FURUNO

OPERATOR'S MANUAL

RADAR SLAVE DISPLAY

MODEL FMD-8000

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NISHINOMIYA, JAPAN

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·Your Local Agent/Dealer

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B : JUL. 0, 1991

PUB. No. OME-33240
(ITAM) FMD-8000

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CONTENTS
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SPECIFICATIONS

DISPLAY UNIT (FMD-8000 linear or log amplifier type)

1. Indication System: PPI, raster scan, daylight display
2. Picture Tube: 12" rectangular CRT

3. Range (nm):
4. Range Ring Interval (nm):
5. Number of Rings:

0.25	0.5	0.75	1.5	3	6	12	24	48	96
0.05	0.1	0.25	0.25	0.5	1	2	4	8	16
5	5	3	6	6	6	6	6	6	6

6. Display Mode:
   1) Head-up "HU"
   2) Course-up "CU" *
   3) North-up "NU" *
   4) Head Set "HS" **
   * gyrocompass required
   ** when no gyro is connected
7. Range Discrimination: Same as main radar + (0 to 24m) on 1.5nm range
8. Bearing Resolution: Same as main radar + (0 to 0.5°) at 1.5nm scale on 1.5nm range
9. Bearing Accuracy: Better than ±1°
10. VRM/Range Ring Accuracy: Better than 0.9% of maximum scale in use
11. Marks: Heading Mark, North Mark*, Bearing Scale, Range Ring, VRM1 & VRM2, EBL1 & EBL2, Guard Zone.
12. Numeral/Character Indication: Range in Use, Range Ring Interval, Display Mode (HU, NU*, CU*, HS**), Interference Rejector (IR), Alarm (GUARD), GYRO*, Echo Stretch (ES), EBL, EBL Bearing Mode (R, T*), VRM, Echo Average (EAV1, EAV2, EAV3), ZOOM, Protting Time.
    * gyrocompass required
    ** when no gyro is connected
13. Echo Trail: Continuous (max. 99min 59sec), 30sec, 1min, 3min or 6min
14. Interference Rejector: Built in
15. Off-center Display: Built in
16. Zoom Function: Selected area is doubled in size (not activated when off-centering)
17. Alarm Function: Built in
18. Echo Average: Correlates echo scan-to-scan
19. Echo Stretch: Enhances echo on mid/long ranges
20. Floating EBL: Measures range and bearing between any two targets

ENVIRONMENTAL CONDITIONS

1. Vibration:

Total Amplitude	Vibration Cycle
+ 1.6mm	1 to 12.5Hz
+ 0.38mm	12.5 to 25Hz
+ 0.10mm	25 to 50Hz

2. Ambient Temperature: Display Unit ------ -15°C to +55°C
3. Humidity: Relative Humidity 95% at +40°C

POWER REQUIREMENTS

12/24/32VDC, 50W (24VDC)
100/110/115/220/230VAC, 100VA (100V), 50-60 Hz, 1φ (rectifier required)

COLOR

Display Unit: 2.5GY-5/1.5 Embossed T25 (Cabinet)
N3.0 Newtone No.5 (Control Panel)

APPLICABLE RADARS

1. FMD-8000 Linear Amplifier Type (with using INT kit OP03-25)

   FR-700(A)/1000(A) series, FR-700 MARK-II(A)/1000 MARK-II(A) series
   FR-1201/1211(A)/1221(A)/1221C

2. FMD-8000 Linear Amplifier Type

   FR-800(DA) series, FR-1500D(A) series, FR-8000D(A) series
   FCR-1400A/1400 MARK-II-A series, FR-2001/2001M

3. FMD-8000 Log Amplifier Type

   FR-800DS series, FR-1500DS series, FR-8000DS series
   FR-2000/2000T/2000X/2000S series, FR/FAR-2800 series
   FR-1400/1400DS series
   FR-1500D(A) (LOG) series, FR-8000D(DA) (LOG) series
   FR-1222/1223/1222X/1252X/1622X/1652X/1262S/1662S
   FCR-1400/1400 MARK-II series, FCR-1400 MARK-3 series
   CD-140/141 or FMD-800 (with connecting log type radar)

INPUT SIGNAL SPECIFICATIONS

1. Without using interface board 03P5556

	Signal	Polarity	Level/Pulsewidth	Impedance	Remarks
	Video	Negative	3.4 to 5 V	75 ohms	Log or linear
	Trigger	Negative-edge trigger	4 to 12 V 7 to 50 us	10 kohms	Timing -- start of RX
Scanning Sig.	Heading	Negative-edge trigger	H -- 9 to 12 V L -- 0 to 2 V	10 kohms	
Scanning Sig.	Bearing (Pulse)	Positive	H -- 9 to 12 V L -- 0 to 2 V Duty -- 50 ±10 % Jitter -- ±10 %	10 kohms	Ant. rotation 12 to 30 rpm No. of pulse 360 or 450 ppr

2. With using interface board 03P5556

	Signal	Polarity	Level/Pulsewidth	Impedance	Remarks
	Video	Any	2 to 5V	75 ohms	Log or linear
	Trigger	Any	2.5 to 20 V 1 to 10 us	10 kohms	Timing -- start of TX or 1 to 10 us advanced
Scanning Signal	Heading	Any	2.5 to 20 V	10 kohms	
Scanning Signal	Bearing (pulse)	Any	2.5 to 20 V Duty -- 50 %	10 kohms	Ant. rotation 12 to 30 rpm No. of pulse 360 or 450 ppr
Scanning Signal	Bearing (Synchro)	AC 60 Hz to 400 Hz	Ref -- 115 V Sig -- 90 V	200 kohms	
Scanning Signal	Bearing (Resolver)	AC 1 KHz to 10 kHz	Ref, XY 2.5 to 100 V	50 kohms	

COMPLETE SET

No.	Name	Type	Q'ty	Weight	Remarks
1	Display Unit	RDP-074-LIN	1	19 kg	Linear amplifier type
		RDP-074-LOG			Log amplifier type
2	Installation Materials	CP03-06501	1 set		
		S03-22-5/10/15	1		signal cable (RW-4864) 5, 10 or 15m
3	Accessories	FP03-03000	1 set		
4	Spare Parts	SP03-05000	1 set		

OPTION SUPPLY

No.	Name	Type	Code No.	Remarks
1	Rectifier Unit	RU-3423		For AC power supply
2	Power Cable	CVV-S 8x2C *15M*	000-560-634	
3	Video Plotter	RP-3		
4	Memory Card (RAM)			For RP-3
5	Chart ROM			For RP-3
6	Auto Plotter	ARP-3		
7	A-D Converter	AD-10S/100		For gyro compass sig
8	External Buzzer	OP03-21	000-030-097	with 1m cord
9	Radar Color Display	CD-140/CD-141		
10	Radar Slave Display	FMD-800/FMD-8000		
11	INT Kit	OP03-25	008-999-180	Interface board for FR-700/1000 series etc.
12	Interface PCB (I/O Board)	03P5556	008-206-080	For other makes of radar, Log type
		03P5556A	008-206-090	For other makes of radar, Linear type
13	Signal Cable Assy	S03-15-5	008-100-360	For nav data

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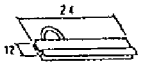
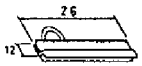
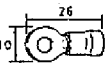
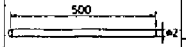
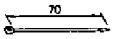
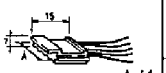
CODE No.	008-239-130	03DA-X-9401-1
TYPE	CP03-06501	

工事材料表 INSTALLATION MATERIALS	FMD-8000	レーダー副指示器 RADAR SLAVE DISPLAY	

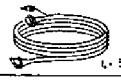
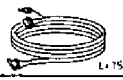
番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	NHコネクタ組品 NH CONNECTOR ASSY.		03-1197 (8P) CODE No. 008-375-990	1	
2	NHコネクタ組品 NH CONNECTOR ASSY.		03-1198 (9P) CODE No. 008-376-000	1	
3	圧着端子 CRIMP-ON LUG		FV5.5-4 CODE No. 000-538-123	4	
4	圧着端子 CRIMP-ON LUG		8NK4 CODE No. 000-538-180	6	
5	スミチューブ F HEAT-SHRINK TUBE		3x0.25 クロ CODE No. 000-568-171	1	
6	コンベックス PLASTIC BAND		CV-70 CODE No. 000-570-324	10	
7	NHコネクタ組品 NH CONNECTOR ASSY.		03-302 (4P) CODE No. 008-300-570	1	
			CODE No.		
			CODE No.		
			CODE No.		

図番 DWG. No.	C3324-002-B	
検図 CHECKED		

FURUNO

CODE No.		03DA-X-9402
TYPE		

工事材料表 INSTALLATION MATERIALS	FMD-8000	レーダー副指示器 RADAR SLAVE DISPLAY (信号ケーブル SIGNAL CABLE)	

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	信号ケーブル組品 SIGNAL CABLE ASSY.		S03-22-5 (RW-4864 *5M*) CODE No. 008-239-140	1	選択 Selection
2	信号ケーブル組品 SIGNAL CABLE ASSY.		S03-22-10 (RW-4864 *10M*) CODE No. 008-239-150	1	
3	信号ケーブル組品 SIGNAL CABLE ASSY.		S03-22-15 (RW-4864 *15M*) CODE No. 008-239-160	1	
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		

図番 DWG. No.	C3324-003-A	
検図 CHECKED		

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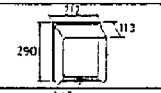
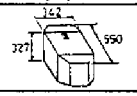
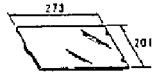
CODE No.	000-080-903	03CS-X-9502
TYPE	FP03-03000	

付属品表
ACCESSORIES

FR-8050D(DA) FR-8100DS レーダー
FR-8100D(DA) FR-8300DS
FR-8250D(DA) FMD-8000 RADAR

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	フード組品 HOOD ASSY.		FP03-02910	1	
			CODE No. 008-223-520		
2	ビニールカバー VINYL COVER		03-034-0401-0	1	
			CODE No. 000-801-657		
3	フィルタ FILTER		03-034-9601	1	
			CODE No. 100-101-880		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		

