No. : OM-E2206-1G

FURUNO

OPERATOR'S MANUAL

NAVIGATIONAL ECHOSOUNDER

MODEL F-851S

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

870110J(871)
PRINTED IN JAPAN

FURUNO

CONTENTS

* * * * * * * *

FURUNO

SPECIFICATIONS OF F-851S NAVIGATIONAL ECHOSOUNDER

1. DEPTH RANGES, SOUNDING RATES & PAPER SPEED

Depth Ranges(meters)	Sounding Rates(/min.)	Paper Speed(mm/min.)	
		Fast	Slow
0- 40 30- 70 60- 100 90- 130	310	12.8	6.4
0- 80 60-140 120- 200 180- 260	155	6.4	3.2
0-200 150-350 300- 500 450- 650	62	2.6	1.3
0-400 300-700 600-1000 900-1300	31	1.3	0.7

2. MAX. SOUNDING(Under favorable conditions. Guidance only.)

28KHz: 1500m, 50KHz: 900m, 200KHz: 400m

3. RECORDING SYSTEM & RECORDING PAPER

Belt straight line recording system
Dry electrosensitive paper AD-20: 204mm x 20m
Effective width 180mm

4. TRANSMITTER CHARACTERISTICS

Frequency: 28, 50 or 200KHz
Pulselength: Associated with gain control switch.

Gain Settings	28/50KHz	200KHz
0 - 2	0.7msec	0.3msec
3 - 10	1.5msec	0.7msec

Output power: 100W

5. TRANSDUCER & TANK

Frequency(KHz)	Transducer	Beamwidth(-3dB)	XDR Tank
28	28F-18	22°	TTS-2800-2
50	50B-9	$12^{\circ} \times 28^{\circ}$	TTS-5000-2
200	200B-8	5.4°	TTS-2000-2

6. POWER SUPPLY & POWER CONSUMPTION

1) DC 12/24/32V
2) AC 110/220V, 50/60Hz, 1ϕ, 75VA
(50/60Hz --- Different gear used)

7. COATING COLOR

Munsell notation 2.5G 7/2 (standard)

COMPLETE SET

Standard Supplies

No.	Name		Q'ty	Dimensions (mm)	Weight (Kg)
1	Recorder *	Bulkhead Mount	1	410 x 530 x 202	35
		Flush Mount		518 x 640 x 218	43
2	Transducer with 15m Cable & Tank *	TTS-2800-2	1		
		TTS-5000-2			
		TTS-2000-2			
3	Installation Materials		1 set		
4	Spare Parts		1 set		
5	Spare Parts Box, JIS F0902 (23-20)		1	355 x 220 x 205	3.6

Optional Supplies

Junction Box**
Matching Box**
Transducer Switch Box
Sub-indicator or ED-202 Depth Indicator

* Specify necessary type.
** Junction Box is required for extension of transducer cable. Matching Box is required instead of Junction Box when transducer cable length exceeds 100m. Specify necessary quantity.

INSTALLATION MATERIALS

(Supplied only for bulkhead mount type recorder.)

Name	Type	Q'ty
Bracket with Bolt		3
Rubber Packing		6
Washer		3
Hex. Nut	M10	3

STANDARD SPARE PARTS & TOOLS

Name	Q'ty	
Recording Belt	1 pc.	
Recording Stylus Assy.	2 pcs.	
Collector Stylus Assy.	2 pcs.	
Stylus Nib	10 pcs.	
Fuse		
1A for AC110/220V sets	2 pcs.	
3A for DC24/32V sets	2 pcs.	
10A for DC12V sets	2 pcs.	
Lamp (Winker type, 6V, 1.5W)	6 pcs.	
Recording Paper PD-2020(AD-20)	4 rolls	One roll fitted in recorder
Screwdriver (+ head, large)	1 pc.	
Screwdriver (+ head, small)	1 pc.	
Long Nose Plier	1 pc.	
Adjustable Spanner	1 pc.	
Machine Oil	1 pot	
Grease	1 tube	
Resistors for Source Volt. Alteration	1 set	For DC set only
100 ohms	1 pc. each	
120 ohms		
390 ohms		
3.3K ohms		
4.7K ohms		
82 ohms	2 pcs. each	
150 ohms		

CHAPTER 1. INSTALLATION

1-1. Recorder Unit

The recorder unit is available either in bulkhead or flush mount type and is generally mounted on the bulkhead in the steering bridge. The unit should be installed in any dry, well ventilated and waterproof location, and at a place where easy access to the unit and effective observation of the recordings are ensured.

In bulkhead mount type, three installation brackets (bolt welded) should be fixed on the bulkhead as in Dwg.No.C2206-003-B, and then the unit is settled on the brackets by tightening the nuts. In flush mount type, cut out the panel as in Dwg.No.C2206-004-B, and then settle the unit with screws or bolts and nuts.

1-2. Cabling

Cabling to the recorder unit is very simple. This is made by connecting only the power and transducer cables to the terminal board. Refer to Dwg.No.E2206-013-B.

When the sub-indicator or ED-202 digital depth indicator is combined, refer to the installation drawings in the respective Operator's Manuals.

1-3. Transducer

The transducer is contained in a transducer tank and the tank is installed in the hull so that the face of the transducer is just flush with the hull bottom (hull bottom interior installation) in normal way.

The installation of the transducer should be accomplished by a dockyard referring to the installation drawings.

NOTE: Discussions should take place and agreement reached with the dockyard for sufficient reinforcement and watertightness of the hull to comply with the regulations concerned.

When installing the transducer, the following points should be taken into account.

FURUNO

1. One of the most important considerations is the selection of the transducer position. The ideal position is one in which there is "solid" water free from aeration beneath the transducer, and where the effect of surface, engine and propeller noise are at a minimum. A position found to be satisfactory in one design of ship will not necessarily produce equally good results in another.

2. The air bubble stream normally starts about a quarter length of the ship from the stem, and divides about three quarters of the length from the bow. The bubble stream varies in form and intensity according to the speed, draught, shape of bow and hull, and the trim of the ship as well as the sea state.

3. In a laden ship of normal design, a position somewhere near a quarter of the ship's length from the stem will often be found to give satisfactory results. With ships making long voyages in ballast, however, such as oil tankers, because of the light draught forward an after position about three quarters of the ship's length from the stem is often most suitable.

4. It is recommended to install the transducer on or off the keel line; between 600mm and 900mm from the keel to minimize the effect of aerated water.

5. Siting near obstructions such as the forward propeller, bow thruster, water intake pipes and external speed measuring devices should be avoided.

6. Select a place giving a minimum mechanical shock.

7. Do not lay the transducer cable near or in parallel with other electric cables.

8. To extend the transducer cable, junction box is required and 660V DPYCS-2.0 or equivalent should be used.

9. When the transducer cable length exceeds 100m, matching box is required instead of junction box. The matching box should be installed as near the transducer as possible.

1-4. Thru-hull Pipe

1. Remove cap nut, washer and packing from the thru-hull pipe.

2. Apply seal tape to the threads of the pipe for watertightness.

3. Install the transducer tank in the hull and then feed the transducer cable into the inside of the hull through thru-hull pipe.

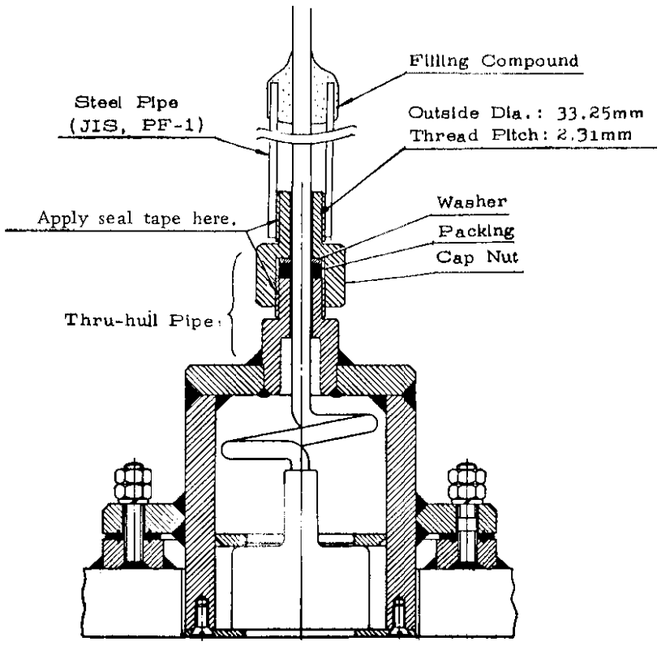
4. With the transducer supported by a stand or so, carefully pull up the transducer cable from the inside of hull until the cable is left about 30cm below thru-hull pipe. Note that the strong tensile or careless handling of the cable, such as contact with sharp edge, may result in damage of the cable.

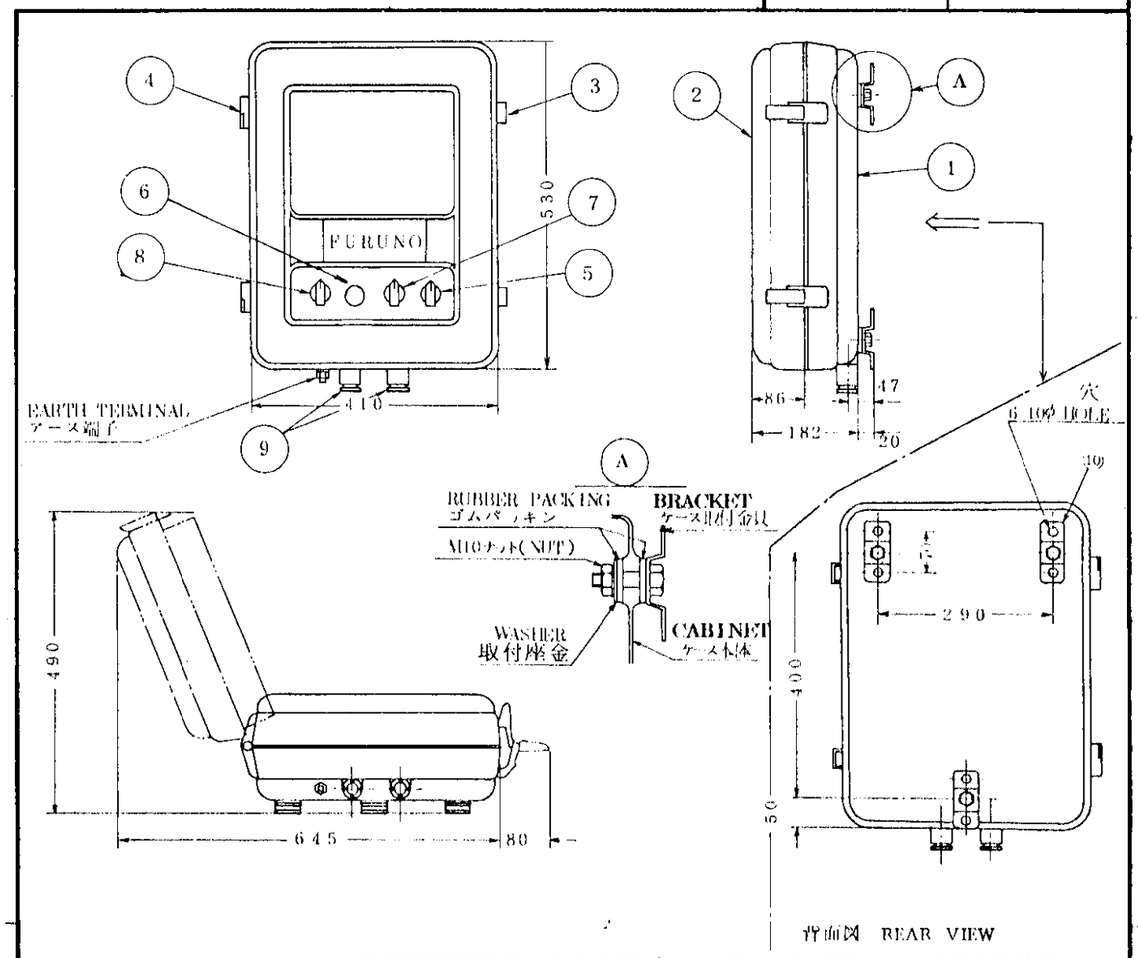
5. Pass the cable thru the packing, washer and cap nut.

6. Apply grease to the packing and washer, and settle them on the thru-hull pipe.

7. Screw the cap nut onto the pipe by hand and then continue about two turns with a spanner. Never tighten the nut too much. Excessive tightening may cause the cable to be damaged.

