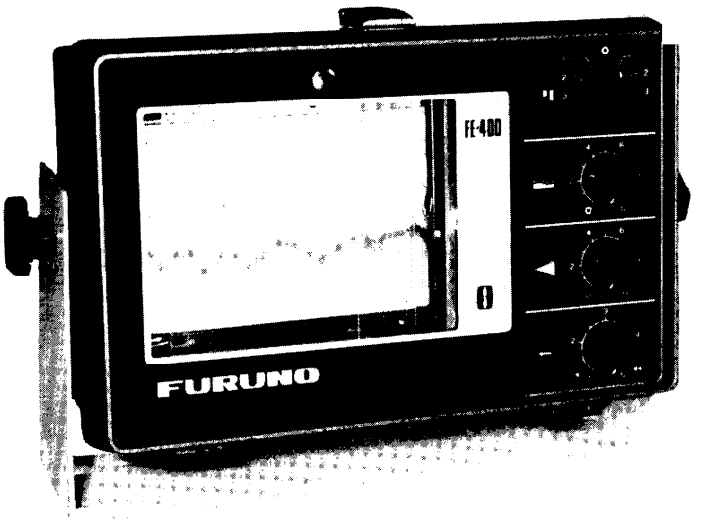
FURUNO

Publication No. OM-E2241-OE

OPERATOR'S MANUAL

ECHOSOUNDER

MODEL FE-400



FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

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FURUNO

CONTENTS
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SPECIFICATIONS OF FE-400

1. DEPTH RANGE

	DEPTH RANGES	SOUNDING RATES(PPM)	FREQ.
FE-400A	0 - 30 - 60 - 90 meters	422	200kHz
	0 - 60 - 120 - 180 meters	211	50kHz
FE-400AF	0 - 15 - 30 - 45 fathoms	422	
	0 - 30 - 60 - 90 fathoms	211	
FE-400AT	0 - 90 - 180 - 270 feet	422	
	0 - 180 - 360 - 540 feet	211	
FE-400B	0 - 40 - 80 - 120 meters	317	200kHz
	0 - 80 - 160 - 240 meters	158.5	50kHz
FE-400BF	0 - 20 - 40 - 60 fathoms	317	
	0 - 40 - 80 - 120 fathoms	158.5	
FE-400BT	0 - 120 - 240 - 360 feet	317	
	0 - 240 - 480 - 720 feet	158.5	
FE-400C	0 - 80 - 160 - 240 meters	158	50kHz
	0 - 160 - 320 - 480 meters	79	
FE-400CF	0 - 40 - 80 - 120 fathoms	158	
	0 - 80 - 160 - 240 fathoms	79	
FE-400CT	0 - 240 - 480 - 720 feet	158	
	0 - 480 - 960 -1440 feet	79	

2. INDICATION
   Straight line recorder

3. RECORDING PAPER
   Dry Electrosensitive Paper
   Type PD-1015, 100mmx15m
   Effective Paper Width, 90mm

4. PAPER ADVANCE
   5-20mm/min, continuously adjustable

5. FREQUENCY
   FE-400A/B: 200kHz or 50kHz
   FE-400C : 50kHz

6. PULSE LENGTH 1ms

7. OUTPUT POWER 100W

8. POWER SUPPLY
   DC11-15V, 6W average
   DC19-40V with optional built-in power adaptor

9. COATING COLOUR
   Newtone Grey No. 3

10. EQUIPMENT LIST

STANDARD

1. Recorder Unit
   (W/vinyl cover & Bracket)
2. Transducer
   200B-5N (For 200kHz)
   Beam width: 10° (3dB down)
   50B-5N (For 50kHz)
   Beam width: 50° (3dB down)
3. Spare Parts

Lamp(P-12)	1pc.
Fuse(F-7161, 2A)	1pc.
Stylus assembly	1pc.
Recording Paper	3rolls
Sandpaper	1sheet

OPTIONAL

1) Power Adaptor for DC19-40V(To be fitted in the recorder)
2) Transducer Adaptor (For use with 50B-6G or 200B-5)

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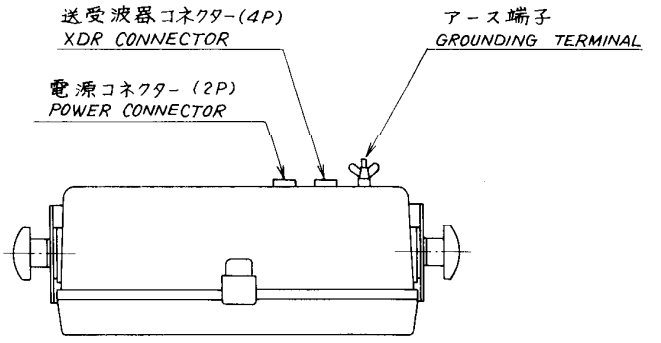

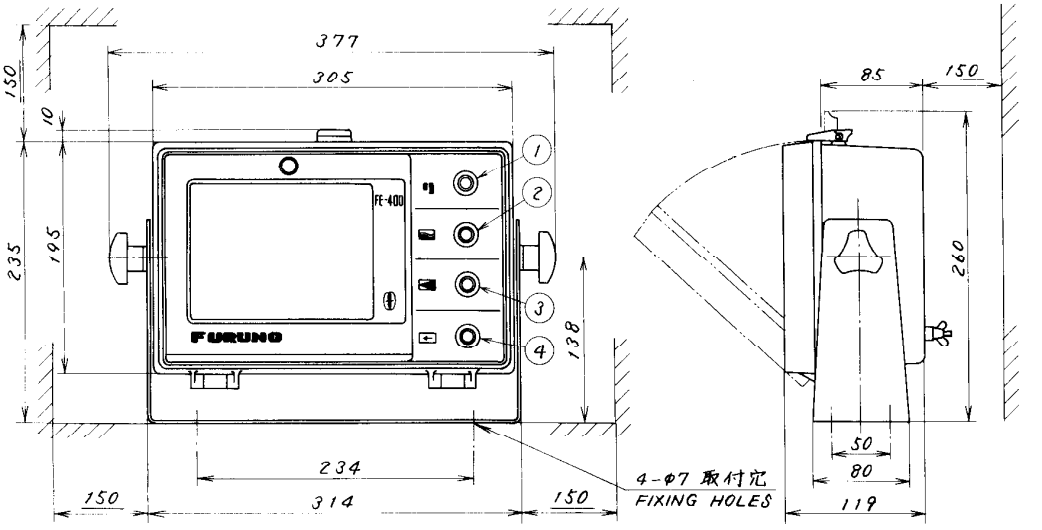

ITEM 品番	NAME 品名	MATERIAL 材質	Q'TY 数量	DWG.NO 図番	REMARKS 摘要
4	紙送り速度 PAPER SPEED		1		
3	感度つまみ GAIN		1		
2	判別つまみ WHITE-LINE		1		
1	電源 深度範囲つまみ POWER & RANGE		1		

承認 APPROVED	OCT·12·'78	三角法 THIRD ANGLE PROJECTION	名称 TITLE FE-400 記録器外観図 RECORDER
検図 CHECKED	Oct. 12. '78	尺度 SCALE 1/5	
製図 DRAWN	Oct. 11 '78	重量 WEIGHT 5 kg	図番 DWG. NO. C2241-001-B

