FUSE AND MAY VERY WELL DAMAGE INTERNAL COMPONENTS.

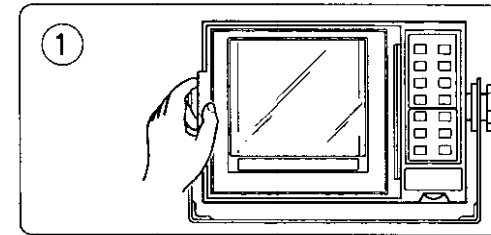
### GROUNDING

The FE-4000 is designed to operate normally without grounding the recorder unit, provided that the cable routing precautions stated before are taken. However in some cases, interference may show up at high gain settings, and it may become necessary to ground the unit to the boat's grounding bus to eliminate the problem. In such cases, run a heavy duty ground wire from the grounding terminal on the rear bottom of the recorder unit to the nearest grounding point on the boat.

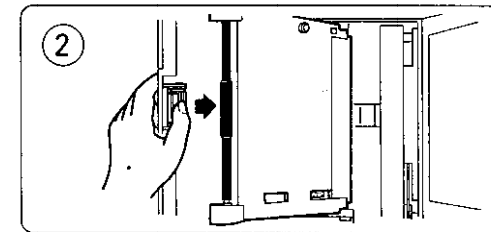
On a fiberglass boat, it is best to install a ground plate that measures about 20 cm by 30 cm (0.8 feet by 1.0 feet) on the outside of the hull bottom to provide a ground point. If this is not practical, the engine block can be used.

### LOADING OF RECORDING PAPER

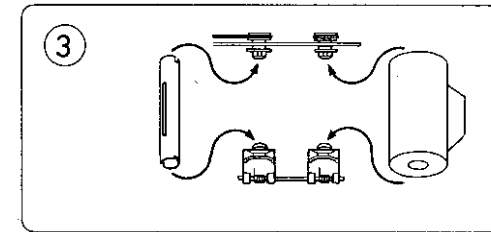
Prior to operating the FE-4000, it is necessary to load the recording paper into the recording unit. Loading is facilitated by means of an easy-loading cassette. Use the following procedure to load the recording paper.



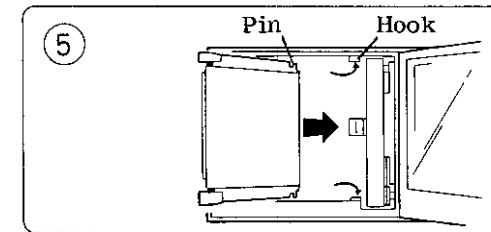
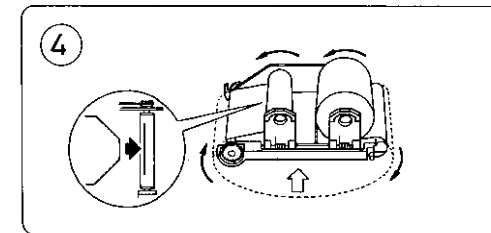
Open the front panel by hand.



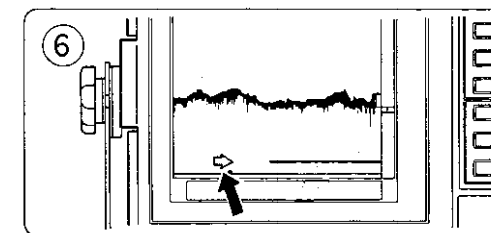
Press the clamber, and the cassette for paper loading pops-up. You can take it out from the main unit.



Feed the recording paper referring to the illustration at left.



Insert the loading cassette into its compartment making sure the loading cassette mates with the pin and hook. You will hear a click sound indicating that the cassette is engaged accurately.



When a red arrow mark appears on the paper, this indicates 1.5 meter of paper remains. (The mark appears when 10% of the total length of the roll remains.)

## OPERATIONAL OVERVIEW

The FE-4000 is very easy to operate. For most operations, each time a control touchpad is pressed an audible "beep" is produced to signal the operator that the unit has received his command.

The Recorder Unit is separated into two sections; controls on the right-hand side, and the recording part on the left-hand side. Most of the touchpad controls have associated with them an indication on the recording paper using the same label found on the touchpad. Changing a touchpad setting will cause a corresponding change in the indication on the recording paper, as well as a change in the appearance of the echoes being viewed.

To familiarize yourself with the controls of your unit, turn it on (presuming that it has already been installed) and try pushing some of the keys as you review this section.

### CONTROLS

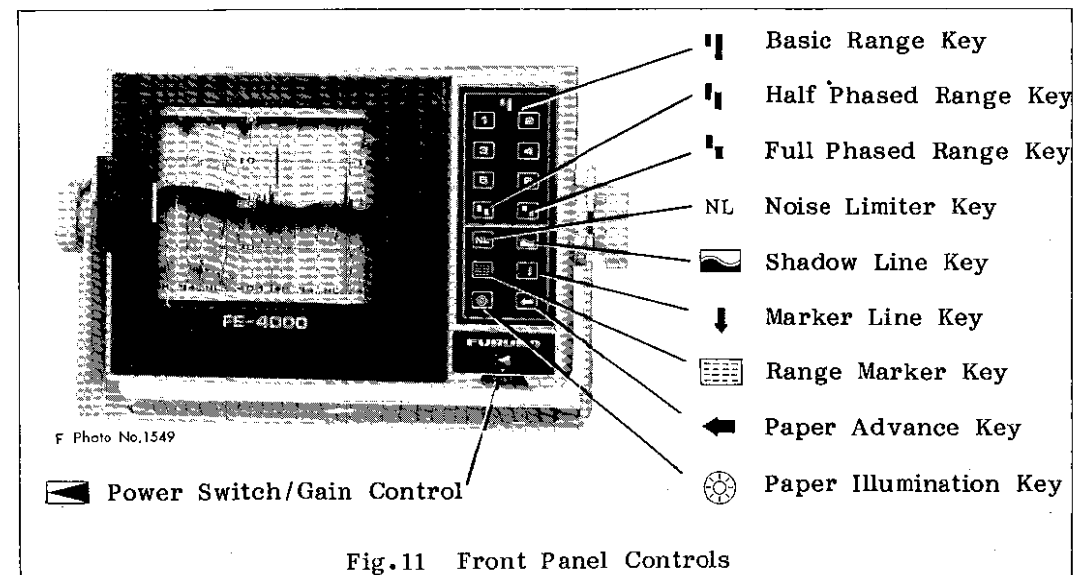


Fig.11 Front Panel Controls

#### Power Switch/Gain Control:

Power is supplied to the unit by turning the knob clockwise until a click is heard, followed by a "beep" sound. Further clockwise rotation adjusts the sensitivity of the receiver. Normally, the gain is set to the point just below where excessive noise appears on the recording paper. As a general rule of thumb, use a higher gain setting for greater depths and a lower setting for shallower waters. For example, if you are looking for fish between the surface and the bottom in the range of perhaps 15 to 45 feet, you may not be concerned at all with seeing the bottom. You might use a Basic Range setting of 2 (30-foot range window) with a Half Phased Range setting of 15 feet. You would bring up the gain until excessive noise is shown on the recording paper and then you would back it off just a little. Now fish will show when they are encountered.