8. It is recommended to enclose the transducer cable in conduit or pipe for waterproof purpose and electrical shield. The conduit should be secured on the upper section of the thru-hull pipe. The pipe should be of such a length that is well above the water level when the ship is fully loaded. The top end should be finished with filling compound.

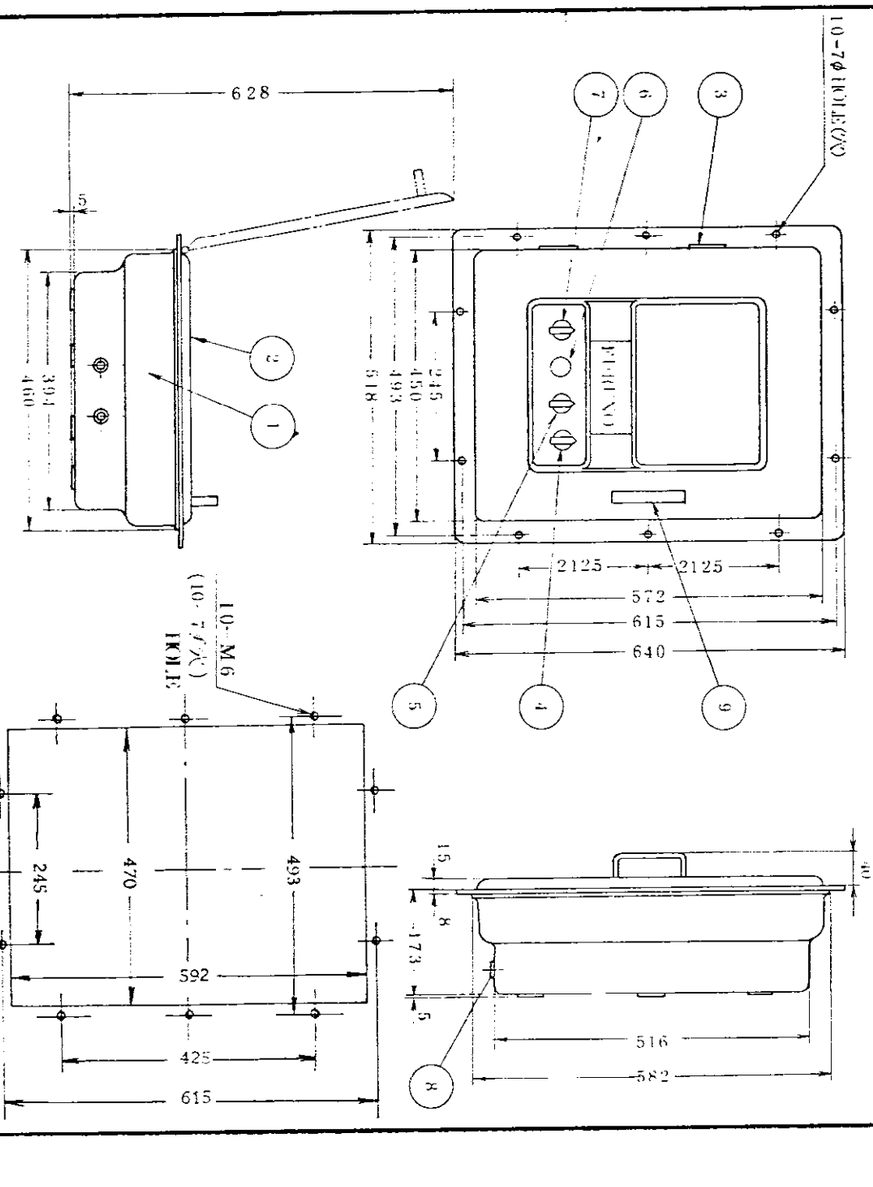




ITEM	NAME	MATERIAL	Q'TY	DWG. NO.	REMARK
10	ケース取付金具 BRACKET WITH BOLT	SUS304	3		
9	電線貫通金物 CABLE GLAND		2		JIS F8801-A20b
8	感度調整 GAIN CONTROL	フェノール樹脂 SYNTH. RESIN	1		
7	電源及び深度切換 SOURCE & RANGE SWITCH	〃	1		
6	吃水調整 DRAFT CONT	〃	1		AC-セットのみ AC SET ONLY
5	照度調整 ILLUMINATION CONTROL	フェノール樹脂 SYNTH. RESIN	1		
4	蝶番 HINGE	SUS304	2		
3	バッチン錠 LOCK	SUS304	2		
2	ケース蓋 CABINET DOOR	AC7A-F	1		
1	ケース本体 CABINET	AC7A-F	1		

課長 APPROVED	76.2.6	尺度 SCALE	1/10	名称 TITLE: F-851S 記録器外観図 (ACセット, 壁掛型) RECORDER OUTLINE DRAWING (AC SET, BULKHEAD MOUNT)
検図 CHECKED		図法 DRAWING	三角法 TRIGON	
製図 DRAWN		重量 WEIGHT	35 kg	図番 DWG. NO. C2206-003-B

FURUNO ELECTRIC CO., LTD.

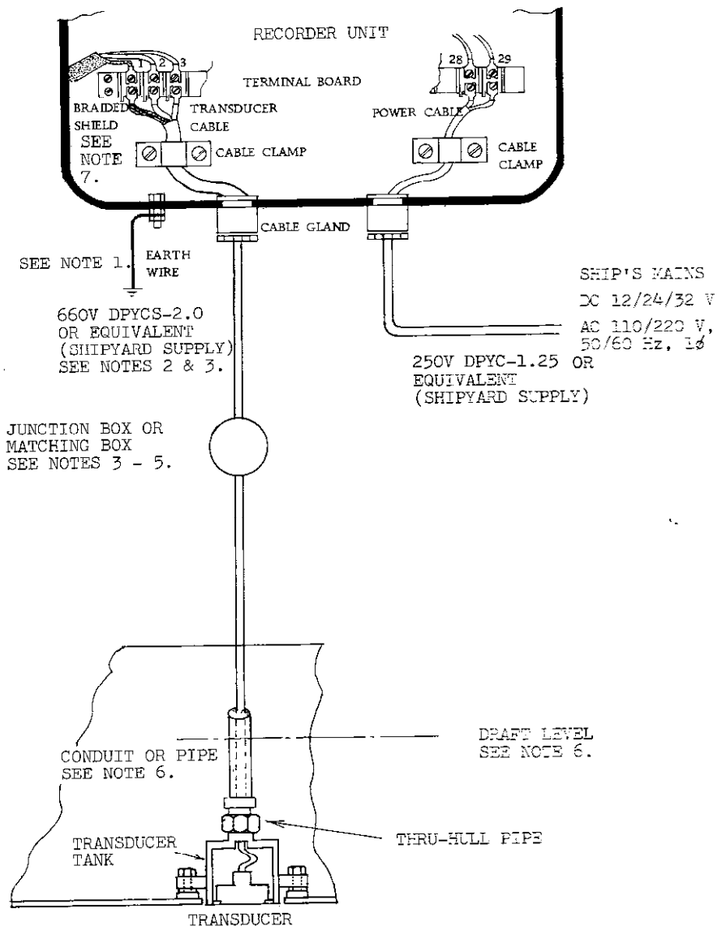


品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO	摘要 REMARK
9	把手 HANDLE	ｱﾙﾐ	1		
8	ゴムブッシュ RUBBER BUSH	合成ｺﾞﾑ RUBBER	2		内径 INN-DIA 15φ
7	感度調整 GAIN CONTROL	ﾌｪﾉｰﾙ樹脂 SYNTH-RESIN	1		
6	吃水調整 DRAFT CONTROL	〃	1		ACセットのみ AC SET ONLY
5	電源及び深度切換スイッチ SOURCE & RANGE SWITCH	〃	1		
4	照度調整 ILLUMINATION CONTROL	ﾌｪﾉｰﾙ樹脂 SYNTH-RESIN	1		
3	蝶番 HINGE	SUS304	2		
2	ケース蓋 CABINET DOOR	AC7A-F	1		
1	ケース本体 CABINET	AC7A-F	1		

課長 APPROVED		尺度 SCALE	1/10	名称 TITLE	F-851S 記録器外観図 (ACセット，埋込型) RECORDER OUTLINE DRAWING (AC SET, FLUSH MOUNT)
検図 CHECKED		図法 DRAWING	三角法 TRIGON		
製図 DRAWN		重量 WEIGHT	4.3 kg	図番 DWG. NO	C2206-004-B

FURUNO ELECTRIC CO., LTD.

FURUNO



NOTE 1. THE RECORDER CABINET SHOULD BE PERFECTLY GROUNDED WITH A HEAVY FLEXIBLE COPPER WIRE THRU THE GROUNDING TERMINAL.

2. THE TRANSDUCER CABLE SHOULD NOT BE LAID IN PARALLEL WITH THE POWER CABLE TO AVOID THE INTERFERENCE FROM THE POWER SUPPLY.

3. TO EXTEND THE TRANSDUCER CABLE, JUNCTION BOX IS REQUIRED AND 660V DPYCS-2.0 OR EQUIVALENT SHOULD BE USED.

4. IN JUNCTION BOX, THE SHIELD OF THE TRANSDUCER CABLE MUST NOT BE GROUNDED. IN OTHER WORDS, ONE POINT EARTH SHOULD BE ESTABLISHED IN THE RECORDER CABINET.

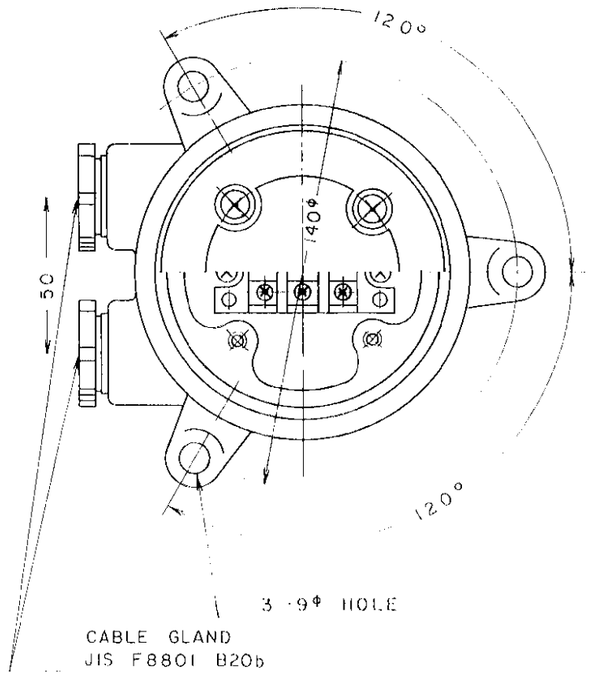
5. WHEN THE TRANSDUCER CABLE LENGTH EXCEEDS 100m, MATCHING BOX IS REQUIRED INSTEAD OF JUNCTION BOX. THE MATCHING BOX SHOULD BE INSTALLED AS NEAR THE TRANSDUCER AS POSSIBLE.

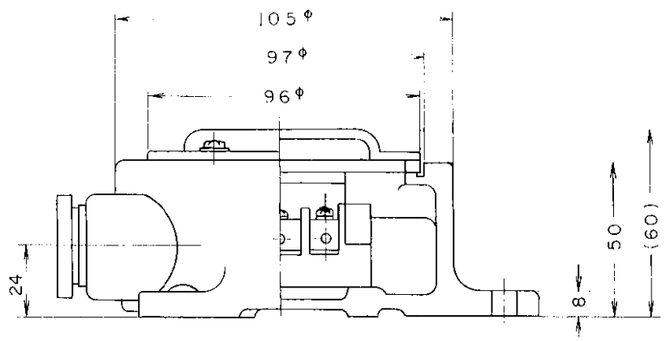
6. IT IS RECOMMENDED TO ENCLOSE THE TRANSDUCER CABLE IN CONDUIT OR PIPE FOR WATERPROOF PURPOSE. THE CONDUIT SHOULD BE SCREWED ON THE UPPER SECTION OF THE THRU-HULL PIPE. THE CONDUIT SHOULD BE OF SUCH A LENGTH THAT IS WELL ABOVE THE WATER LEVEL WHEN THE SHIP IS FULLY LOADED. THE TOP END SHOULD BE FINISHED WITH FILLING COMPOUND.

7. SINCE EXCESSIVELY LONG CONDUCTOR NOT SHIELDED INDUCES A LOT OF NOISE, THE BRAIDED SHIELD SHOULD BE SLIDED BACK AS LITTLE AS POSSIBLE.

Scale		TITLE
Date	1976-11	CABLING DIAGRAM FOR F-850 MK-II & F-851S NAVIGATIONAL ECHOSOUNDER
Checked		
Ref.		DWG. No. E2206-013-B

FURUNO ELECTRIC CO., LTD.