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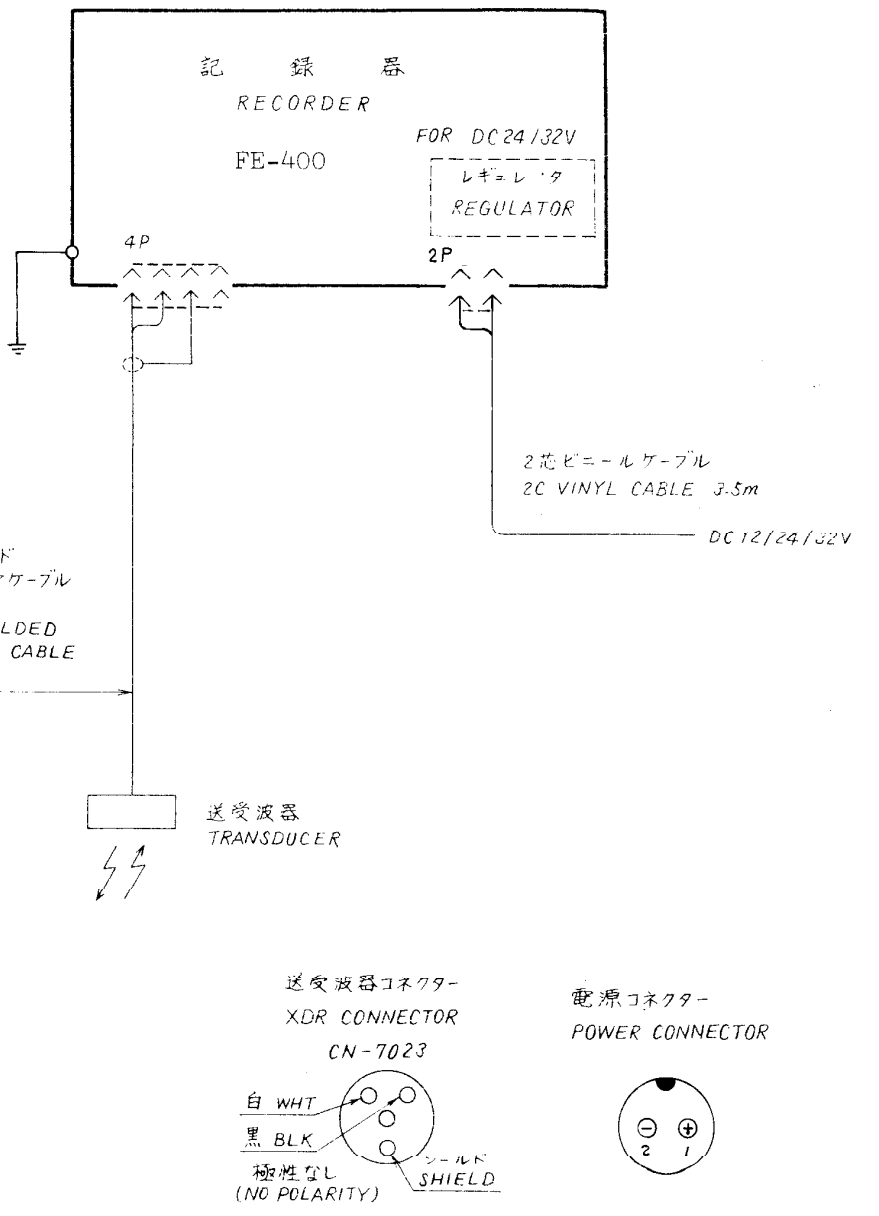

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	APR.19.'79	三角法 THIRD ANGLE PROJECTION	名称 TITLE FE-400 結線図 CABLING DIAGRAM
検図 CHECKED	Apr.18.'79 D.Kondo	尺度 SCALE	
製図 DRAWN	APR.18.'79	重量 WEIGHT kg	図番 DWG.NO. C2241-003-B

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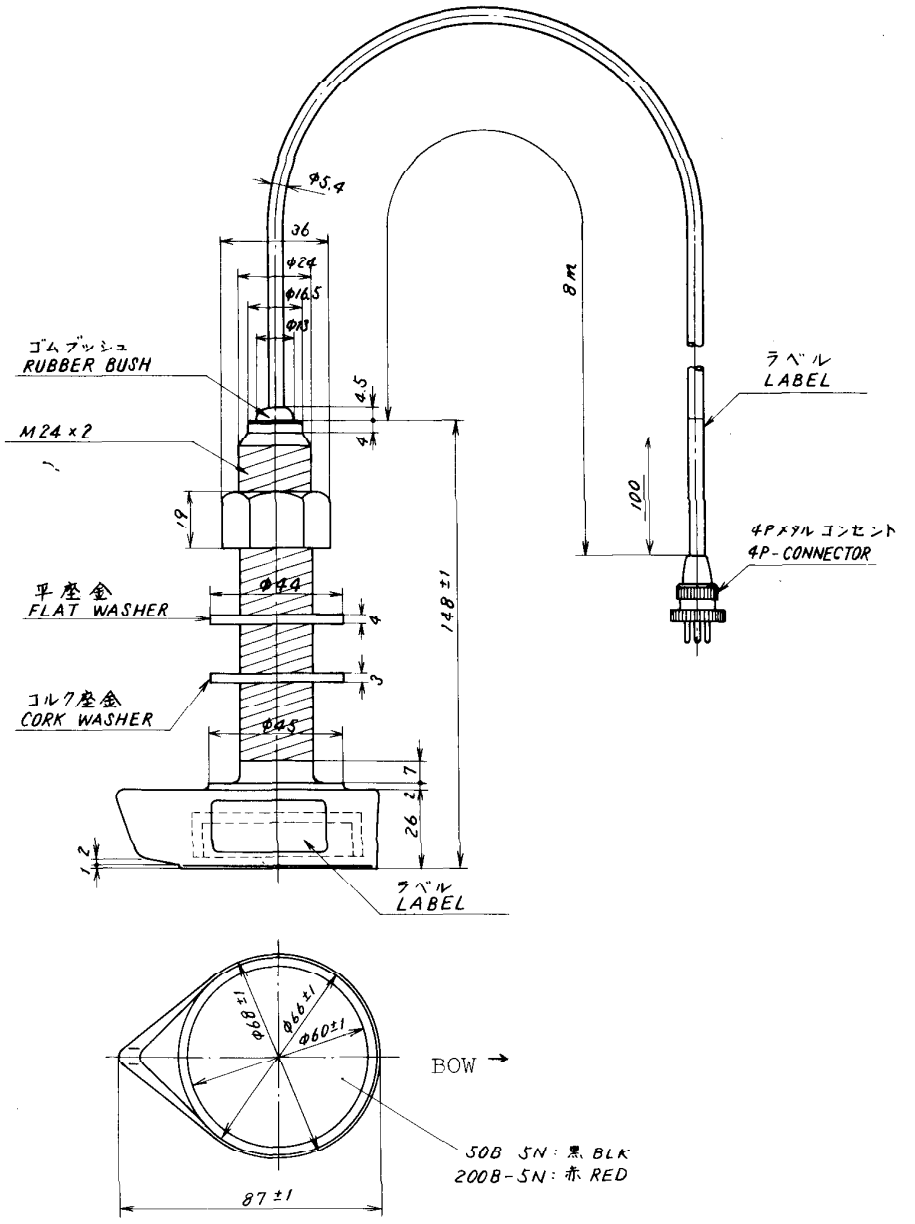

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED		三角法 THIRD ANGLE PROJECTION		名称 TITLE	送受波器 TRANSDUCER
検図 CHECKED		尺度 SCALE	1/2		
製図 DRAWN	Oct.19.'88	重量 WEIGHT	kg	図番 DWG.NO.	C2241-002-B

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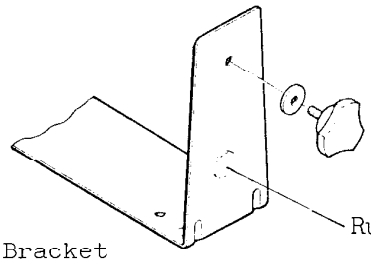
Chapter 1. INSTALLATION

1-1. Recorder Unit

Prior to mounting , select a place easy and convenient for operation, for example, dashboard of steering room.
Fix the mounting bracket at a suitable place with four wood-screws or bolts and nuts. Note that the recorder unit is connected to the transducer, power supply and ship's structure(grounding).