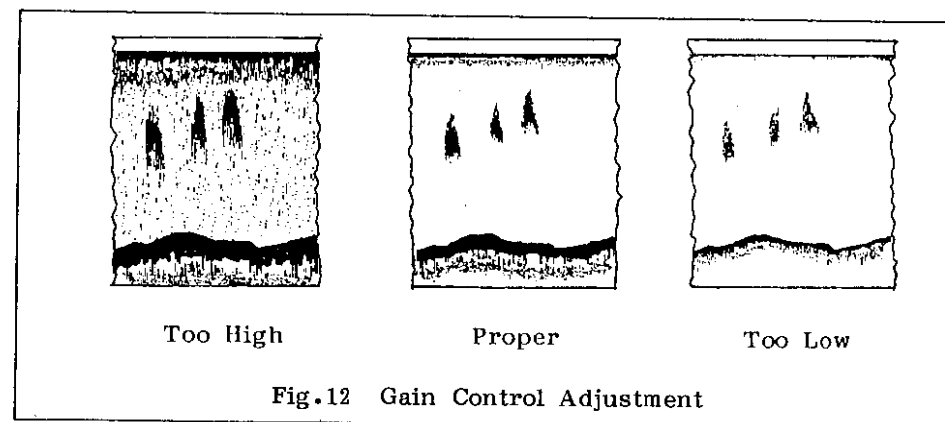


Fig.12 Gain Control Adjustment




As another example, if you are interested in seeing fish close to or on the bottom at 200 feet, you might be using a Basic Range of 5 (240 foot window) without using a Phased Range. Here you would bring up the gain until the bottom is shown in the highest intensity level and then increase the gain a bit further until excessive noise appears between the surface and bottom. Again you would back off the gain until the noise just disappears. In both of these cases you are setting up the maximum level of usable gain, assuring you of the greatest possibility for seeing fish.




Every time power is applied, the internal settings will default to the following:


Phased Range:	"OFF"	Shadow Line:	"OFF"
Basic Range:	"4"	Range Marker:	"ON"
Paper Advance Speed:	"M"	Paper Illumination:	"OFF"
Noise Limiter:	"OFF"		

To turn off the unit, turn the knob fully counterclockwise until a click is heard.

#### Range Selection:

The Basic Range () and Phased Range (, ) keys used together give the operator the means to select the depth he can observe directly under the boat. The Basic Range can be thought of as providing a "window" into the water column. The start of this window is determined by switching on the Half or Full Phased Range key. For example, if you select Basic Range 5, you will have 240 foot deep viewing area, which may be moved by using the Phased Range Keys. To continue our example, if the Half Phased Range key is depressed once, the top of the range window would be at 120 feet, and the bottom of the range window would be at 240 plus 120 feet, or 360 feet. If you again press the key, the Half Phased Range will be put back to the original viewing area. If you press the Full Phased Range key, the top of the range window would be at 240 feet, and the bottom would be at 480 feet.

You may want to look closely at the symbols for these three Range functions. The Basic Range symbol (; short and longer bars) indicates that pushing this key will change the "window" size. The two Phased Range symbols (, ) show two equally sized bars that are staggered vertically next to each other, indicating that the start of the range window is shifted down by half or full of basic range setting.

**Basic Range Keys:**  (1) ... (6)

There are six Basic Range keys and each has a number on it. Select a basic range "window" by referring to the table below.


Basic Range	1	2	3	4	5	6
Meters	0- 5	0- 10	0- 20	0- 40	0- 80	0-160
Feet	0- 15	0- 30	0- 60	0-120	0-240	0-480
Fathoms	0- 3	0- 5	0- 10	0- 20	0- 40	0- 80

**Full Phased Range/Half Phased Range Keys:**  

These keys are used to change the start of the range window. Because the Phased Range value is already determined by full or half of the pre-selected Basic Range, press the key to change the start of the range window by either half or full of the Basic Range.

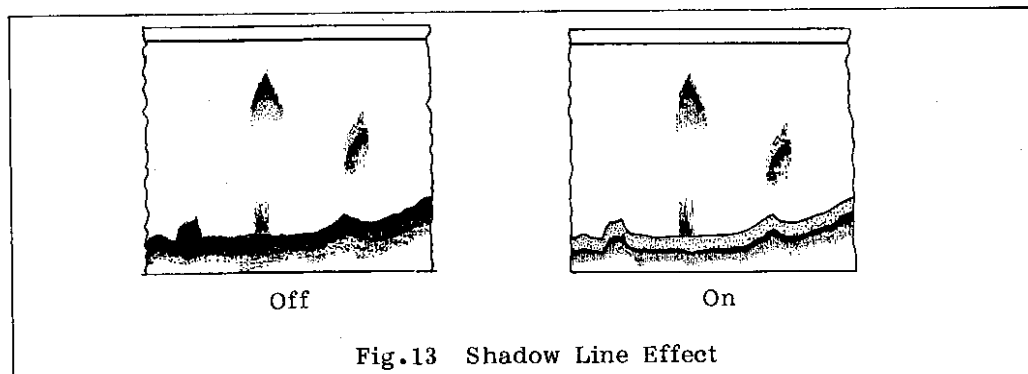
To put the phased range back to the original Basic Range, press the key again.

For example, if you are using a Basic Range setting of 2 (30 foot range window), the Half Phased Range key will cause a shift of 15 feet, i.e., the start of range window is 15 feet and the bottom range is 30 plus 15 feet, or 45 feet. If you press the Half Phased Range key again, the viewing area is put back to Basic Range 2 (30-foot).

**Shadow Line Key:** 

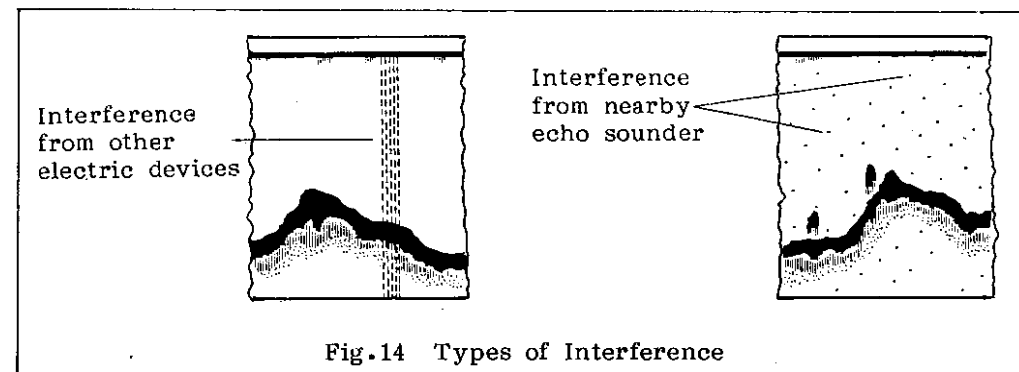
The Shadow Line key is used for discriminating fish lying just above the bottom. Even though fish echoes are considerably weaker than bottom echoes, they may still be strong enough so that when the fish are close to the bottom, the two traces will merge and the fish trace will be indistinguishable from that of the bottom. The Shadow Line key can be employed in this situation. It is most effective when the bottom is rocky and hard since the difference in echo strength from the bottom compared to fish is large. On mud, seaweed-covered, or sloping bottoms, where the echo differential is less, the benefit in using the Shadow Line feature will be less pronounced.

Note that using the Shadow Line Key with the gain set too high causes both the bottom contour and fish to be recorded in the same intensity and fish close to the bottom again become difficult to discriminate from the bottom.



**Noise Limiter Key (Interference Rejector):** **NL**

When noise interference from other echo sounders operating nearby or other types of electrical interference exist, you may use the Noise Limiter to eliminate or reduce the interference. If the Noise Limiter is left on when no interference exists, weaker echoes may be missed or eliminated. An "NL" symbol appears at the lower part of the recording paper to alert the operator that the Noise Limiter is "ON".



**Marker Line Key:** 

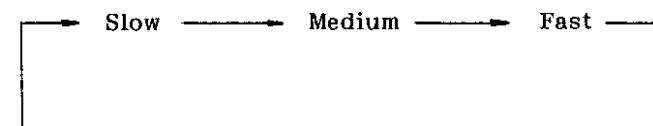
This key is used to inscribe a vertical line onto the recording paper. It is used to mark interesting echoes, etc. If there is an interesting echo that you would like to make note of, press the key, and a vertical line will be inscribed on the paper. Release hold of the key to stop printing the mark.