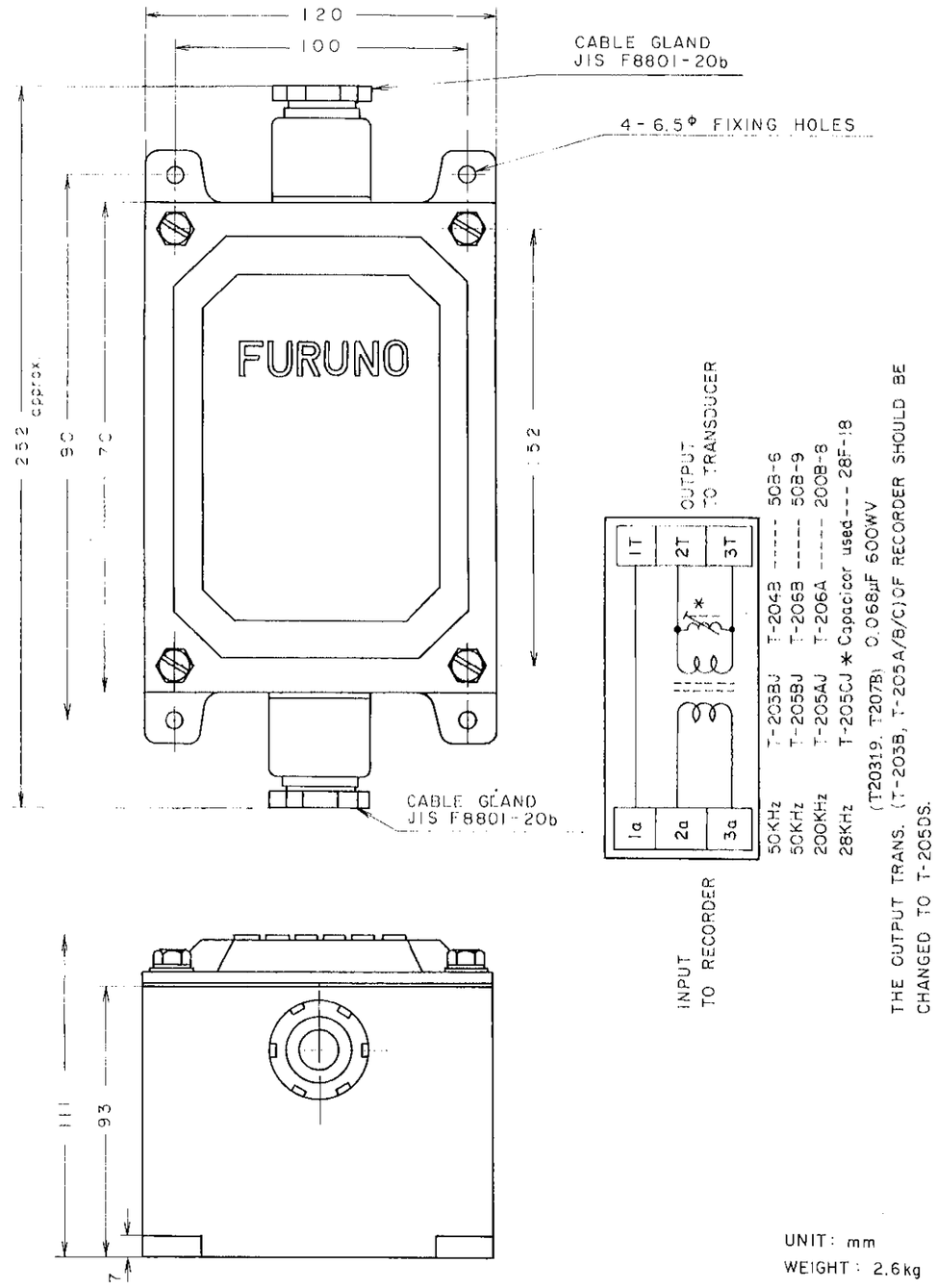




Date	1975-12	Scale	1/2
Checked			
Ref.			

TITLE: WATERTIGHT TYPE JUNCTION BOX JISF8821-1

DWG. No. E0002-001-A (DFE-2308)

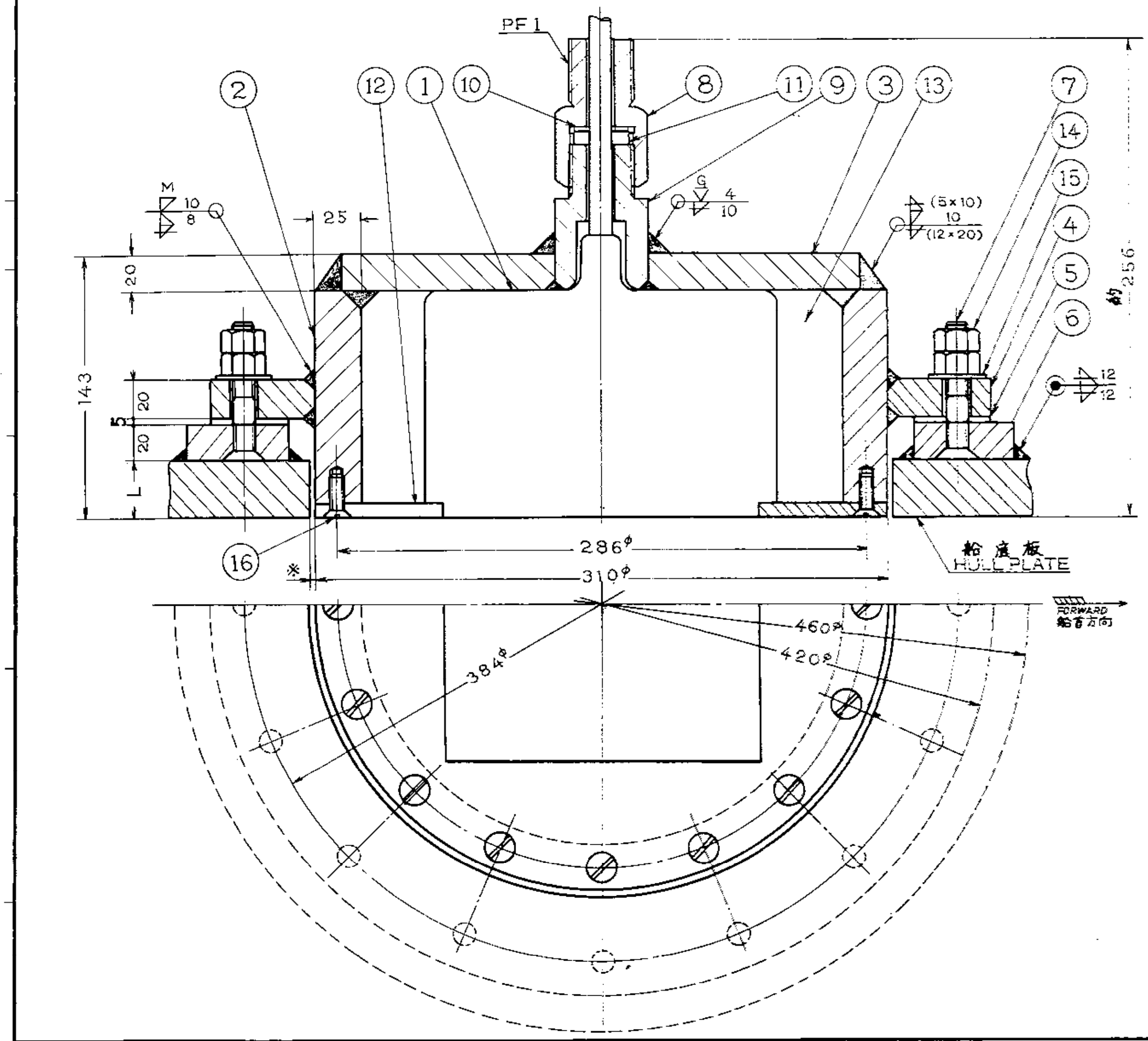


Date	1976-9	Scale	1/2
Checked			
Ref.			

TITLE: OUTLINE DRAWING OF MATCHING BOX

DWG. No. E2006-001-B

TTS-2800-2



L = ☐ mm

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘用 REMARK
16	FLAT HEAD SCREW 皿小ネジ	SUS304	16		M8×16
15	FLAT WASHER 平座金	SS41	16		M12
14	HEXAGONAL NUT 六角ナット	S25C	32		M12
13	FILLER 防蝕体	SPONGE スポンジ	1		
12	RETAINING FLANGE 振動子止め板	SUS304	1		
11	PACKING (1) パッキン (1)	CR	1		
10	WASHER 座金	SUS304	1		
9	GLAND (2) グランド (2)	SS41	1		
8	GLAND (1) グランド (1)	SS41	1		
7	STUD BOLT 植込みボルト	S25C	16		M12
6	FLANGE WITH BOLT ボルト付フランジ	KAS	1		
5	PACKING (2) ゴムパッキン (2)	CR	1		
4	SUPPORTING FLANGE フランジ	KAS	1		
3	TRANSDUCER TANK (B) 送受波器タンク (B)	KAS	1		
2	TRANSDUCER TANK (A) 送受波器タンク (A)	KAS	1		
1	28KHz TRANSDUCER 28KHz		1		28F-18

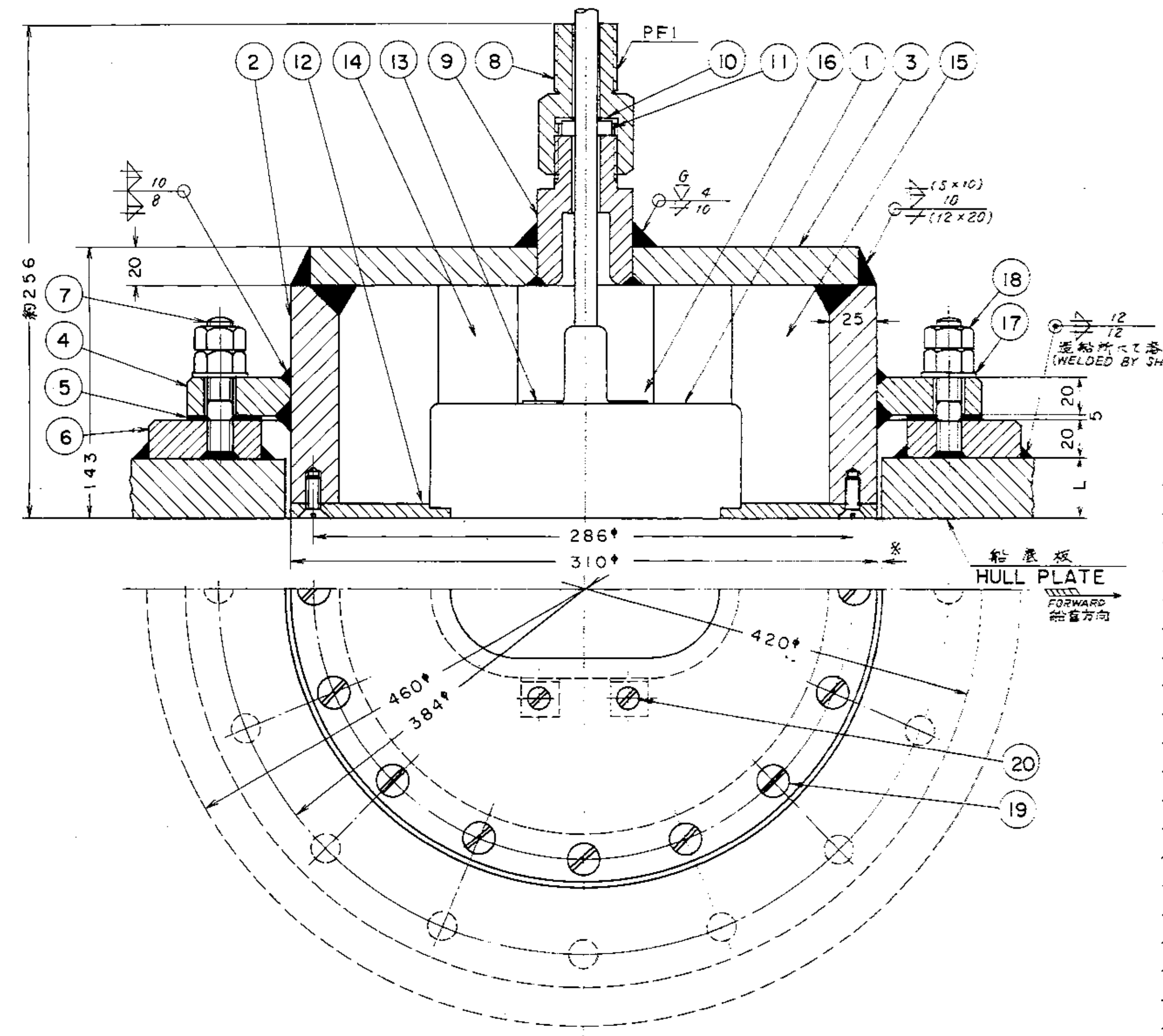
1) MARKING "L" IS THE THICKNESS OF THE SHIP'S HULL.
記号"L"は造船所指定の寸法によること。
2) MARKING "※" IS THE CLEARANCE OUT SIDE THE TRANSDUCER TANK.
THIS CLEARANCE SHOULD BE LESS THAN 4mm.
※印の間隙は4mm以下としタンク外面に触れないように注意して装備のこと。

変更通知書番号 REVICED NO.	符号 SYM.	訂正年月日 DATE	訂正記事 DESCRIPTION	担当 REVISER

課長 APPROVED 76.7.6	尺度 SCALE 1/2.5	名称 TITLE	ECHO SOUNDER 28KHz TRANSDUCER INSTALLATION
検図 CHECKED	図法 DRAWING 三角法 TRIGON		28KHz 船内タンク式装備図
製図 DRAWN	重量 WEIGHT 64 kg	図番 DWG. NO.	C2001-100-C

FURUNO ELECTRIC CO., LTD.