In case that the recorder is resonant with boat's vibration, remove the rubber cushion attached to the inner side of the mounting bracket. See below.



1-2. Power Supply

The recorder can be operated from DC11-15V as standard. DC19-40V is also available with optional built-in power adaptor. Be careful of the polarlity when connecting to the power supply.

1-3. Transducer

Fig. 1-1 shows examples of transducer installations. The transducer is usually installed through the hull bottom after making a small hole.

Precautions for transducer installation:

1. Select a place as far from engine and generator as possible. In small boat, the mid-boat position is usually a good place for the transducer.

2. Make a hole of 25mm dia. on the hull plate. Refer to the drawing C2241-002-B.

3. Pass the transducer cable through attached nut and washers.

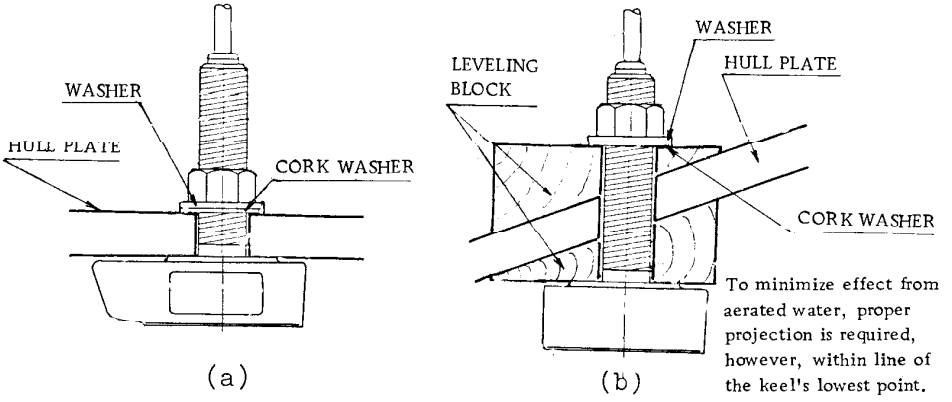


Fig. 1-1

4. Fix the transducer with the nut hand-tight.

5. When the hull bottom is slant, make the transducer face straight down by adding leveling blocks. Refer to Fig. 1-1 (b).

Fig. 1-2 shows the example of sideboard installation. In this case, the transducer should be submerged deep enough to avoid the effect of air bubbles during cruising.

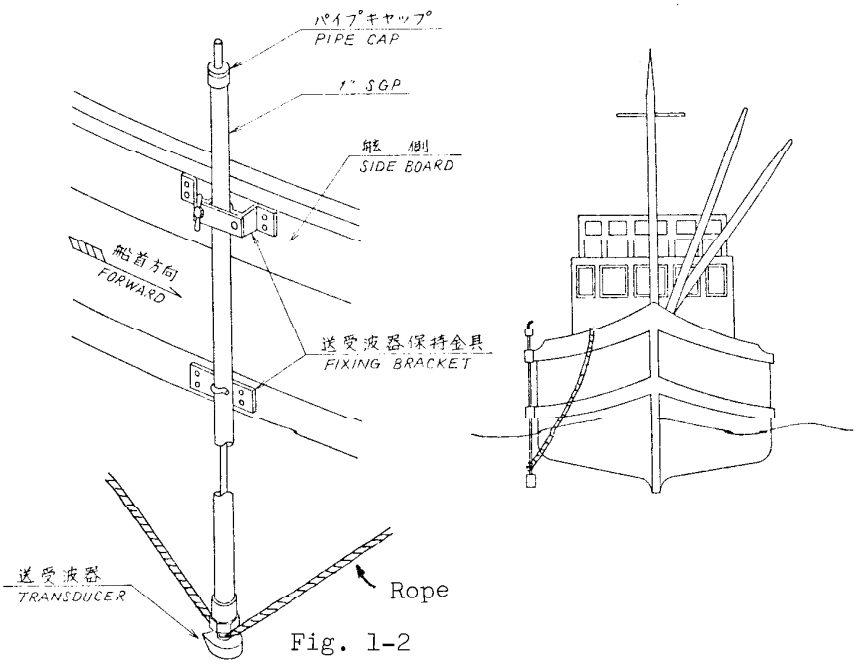


Fig. 1-2

NOTE:

1. When making a hole thru leveling block, take into account that the hole may become smaller in water due to expansion.

CHAPTER 2. OPERATION

2-1. Description of Controls and Switches

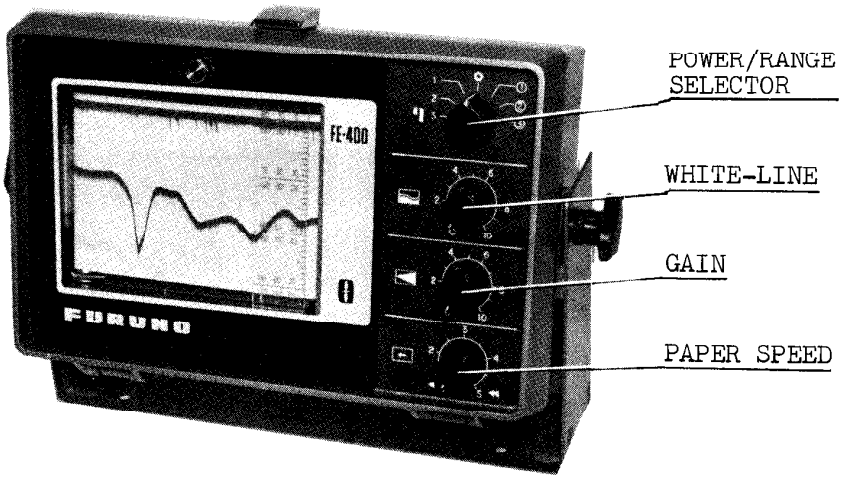
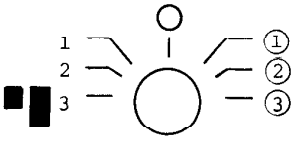


Fig. 2-1 Front Panel Controls

POWER/RANGE SELECTOR

This switch has two functions; power supply "On-Off" and selection of sounding range.



The sounding range is arranged on either side of "○"(Off-position). The left side (1, 2, 3) is for shallow water sounding and the right side (①, ②, ③) for deep sounding respectively.

GAIN

The sensitivity of the amplifier is controlled by this knob. Turn this knob clockwise to get clear and distinct recording.

WHITE-LINE

Turn this knob clockwise, and a white-line appears just below the seabed contour. This function facilitates detecting fish schools near or in contact with the seabed.
If not required, turn it fully counterclockwise(Off-position).