**Range Marker Key:** 

Press this key to print range markers on the paper. The interval of markers is determined by the Basic and the Phased Ranges in use. If these marks interfere with echoes you want to see, press the Range Scale Key again to eliminate the marks.

**Paper Advance Key:** 

This key is used to select the speed at which the recording paper advances. Because the recording is built-up one recording line at a time, from right to left across the recording paper, the amount of history recorded on the paper is directly related to the paper advance speed. There are three choices; S (Slow), M (Medium) and F (Fast). The paper advance speed is changed by pressing the key successively as follows.



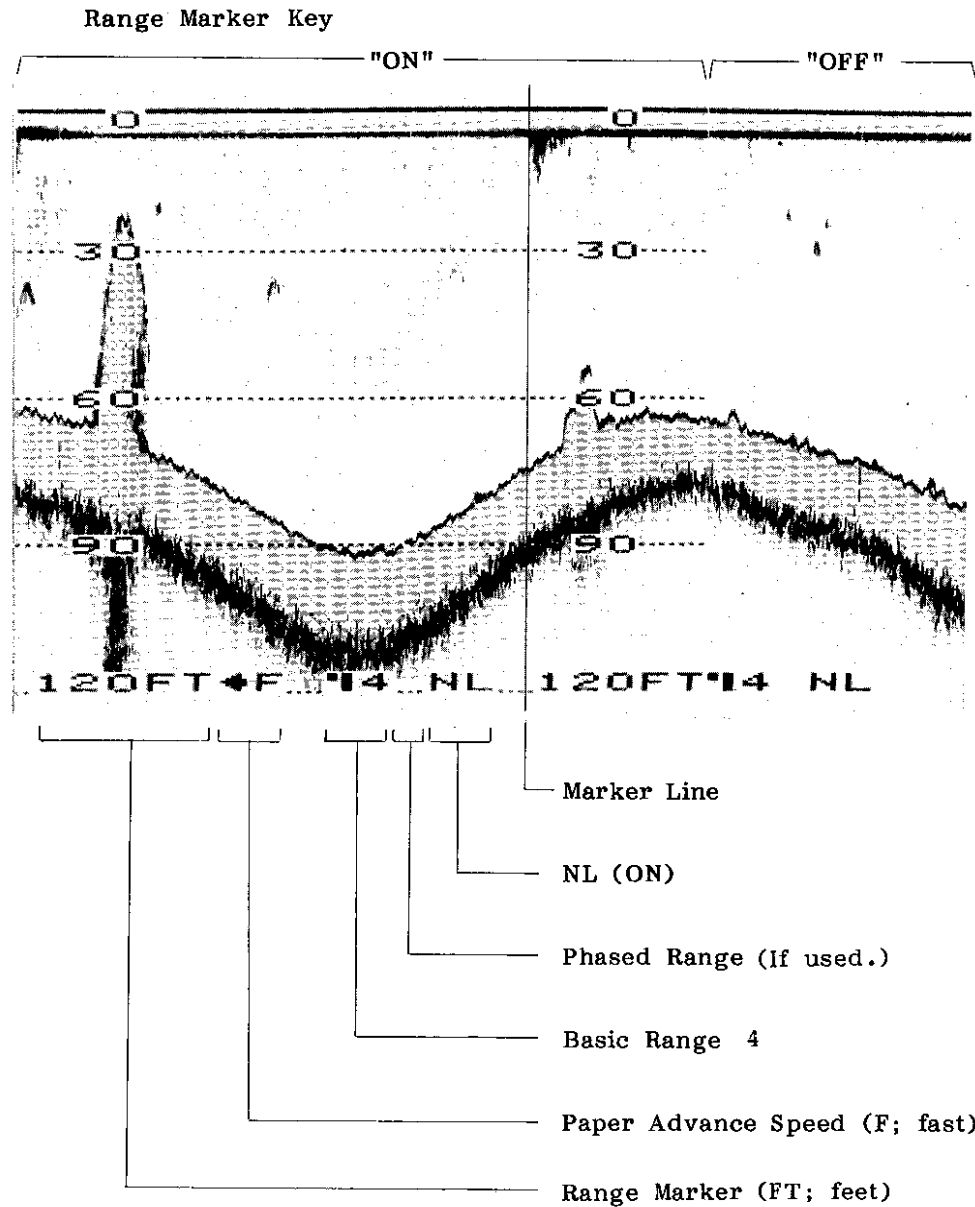
The selected speed is indicated on the lower part of the recording paper.

**Paper Illumination Key:** ☉

This key provides background illumination for the recording paper. To illuminate the recording paper, press the key. To turn off the illumination lamp, press the key again.

**INDICATORS**

Below is a summary of all the various indicators that are shown on a typical recording paper. As shown below, the range calibration marks can be eliminated by pressing the Range Marker Key. The Paper Advance Speed and the Basic Range are always indicated, but the Phased Range and the Noise Limiter are indicated only when employed.



Range Markers

These are the range calibration marks (including depth measuring unit) and are determined by the Basic and Phased Range's in use. The range markers are printed on the recording paper approximately every 3 - 10 minutes, depending on paper speed. Other marks are also printed in the same interval, as long as a setting is not changed. If you change a setting, new indication will be printed just after pressing the key.

Paper Advance Speed

The presently selected speed (S, M or F) is indicated.

Basic Range

The presently selected Basic Range and its symbol are indicated.

Phased Range

Only the symbol of the presently selected Phased Range, Half Phased Range or Full Phased Range is indicated. If not used, there is no indication.

NL (ON)

An "NL" symbol appears next to the Phased Range indication when the Noise Limiter is being used.

Marker Line

A vertical line is inscribed when you press the Marker Line Key.

## INTERPRETING THE RECORDING

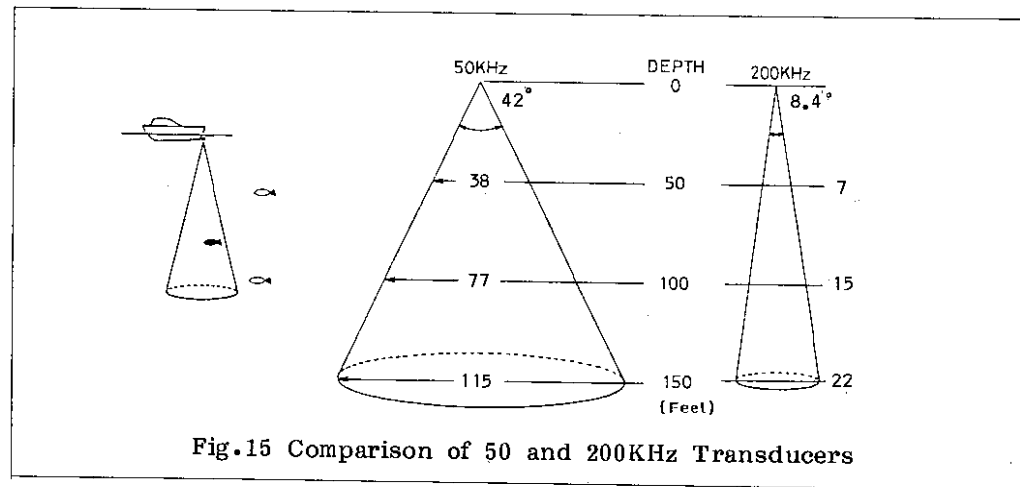
As mentioned before both fish echoes and bottom contour echoes are composed of a series of vertical scan lines moving right to left across the paper. It is possible for the same object to be recorded on the paper in a variety of shapes depending on the distance to the object, the angle at which the fish is struck by the transmitted pulse, echo strength, etc.