装備方法番号 INSTALLATION METHOD TTS-5000-2



L = ☐ mm

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	摘用 REMARK
20	皿小ネジ FLAT HEAD SCREW	SUS304	4		M4×15ℓ
19	皿小ネジ FLAT HEAD SCREW	SUS304	16		M8×16ℓ
18	六角ナット HEXAGONAL NUT	SS41	32		
17	平座金 FLAT WASHER	SS41	16		
16	防波体 (2) FILLER (2)	スポンジ SPONGE	1		
15	防波体 (1) FILLER (1)	スポンジ SPONGE	1		
14	ゴム間座 SPACER	CR	2		
13	振動子締付バンド BAND FOR TRANSDUCER	SUS304	2		
12	振動子止め板 RETAINING FLANGE	SUS304	1		
11	ゴムパッキン (1) PACKING (1)	CR	1		
10	座金 WASHER	SUS304	1		
9	グランド (2) GLAND (2)	SS41	1		
8	グランド (1) GLAND (1)	SS41	1		
7	植込みボルト STUD BOLT	S25C	16		
6	ボルト付フランジ FLANGE WITH BOLT	KAS	1		
5	ゴムパッキン (2) PACKING (2)	CR	1		
4	フランジ SUPPORTING FLANGE	KAS	1		
3	振動子タンク (B) TRANSDUCER TANK (B)	KAS	1		
2	振動子タンク (A) TRANSDUCER TANK (A)	KAS	1		
1	50KHz 振動子 50KHz TRANSDUCER		1		50B-9

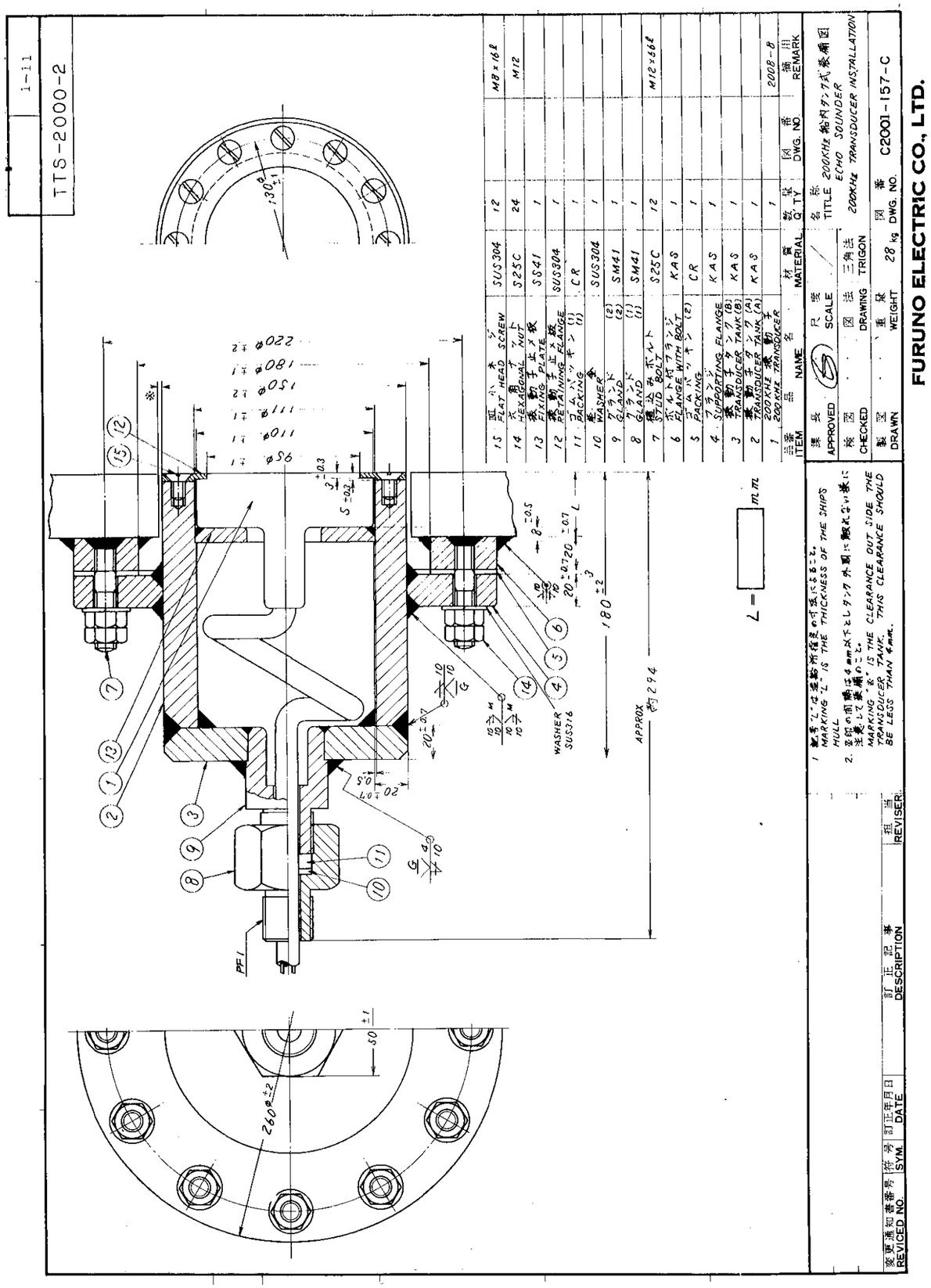
NOTE,

1. 記号"L"は造船所指定の寸法によること。
MARKING "L" IS THE THICKNESS OF THE SHIP'S HULL.
2. "※"印の間隙は4mm以下としタンク外面に触れない様に注意して装備のこと。
MARKING "※" IS THE CLEARANCE OUT SIDE THE TRANSDUCER TANK.
THIS CLEARANCE SHOULD BE LESS THAN 4mm.

変更通知書番号 REVICED NO.	符号 SYM.	訂正年月日 DATE	訂正記事 DESCRIPTION	担当 REVISER

課長 APPROVED	尺度 SCALE	名称 TITLE	50KHz 船内タンク式装備図 50KHz TRANSDUCER INSTALLATION ECHO SOUNDER
検図 CHECKED	図法 DRAWING 三角法 TRIGON		
製図 DRAWN	重量 WEIGHT 52 kg	図番 DWG. NO.	C2001-102-C

FURUNO ELECTRIC CO., LTD.



CHAPTER 2. OPERATION

Adjustment and function for the respective operating controls will be discussed in this chapter. The user should familiarize himself with all the operating controls in order to make the best possible use of the echosounder.

2-1. Description of the Controls

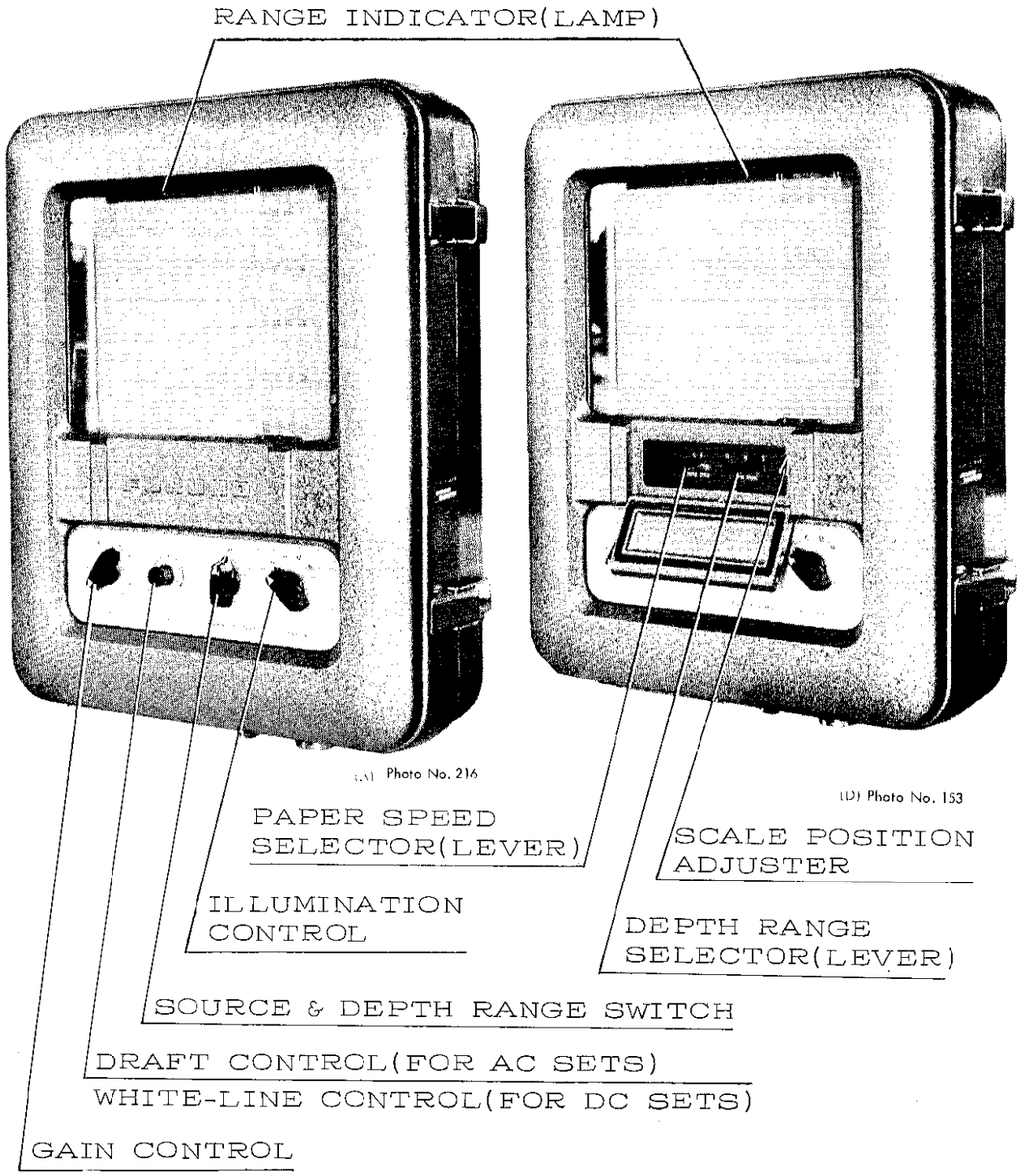


Fig.2-1 F-851S Recorder Unit (Bulkhead Mount Type)

POWER/RANGE SELECTOR
DEPTH RANGE SELECTOR (INSIDE LEVER)

"On-off" of the power to the system can be made by the POWER/RANGE SELECTOR. Turn this switch from the position O (off) to one of other positions, and in approximately two seconds the recording belt will start to rotate.

Desired sounding range can be selected by both the POWER/RANGE SELECTOR switch and the DEPTH RANGE selector (inside lever). Refer to Table 2-1 below. The shallow range group (0-40m/0-80m range group)is selected by placing the DEPTH RANGE selector in the position "X1". The selection of the deep range group (0-200m/0-400m range group) is done by placing it in the position "X5". Setting the POWER/RANGE SELECTOR switch at a proper position will select 0-40m/0-200m range group or 0-80m/0-400m range group.