PAPER SPEED ⬅

The paper advance speed is controlled by this knob. It varies from 5mm/min. (◀) to 20mm/min. (◀◀).

ILLUMINATION

When illumination is required, turn this switch to ON. See Fig. 2-2.

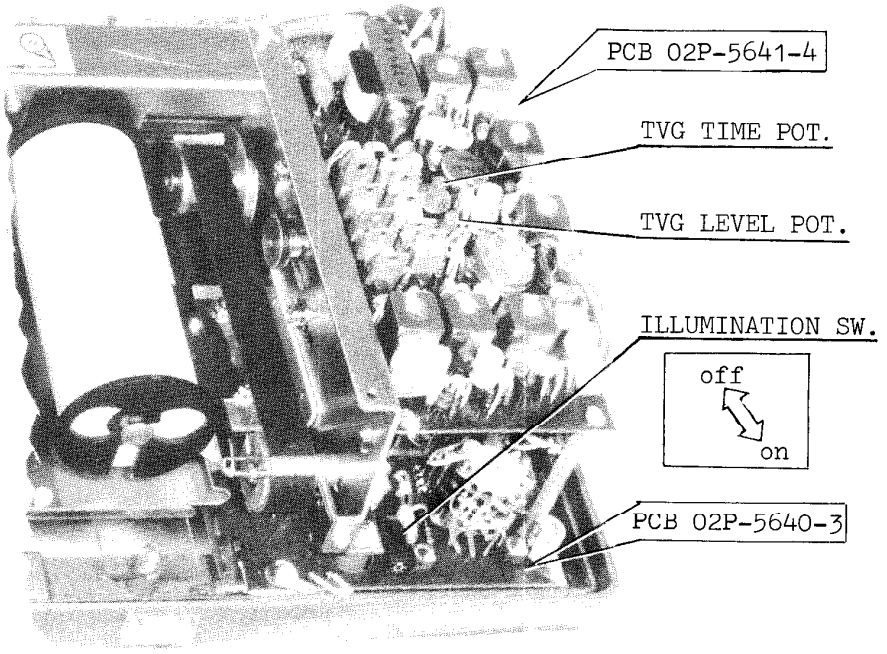


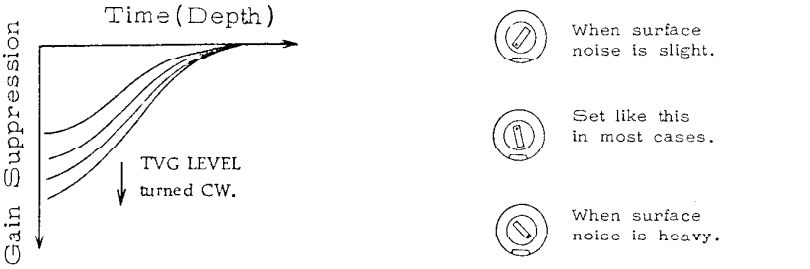
Fig. 2-2 Internal Controls & Switch (Front Door Opened)

TVG LEVEL POT. & TVG TIME POT.

TVG(Time Varied Gain) function is incorporated to improve the echo presentation, namely to eliminate surface noise which may mask small object.

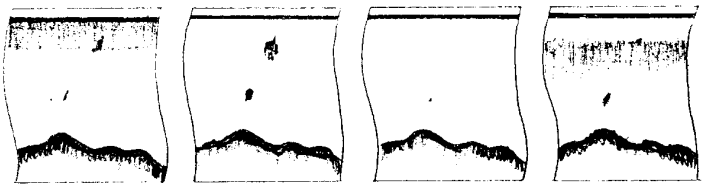
Refer to Fig. 2-2 which shows the location of these POTS. They are set at fully counterclockwise(minimum) position at the factory. Therefore, they are required to adjust with respect to fishing ground condition or customer's request.

TVG LEVEL POT. controls the degree of TVG effect. Refer to Fig. 2-3(a). Turn it clockwise for reducing the amplifier gain at close range.
Fig. 2-3(b) shows the samples of TVG LEVEL setting.



(a) TVG LEVEL (b) Setting of TVG LEVEL

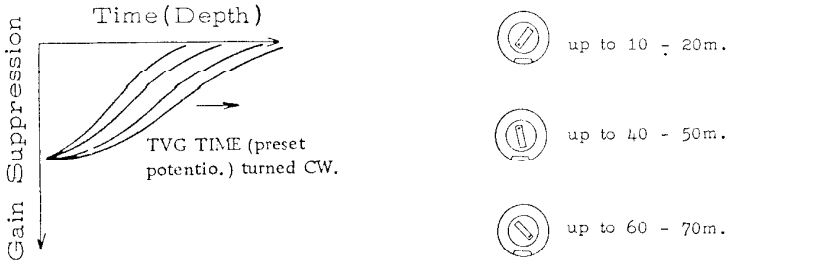
Fig. 2-3



(a) TVG LEVEL set too low (b) TVG LEVEL set properly (c) TVG LEVEL set too high (d) TVG TIME (preset) set too low

Fig. 2-4 TVG Effect

When the surface noise cannot be effectively eliminated as in Fig. 2-4(d), adjust TVG TIME POT. control for proper TVG range. Refer to Fig. 2 5(a). Turn it clockwise for expanding the effective range(depth) of TVG.
Fig. 2-5(b) shows the examples of TVG TIME setting.



(a) TVG TIME (b) Setting of TVG TIME

Fig. 2-5

2-2. Operating Procedure

1. Turn POWER/RANGE SELECTOR to desired sounding range, and power is applied to the equipment.

2. Turn GAIN control knob clockwise until noise slightly appears on the recording paper, then turn it counterclockwise a little.

3. If the zero line is plotted outside "0" of scale, correct its position referring to the para. 2-3, below.

4. Turn WHITE-LINE control knob clockwise when the detection of fish schools near or in contact with the seabed is required.
   If not required, keep it fully counterclockwise(Off-position).

5. Adjust the PAPER SPEED knob for desired paper advance speed.

2-3. Adjustment of Zero Line

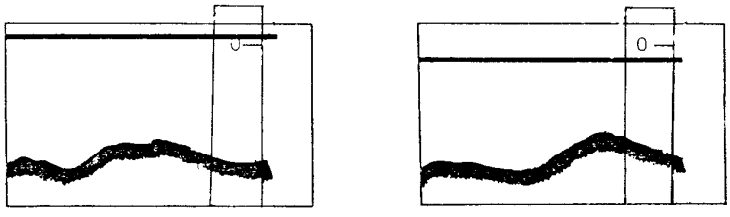
When the zero line is plotted outside "0" of scale, it can be corrected by the zero line adjuster.

To do this

1. Remove the plastic front panel by loosening the fixing screw. See Fig. 2-7.

2. Loosen the setscrew of zero line adjuster by hand, and move it until the zero line comes to "0" reading of scale. See Fig. 2-6.