### DETECTING AREA

The detecting area varies depending on the main beamwidth of the transducer, as shown below. Objects out of the main beam but close to the beam will be presented less densely, smaller in size, and at a lower intensity.

With the FE-4000, the operator has the choice of either 50kHz or 200kHz transducer operation. Each frequency requires a different recording unit and transducer. There are advantages and disadvantages to both frequencies and you should select the frequency best suited to your needs.

Generally, beamwidth depends on transmission frequency; a narrower beamwidth is usually obtained at the higher frequency (200kHz). For example, the TBM50-200-10 200 KHz transducer has a "-3 dB" beamwidth of 8.4 degrees, whereas the NBM40-50-10 50 KHz transducer has a beamwidth of 42 degrees.



Because the beamwidth of the 200kHz transducer is narrow, the operator has the advantage of higher resolution. In addition, the effects of cruising noise and air bubbles are greatly reduced, since air bubbles resonate at a frequency between 15 and 100kHz. On the minus side, a narrow beamwidth transducer will plot even the smoothest bottom contour in a sawtooth pattern if the boat is moving up and down due to pitching and rolling of the boat.

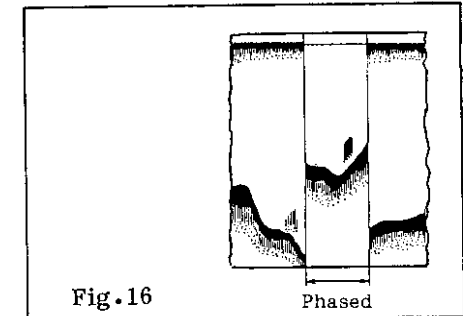
This makes discrimination of fish down close to the bottom difficult. Also, because of the limited coverage area, a narrow beamwidth tends to overlook catchable fish at the sides of the boat. (The maximum percent of depth covered on the bottom for a TBM50-200-10 is 15% of the depth. For example, if the bottom depth is 300 feet, the diameter of the coverage circle on the bottom would be only 44 feet.)

One of the advantages in employing a wider-beam lower frequency transducer (50kHz) is that it allows you to see those catchable fish at the sides of your boat. For example, the NBM40-50-10 transducer can see a circle whose diameter is 77% of the depth. At 300 feet, this means the NBM40-50-10 would see a circle of 230 feet diameter.

In addition, low frequency ultrasonic waves can travel further than higher frequency ones, resulting in a greater depth sounding range. On the negative side, a wide beamwidth lowers the resolution capability, and the recording is more susceptible to the effects of cruising noise and air bubbles.

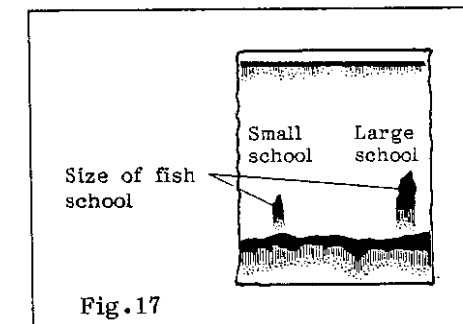
### ZERO LINE

The zero line (sometimes referred to as the transmission line) represents the transducer's position, and moves off the paper when a phased range is used.



### FISH SCHOOL ECHOES

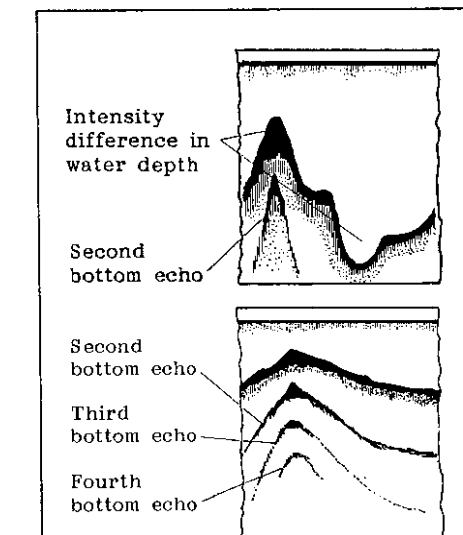
Fish school echoes will generally be plotted between the zero line and the bottom. Usually the fish school/fish echo is weaker than the bottom echo because the reflection surface and the reflection property are much smaller than compared to the bottom. The size of the fish school can be ascertained from the density of the recording.



### BOTTOM ECHO

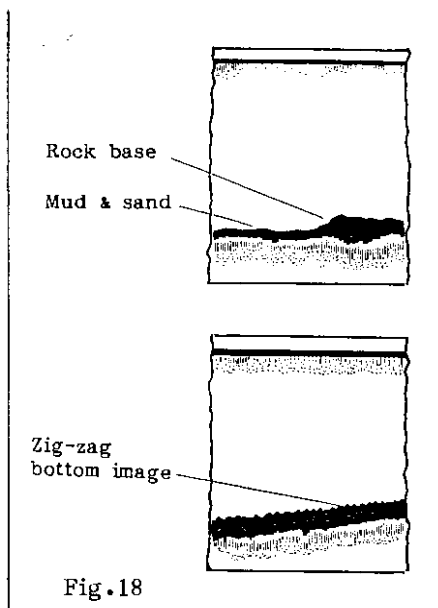
Echoes from the bottom are normally the strongest and are plotted in the highest intensity, but intensity and width will vary with bottom composition, water depth, frequency, sensitivity, etc.

In a comparatively shallow depth, a high gain setting and a strong bottom echo will cause a second or sometimes a third or a fourth echo to be plotted at the same interval between them below the first echo trace. This is because the echo travels between the bottom and the surface twice or more in shallow depths.



The width of the bottom echo can be used to help determine the density of the bottom material (soft or hard). The harder the bottom, the wider the trace. If the gain is set to show only a single bottom echo on mud, a rock bottom will show a second or third bottom return. The Basic Range chosen should be set to show the first and second bottom echoes when bottom hardness is being determined.

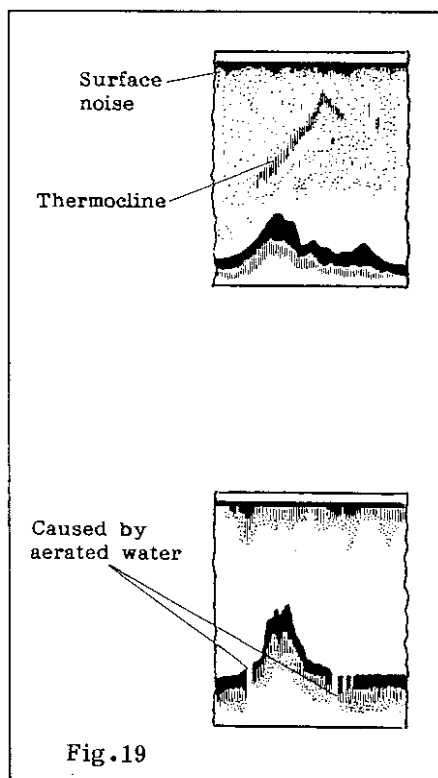
In rough waters the bottom is recorded in a zig-zag pattern, similar to the teeth of a saw. This is caused by the heavy pitching and rolling of the boat, causing the sounding direction to fluctuate and the distance to the bottom to vary.



#### SURFACE NOISE/AERATION

When the waters are rough or the boat passes over a wake, surface noise may appear near the zero line. As surface turbulence is acoustically equivalent to running into a brick wall, the bottom echo will be plotted intermittently. Similar noise sometimes appears when a water temperature difference (thermocline) exists. Different species of fish tend to prefer different temperature zones, so thermocline information may be useful to help identify target fish. 200KHz tends to show shallow thermoclines better than 50KHz.

In rough waters the recording is occasionally interrupted due to below-the-ship air bubbles obstructing the sound path. This also occurs when the boat makes a quick turn or reverses movement. Lowering the paper advance speed may reduce the interruption. However, reconsideration of the transducer installation may be necessary if the interruption occurs frequently.