貿易用
FOR EXPORT

図番 DWG. No. C3314-015-A

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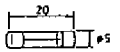
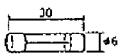
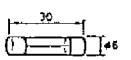
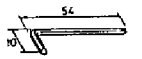
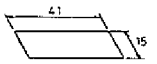
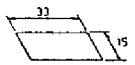
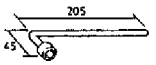
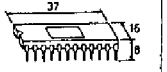
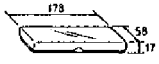
CODE No.	000-080-905	BOX No. P
TYPE	SP03-05000	

SHIP No.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL
	FMD-8000 レーダー副指示器 RADAR SLAVE DISPLAY		

ITEM No.	NAME OF PART	OUTLINE	DWG. No. OR TYPE No.	QUANTITY WORKING PER SET	QUANTITY WORKING PER VES.	QUANTITY SPARE	REMARKS/CODE No.
1	ヒューズ FUSE		UL-TSC 125V 2A	1		3	000-101-132
2	管入りヒューズ GLASS TUBE FUSE		FG80 25A AC125V	1		2	000-549-016
3	管入りヒューズ GLASS TUBE FUSE		FG80 10A AC125V	1		2	000-549-065
4	六角レンチ HEX. WRENCH		対辺 1.5MM		1		000-830-112
5	貼りマーク 1 LABEL (1)		03-019-1001		1		100-051-010
6	貼りマーク 2 LABEL (2)		03-019-1002		1		100-051-020
7	キセル型レンチ L-HANDLE SOCKET WRENCH		M8用 対辺 13MM		1		000-830-110
8	P-ROM 書込み品 PROGRAM ROM		PROM 03581101		1		008-400-430
	予備品箱 SPARE PARTS BOX		F710用		1		000-831-610

MFR'S NAME	FURUNO ELECTRIC CO., LTD.	DWG. No.	C3324-001-C

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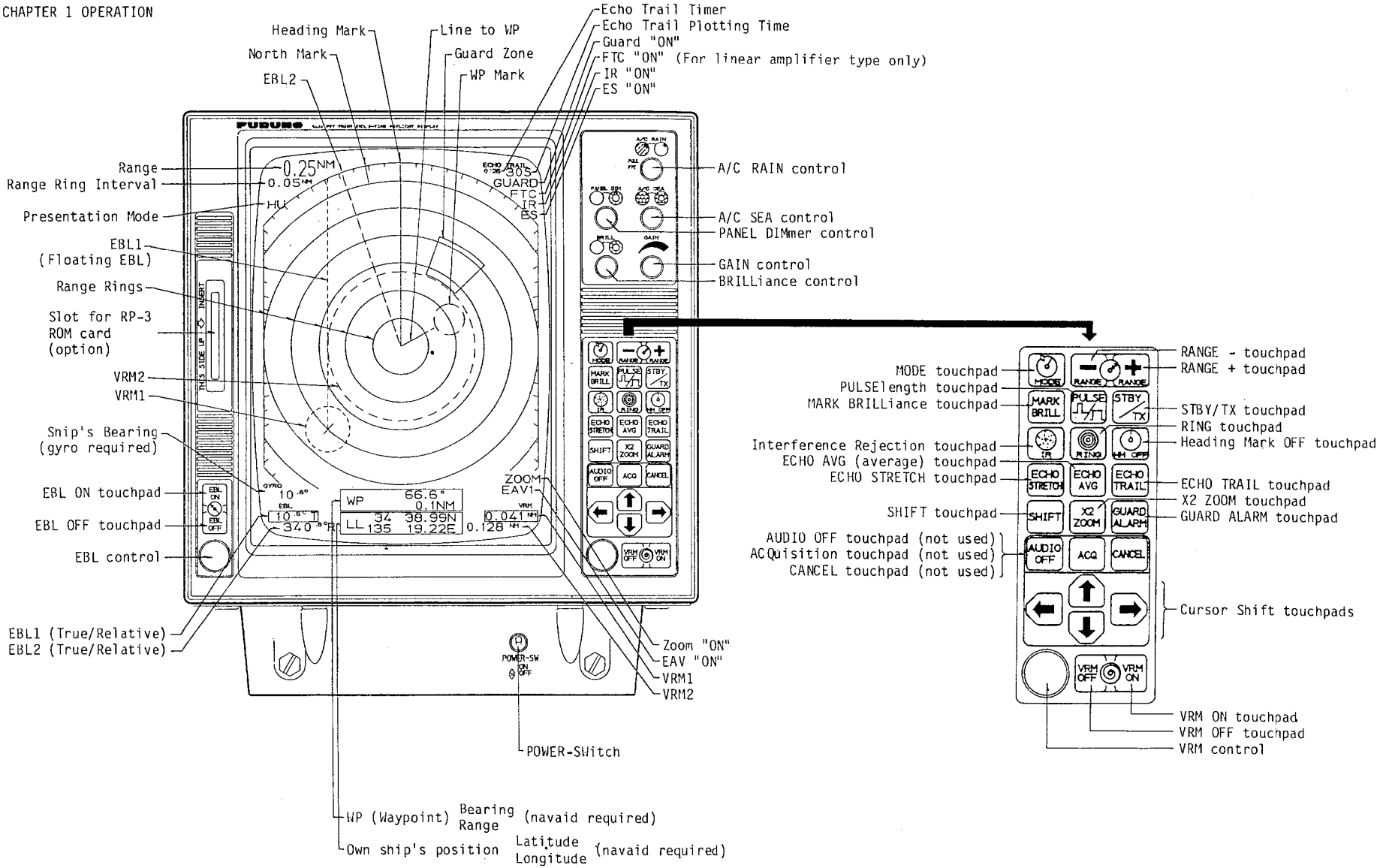

Heading Mark
North Mark
EBL2
Line to WP
Guard Zone
WP Mark
Echo Trail Timer
Echo Trail Plotting Time
Guard "ON"
FTC "ON" (For linear amplifier type only)
IR "ON"
ES "ON"
Range
Range Ring Interval
Presentation Mode
EBL1
(Floating EBL)
Range Rings
Slot for RP-3
ROM card
(option)
VRM2
VRM1
Ship's Bearing
(gyro required)
EBL ON touchpad
EBL OFF touchpad
EBL control
EBL1 (True/Relative)
EBL2 (True/Relative)
A/C RAIN control
A/C SEA control
PANEL DIMmer control
GAIN control
BRILLiance control
Zoom "ON"
EAV "ON"
VRM1
VRM2
POWER-SWitch
WP (Waypoint) Bearing Range (navaid required)
Own ship's position Latitude Longitude (navaid required)
MODE touchpad
PULSElength touchpad
MARK BRILLiance touchpad
Interference Rejection touchpad
ECHO AVG (average) touchpad
ECHO STRETCH touchpad
SHIFT touchpad
AUDIO OFF touchpad (not used)
ACQuisition touchpad (not used)
CANCEL touchpad (not used)
RANGE - touchpad
RANGE + touchpad
STBY/TX touchpad
RING touchpad
Heading Mark OFF touchpad
ECHO TRAIL touchpad
X2 ZOOM touchpad
GUARD ALARM touchpad
Cursor Shift touchpads
VRM ON touchpad
VRM OFF touchpad
VRM control

Fig. 1-1

GENERAL

This display unit is equipped with numerous functions which help the operator assess marine traffic and fishing conditions (location of floats, etc.) These functions are, however, easy to access. If you change a control setting you will see the associated reaction almost immediately on the screen. Key entry is confirmed by a beep tone, while three beeps in succession alert wrong use of key. The location of each control and touchpad and the arrangement of legends, markers, etc. on the screen are given on page 1-1.

BASIC OPERATION

Turning the Power On / Displaying the picture POWER-SW ON OFF, STBY/TX

Flip the POWER switch to ON to apply power to the unit. The message ST-BY, DIP switch setting, program number, results of the ROM and RAM checks, total on time and total TX time are displayed.

NOTE: The total TX time is disregarded when the unit is used as a slave display.

If the master radar is transmitting, press the STBY/TX touchpad to display the radar picture.

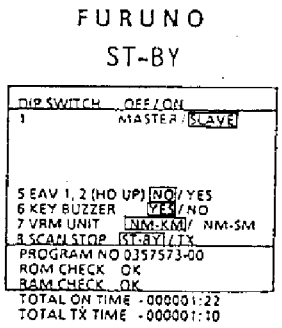


Fig.1-2

Pulselength Selection PULSE

The pulselength can not be selected from the slave display unit --- this key is ineffective.

Range Selection RANGE - RANGE +

The RANGE touchpads are used to select the RANGE. The range selected determines automatically the fixed range ring interval. Press the + touchpad to increase the range, or press the - touchpad to lower the range. The range selected and the fixed range interval are indicated at the upper left-hand corner of the screen.

GAIN Control Adjustment GAIN (effective for log amplifier type only)

The GAIN control is used to adjust the sensitivity of the receiver, and thus the strength of echoes as they appear on the screen. It is adjusted so that the speckled noise background is just visible on the screen.

To properly set the gain, first select one of the long ranges--the speckled background noise is more apparent. Turn the GAIN control clockwise slowly until you can see feeble speckled background noise. If you set up for too little gain, weak echoes may be missed. If you turn the control too far clockwise, yielding too much speckled noise background, targets may be missed because of the poor contrast between desired echoes and the background noise on the screen.

A/C SEA Control Adjustment  (effective for log amplifier type only)

In rough seas, sea clutter appears on the screen as a large number of small echoes (see Fig.1-3) which might impair radar performance in close ranges. The action of the A/C SEA (Anti Clutter Sea) circuit is to reduce the amplification of echoes at short ranges (where clutter is the greatest) and progressively increase amplification as the range increases, so that amplification will be normal at those ranges where sea clutter is not experienced. The control is effective to a maximum of about 6 miles.