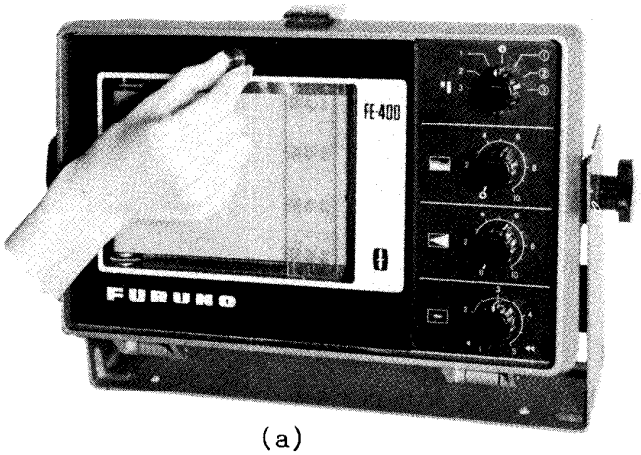
3. Tighten the setscrew and put back the front panel as it was.



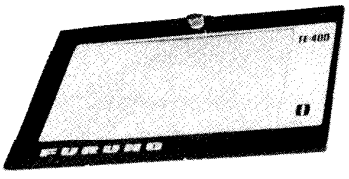
(a) Zero line plotted above "0" of scale.

(b) Zero line plotted below "0" of scale.

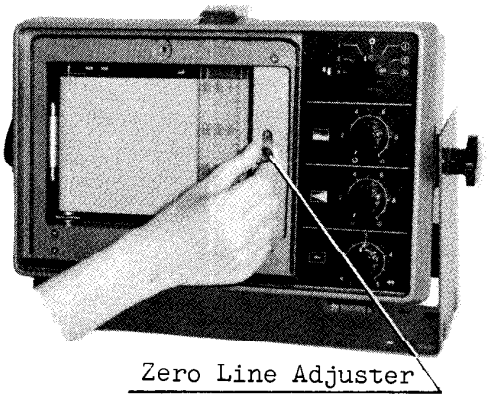
Fig. 2-6



(a)



Front Panel



(b)

Fig. 2-7

NOTE: The zero line can be shifted up to the half of paper width only on basic ranges, starting at zero. This feature enables the recording paper to be used two or more times.

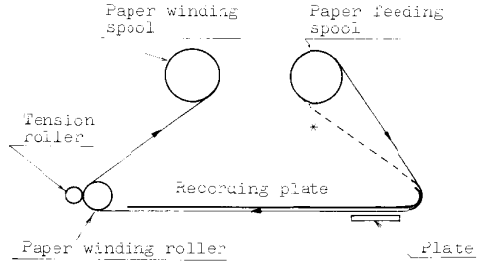
When re-using the used-up paper, wind it tightly with its reel core held by hand, then set it again referring to Fig. 2-8 in para. 2-4.

2-4. Replacement of Recording Paper

Prior to the replacement, turn the POWER/RANGE switch to "○" (Off-position) and open the cabinet door towards you after releasing the clasp.

Procedure

1. Send the recording belt to the rotating direction by hand until the stylus is clear of the paper.
2. Rotate the paper winding roller knob clockwise to wind-up the used paper. (Fig. 2-9 Ⓐ Ⓑ)
3. Remove the brims and take out the used-up paper roll and paper feeding spool.
4. Set the new paper to the paper feeding shaft.
5. Insert the end of the paper into the slot of the winding spool, which was the paper feeding spool, and wind it two or three turns, then set it to the paper winding shaft. (Fig. 2-9 Ⓒ)
6. Put back the brims and correct the paper mis by the paper winding roller. (Fig. 2-9 Ⓓ)
7. Lock the clasp as it was.



* Dashed line for re-using the used-up paper

Fig. 2-8 Recording Paper Set-up

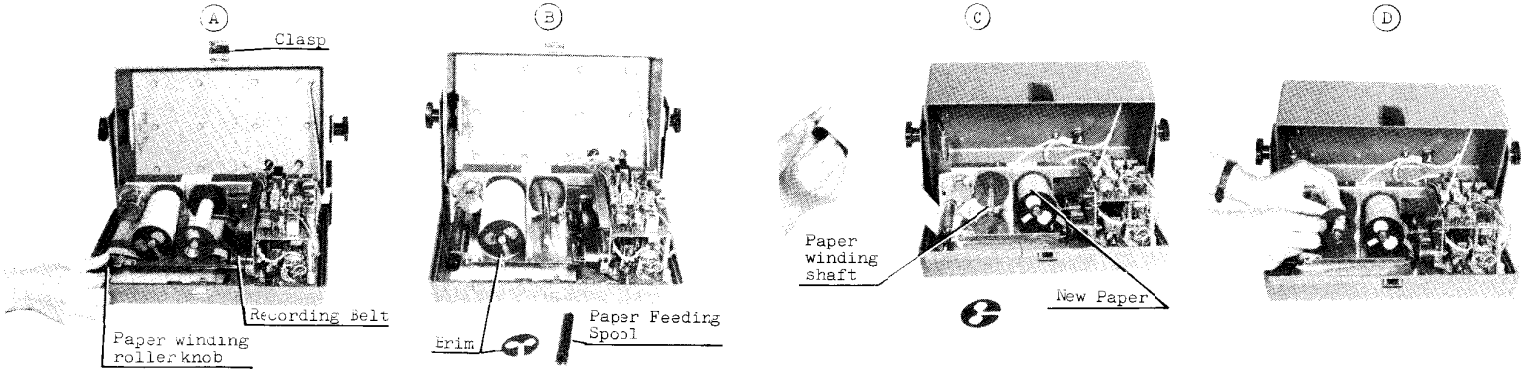


Fig. 2-9

CHAPTER 3. OBSERVATION OF RECORDING

3-1. Detecting Area

The detecting area varies depending on the main beamwidth (beam extent) as shown below. The objects out of the main beam but close to the beam, may also be presented in less dense and size.
Generally beamwidth depends on transmission frequency; narrower beamwidth is obtained with higher frequency.

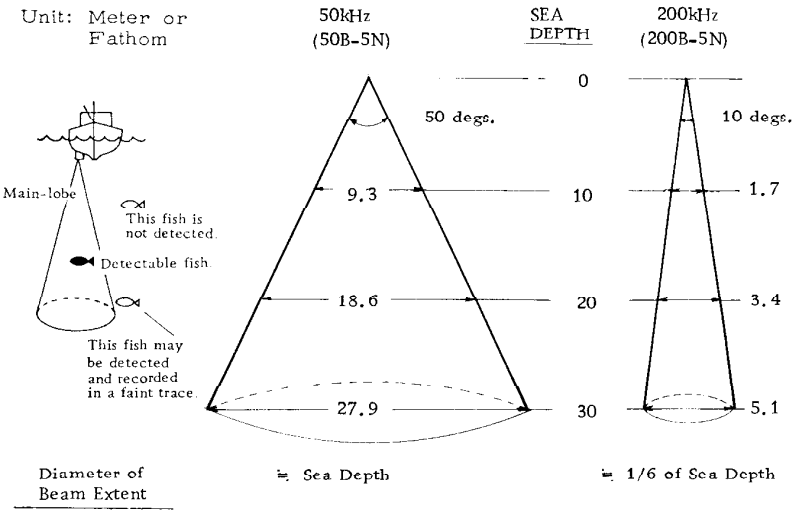


Fig. 3-1

3-2. Observation of Recording

Refer to Fig. 3-2, an example of recording.

1. Zero Line

The zero line appears at the upper edge of the recording paper when the basic range (e.g. 0 - 30m in type A) is selected. In the other range (shifted range) setting, no zero line appears. The line shows the position of the transducer installed on the ship's bottom or sideboard of boat.