For example, when the DEPTH RANGE selector is turned to "X1" and the POWER/RANGE SELECTOR switch is positioned in "0-40", the selected depth range is 0-40m.

CAUTION: Change the setting of the DEPTH RANGE selector with the belt rotating, otherwise the gearing may not be engaged smoothly.

Table 2-1
DEPTH RANGES
(in meters)

SETTING OF DEPTH RANGE SELECTOR (INSIDE LEVER)		SETTING OF POWER/RANGE SELECTOR			
		0- 40 0-200	30- 70 150-350	0- 80 0-400	60-140 300-700
x 1 (SHALLOW)		0- 40	30- 70	0- 80	60-140
	RANGE INDICATOR	RED		YELLOW	
x 5 (DEEP)		0-200	150-350	0-400	300-700
	RANGE INDICATOR	GREEN		BLUE	

RANGE INDICATOR (LAMP)

To eliminate a misreading of the depth, this indicator is arranged near the upper side of the recording paper. It is colored in red, yellow, green and blue from the right to the left in order and color-illuminated as shown in Table 2-1 depending on the range setting. Each depth scale is also printed in the color corresponding to the range indicator.

GAIN CONTROL

The GAIN control varies the sensitivity (gain) of the receiver amplifier. The gain is successively increased by turning the knob clockwise.

This control should be set so that only dense seabed echotrace is marked. Note that excessive increment of the gain does not give distinct seabed echogram but presents unnecessary echoes from fishes, sea surface noise, wake, etc.

ILLUMINATION CONTROL

This control adjusts the illumination on the recording paper and the depth scale, and has four setting positions; "OFF", "D" (Dimmed), "M" (Medium) and "B" (Bright).

DRAFT CONTROL (FOR AC SETS)

This control is furnished in place of the WHITE-LINE control to the sets operated from AC source.

Echosounder records the depth from the transducer to seabed, not from sea surface. If exact depth from sea surface is required, shift down the zero line to the position of your ship's draft by turning clockwise this control. On the other hand, if only the bottom clearance is referred to, turn this control fully anticlockwise and move the scale with the SCALE POSITION adjuster so that the "0m" is placed at the upper edge of the zero line.

WHITE-LINE CONTROL (FOR DC SETS)

This control is provided in place of the DRAFT control to the sets operated from DC source.

The white-line circuit enables to facilitate the discrimination between seabed and other objects such as mud, seaweed, wreckage, etc. on or close to seabed. When the white-line is effective, the contour of the true seabed is given as a thin line having a white belt below.

This control is normally turned off. Turn it on only when the identification of the true seabed is required to know the exact depth or contour. Clockwise rotation of the control will increase the white-line effect. The adjustment should be made properly together with the GAIN control depending on the depth range setting.

SCALE POSITION ADJUSTER (INSIDE)

Move the depth scale with this adjuster so that the "0m" is placed at the upper edge of the zero line.

PAPER SPEED SELECTOR (INSIDE LEVER)

The paper speed can be changed by using this selector. The position "S" is for "slow speed" and "F" for "fast speed".

STC (PRESET CONTROL)

This control is located inside the recorder as a preset control and only qualified servicemen are allowed to readjust it.

STC reduces the amplifier gain at close range. Turning the control clockwise will reduce distinctive darkening just below the zero line (sea surface noise). The preferable adjustment is to obtain such an echogram that the sea surface noise is presented slightly.

2-2. Operation Procedure

1. Turn the SOURCE & DEPTH RANGE switch from the positions "OFF" to "1" (either red or yellow figure), and in approximately two seconds the recording belt will start to rotate.

2. Adjust the illumination on the recording paper and the scale with the ILLUMINATION control.

3. Select a suitable sounding range with both the DEPTH RANGE selector and the SOURCE & DEPTH RANGE switch, and also select a suitable paper speed, either "fast" or "slow" with the PAPER SPEED selector.

4. Move the scale with the SCALE POSITION adjuster so that the "0m" is placed at the upper edge of the zero line. In AC sets, adjust the zero line by turning the DRAFT control as necessary.

5. Adjust the GAIN control for a distinct echogram.

6. In DC sets, adjust the WHITE-LINE control when the identification of the true seabed is required.

2-3. Replacement of Recording Paper

When the recording paper approaches its end, an end mark is seen on the paper, indicating that the remaining length is about 1 meter. Then it is necessary to prepare new roll of the recording paper. How to replace the recording paper is explained below.

The outline of the paper winding system is illustrated below.

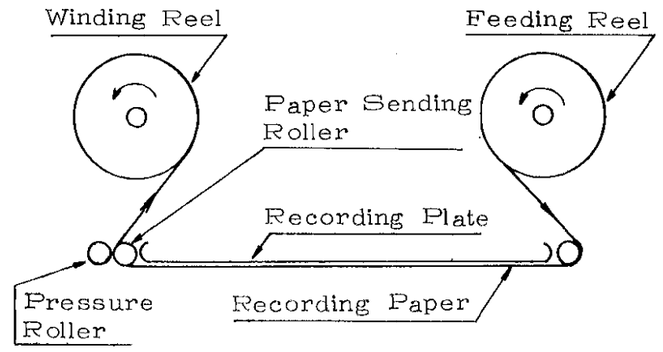


Fig.2-2 Sketch of Paper Winding System

1. Turn the SOURCE & DEPTH RANGE switch to "OFF".

2. Turn the recording belt in the normal direction by hand so that the recording stylus may be off the recording paper. See Fig.2-3.

3. Remove the scale plate. See Fig.2-3.

4. Release the pressure roller by pulling it up. See Fig.2-3.

5. Loosen the recorder assembly fixing screw and swing down the recorder assembly by holding the fixing screw. See Fig. 2-4.

6. Take out the paper winding reel with used paper at the same time pulling the paper winding reel knob to the outside (ref. Fig.2-4 and 2-5), and wind out the remaining part of the paper, also remove the empty paper feeding reel in the same manner(ref. Fig.2-6).

7. Place the new paper between the recording belt and the recording plate as shown in Fig.2-7. Then fix the new paper roll to the recorder assembly with the reel knob pulled outside. Confirm that the paper roll is secured.

8. Place the paper between the stylus guide piece and the recording plate (ref. Fig.2-3), also between the paper sending roller and the pressure roller.

9. Put an end of the new paper roll into the slot of the paper winding reel, then wind one or two turns of the paper on the reel with care so that the paper may be set in the center of the reel. See Fig.2-8.

10. Reset the paper winding reel in the recorder assembly with the reel knob pulled outside. See Fig.2-8. Confirm that the reel is secured.