The proper setting of the A/C SEA control is so that the clutter is broken up into small dots, and small targets become distinguishable. If the control is not sufficiently advanced, other targets will be hidden in the clutter, while if it is set too high, sea clutter and targets will both disappear from the screen. As a general rule of thumb, turn the control clockwise until the clutter has disappeared leeward, but a little is still visible windward. Always leave a little clutter visible on the screen, this ensures weak echoes will not be suppressed. If no clutter is visible on the screen, leave the control in the fully counterclockwise position.

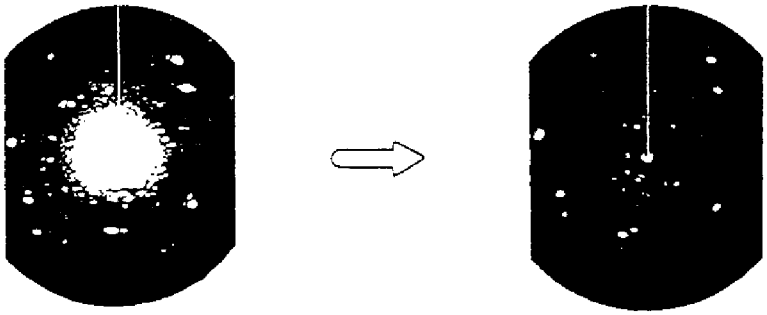


Fig.1-3 Adjusting the A/C SEA Control

Brightness/Illumination Adjustment

CRT Brightness 

The BRILL (Brilliance) control adjusts the brightness of the CRT. Turn it clockwise to increase the intensity of the radar echoes blips, legends and markers. Adjust it so that radar echo blips may be observed clearly.

Mark Brilliance 

The MARK BRILL touchpad is used to adjust the brilliance of the various marks and legends displayed on the screen; i.e., VRMs, EBLs, range rings, north mark (if gyro connected), heading mark and guard zone. There are four levels of brilliance: low, medium, medium high and high. Each time the touchpad is pressed the brilliance changes in the above sequence.

Panel Illumination 

The PANEL DIM (panel dimmer) control adjusts the illumination for both the touchpad and control panels.

Mode Selection

The MODE touchpad is used to select the presentation mode. There are either two or three modes selectable, Head-Up (HU), Course-Up (CU), North-Up (NU) or Head Set (HS), depending on whether a gyrocompass is connected or not. Each time the touchpad is pressed the mode changes in the following sequence, and the mode selected is indicated at the top left-hand side of the screen.

with gyro : HU → CU → NU →

without gyro : HU → HS →

Head-Up Mode

The picture is orientated so that the heading mark appears at the top of the screen. This mode is most suitable for navigation in congested areas or narrow channels.

Note that the north mark appears only when a gyrocompass is connected.

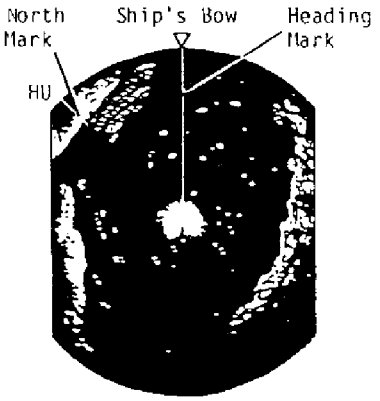


Fig.1-4 Heading-Up Mode Display

North-Up Mode

The radar picture is stabilized so that the north is at the top of the screen and the heading mark changes its position according to the orientation of the ship's heading. This mode is suitable for radar fixing of own ship's position in reference to the navigation chart. The picture is stabilized against yaw of the vessel, reducing the smearing of target echoes.

This mode is available only when a gyrocompass is connected.

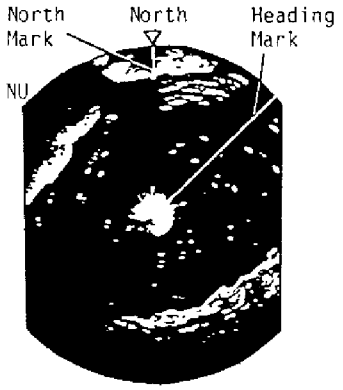


Fig.1-5 North-Up Mode Display

Course-Up Mode

Press the MODE touchpad for the CU mode at the moment the ship's bow is oriented to the desired direction (ship's course to port, waypoint, etc), and the picture is stabilized with the desired direction at the top of the screen. The heading mark changes according to the orientation of ship's heading. The picture is stabilized against yaw of the vessel.

This mode is available only when a gyrocompass is connected.

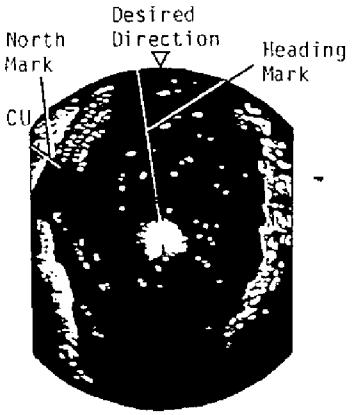


Fig.1-6 Course-Up Mode Display

Head Set Mode

The heading mark may be moved to the desired direction by using EBL and its rotary knob control.

Select the Head-up Mode; press the EBL ON touchpad to display EBL (EBL1 or EBL2); set EBL to the dresird direction by rotating the rotary knob (1-7a). Then select the Head Set Mode, and the heading mark will move to where the EBL is located as shown in Fig.1-7b. Note that this mode is available only when a gyrocompass is not connected.

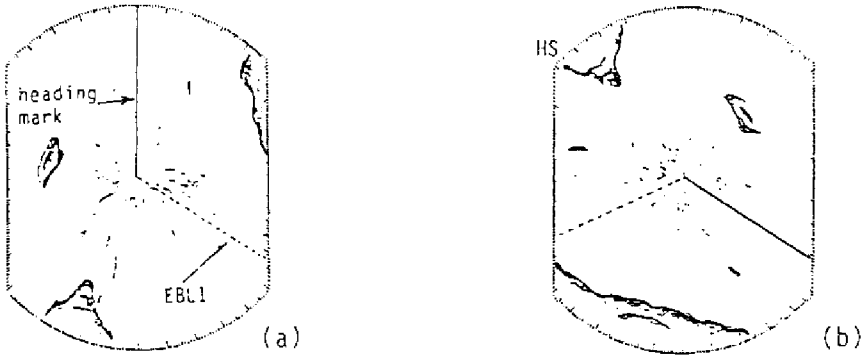
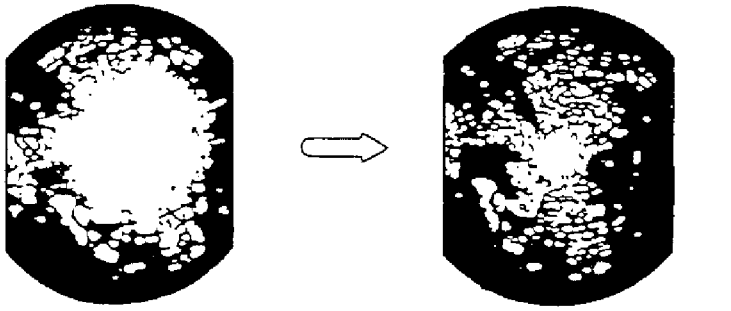


Fig.1-7 Head Set Mode Display

A/C RAIN Control Adjustment

The echoes of ships operating inside rain, hail or snowstorms may be hidden by on-screen rain clutter. Rain clutter is easily recognizable by its woollike appearance on-screen. When this type of interference obscures a large area of the screen, you would use the A/C RAIN control to reduce the clutter.

When solid clutter caused by heavy precipitation is visible on the screen, turn the control clockwise to distinguish targets from the clutter. This control may also be used in clear weather to separate groups of echoes on a congested short range picture. In all cases use discretion when adjusting the control. Advancing it too far clockwise may erase targets from the screen.



rain clutter,
A/C RAIN control CCW

A/C RAIN control adjusted,
rain clutter reduced

Fig.1-8 Effect of the A/C RAIN Control

Reducing Radar Interference

Radar interference may occur when in the vicinity of another shipborne radar operating in the same frequency band. It appears on the screen often as a large number of bright dots either scattered at random or in the form of "curved spokes" (Fig.1-9). This type of interference can be reduced by activating the Interference Rejector circuit. Press the IR touchpad to activate the circuit. The indicator "IR" appears at the upper right-hand corner of the screen. Press the touchpad again to switch it off when no interference exists, otherwise weak targets may be missed. Note that this function should be turned off to receive a radar beacon (racon) signal.

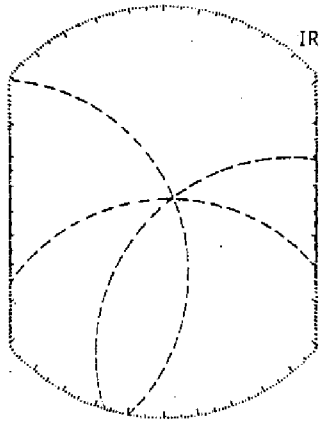


Fig.1-9 Radar Interference

Erasing the Heading Mark/North Mark

When the radar is turned on, the heading mark is displayed. The north mark is also displayed if a gyrocompass is connected. When the heading mark or north mark masks or hinders recognition of a small target echo, press and hold the HM OFF touchpad to temporarily erase them. Release hold to redisplay them.

In addition to erasing the heading mark/north mark, this touchpad can alternate between NM and KM units for the VRM(s) or select true or relative bearing readout for the EBL(s) in HU mode if a gyrocompass is connected. For further details, see the following "RANGE AND BEARING MEASUREMENT."

RANGE AND BEARING MEASUREMENT

The range to a target may be measured with the fixed range rings, erased/displayed by pressing the RING touchpad, or a Variable Range Marker (VRM). The bearing of a target may be measured by an Electronic Bearing Line (EBL).

Selection and operation of the markers used to measure range and bearing are simple. At each bottom corner of the display unit there is a touchpad control, EBL ON/OFF on the left corner and VRM ON/OFF on the right corner, and a rotary knob. The ON and OFF touchpads on each touchpad control are used to display and erase a marker and its readout from the screen. If two alike markers are displayed when the OFF portion is pressed, the readout not circumscribed is erased. Each rotary knob operates two markers, VRM1/VRM2 or EBL1/EBL2. The marker whose readout is circumscribed is currently operable by a rotary knob. To transfer control to the other marker, press the ON portion of the touchpad.