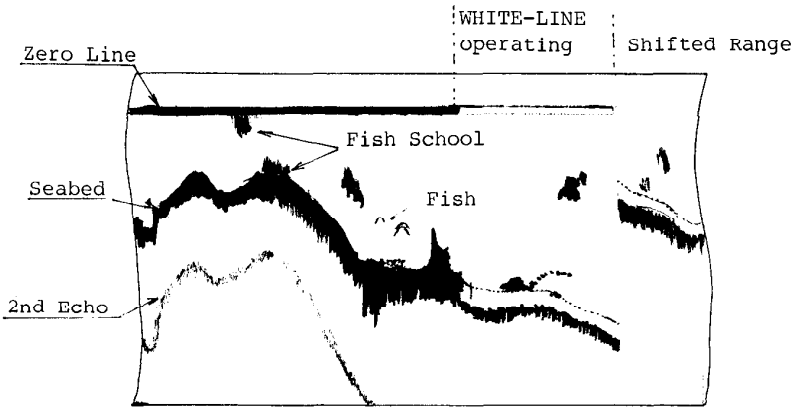


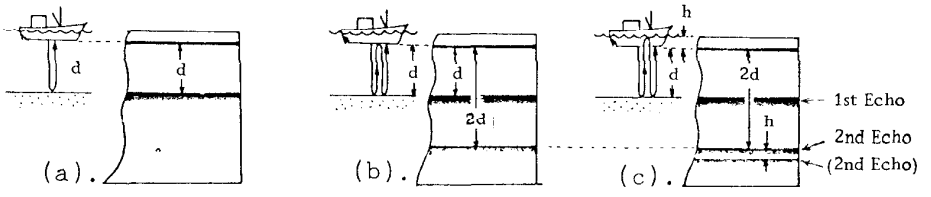
Fig. 3-2 Example of Recording

2. Echoes from Fish School

Fish echoes will generally be plotted between the zero line(no zero line in case of shifted ranges) and first echo of seabed. Usually the fish echo trace is weaker than the seabed echo trace because the reflection surface of fish is smaller and its reflection property is weaker comparing with seabed.
The size of fish school is ascertained from the density of the recording. The GAIN control should be adjusted carefully in order to get a clear recordings.

3. Seabed

The strongest echo is coming from the seabed. Under the shallow depth sounding, the second or third reflection may appear at recurring intervals. The intensity of the seabed echo can be used to determine the feature of the bottom(e.g. soft or hard). The harder the bottom is, the wider the bottom trace is. Beamwidth and amplifier gain also effect the seabed echotrace. Refer to Fig. 3-3 & 3-4.



The transmitted pulse is reflected by seabed.

The sounding pulse coming back from seabed is reflected by ship's hull (Fig. b) or sea surface (Fig. c) and travels in the same path again.

Fig. 3-3

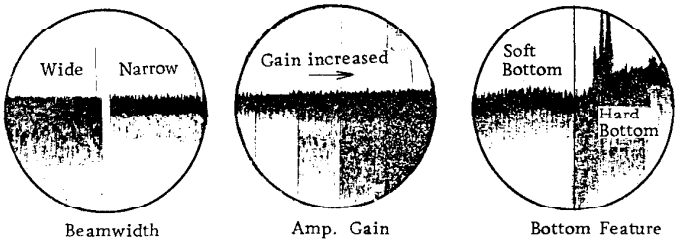
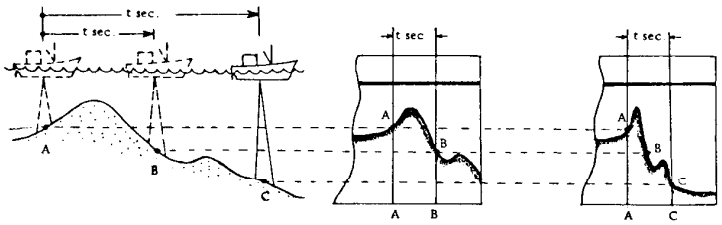


Fig. 3-4

The seabed sometimes appears on the recording paper as if it is very much diminished in size in paper advancing direction. This is based on the relation between ship's speed and paper advancing speed. At a constant paper advancing speed, the appearance of the echo trace is varies with the change of ship's speed as shown below.



(a). Slow Speed (b). Fast Speed

Fig. 3-5

When the sounding frequency is different, the seabed echo is also traced in different form as shown in Fig. 3-6.

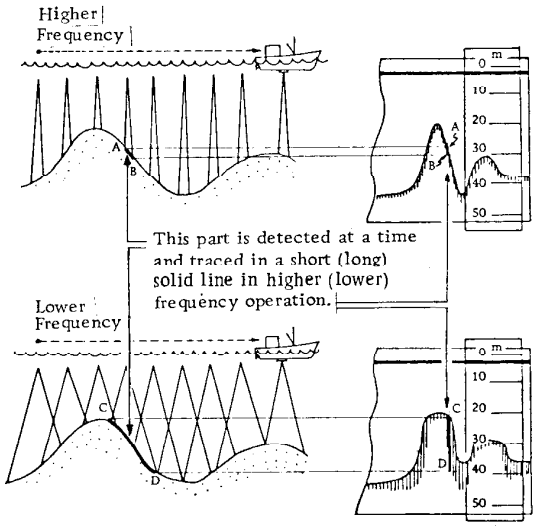


Fig. 3-6

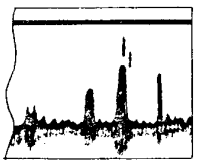
4. Surface Noise

Noise appearing near the zero line is caused by the wake of another boat or aeration. Similar noise sometimes appears when a plancton layer or water temperature difference (thermocline) exists.
The function of TVG is to eliminate the noise masking surface fish and to give clear identification of fish echoes.

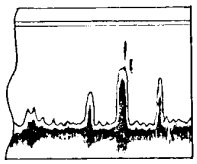
5. White-Line

Generally, fish schools on or close to the seabed are plotted on the recording paper as if they were small rising of seabed. For the identification of such fish schools, white-line function is useful.

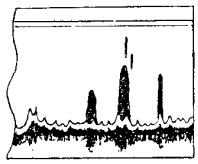
When the while-line circuit is active, the echotrace of seabed is discriminated by a white belt following a thin and feeble line, on which fish close to or in contact with the seabed is recorded. If the seabed line is shaped as shown in Fig. 3-7(a), it is difficult to judge what the rising portion is; rock, any wreckage or bottom fish. The white-line function will then give a suggestion to make a correct judgement. If the rising portion is either rocks, wreckage or protruding parts of the seabed, the seabed line will become like Fig. 3-7(b). If it is a group of bottom fish, the seabed trace will be as Fig. 3-7 (c).



(a). White Line not operated.



(b). White Line operated. No bottom fish.