## MAINTENANCE

### GENERAL

The equipment will maintain optimum performance for a long period. However, continued performance cannot be expected without periodic inspection and maintenance. Important points to be checked from time to time are tabulated below.

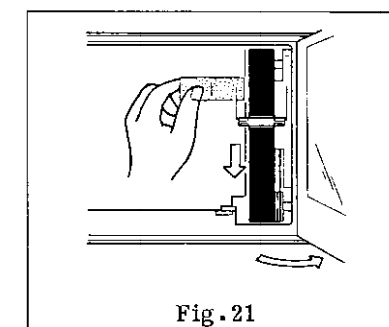
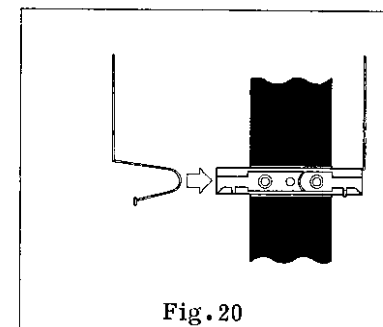
Check Item	Action
Cable run	If cut, repair it.
Power cable plug/ transducer cable plug	If loosened, secure it firmly.
Recorder unit grounding	If corroded, clean it.
Switch knobs	If loosened, secure firmly.
Ship's mains voltage	If out of ratings, correct problem.

### STYLUS REPLACEMENT

An echogram is recorded by breaking down an electrical discharge. The paper has a carbon base and the effect of applying voltage across it is to burn off the top layer, leaving a black carbon undercoat. The type of the stylus used is specially selected wire extruded from a holder. When the recording becomes blurred, it is a time to adjust the pressure between the nib of stylus and the recording paper.

Check Period	Remedy
Check the stylus after every 400 to 500 hours use.	Check the stylus pressure to the paper. If necessary, adjust it by bending slightly.

When the stylus becomes too short for use, it is time for replacement. After replacement, round the nib of the stylus, so as not to scratch the paper surface, by placing the sandpaper under the stylus as illustrated below. (Fig.20 and Fig.21)



## FUSE REPLACEMENT

To protect the equipment from serious damage, a fuse is provided on the rear panel, as illustrated. The fuse protects against overvoltage/reverse polarity of the ship's mains or internal fault of the equipment. If the fuse has blown, first find the cause of the problem before replacing it with a new one. A fuse rated for more than 2A should not be used, since it may cause serious damage to the equipment.

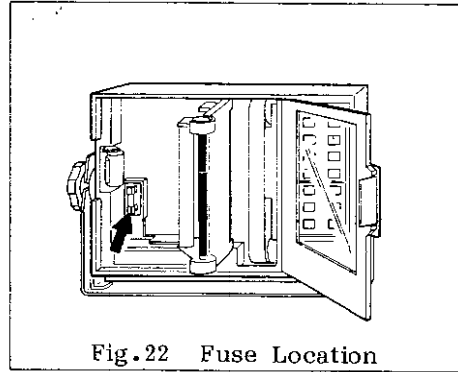


Fig.22 Fuse Location

## CLEANING AND LUBRICATION

As dry recording paper is employed in this unit, it suffers from the disadvantage of creating a lot of carbon dust and giving off an unpleasant odor. Keep the equipment clean and dry at all times. Dust or loose dirt should be wiped off with the supplied sponge brush. To remove heavy dirt, use mild detergent and water on a cotton tipped swab or soft cloth. (Fig.23 and Fig.24)

### CAUTION

Never apply plastic solvent, such as thinner or acetone, for cleaning and lubrication. It may dissolve paint coating/markings on the front panel.

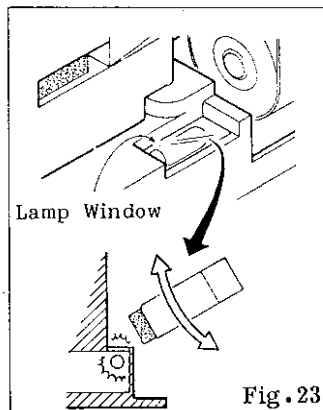


Fig.23

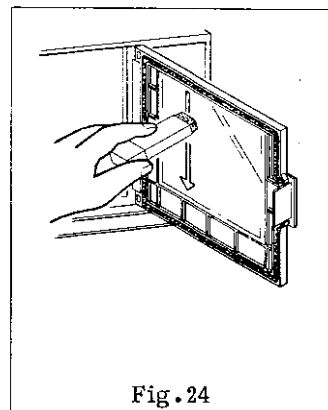


Fig.24

## MAINTENANCE OF THE TRANSDUCER

Underwater growth on the transducer face will result in a gradual decrease in the sensitivity. Check the transducer face each time the boat is drydocked. If any barnacles or seaweed growth is found, remove them very carefully with a piece of wood or sandpaper, taking care not to damage the transducer face.

## TROUBLESHOOTING

In this section, troubleshooting is arranged in two parts: one for the user and the other for the service shop. "Basic troubleshooting for user" includes simple tests of the equipment which the user can handle, such as operation, installation and visual checks. The "More extensive troubleshooting for service shop" is considerably more complicated and must be done by a qualified serviceman. If something appears wrong with your unit, check the equipment referring to the "Basic troubleshooting for user". In case the trouble isn't found after performing these checks, and the unit still appears faulty, call your electronics technician for service.

### BASIC TROUBLESHOOTING FOR USER

Note that the number listed on each possible cause corresponds to that of the illustration on the next page.

<b>Not working at all</b>	
* Is the battery dead? .....	1
* Is the fuse blown? .....	2
Supply voltage is normal?	
* Corrosion on battery terminal? .....	1
* Poor contact of power cable? .....	1
<b>No echo but range calibration mark shows</b>	
* Transducer plug is loose? .....	3
<b>Echo appears but no zero line</b>	
* Is the range phasing operative? .....	4
<b>Low sensitivity</b>	
* Is the GAIN setting too low? .....	5
* Air bubble or underwater growth (barnacle, seaweed, etc.) attached to the transducer face? .....	6
* Highly sedimented water? .....	7
* Soft bottom? .....	8
* Is stylus-pressure normal? .....	9
<b>Heavy noise or interference</b>	
* Is the transducer located too near the engine? .....	10
* Is the unit grounded? .....	11
* Are other echo sounders of the same frequency operating nearby?..	12