Range Measurement  , 

The range to a target is roughly measured with the range rings, which are displayed/erased by pressing the RING touchpad.

For more accurate measurement of the range to a target you would activate the VRM. Press the VRM ON touchpad until the VRM readout you want to operate is circumscribed. Next, rotate the VRM control until the circle described by the VRM just touches the inside edge of the target blip (see Fig.1-10). The range to the target is shown at the lower right-hand corner of the screen; VRM1 readout on top and VRM2 readout below it.

Note that the lengths of the dash and space on VRM1 and VRM2 are different as shown in Fig.1-10.

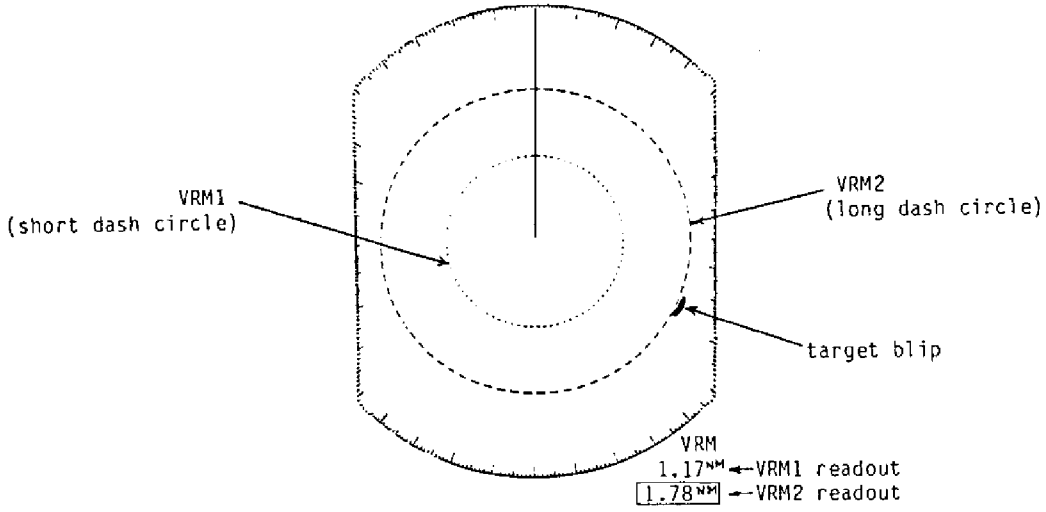


Fig.1-10 Measuring Range With a VRM

VRM Unit Selection  , 

The unit of measurement for the VRM1/VRM2 can be changed from NM to KM (and vice versa). Press the VRM ON touchpad to select valid VRM you want to change, and then press the VRM ON touchpad while pressing and holding the HM OFF touchpad.

Note: Change from NM to SM (statute mile) is possible by changing the setting of a DIP switch. Refer to appendix 1 on page AP1-1.

Bearing Measurement 

Press the EBL ON touchpad until the EBL readout you want to operate is circumscribed. Then, rotate the EBL control until the EBL bisects the target blip (see Fig.1-11). The relative or true bearing is shown at the lower left-hand corner of the display screen; EBL1 readout on top and EBL2 readout below it. (Ship's heading is displayed just above the EBL indicator when a gyrocompass is connected.)

Note that the lengths of the dash and space on EBL1 and EBL2 are different as shown in Fig.1-11.

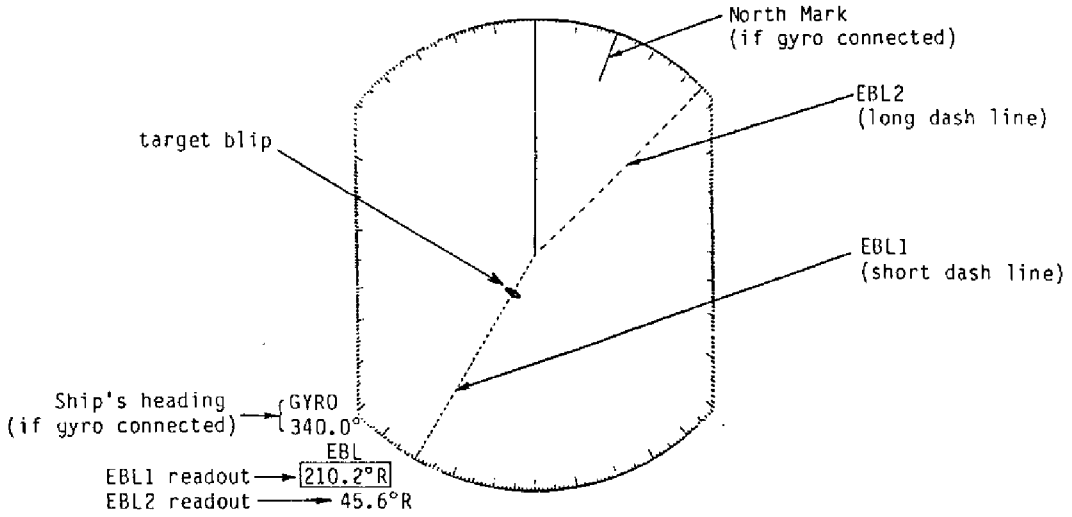
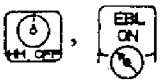
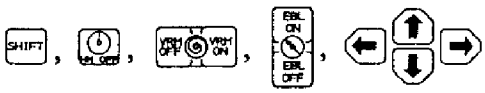


Fig.1-11 Measuring Bearing With an EBL

True Bearing Indication 

EBL readouts are relative to own ship's heading in the Head-Up mode, while true (relative to north) on North-Up or Course-Up modes. When the gyro is in use, however, Head-Up mode permits EBL readout in either relative to heading or true north. Press the EBL ON touchpad to select a desired EBL. Then, press the EBL ON touchpad while pressing and holding the HM OFF touchpad, and the EBL readout alternately changes between "R(relative)" and "T(true)".

Range & Bearing Between Two Targets (Floating EBL) 

The EBL1 origin and VRM1 center can be offset to measure the range and bearing between any two targets on the screen, or predict movement of another ship.

1. Move the cross hair cursor "+" to one of the two targets selected with four cursor shift touchpads.

2. Press the SHIFT touchpad while keeping the HM OFF touchpad pressed, and the EBL1 origin and the VRM1 center are offset to the cross hair cursor intersection marked by "x".

3. Adjust the EBL control so that EBL1 bisects the other target in concern, and adjust the VRM control so that VRM1 rests on the inner edge of the target. Now, the range and bearing between the two are given by VRM1 and EBL1 readouts.

4. To predict another ship's course, place EBL1 over the target after passing several minutes. If EBL1 bisects own ship, the possibility of collision exists. Refer to Fig.1-14 on page 1-11.

SHIFTING THE DISPLAY SHIFT,

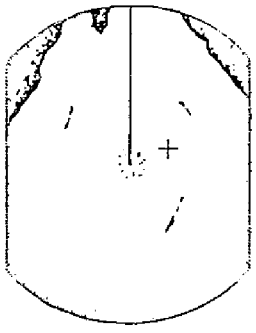
The own ship's position can be shifted to any position on the radar screen. The primary advantage of the shifted (off-center) display is that for any particular range setting the view ahead, behind or on the sides of own ship can be extended without changing the range in use.

The cross hair cursor "+", which may be maneuvered by the four cursor shift touchpads, is used to select the area to be shifted.

Note that the maximum range of the shifted display function is limited to 1.6 times the original range.

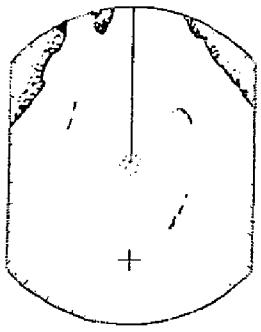
Procedure

1. Press a cursor shift touchpad to present the cross hair cursor on the screen (a). Set the cursor on the area desired (b). After releasing hold of the touchpad, the cursor will flash 3 seconds before being erased.



(a)

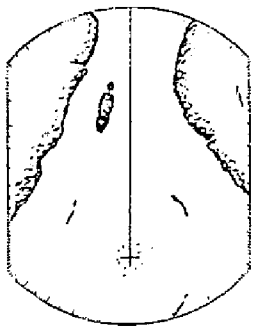
NOTE 1: The cursor can be returned to the center of the screen by pressing the ⬆ and ⬇ touchpads simultaneously.



(b)

NOTE 2: When continuously pressing a cursor shift touchpad, the cursor moves close to the bearing scale, and a series of beep tones will be generated, telling you that the cursor cannot be moved farther outward.

2. Press the SHIFT touchpad, and the own ship's position is off-centered (c). The heading mark is shifted to where the cursor was last positioned, and the cursor is redisplayed 3 seconds before being erased.



(c)

3. To cancel the shift function, press the SHIFT touchpad again.

Fig.1-12 Shifting the Display

ZOOM FUNCTION [X2 ZOOM], [↑↓←→]

The area between own ship and an arbitrary location can be doubled with the zoom function. This function lets you take a closer look at an area of interest without changing the range in use.

Note that this function is not available when the shift function is on. If you attempt to activate it when the shift function is on, successive beep tones will be generated, informing you of unacceptable key entry.

Procedure

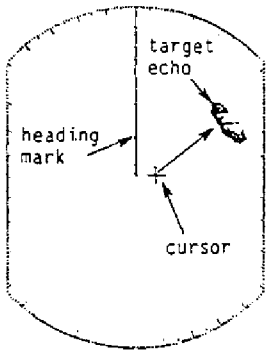
1. Press any cursor shift touchpad to display the cross hair cursor "+" (a); operate four cursor shift touchpads until the cursor is near the target (b). After releasing hold of a cursor shift touchpad, the cursor flashes 3 seconds before being erased from the screen.

   NOTE 1: The cursor can be returned to the center of the screen by pressing the [↑] and [↓] touchpads simultaneously.