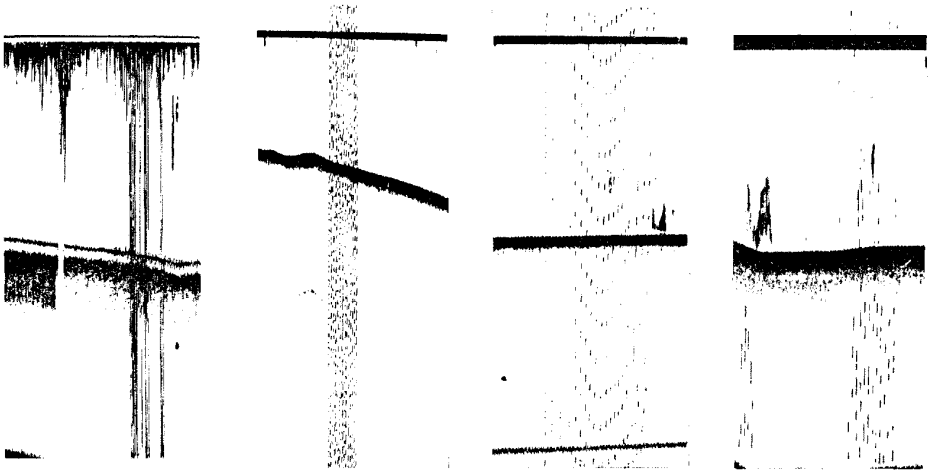
(c). White Line operated. Bottom fish present

Fig. 3-7

6. Interference and Induction

Fig. 3-8 shows the noise caused by the acoustic effect by the swing of the ship, screw noise, induction from other electric wirings, spark and interference from other echosounders. In some cases, reduction of amplifier gain may moderate the appearence of these noises, but it is hard

to eliminate the noise completely without rectifying the noise source. Noise caused by electric induction, such as the one from generator or motor brushes, is plotted in irregular dots or blackening over the recording paper. The interference noise is shown in form of parallel broken lines having regular interval.



(a). Acoustic Effect/ Screw Noise

(b). Electric Induction

(c). Interference from Echosounder operating simultaneously.

(d). Interference from Echosounder operating on Adjacent Ship.

Fig. 3-8

7. Effect of Pitching and Rolling

If the boat rolls and pitches on rough sea, the normal echotrace becomes a zigzag; sawtooth recording.

8. Effect of Sidelobes

When the shape of the seabed is steep, a ghost image is caused by the sidelobe of the beam but this should not cause confusion as it is almost lighter than the actual seabed trace. Refer to Fig. 3-9(a). The effect of sidelobes may also appear on a flat seabed as shown in Fig. 3-9(b).4

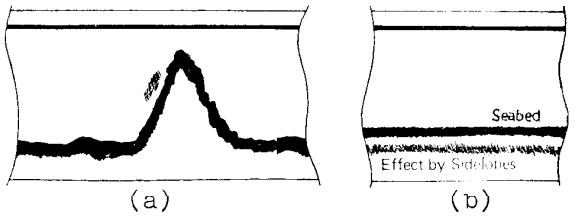


Fig. 3-9

CHAPTER 4. MAINTENANCE

To expect full performance for a long period, periodic inspection and maintenance are necessary. Also connection at the plug-jacks should be kept clean and tight.

4-1. Cleaning & Lubrication

1. Cleaning

As dry electrosensitive paper is used in this set, some carbon powder will pile up on the inner parts around the recording belt. Sweep off the carbon powder with a brush to avoid possible malfunction.

When cleaning, open the front door towards you after releasing the clasp & support string, then sweep off the carbon powder. Refer to Fig. 4-1.

2. Lubrication

When paper winding can not be done smoothly or mechanical noise is encountered, unhook the support string and check the gear engagement, then, if necessary, apply a thin coat of grease to the portions as shown in Fig. 4-1.

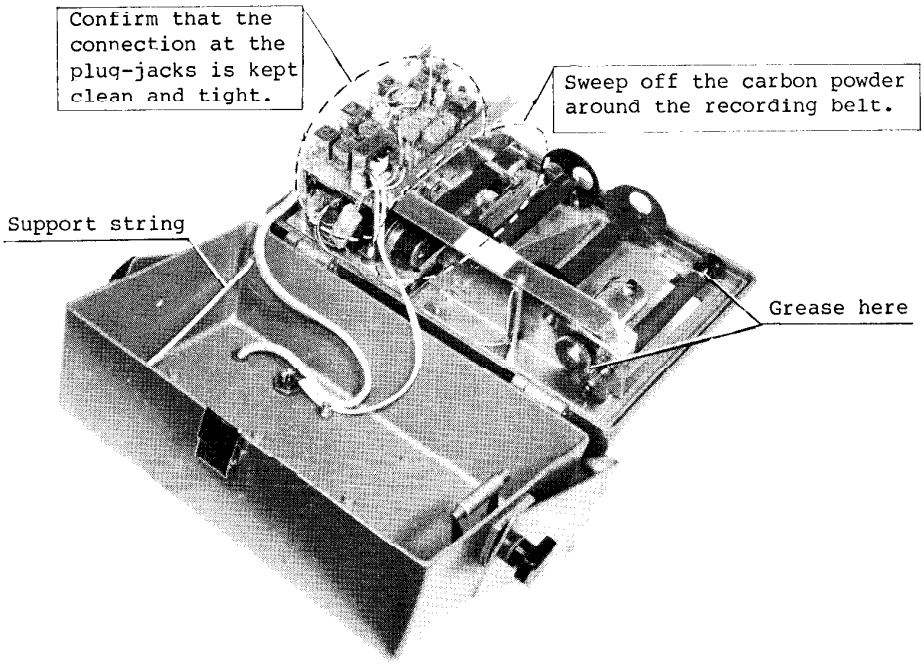


Fig. 4-1

4-2. Replacement of Stylus Assembly

Fig. 4-2 shows the stylus assembly.
When the stylus has worn and becomes shortened causing a poor recording, replace the whole stylus assembly.

In case that the stylus assembly is replaced, round the nib of the stylus by sandpaper or something.

Type: FDW-2250-△4

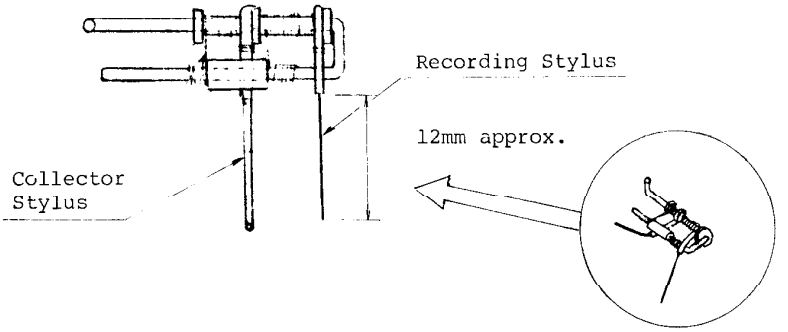


Fig. 4-2 Stylus Assembly

CHAPTER 5. TROUBLESHOOTING

5-1. Troubleshooting Flow Chart

START

Turn POWER/ RANGE SELECTOR to basic range & increase GAIN control for echoes.

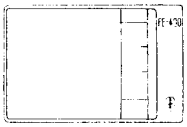
Not working at all

1) Check that 2P power connector is securely plugged in.
2) Open the front panel and check F4201.

Illumination lamp lit but motor not rotating

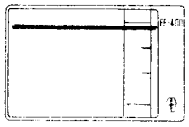
1) Ship's mains voltage drops.
2) Motor or drive circuit defective.
3) Check that application of ship's mains voltage is correct in polarlity.

No zero line and target echoes



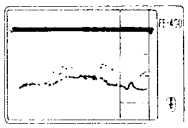
1) Check the trigger pulse is produced by reed sw. and magnet.
2) Check collector/recording styli for contact.

Zero line appears but no target echoes



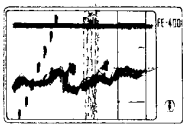
1) Check J4402 for contact.
2) Check the transducer cable if the inner lead is short-circuited or corroded.
3) Faulty transducer
4) Check CR4101, 4102 & Q4101.