11. Adjust the tension of the paper by turning the paper winding reel knob. Reset the pressure roller.

12. Swing up the recorder assembly and tighten the recorder assembly fixing screw. Reset the scale plate.

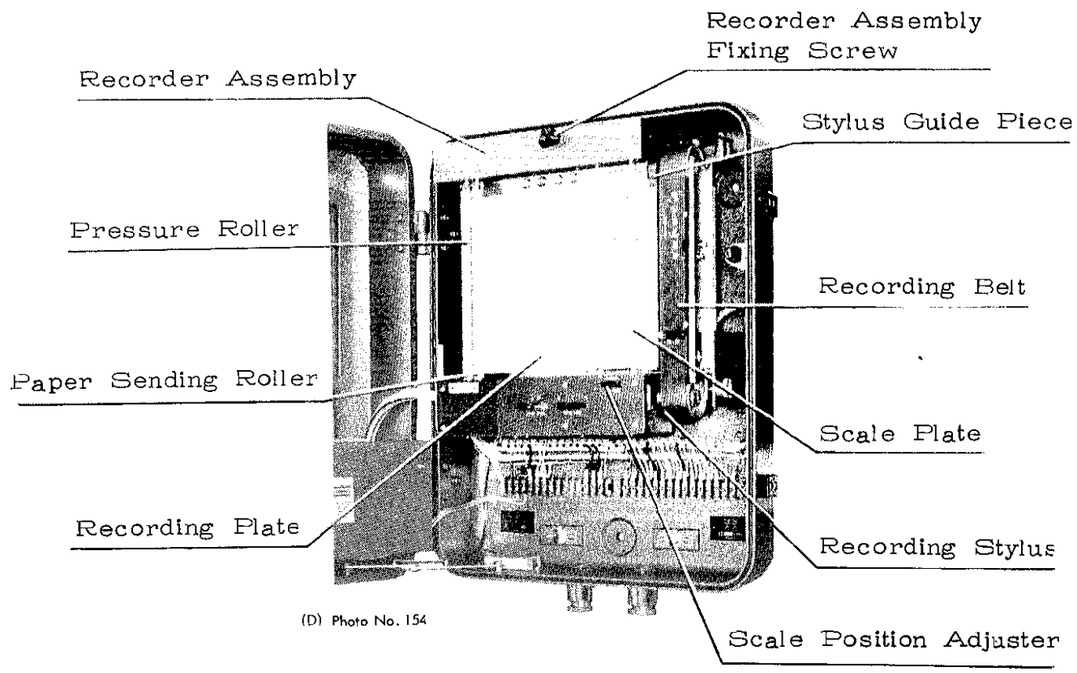


Fig.2-3 Recorder with Cabinet Door opened

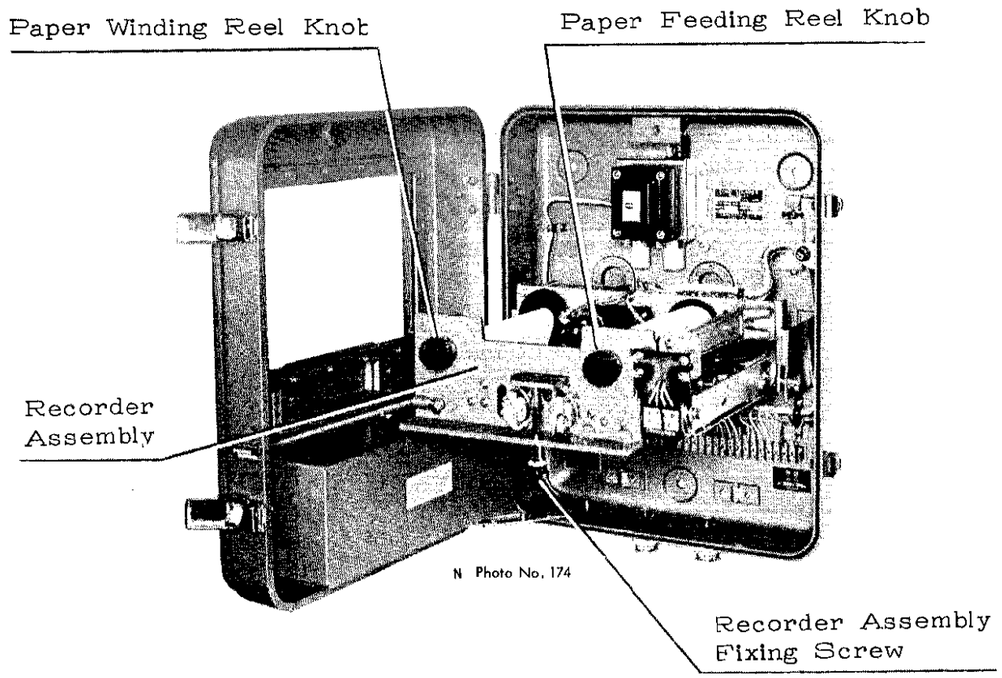


Fig.2-4 Recorder with Recorder Assembly swung down

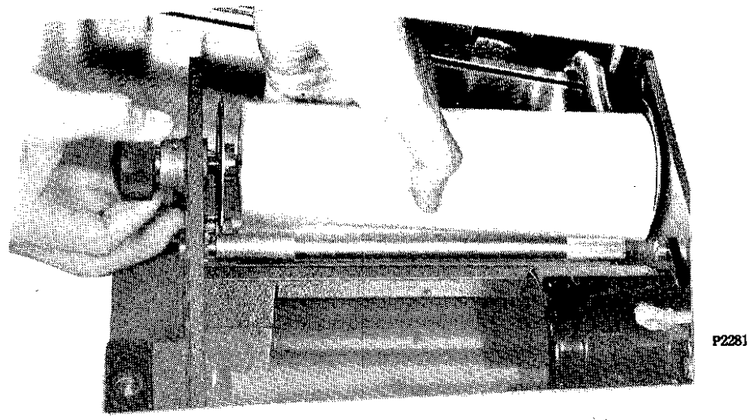


Fig.2-5

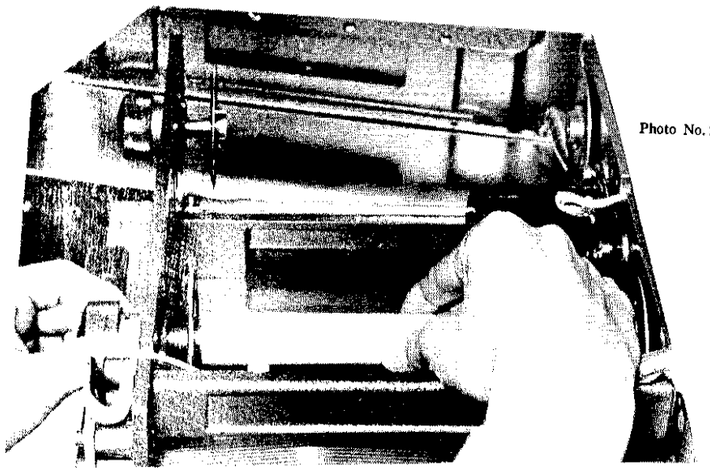


Photo No. 2871

Fig.2-6

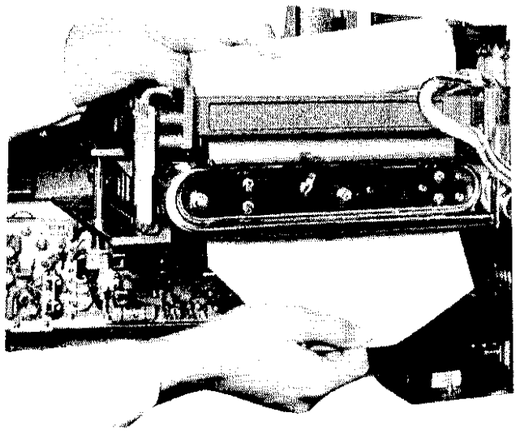


Fig.2-7

Photo No. 2872

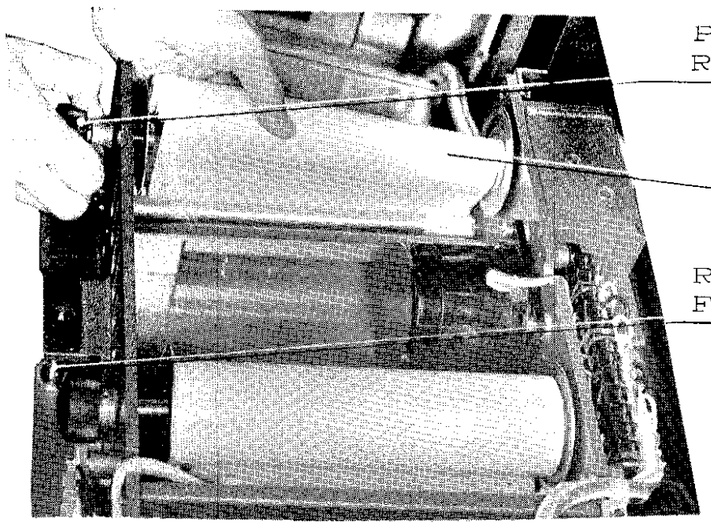


Fig.2-8

CHAPTER 3. OBSERVATION OF RECORDINGS

3-1. Echoes and Multiple Reflection

In a comparatively shallow depth sounding, too high a setting of the amplifier gain and a stiff seabed cause a second or sometimes third or fourth echoes with the same interval between them below the first echo trace. This is because the sounding pulse travels in the same path twice as long or more in the reasonably shallow depth.
Depth measurement should be made between the zero line and the first echo trace by using the scale plate attached.

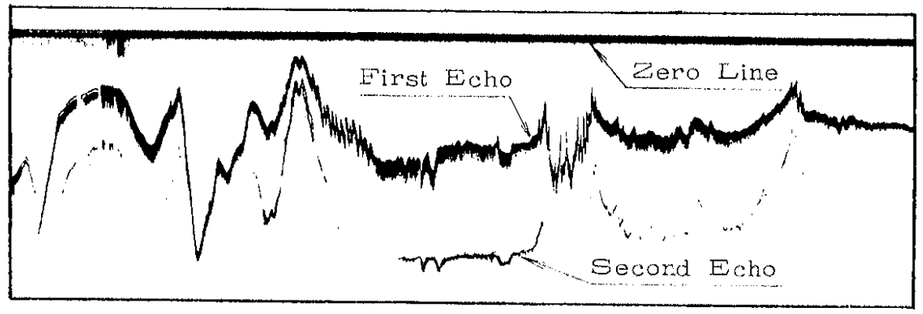


Fig.3-1

3-2. Shifted Echo Trace

It may sometimes occur that seabed you want to see is presented at the lower edge of the paper as shown in Fig.3-2. This will not allow the observer to understand the recording obtained. This situation can be improved by changing the depth range setting to a deeper one, e.g., 0-40m to 30-70m ranges. If the recording appears at an extreme upper position, change the range setting to a shallower one.

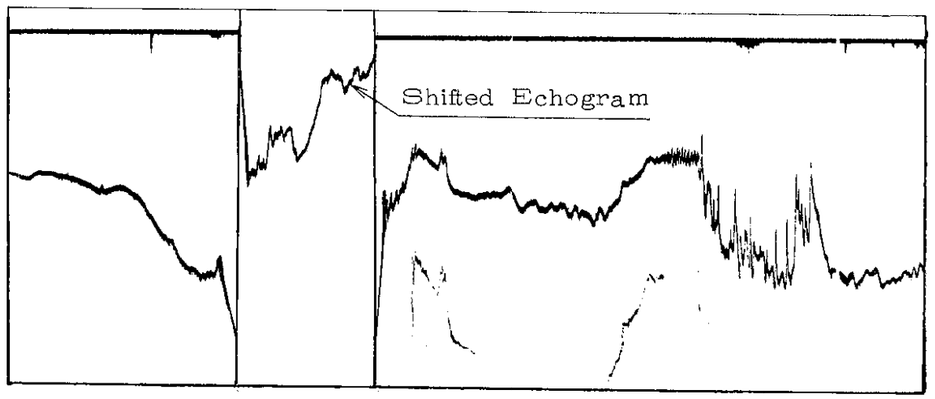


Fig.3-2

3-3. Sea Surface Noise

Sea surface noise is mainly caused by the air foam created by ship's cruising, rough sea conditions, rain, wake, etc. If this noise spoils the important area of recording, reduce the noise by adjusting the STC control.

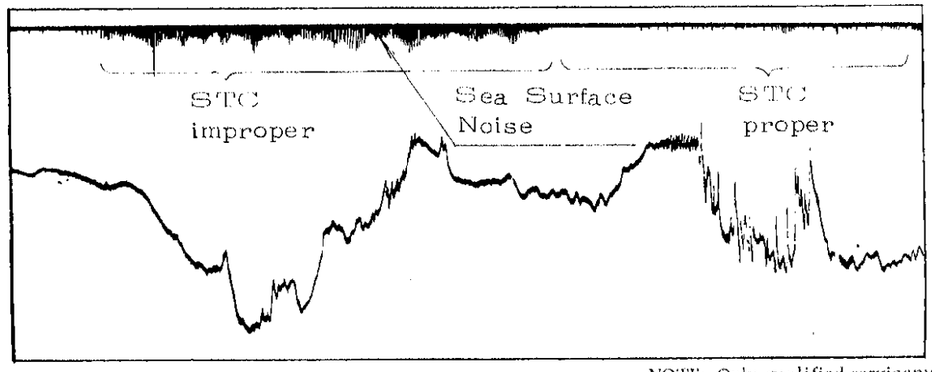
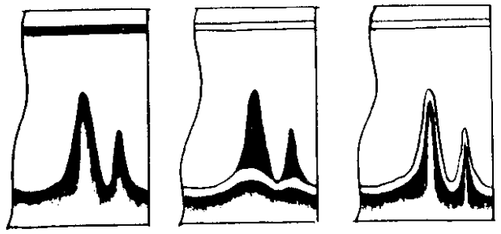


Fig. 3-3

NOTE: Only qualified servicemen are allowed to readjust the STC preset control.

3-4. White Line Recording (in DC sets)

If the seabed line is shaped as shown in Fig. 3-4(a), it is difficult to judge what the rising(crest) portion is; rock, wreckage, bottom fish, seaweed, etc. The white-line function will then give a suggestion to make a correct judgement. If the rising portion is wreckage, bottom fish school, a group of seaweed or so, the seabed tracing will become like Fig. 3-4(b). If it is rock, protruding part of seabed or so, the seabed line will be as shown in Fig. 3-4(c).



White-line not operated.

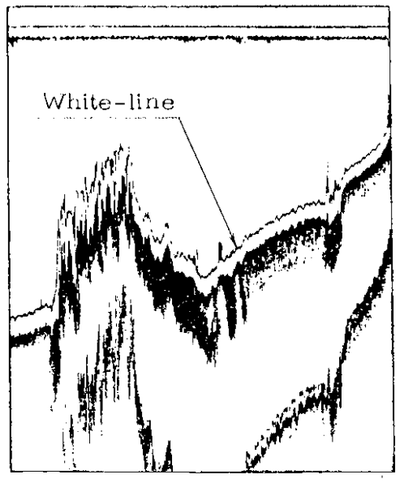
Fig. 3-4(a)

White-line operated. Wreckage, etc.

Fig. 3-4(b)

White-line operated. Rising of seabed

Fig. 3-4(c)



White-line effect in actual echogram

Fig. 3-4(d)

3-5. Noise caused by Interference and Induction

Fig. 3-5 shows the noise caused by induction of other electric wirings, acoustic effect by swing of the ship and interference from other echosounders. Reduction of the amplifier gain will moderate the appearance of these noises and the observation of the actual echo will become easier.
The interference noise from other echosounders is shown in form of parallel broken lines inclined a little across the paper sending direction. Noise caused by electric induction, such as the one from a motor or generator, is plotted in irregular dots of blackening over the recording paper.

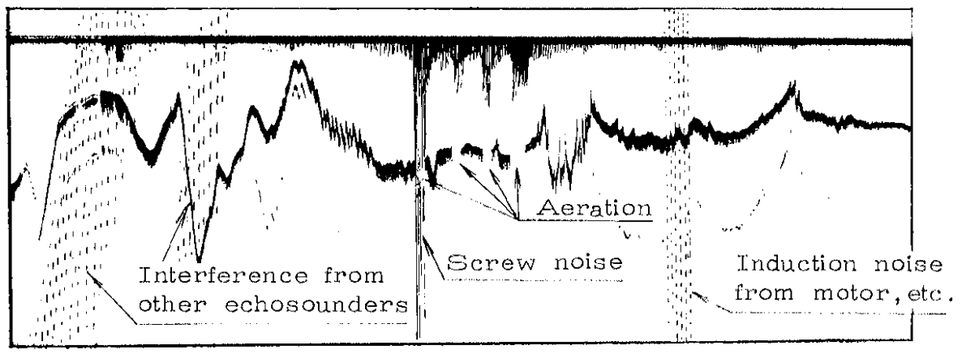


Fig. 3-5

In rough sea, the effect of aerated water becomes extremely great. Such being the case, the sound beam energy is attenuated by a lot of air bubbles and the plotting of the seabed is sometimes suspended as shown in Fig. 3-5.

CHAPTER 4. MAINTENANCE

Reliable operation of the echosounder largely depends on maintenance of the equipment. The maintenance should be made periodically with care.

4-1. General Maintenance of Recorder Unit

1. Since this model is provided with a dry paper recording system, a lot of carbon powder is produced during the actual operation. The carbon powder will pile up on the inner mechanism, particularly the electrical wiring and circuit boards. This may cause troubles in mechanical and electrical performance.
   The powder accumulations should be cleaned out with a brush at least once a week.

   CAUTION: Be sure to turn the POWER/RANGE SELECTOR to "O" before opening the cabinet door.