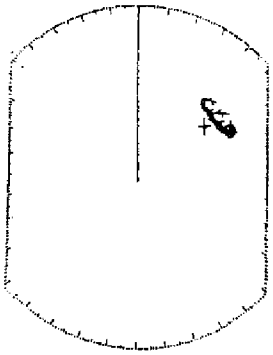
   NOTE 2: When continuously pressing a cursor shift touchpad the cursor moves close to the bearing scale, a series of beep tones will be generated, telling you that the cursor cannot be moved farther outward.

2. Press the X2 ZOOM touchpad to activate the zoom function. The own ship will shift to an opposite position to the cursor in reference to the screen center, thereby producing a doubled screen size for the same range between the own ship and the target (c). The message "ZOOM" flashes at the lower right-hand side of the screen.

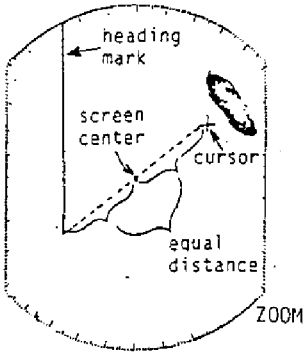
3. To cancel the zoom function, press the X2 ZOOM touchpad. The zoom function can also be cancelled by pressing the SHIFT touchpad or changing the range.



(a)



(b)



(c)

Fig.1-13 Using the Zoom Function

TRAILING TARGET ECHOES

The ECHO TRAIL touchpad is used to plot the relative movement of all targets to own ship in a lower intensity. (True motion plotting is available when connected to the RP-3 Video Plotter and gyrocompass.) This feature helps the operator to evaluate traffic situations of all targets. Each time the ECHO TRAIL touchpad is pressed, the plotting time changes in the following sequence.

→30 sec.→1 min.→3 min.→6 min.→continuous→off

When the plotting function is turned on, e.g., 30 sec. is selected, "30S" (plotting time) is indicated at the upper right on the screen, the timer shown to the left of "30S" starts counting up and the trail of every target starts extending. As soon as the timer counts 30 sec., the timer indication disappears and thereafter only plotting is continued. The trail of the target is erased from its oldest tip and only the last 30 sec. remains on the screen. The faster the relative speed of the target, the longer the trail of the target.

NOTE: If continuous plotting is selected, the timer continuously stays on the screen, and it counts up from 0:00 to 99:59 and the trail extends continuously without being erased.

If the range is changed while plotting is being performed, the indication "ECHO TRAIL" is displayed in inverse video (black characters, green background), informing the operator that the plotting mode is suspended. Return to the previous range setting to resume plotting.

To erase the traces, press the ECHO TRAIL touchpad 10 seconds after the previous press.

Collision Course?

To ascertain another ship as a hazardous target place the EBL on it. If the extension of its latest tracks is on the EBL, it can be a hazardous one. In Fig.1-14, ship A can be on collision course and ship B will pass clear to starboard.

"Floating EBL" (page 1-8) is another method to predict other ship's course. Suppose that ship C (initial position) goes to C' after several minutes. Since the floating EBL1 passes through own ship, possibility of collision exists.

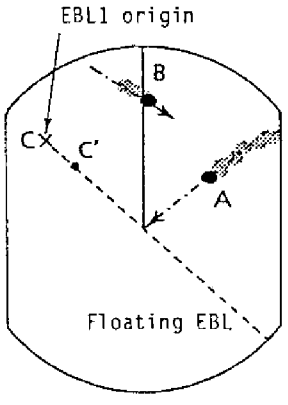


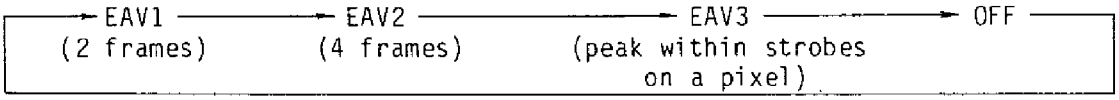
Fig.1-14

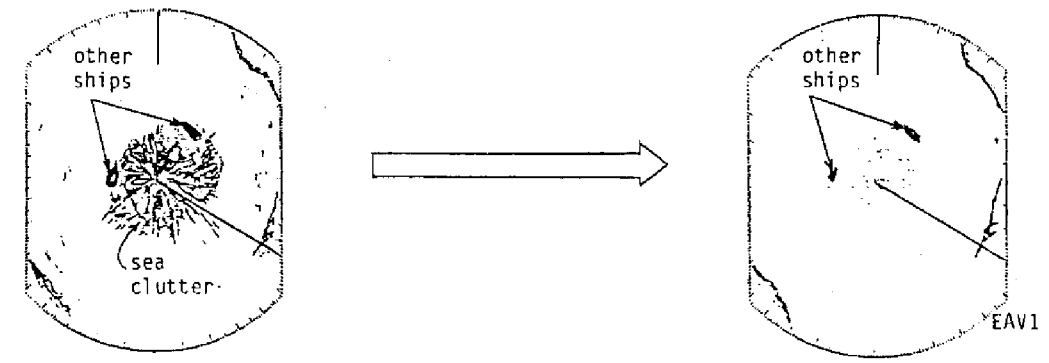
ECHO AVERAGING

Echo averaging function is turned on or off by pressing the ECHO AVG touchpad, and its basic idea is to paint stable targets in normal intensity and unstable echoes in lower intensity.

Echoes received from stable targets such as other ships (moving at the slower relative speed to own ship) appear on the screen at almost the same position for every sweep, while unstable echoes such as sea clutter appear at random. To distinguish target echoes from sea clutter, this radar uses the scan-to-scan correlation method, which stores and averages successive two or four picture frames. If the echo is stable it is presented in its actual strength level. To the contrary, if it is unstable it is suppressed in intensity, allowing you to discriminate targets from sea clutter.

To properly use the echo averaging function, first suppress sea clutter with the A/C RAIN control (A/C SEA control: fully CCW). Then, press the ECHO AVG touchpad. Each time the touchpad is depressed the level of correlation changes in the following sequence, and annunciator appears at the lower right-hand corner of the screen. EAV3 does not provide correlation but picks up the peak level among several strobes in a frame. This is useful to track target masked by short range sea clutter.





radar picture before engaging echo averaging

radar picture after engaging echo averaging

Fig.1-15 Echo Averaging Function

Echo average 1 & 2 should not be used when speed difference between own ship and other ships is large or when own ship is being subjected to heavy pitching or rolling.

Note: In Head-Up mode, EAV1 and EAV2 cannot be used. (EAV3 may be used in this mode.) It, however, is possible to make EAV1 and EAV2 work in Head-Up mode. Change the setting of DIP switch S1 #5, referring to Appendix 1.

SETTING THE ALARM  ,  , 

An alarm may be set to visually (flashing) and audibly (beep sound) alert you should targets (ships, landmasses, etc.) above a certain signal level enter into a preset guard zone. A guard zone is defined as an area where you do not want targets to enter in. The size of the guard zone may be set between 0 and maximum range for distance and between 0° and 360° in bearing.

This alarm is very effective as an anti-collision aid when using an autopilot or navigating in narrow channels. However, it does not relieve the operator of the responsibility to watch out for possible collision situations. It should never be used as a primary means to detect possible collision situations.

The procedure to set the guard zone and alarm is as follows.

Range Setting

1. Press the VRM ON touchpad to display VRM1; and then rotate the VRM control until VRM1 is at the range desired for the inner limit of the alarm.

2. Press the VRM ON touchpad again to display VRM2; rotate the VRM control until VRM2 is at the range desired for the outer limit of the alarm.

Sector Setting

3. Press the EBL ON touchpad to display EBL1; rotate the EBL control until EBL1 is at the bearing desired for the counterclockwise limit of the alarm.

4. Press the EBL ON touchpad again to display EBL2; rotate the EBL control until EBL2 is at the bearing desired for the clockwise limit of the alarm.

Alarm Setting

5. Press the GUARD ALARM touchpad, and the indication "GUARD" will appear at the top right-hand side of the screen. Any targets entering the guard zone will trigger the alarm. The EBLs and VRMs may be operated without disturbing the settings of the alarm.

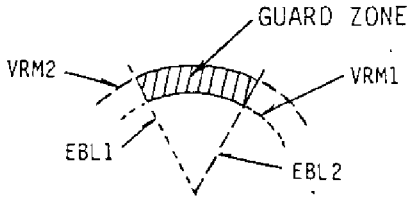


Fig.1-16 Guard Zone

To suspend the alarm sound, press the GUARD ALARM touchpad once. The message "GUARD" will be reversed. Press the GUARD ALARM touchpad again to restore sound. To cancel the alarm function, press and hold the touchpad for more than one second.

NOTE 1: When the range in use is lower than the range of the guard zone, the indication "GUARD UP RANGE" appears on the screen, replacing the indication "GUARD."

NOTE 2: The alarm sounds when targets having a certain level of strength enter the guard zone. This level includes not only ships and landmasses, but also returns from seaface or precipitation. Since the level is changeable with the environment, the operator is required to properly adjust the gain and anti-clutter controls. It should be noted that excessively high settings of A/C controls can fail in alerting small targets.

MAGNIFYING TARGET ECHOES ECHO STRETCH

As a general rule of thumb, the reflected echoes from long distance targets are displayed on the screen as weaker and smaller blips even though they are compensated by the radar's internal circuitry.

The echo stretch function is provided to magnify small targets in middle and long ranges, i.e., 1.5 nm range or higher. Press the ECHO STRETCH touchpad, and the indicator "ES" is displayed at the upper right-hand corner of the screen and the echoes are doubled lengthwise. Note that this function is inactive in short ranges; "ES" is indicated in inverse video.

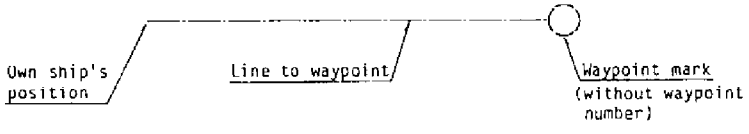
DISPLAYING OWN SHIP'S POSITION & WAYPOINT (OPTION) MODE, HM OFF

Own ship's position in latitude/longitude, and range/bearing to a waypoint selected on the nav aid may be displayed at the lower center of the screen if an external navigator having NMEA0183 or FURUNO CIF format is connected. In case of FURUNO CIF format, it is necessary to cut jumper wire JP5 on the PROCESSOR board. JP5 is connected for NMEA0183 when the radar is shipped.