Zero line appears but poor sensitivity



1) In the following bottom condition, the recording becomes feeble because the radiated energy is absorbed.
   * muddy bottom
   * algae growing bottom
   * bottom where the rapid current is surging.
2) Replace the transducer with new one for quick check.
3) Check that the recording/ collector styli are in contact with the paper in good condition.

Noise appears

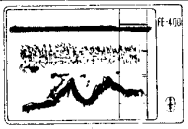


(2) (1)

1) Patchy Noise--- (1)
Caused by other electrical equipment. Find out & rectify noise source.

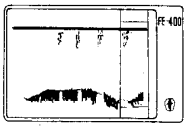
2) Intermittent & comparatively regular noise---(2)
Caused by other echosounders. Go away from other ship.

Fish school masked by the surface noise



1) Readjust TVG LEVEL & TVG TIME as necessary.
2) If the TVG function is not operating, check TVG circuit, C4114, Q4103 & Q4104 etc.

Intermittent echotrace



1) In most case, it is caused by aeration. In case that this phenomenon is always encountered, it is required to relocate the transducer position.

Adjust PAPER SPEED

Paper speed control not operative

1) Check gears, rollers & reels etc.
2) Check &, if necessary, replace Q4210 & motor B4402.

Paper edge torn by recording stylus

1) Check the contact between the recording stylus and the paper.

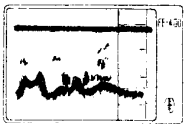
Change DEPTH RANGE

No echotrace on particular depth range

1) Check the reed switch related to that range.
2) Check the magnet on the belt and, if necessary, replace the whole belt assy.

Turn WHITE-LINE control "ON"

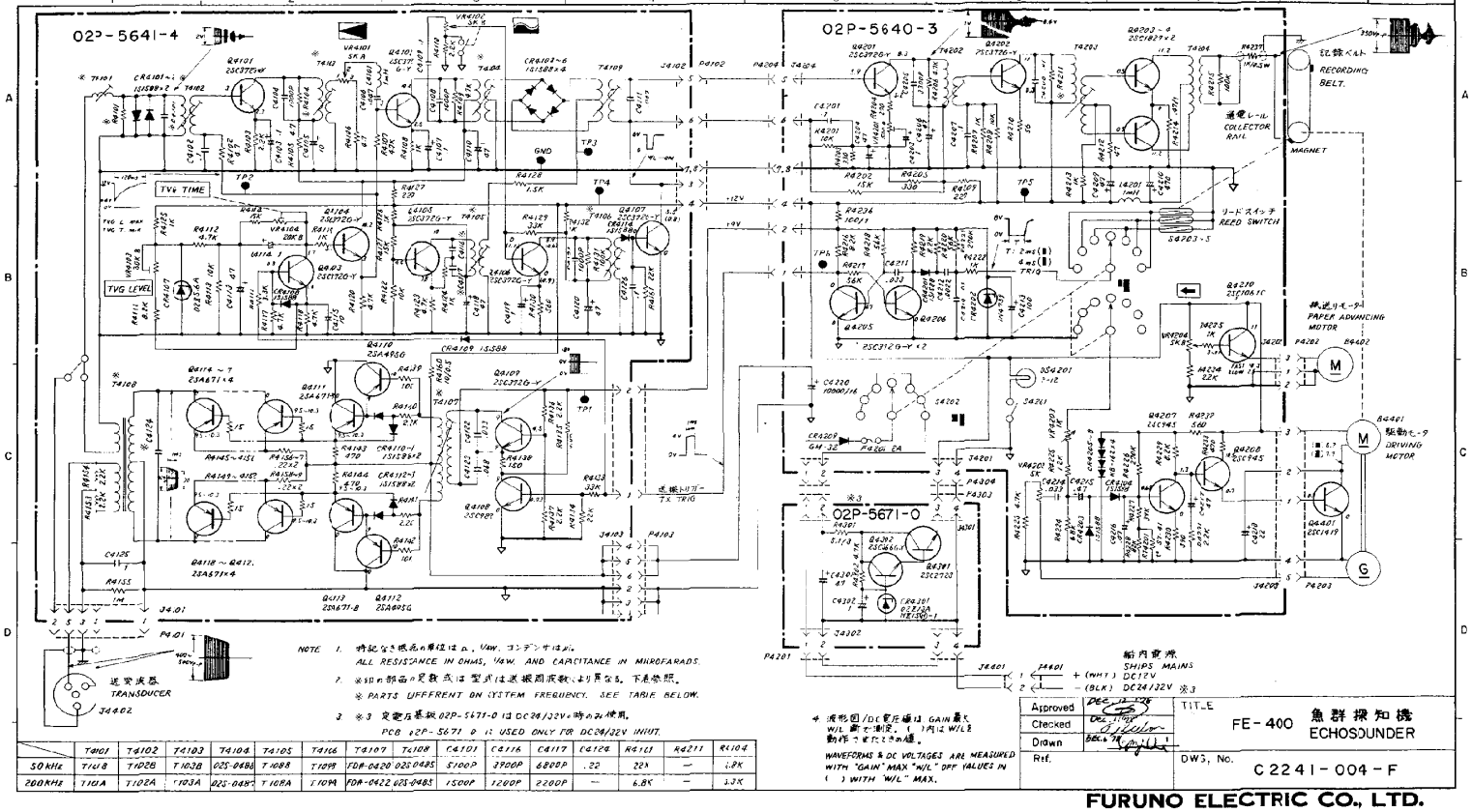
WHITE-LINE not operating



1) Too low GAIN setting. Increase GAIN, then adjust WHITE-LINE control.
2) Faulty white-line circuit. Check Q4106 & Q4107.

FURUNO

S-1



NOTE 1. 特記なき抵抗の単位は Ω, 1/4W, コンデンサは μF.
ALL RESISTANCE IN OHMS, 1/4W, AND CAPACITANCE IN MICROFARADS.

2. ※印 n 部品の定数 or 型式は送受周波数により異なる。下表参照。
※ PARTS DIFFERENT ON SYSTEM FREQUENCY. SEE TABLE BELOW.

3 ※3 定電圧基板 02P-5671-0 は DC24/32V 時のみ使用。
PCB 02P-5671 0 IS USED ONLY FOR DC24/32V INPUT.

4 波形図/DC電圧値は GAIN 最大 W/L 最大で測定。( )内は W/L 動作させたときの値。
WAVEFORMS & DC VOLTAGES ARE MEASURED WITH "GAIN" MAX "W/L" OFF VALUES IN ( ) WITH "W/L" MAX.

	T4101	T4102	T4103	T4104	T4105	T4106	T4107	T4108	C4101	C4116	C4117	C4124	R4101	R4211	R4104
50 kHz	T101B	T102B	T103B	025-0498	T108B	T109B	FDA-0420	025-0485	5100P	3900P	6800P	.22	22K	—	1.2K
200 kHz	T101A	T102A	T103A	025-0487	T108A	T109A	FDA-0422	025-0485	1500P	1200P	2200P	—	6.8K	—	3.3K

Approved	DEC. 1'78	TITLE	FE-400 魚群探知機 ECHOSOUNDER
Checked	DEC. 1'78		
Drawn	DEC. 1'78	DWG. No.	C2241-004-F
Ref.			

FURUNO ELECTRIC CO., LTD.