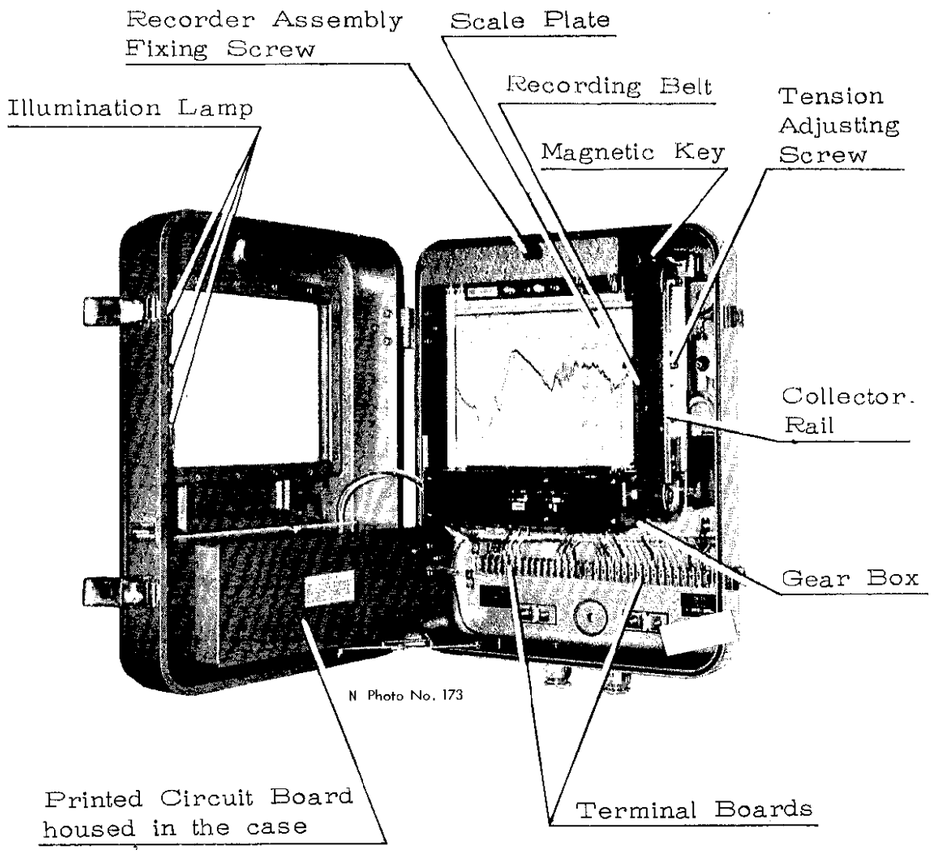


Fig.4-1 Recorder with Cabinet Door opened

2. Frequently wipe off the carbon powder, dust or stain on the collector rail with a soft cloth.

3. The recorder cabinet should always be kept clean and free from corrosion. Frequently wipe traces of salt water from the cabinet with a cloth damped in fresh water. It is particularly important to clean around fittings, operating controls and projections since corrosion tends to start in such places.

4. Illumination lamps and scale plate should be cleaned from time to time.

5. Cable connection at terminal boards should be kept clean and tight for a good contact.

4-2. Tension of Recording Belt

The recording belt is held with three pulleys. The tension should be adjusted to the optimum setting. Insufficient belt tension will cause bad recordings while excessive tension will place an overload on the driving motor. The tension pully can be fixed at any required location with the tension adjusting screw as shown in Fig.4-2.

Rule to adjust the tension is as follows. Loosen the tension adjusting screw and the fulcrum screw, relocate the tension pulley so that the belt may just begin to tighten, move a bit more the tension pulley to the outside, then tighten both the tension adjusting screw and the fulcrum screw.

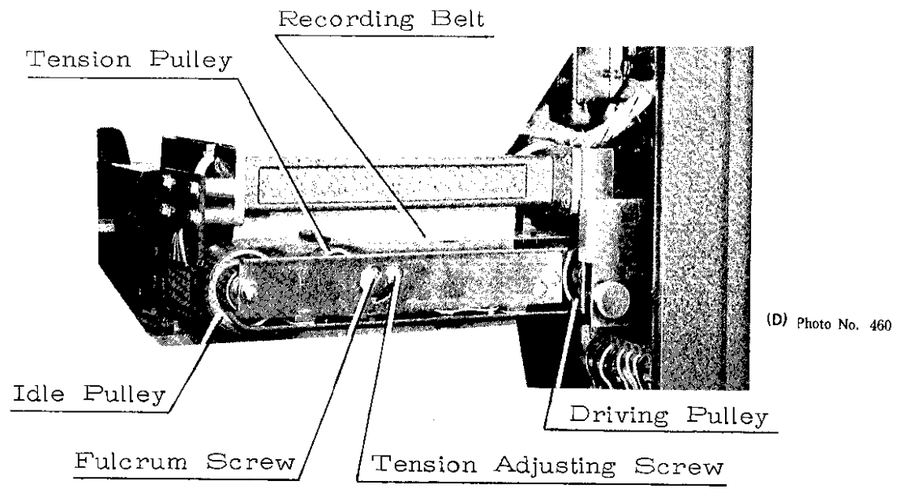


Fig.4-2 Adjusting of Belt Tension

4-3. Replacement of Recording & Collector Styli

The recording and collector styli are fixed on the same stylus stand which is mounted on the recording belt as shown in Fig. 4-3. These styli are removed by pushing the end of each stylus holder in the direction of the arrow.

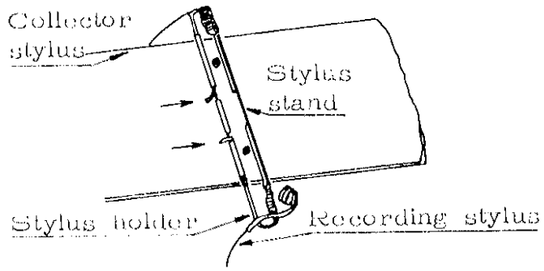


Fig.4-3

Prolonged use wears away the recording stylus wire. The stylus should be made to protrude about 10mm by pulling its end with the long nose plier supplied as a maintenance tool. See Fig.4-4. When the stylus wire comes to an end after lengthy use, replace the stylus wire or the whole piece (stylus with holder) with a new one.

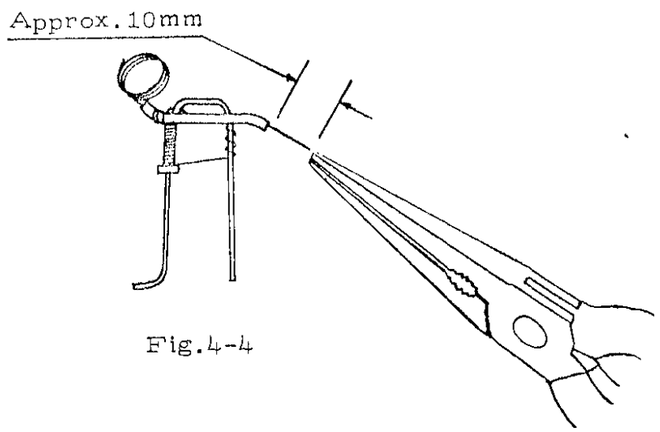


Fig.4-4

The collector stylus is made of different material from the recording stylus, so it does not need replacing as often as the recording stylus. When its replacement is required, replace the whole piece (stylus with holder).

4-4. Lubrication

The gears in the gear box of the recorder assembly (ref. Fig. 4-1) should be checked for good operation. The gears are lubricated with grease or machine oil when the equipment leaves the factory, but it is required to relubricate at regular intervals or when the old grease and oil seem to have deteriorated. See Fig.4-5.

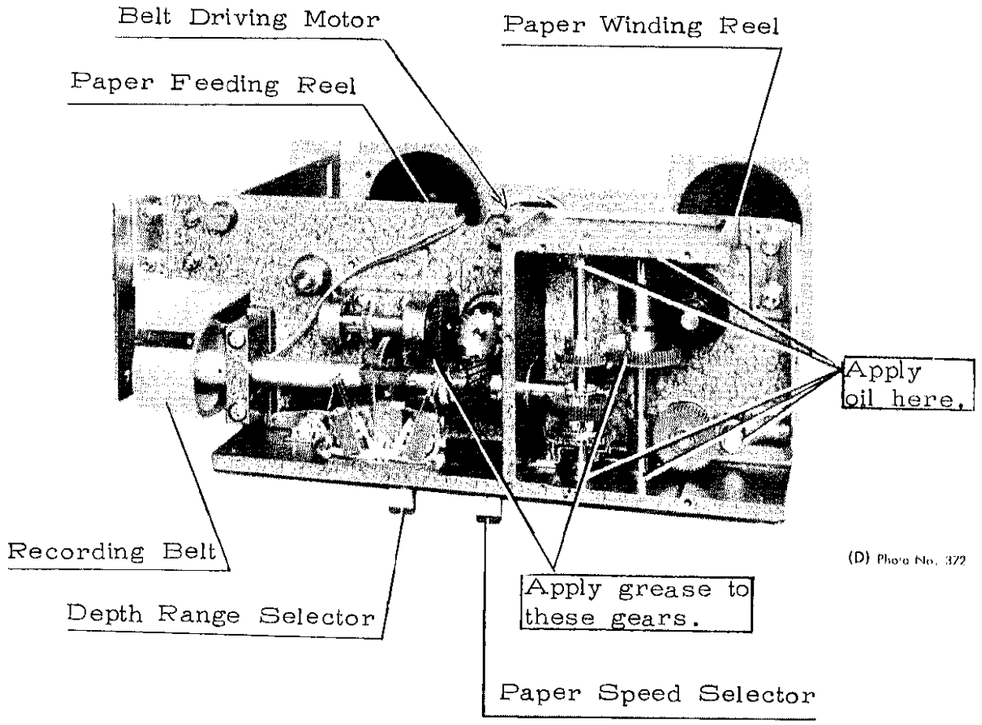


Fig.4-5 Recorder Assembly Gear Box with Cover removed

CHAPTER 5. TROUBLE SHOOTING

Trouble 1. Recorder unit not operating with source switch turned on

Cause:
a) Incorrect polarity of power supply
b) Low source voltage
c) Fuse blown off
d) Bad contact or disconnection of power cable

Remedy:
a) Check the polarity of source voltage on the terminals #28 and #29. The normal condition is that #28 is negative and #29 positive. In case of AC source, no polarity.

b) In this case the rated voltage appears between terminals #28 and #29 with the source switch off, but turning on the source switch causes an abrupt drop of the source voltage. Therefore, the DC ship's main should be recharged. If the source is faulty, renew it.

c) Refer to the followings.

(i) Inferiority or shortcircuit of Tr306D, Tr307D, Tr308D, Tr208D and Tr209D
(ii) Shortcircuit exists in some portion.
(iii) Rating of fuse F301D in use.
10 A for DC 12 V
3 A for DC 24/32 V
1 A for AC 110/220 V

If all of above points are in good order, this trouble will be caused by the inferior quality of fuse in use. So replace it with new one according to above specification.

d) In case of the bad contact condition, connnect the cable firmly to the terminals. Perform a conduction test on the cable with a circuit tester.

Trouble 2. Motor rotating but no recording

Cause:
a) Bad contact of recording or collector stylus
b) Bad amplifier circuit
c) Bad power supply circuit or inverter circuit

Remedy:
a) Check the contact condition of the recording or collector stylus. If the stylus is worn out, renew it.

b) If the amplifier circuit board is faulty, replace it with new one. Check if the transistor Tr109D is short-circuited or inner-opened.

c) Check if more than +20V is applied between the terminals #4 and #5 and if less than -20V is applied between terminals #4 and #6 by using a circuit tester.

If each line voltage is abnormal, the inspection on the following points should be made.

(i) Faulty rectifier circuit
(ii) Faulty inverter circuit

Trouble 3. Illumination lamp lit but motor not rotating

Cause:
a) Low supply voltage
b) Incorrect adjustment of inverter circuit
c) Inoperative motor circuit or faulty motor

Remedy:
a) Check if the rated voltage is applied between terminals #28 and #29 with circuit tester.

b) Check if 100 to 110V AC with 60 Hz is fed between terminals #15 and #16 with circuit tester.
If the voltage between #15 and #16 is lower than 100V with normal ship's line, this is caused from incorrect adjustment of the inverter circuit. Adjust the voltage between #15 and #16 up to 110V AC by turning VR304D.

c) In this case, the following troubles are considered.

(i) Faulty capacitor C315D
(ii) Faulty motor --- Faulty bearing, disconnection of wirings etc.

Should the above matters be in good order, the following points must be checked.

(i) Check if the recording belt slips out of the pulley and if a lot of carbon powder piles up between the pulley and recording belt. Polish the pulley after removing the belt.
(ii) Check the tension of the recording belt.
(iii) Check if a lot of carbon powder and rubbish pile up in the gear mechanism.

(iv) Check the bearing in the pulley bracket.

Trouble 4. Motor rotating but illumination lamp not lit

Cause: a) Illumination lamp blown off
b) Disconnection of the wirings concerning the illumination lamp

Remedy: a) Replace the illumination lamp blown off with new one.
b) Check the wiring by using a circuit tester.

Trouble 5. No zero line (NOTE: With the SOURCE & DEPTH RANGE switch placed in "2" thru "4", no zero line appears.)