1. Press the MODE touchpad while keeping the HM OFF touchpad pressed, and WP (Waypoint) and LL (Latitude/Longitude) are displayed, provided that the waypoint number is not indicated.

2. Repeat step 1 to cancel the WP/LL indication.

Note: If a gyrocompass is connected, both a mark and a line to a waypoint are displayed on the radar screen, provided that only the line is drawn if the waypoint is out of the range selected.



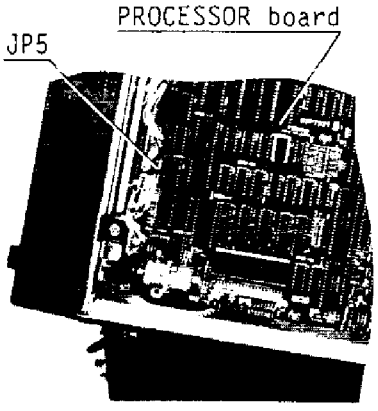


Fig.1-17

N Photo No.2498

CHAPTER 2 MAINTENANCE

This equipment is designed and constructed to give the user many years of trouble-free operation. However, to maintain optimum performance maintenance must be performed at regular intervals. Recommended maintenance intervals and check points are given in the table below.

"CAUTION"

Before beginning maintenance work, be sure to switch off the equipment at the main switchboard. When checking inside the units, wait for a few minutes until the high voltage components (CRT or HV capacitors) can discharge the residual charge.

Interval	Check Point	Check/Measures	Remarks
3 to 6 months	CRT screen	Dirt on this creates symptoms identical to poor sensitivity. Clean CRT surface carefully, using care not to scratch it.	*Use a soft cloth with a slight amount of anti-static-charge spray. Never apply plastic solvent.
6 months to 1 year	CRT anode	High tension on CRT attracts dust in environment, and moist dust will cause poor insulation.	*If any crack is found on rubber cap or wire sheath, call for service to replace damaged part. Do not touch these parts since high voltage may exist.
	Terminal boards, sockets and plugs	Check for loose connections. Clean contacts or replace plug, if necessary.	

CHAPTER 3 TROUBLESHOOTING

Whenever you suspect the radar is not functioning properly, turn it off and check plug connections on p.c.boards, then proceed to the Trouble Finding List on the next page, if necessary. If a p.c. board is found to be faulty, replace it or call for service. Do not attempt further component check in any p.c. board. Careless handling may damage the board.

"CAUTION"

There are high tension points in the CRT display unit. Take special care when approaching the CRT circuit.

Service Call

Please provide the following information when requesting service.

1. Name of the vessel
2. Vessel's location (port/berth)
3. Sailing Schedule
4. Radar model (Serial number/Date manufactured)
5. Description of the problem (include results of the troubleshooting checks)
6. Previous service

Trouble Finding List

Operation	Symptom	Check Point	Remarks
Turn POWER-SW on and adjust PANEL DIMMER control.	Illumination lamps for front panel do not come on with PANEL DIMMER turned fully CW.	1. Main fuse F1351 (25A or 10A)	*25A for 12VDC mains, 10A for 24/32VDC mains
		2. Mains voltage/ polarity	*Measure mains voltage at DTB-I #1(+) and #2(-). See Fig.4-1. The voltage should be: 10.2 to 15VDC (12VDC set) 20.4 to 40VDC (24/32VDC set)
		3. POWER SUPPLY board	
		4. Illumination lamps	
Adjust BRILLIANCE control.	Nothing appears on CRT.	1. CRT	*Visually check that CRT heater is lit.
		2. CRT H.T.	
		3. DEFLECTION board	*Adjust CONTRAST pot. (RV101) and BRIGHT pot. (RV204) on DEFLECTION board. If picture appears, CRT assembly is OK.
		4. PROCESSOR board	
	Picture synchronization is abnormal.	1. CRT assembly (DEFLECTION board, etc.)	*Adjust V-HOLD pot. (RV202) and H-HOLD pot. (RV401) on DEFLECTION board. If synchronization is not achieved, DEFLECTION board is defective.
		2. PROCESSOR board	

CHAPTER 4 PARTS LOCATION

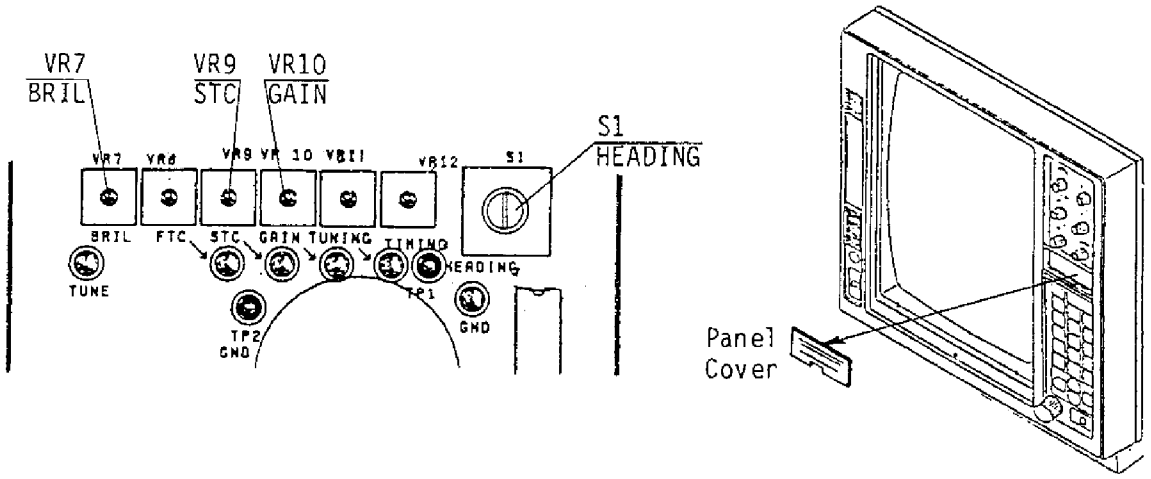


Fig.4-1 Arrangement of Preset Pot.

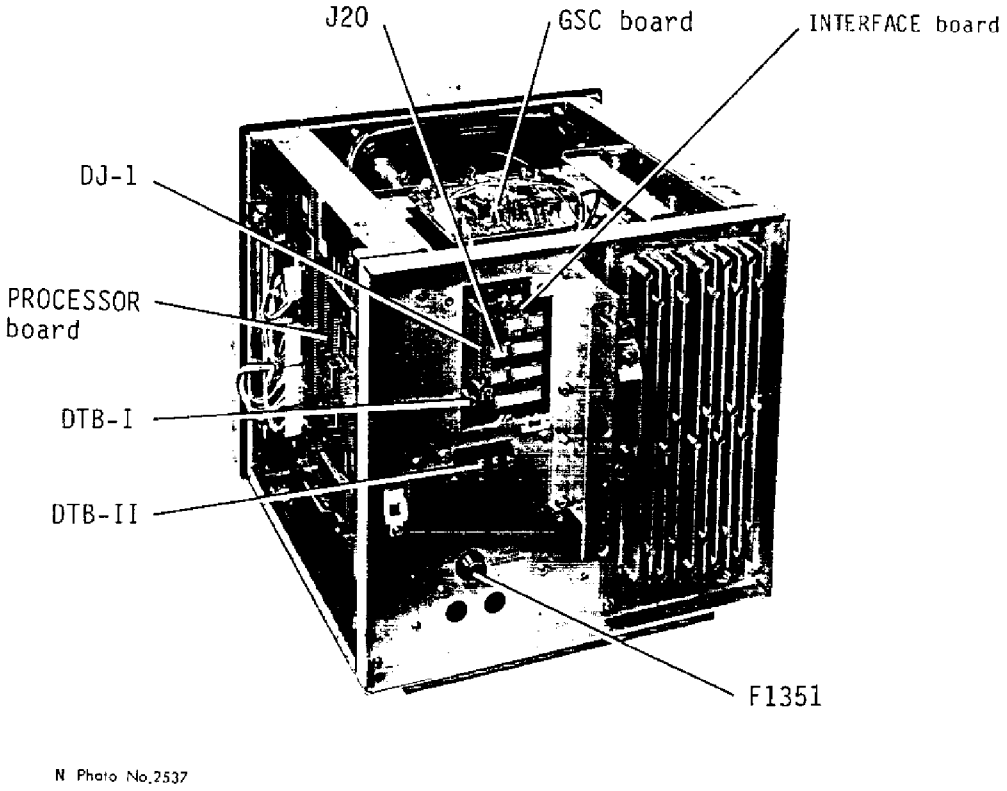


Fig.4-2 Display Unit (Rear view)