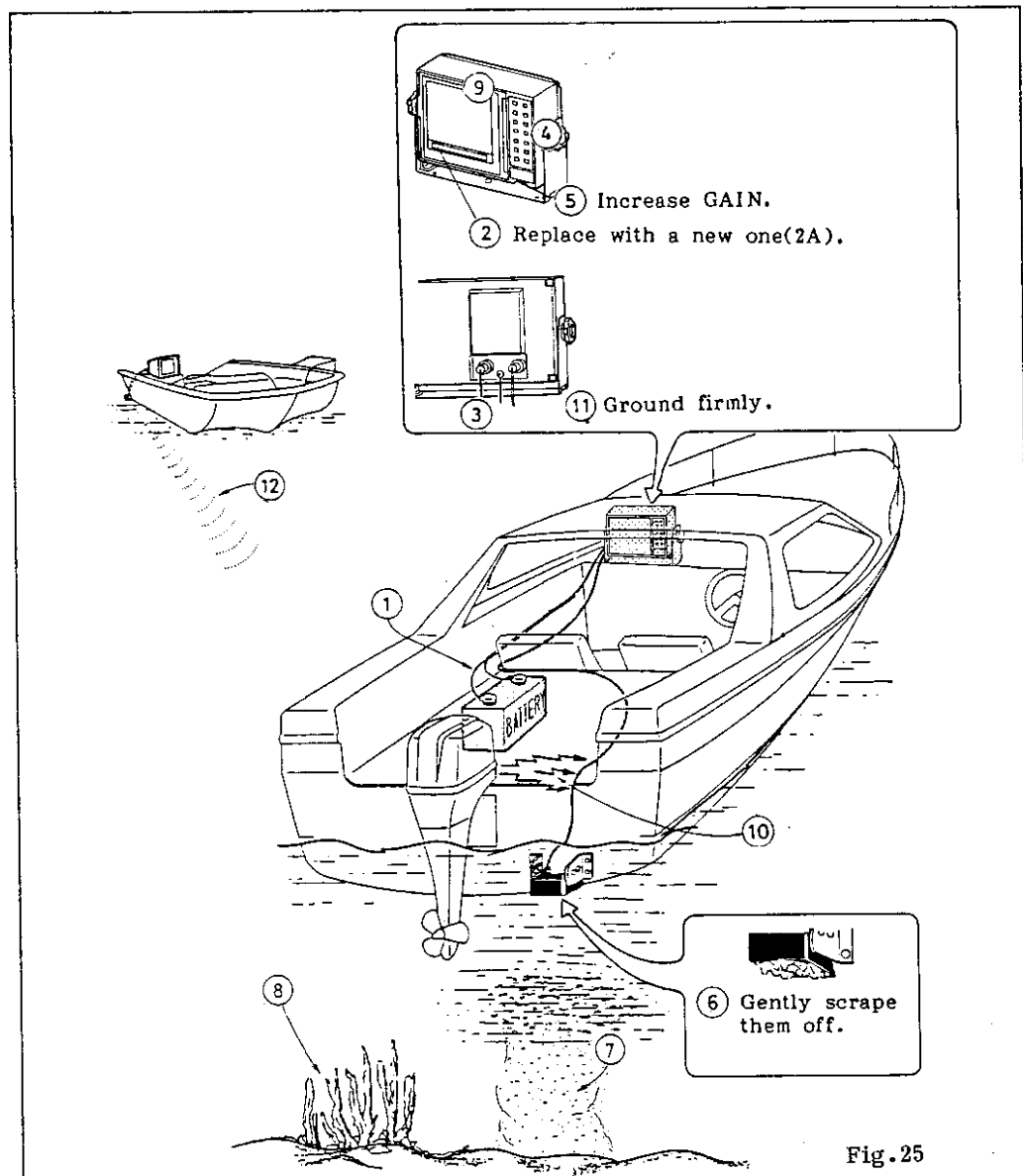


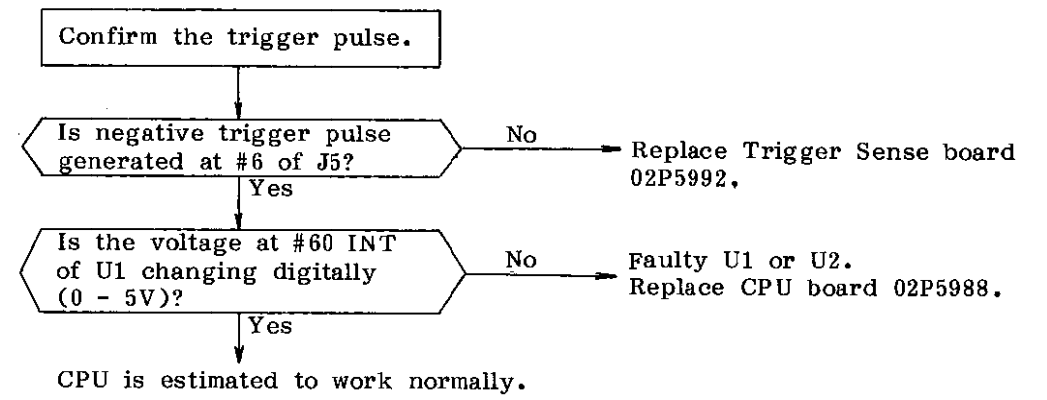
Fig. 25

⑩ Try to mount a large electrolytic capacitor right at the output terminals of the alternator as close as possible. The capacitor must be rated for the nominal output voltage of the alternator, plus a 50 % safety factor and capacity should be about 10,000 microfarads or so. The positive lead of the capacitor is connected to the output terminal of the alternator in parallel with the heavy lead going to the battery bank. The negative terminal of the capacitor should go to a mounting bolt used to secure the alternator to its mounting frame. Be careful to observe polarity of the capacitor. Reverse polarity will destroy the capacitor, and could damage the charging system as well.

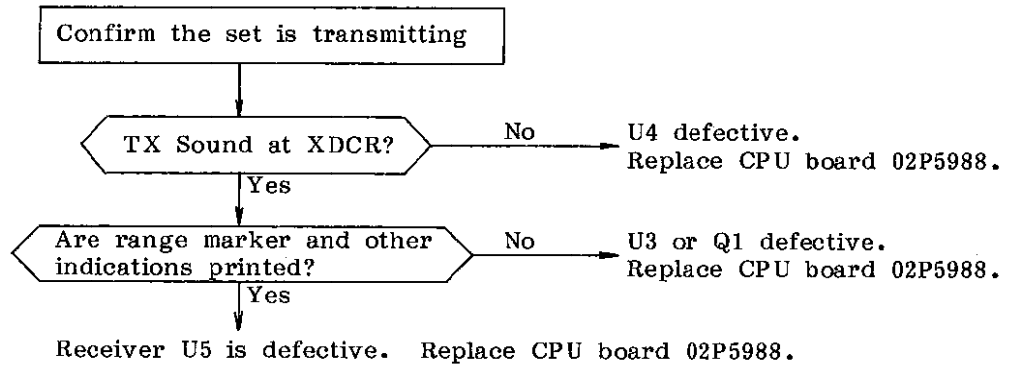
Do not connect the capacitor to the field terminal of the alternator, at the risk of destroying the alternator itself.

**MORE EXTENSIVE TROUBLESHOOTING FOR SERVICE SHOP**

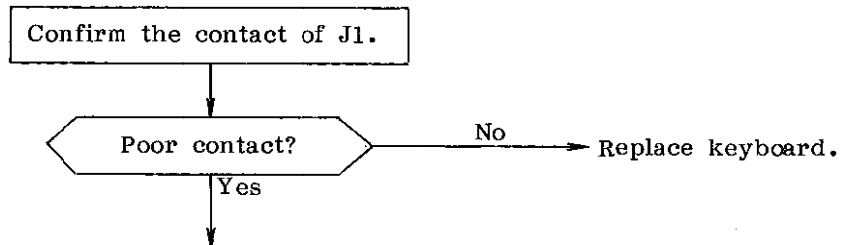
The built-in CPU is initialized by the trigger pulse from the reed switch at every recording timing. Therefore the check of the electric circuit should be started from the generation of the trigger pulse as well as from the power supply voltage. This is easily performed by measuring High and Low level (0 - 5V) with a multimeter. But note that troubleshooting is based on board exchange.