Cause: a) Faulty magnetic key
b) Faulty magnet on the recording belt
c) Faulty pulse driver

Remedy: a) Replace the faulty magnetic keying board 6702.
b) Replace the recording belt with new one.
c) Check if the pulse is applied to the point S on the PCB 6704 from the magnetic key. Faulty pulse driver PCB should also be renewed. Check if Tr208D and Tr209D are short-circuited.

Trouble 6. Heavy noise

Cause: a) Bad cable connection
b) Improper installation of transducer
c) Induction from other electrical or mechanical equipment on board
d) Defective transducer

Remedy: a) Refer to the followings.

(i) Connect the transducer cable to terminals #1,#2 and #3. Among them, #1 is for shield wire and #2 and #3 for inner conductors. Excessively long conductor not shielded induces a lot of noise, which lowers the performance of detection in the deep sea.
(ii) The wiring of the power source should be as apart from the transducer cable as possible and should not be laid in parallel with the transducer cable.
(iii) The earth terminal located at the lower end of recorder cabinet should be grounded to the hull or grounding plate.

b) If the transducer is installed at the improper location of the hull, air foams and bubbles will interfer with sounding.

c) In this case, the induced noise is mostly caused by generator or motor.

(i) Insert a capacitor with adequate capacitance between the input terminals of generator or motor.
(ii) In case of noise induced from the mechanical vibration of the engine, insert the rubber plate under the base plate of the equipment.

d) This trouble is caused from the breakout of the mold or disconnection of the cable of the transducer.
If necessary, replace the faulty transducer with new one.

Trouble 7. Poor sensitivity

Cause: a) Frequency deviation in the amplifier or oscillator, or poor quality of them
b) Lowered supply voltage
c) Defective transducer

Remedy: a) Readjust the frequency of RF amplifier, IF amplifier and local oscillator, and check the amplifier gain.

Connect the terminals #2 and #3 to the vertical input and the standard signal generator to the horizontal input on a synchroscope. Then readjust the transmission frequency by turning the core of T201(A,B, C) and T202 (A,B,C) observing a "Lissajous Figure" appearing on the scope.

b) Even reasonably low supply voltage allows the recorder operating but sufficient recording will not be obtained. Check the source voltage on the terminals #28 and #29.

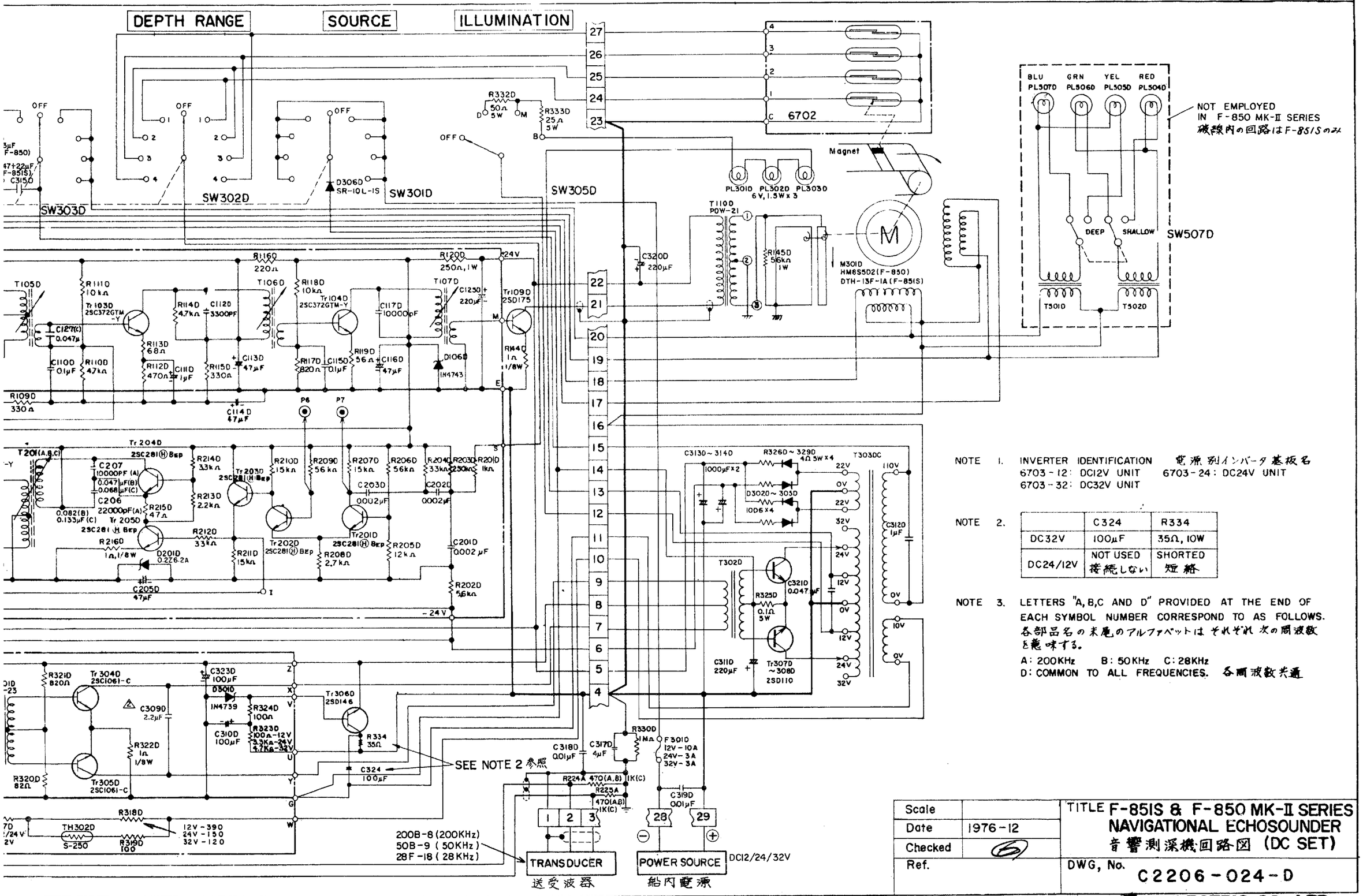
c) Check if the transducer cable is broken down or if the mold is broken off.

Trouble 8. Poor accuracy

Cause: Inaccurate sounding rate due to the deviated frequency of the inverter PCB 6703.

Remedy: Adjust double potentiometers VR301D and VR302D so that exactly 60 Hz is obtained from the inverter circuit to drive a 60 Hz synchronous motor. Frequency can be observed between terminals (15) and (16).

S-1



NOTE 1. INVERTER IDENTIFICATION 電源別インバータ基板名
6703-12: DC12V UNIT 6703-24: DC24V UNIT
6703-32: DC32V UNIT

NOTE 2.

	C324	R334
DC32V	100μF	35Ω, 10W
DC24/12V	NOT USED 接続しない	SHORTED 短絡

NOTE 3. LETTERS "A, B, C AND D" PROVIDED AT THE END OF EACH SYMBOL NUMBER CORRESPOND TO AS FOLLOWS.
各部品名の末尾のアルファベットはそれぞれ次の周波数を意味する。
A: 200KHz B: 50KHz C: 28KHz
D: COMMON TO ALL FREQUENCIES. 各周波数共通

Scale	
Date	1976-12
Checked	
Ref.	

TITLE F-851S & F-850 MK-II SERIES
NAVIGATIONAL ECHOSOUNDER
音響測深機回路図 (DC SET)

DWG, No. C2206-024-D

FURUNO ELECTRIC CO., LTD.

FURUNO

GAIN

WHITE LINE

S.T.C.

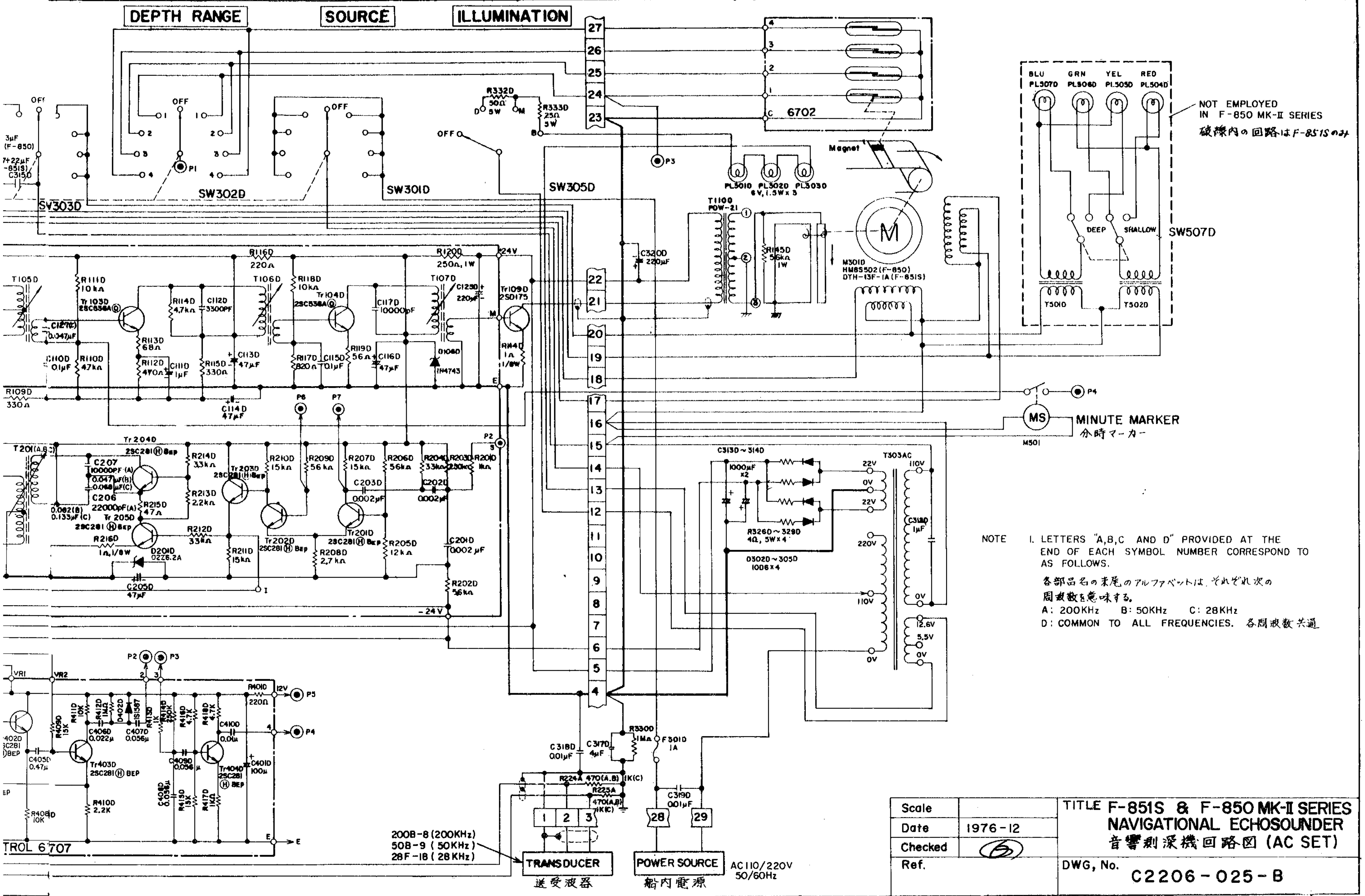
DEPTH RANGE

AMPLIFIER/PULSE DRIVER
6704 - A (200KHz)
6704 - B (50KHz)
6704 - C (28KHz)

6703 - 12/24/32 SEE NOTE 1. 参照
INVERTER

(28KHz)

(28KHz)



NOTE I. LETTERS "A,B,C AND D" PROVIDED AT THE END OF EACH SYMBOL NUMBER CORRESPOND TO AS FOLLOWS.
各部品名の末尾のアルファベットは、それぞれ次の周波数を意味する。
A: 200KHz B: 50KHz C: 28KHz
D: COMMON TO ALL FREQUENCIES. 各周波数共通

Scale		TITLE F-851S & F-850 MK-II SERIES NAVIGATIONAL ECHOSOUNDER 音響測深機回路図 (AC SET)
Date	1976-12	
Checked		
Ref.		DWG, No. C2206-025-B

FURUNO ELECTRIC CO., LTD.

FURUNO

GAIN

S.T.C.

DEPTH RANGE

AMPLIFIER/ PULSE DRIVER
6704 - A (200KHz)
6704 - B (50KHz)
6704 - C (28KHz)

SW501D

SW304D

SW303D

SW302D

DRAFT

DRAFT CONTROL 6707