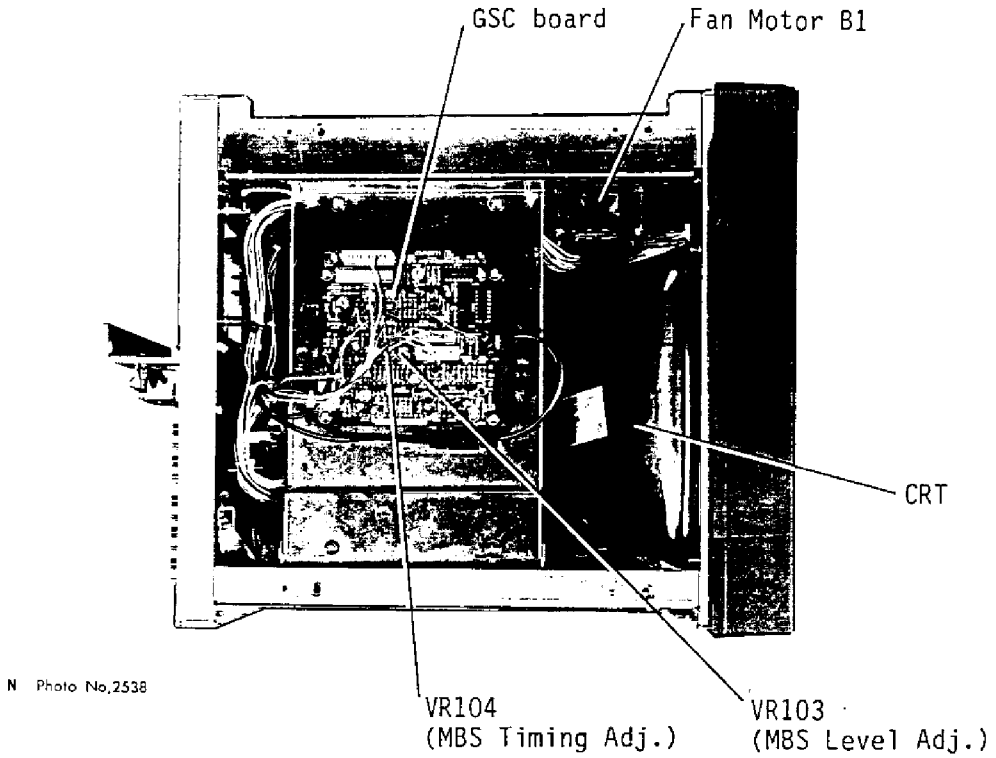


Fig.4-3 Display Unit (Top view)

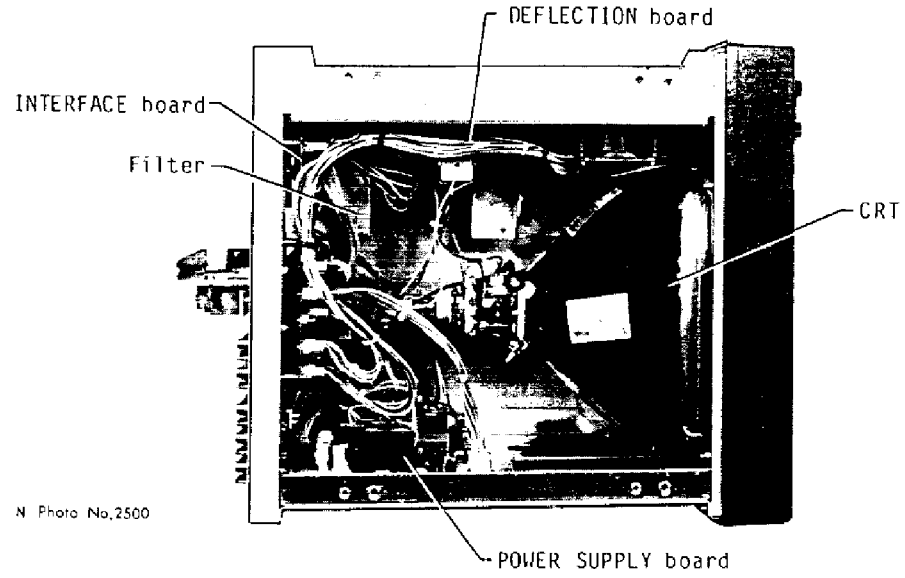
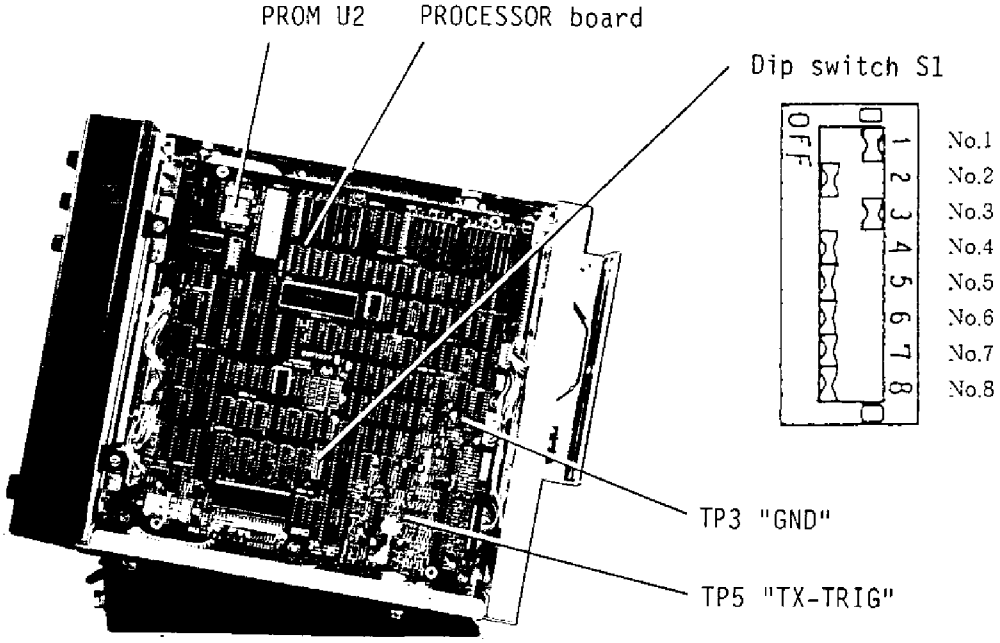
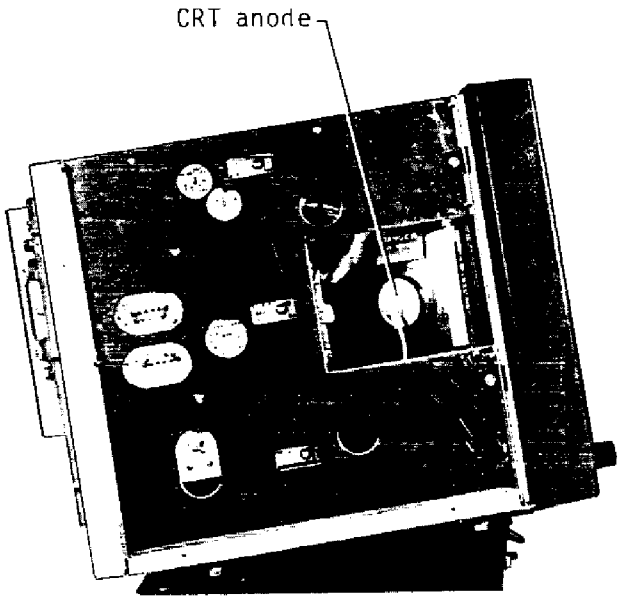


Fig.4-4 Display Unit (GSC board fixing plate removed)



N Photo No.2498

Fig.4-5 Display Unit
(Side View, cover removed)



N Photo No.2499

Fig.4-6 Display Unit
(Side view, cover removed)

APPENDIX 1 DIP SWITCH

The specifications of this equipment can be changed by switching the settings of DIP switch S1 on the PROCESSOR board. The specifications of each switch are given in the table below.

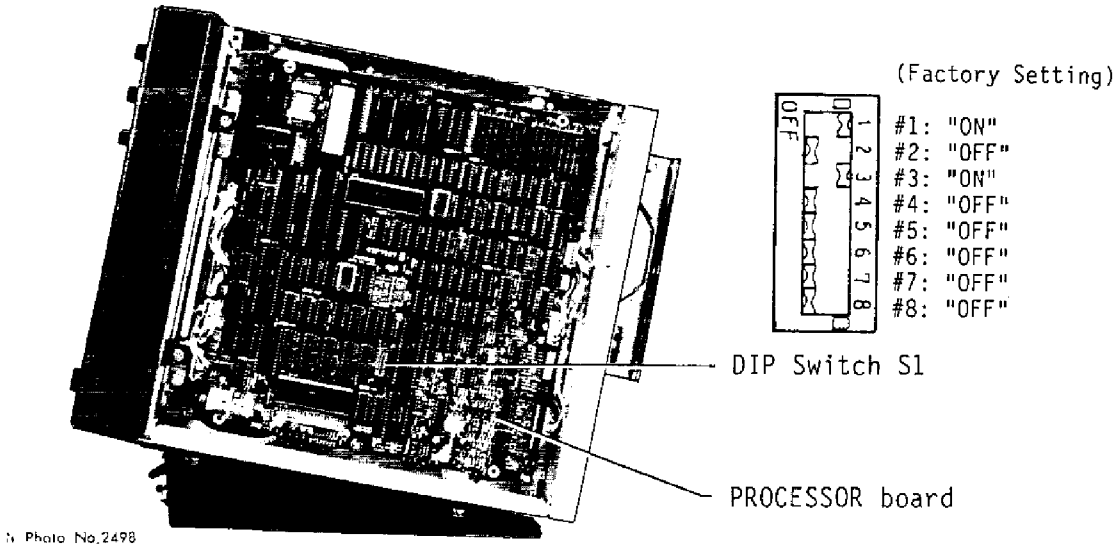


Fig. 1 Display Unit (cover removed)

No.	Specification	OFF	ON
1	Radar Selection	Master Radar	Slave Display
2	Model Selection FMD-8000	No.2 OFF	No.3 ON
4	WP & L/L Indication (if nav aid connected)	Nav Data	
5	Use of Echo Averaging Levels 1 & 2 in the Head-up Mode	NO	YES
6	Key Operation Confirmation (beep tone)	YES	NO
7	Unit of Variable Range Marker	NM/KM	NM/SM
8	Transmit or no when scanner rotation is suspended.	NO (ST-BY)	YES (TX)

#8 of DIP switch S1 is ineffective when #1 of S1 is set to "ON".

The settings of the DIP switch are displayed for 3 minutes after the power is turned on. Active settings are circumscribed.