**No Recording on the paper**

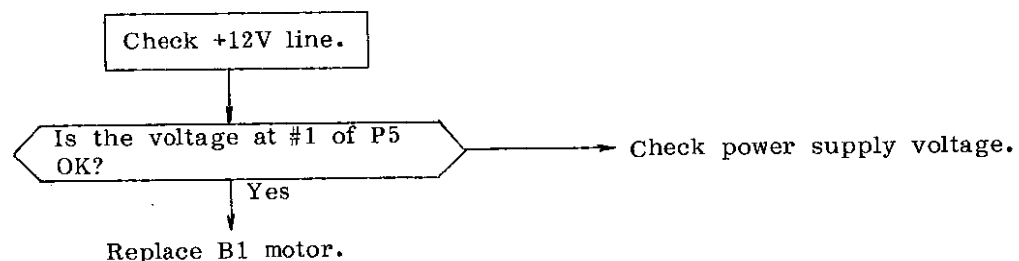


**Keyboard is inoperative**

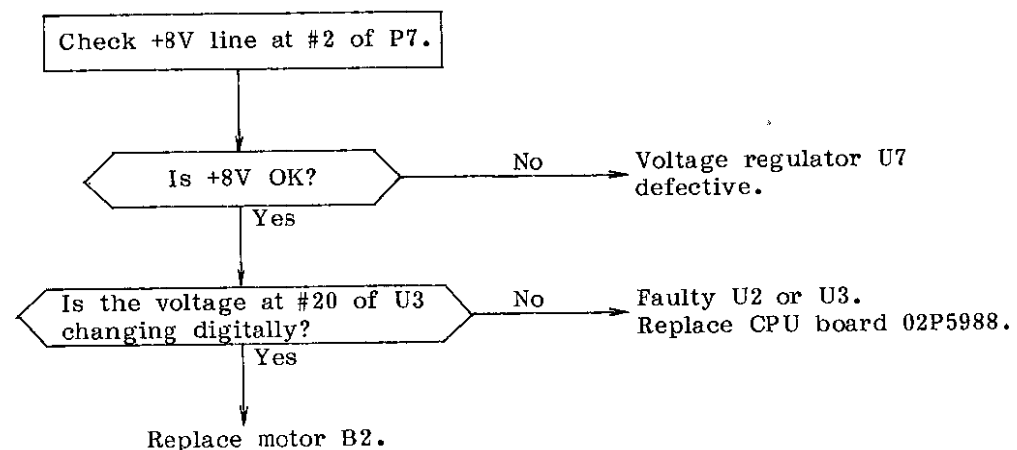


Ensure proper contact. (Even the keyboard status is not transferred to CPU board, the set is working with initial setting but not controlled by keyboard.)

Belt drive motor doesn't rotate.



Paper is not advanced.



### TRANSDUCER CHECK

A simple and reliable check of the transducer is to temporarily substitute a new transducer instead of the existing one to the Recorder Unit. If the recording sensitivity is considerably improved through this exchange, the transducer is considered to be faulty. On the contrary, if no differences are found, the Recorder Unit may be faulty. This method is especially useful for inside-hull or through-hull installation.

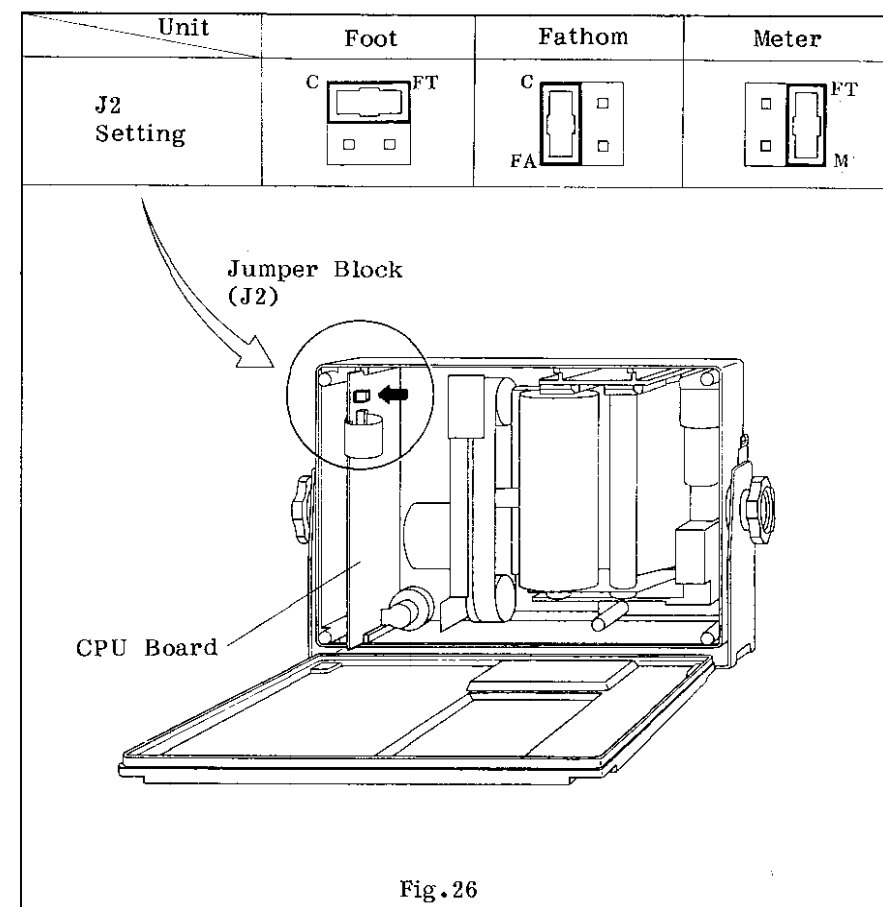
The following quick check also helps to judge the performance of the transducer to some extent.

Haul the transducer from the water and turn on the POWER. Put your ear near the transducer face and carefully listen to the transmission sound. If you can hear a clicking sound, the transducer probably is OK. Next, rub the transducer face with your hand and observe whether any noise appears on the recording paper. The appearance of noise indicates that the transducer is normal. In case of neither sound nor noise, the transducer is likely to be faulty.

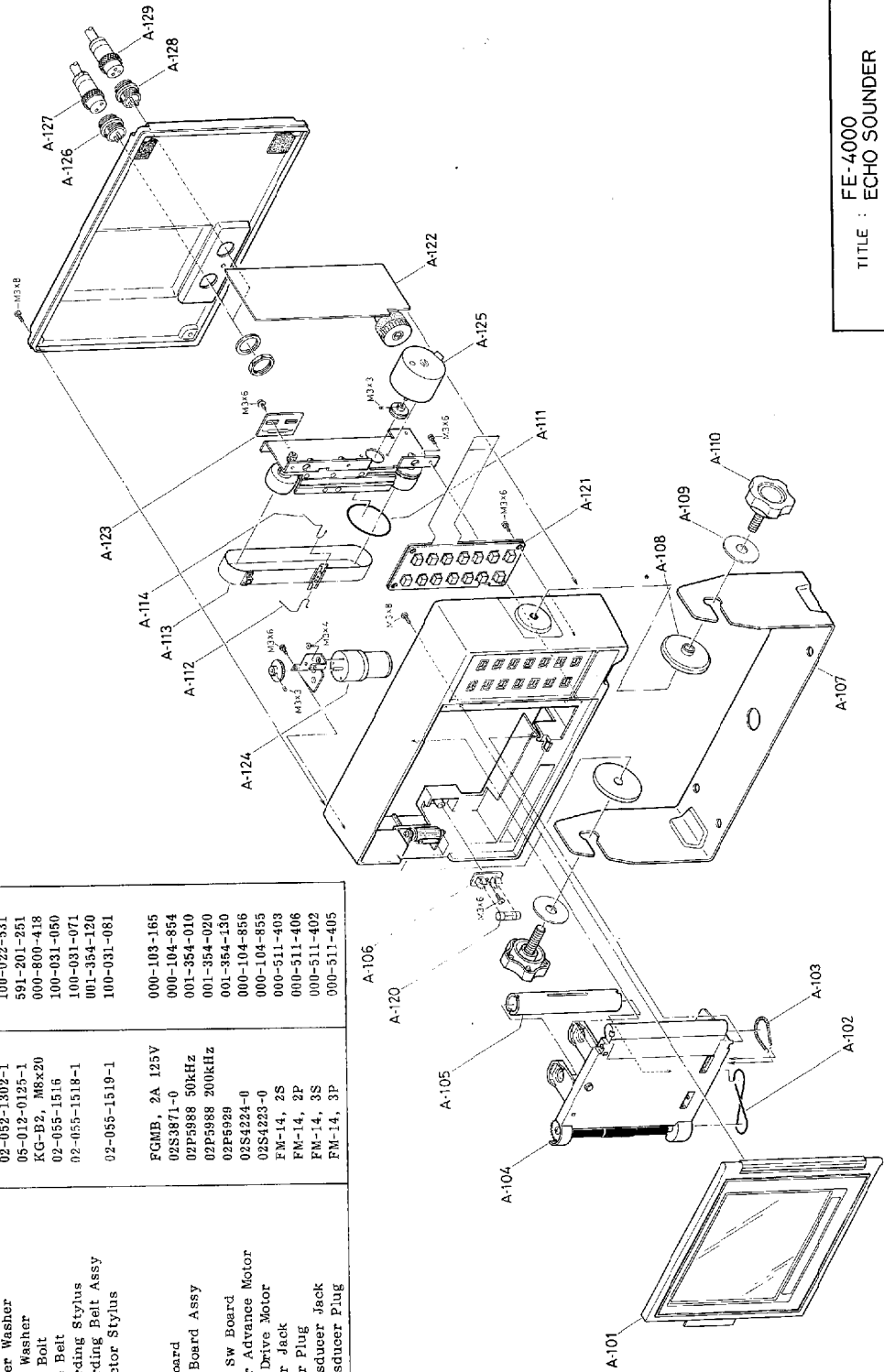
## HOW TO CHANGE INTERNAL SETTING

### CHANGE OF DEPTH UNIT

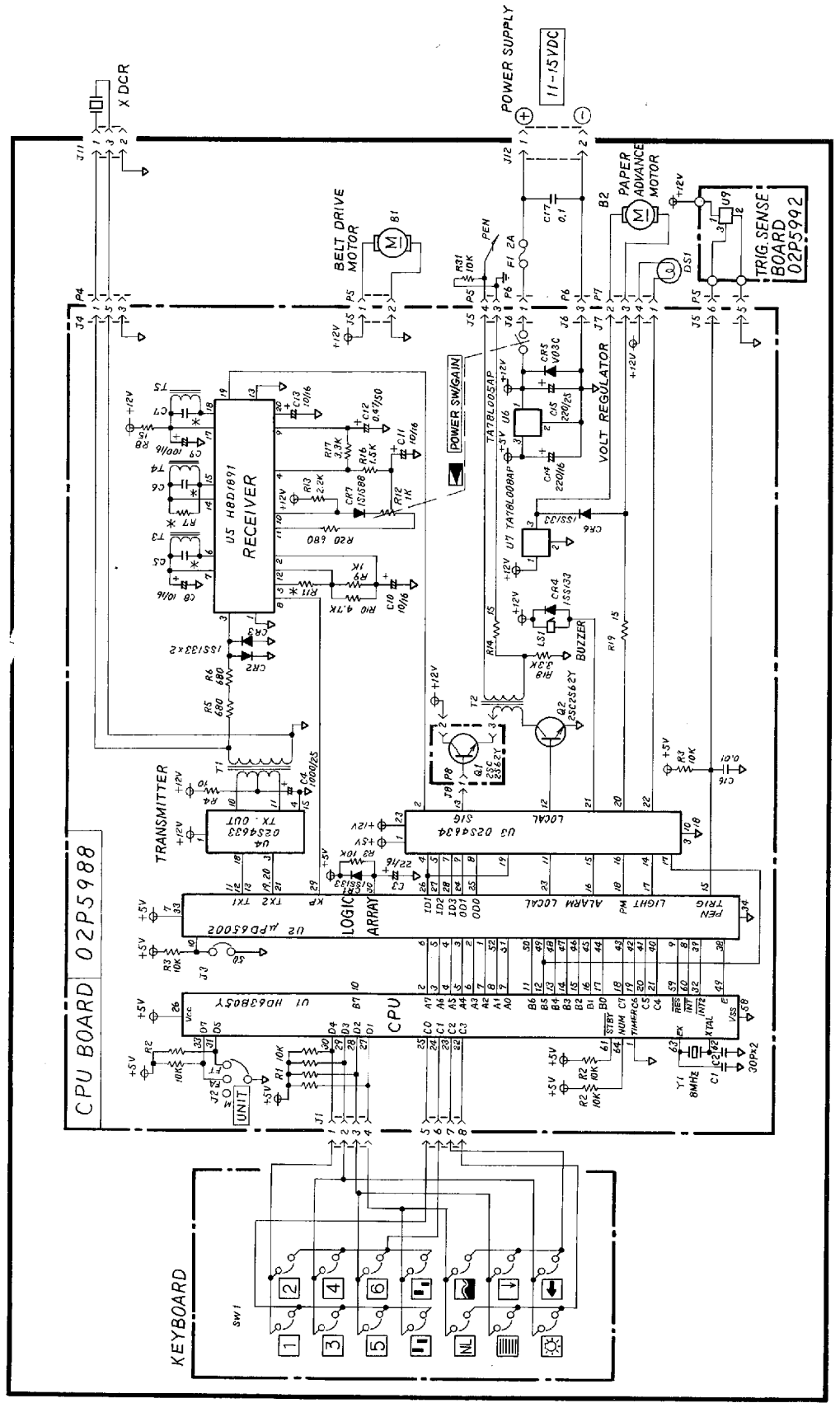
A jumper block is provided on the CPU board to allow custom tailoring of the unit to specific uses, such as fishing method, fishing ground, etc. To change the depth unit; (1) turn off the POWER, (2) remove the rear cover and (3) move the jumper block with a needle-nose plier as shown below.



SYMBOL	NAME	TYPE	CODE NUMBER
A101	Window Plate Assy	02-055-1300-0	001-354-260
A102	Paper Advance Belt	02-055-1413	100-030-890
A103	Break Spring	02-055-1412	100-030-880
A104	Recorder Cassette Assy		001-354-190
A105	Winding Reel	FGS-210020	210-100-212
A106	Fuse Holder	F-6	000-510-638
A107	Rubber Washer	02-055-1601-1	100-031-091
A108	Knob Washer	02-052-1302-1	100-022-581
A109	Knob Bolt	05-012-0125-1	591-201-251
A110	Drive Belt	KG-B2, M8x20	000-800-418
A111	Recording Stylus	02-055-1516	100-031-050
A112	Recording Belt Assy	02-055-1518-1	100-031-071
A113	Collector Stylus	02-055-1519-1	001-354-120
A114			100-031-081
A120	Fuse	FGMB, 2A 125V	000-103-165
A121	Keyboard	02S3871-0	000-104-854
A122	Cpu Board Assy	02P5988 50kHz	001-354-010
A123	Reed Sw Board	02P5988 200kHz	001-354-020
A124	Paper Advance Motor	02P5929	001-354-130
A125	Belt Drive Motor	02S4224-0	000-104-856
A126	Power Jack	02S4223-0	000-104-855
A127	Power Plug	FM-14, 2S	000-511-403
A128	Transducer Jack	FM-14, 2P	000-511-406
A129	Transducer Plug	FM-14, 3S	000-511-402
		FM-14, 3P	000-511-405



TITLE : FE-4000  
ECHO SOUNDER  
DWG. NO. : E2297-002-A



R7	R11	CS-7	33
50 KHE	10K	0.75K	1800P
200KHE	3.0K	1K	Open

TITLE : FE-4000  
SCHEMATIC DIAGRAM  
DWG. NO. E2297-001-C



**FURUNO ELECTRIC CO., LTD.**

No. 9-52, ASHIHARA-CHO,  
NISHINOMIYA-CITY, JAPAN

TELEPHONE : 0798-65-2111  
CABLE : FURUNO NISHINOMIYA  
TELEX : 5644-325/326 FURUNO J  
TELEFAX : 0798-65-4200 (G I / G II)

YOUR LOCAL AGENT/DEALER