DIP SWITCH	OFF / ON
1	MASTER / [SLAVE]
5 EAV1,2 (HD UP)	[NO] / YES
6 KEY BUZZER	[YES] / NO
7 VRM UNIT	[NM↔KM] / NM↔SM
8 SCAN STOP	[ST−BY] / TX

PROGRAM NO : 0357573−00
ROM CHECK OK
RAM CHECK OK

TOTAL ON TIME=000019 : 55

TOTAL TX TIME=000010 : 09

Appendix 2 Precautions when the FMD-8000 is connected to a radar different from what was specified before shipment

Normally, the radar (master radar) to which the FMD-8000 is to be connected is specified when ordering, and the FMD-8000 is factory-preset according to the order. If, for some reason, the radar to be connected is different from what was specified, the internal preset of the FMD-8000 must be changed.

Selection according to the type of IF Amplifier of Master Radar

Difference between Linear Amplifier type and Log Amplifier type.

	Linear Amp type	Log Amp type
I/O board	03P5556A (no R22)	03P5556 (R22 incorporated)
GSC board (03P6571)	not incorporated	incorporated

Selection according to the Bearing Signal Pulse Count

The system program ROM (U2 on the Processor board 03P7529) differs according to the bearing signal pulse count of the connected radar.

Program No. (PROM U2)	No. of bearing pulse	Connected radar (Master radar)
03581101xx	450 ppr	FR-801D/802D/803D
03575737xx	360 ppr	other than above

(xx ... revision level)

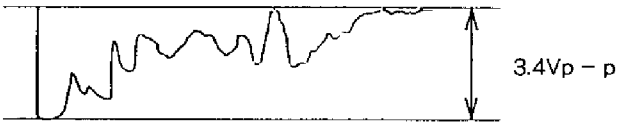
The PROM for 360 ppr is mounted on the Processor board at the factory and the PROM for 450 ppr is supplied as spare parts.
When connecting to FR-801D/802D/803D radar, change the PROM U2.

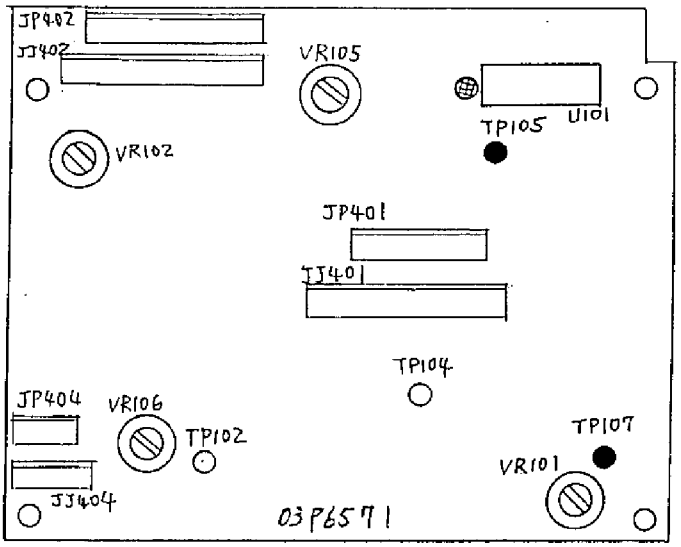
Appendix 3 Post Installation Adjustment

1. Video Signal Level Adjustment (Log Amplifier Type only)

GSC board 03P6571 is built in FMD-8000 Log Amplifier Type. The video signal level should be adjusted by the potentiometer on the GSC board.

1) Transmit the master radar on 24 mile range, long pulse with the scanner rotation suspended.
2) Connect the probe of oscilloscope to TP107 on the GSC board. (50us/div, 1v/div)
3) Adjust VR101 on the GSC board so that the level of the strongest signal (or main bang) should be 3.4Vp-p.





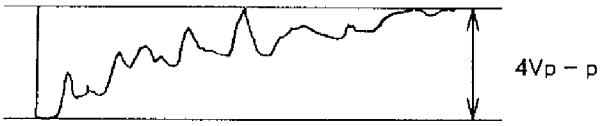
2. Heading Alignment

If the picture is shifted cw or ccw due to the heading error, adjust the HEADING align switch S1 on the PANEL board. (Take off the preset panel cover for access to the HEADING switch S1.) The heading error of ±5° can be corrected in 0.7° step.

3. Adjustment of I/O Board 03P5556 (for connection with other makes of radar)

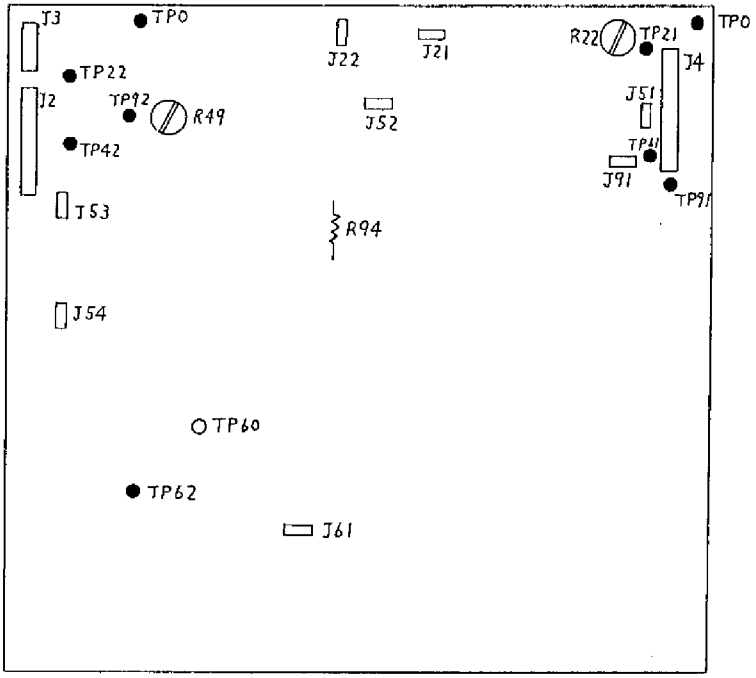
Video Signal Level Adjustment

Connect the probe of oscilloscope to TP22 on the I/O board and external trigger probe to TP22. (50us/div, 1V/div) Adjust the potentiometer R22 for maximum video signal of 4Vp-p.



Trigger Timing Adjustment

Adjust the potentiometer R49 on the I/O board so that the straight target (wharf or breakwater etc.) is displayed straight on the screen.



I/O board (03P5556)

TP22: Video Signal Output
TP42: Trigger Signal Output
TP92: Heading Signal Output
TP62: Bearing Signal Output

NOTE: The I/O board is mounted on the GSC board fixing bed. If the GSC board is mounted, the I/O board is fixed on the other side of the GSC board fixing bed.

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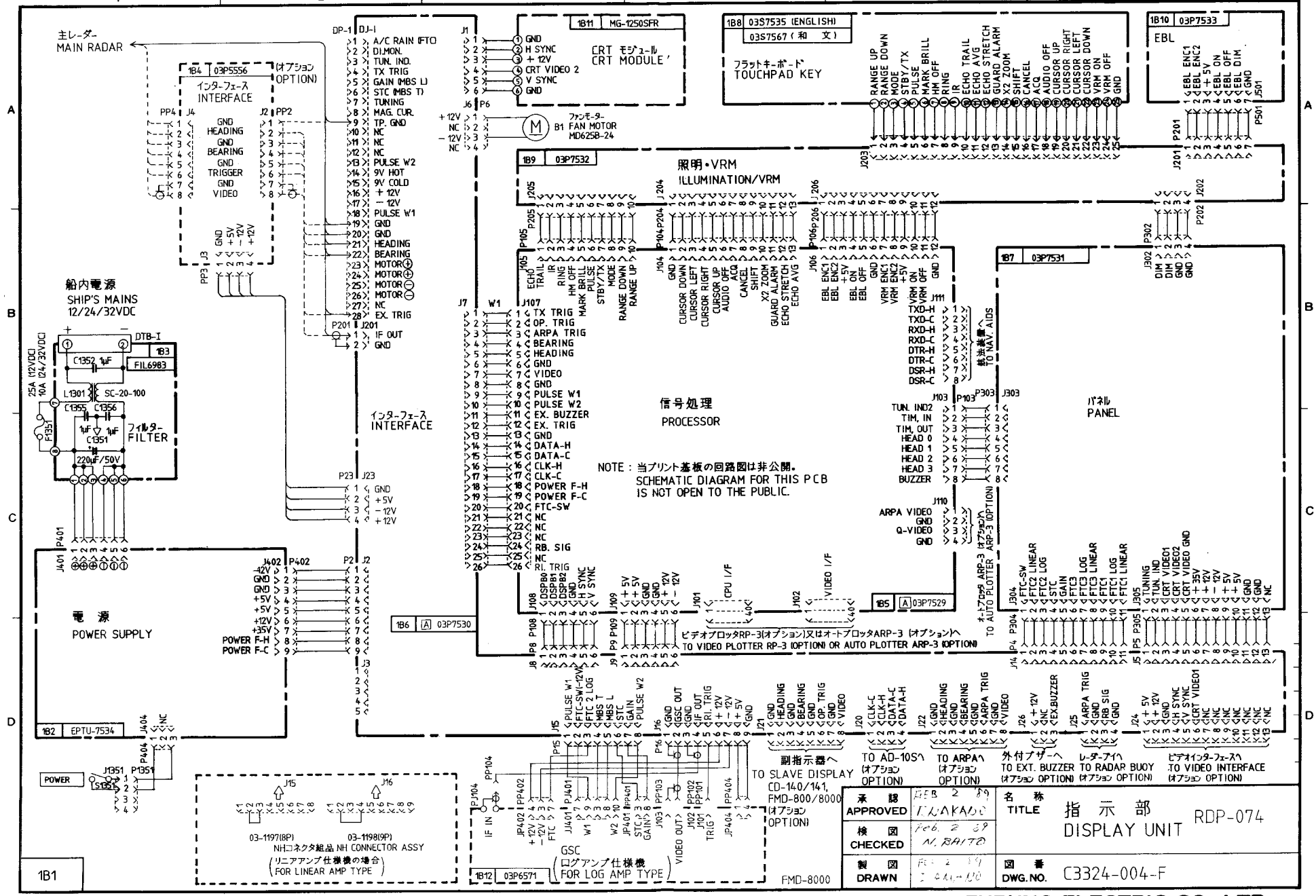
S - 1



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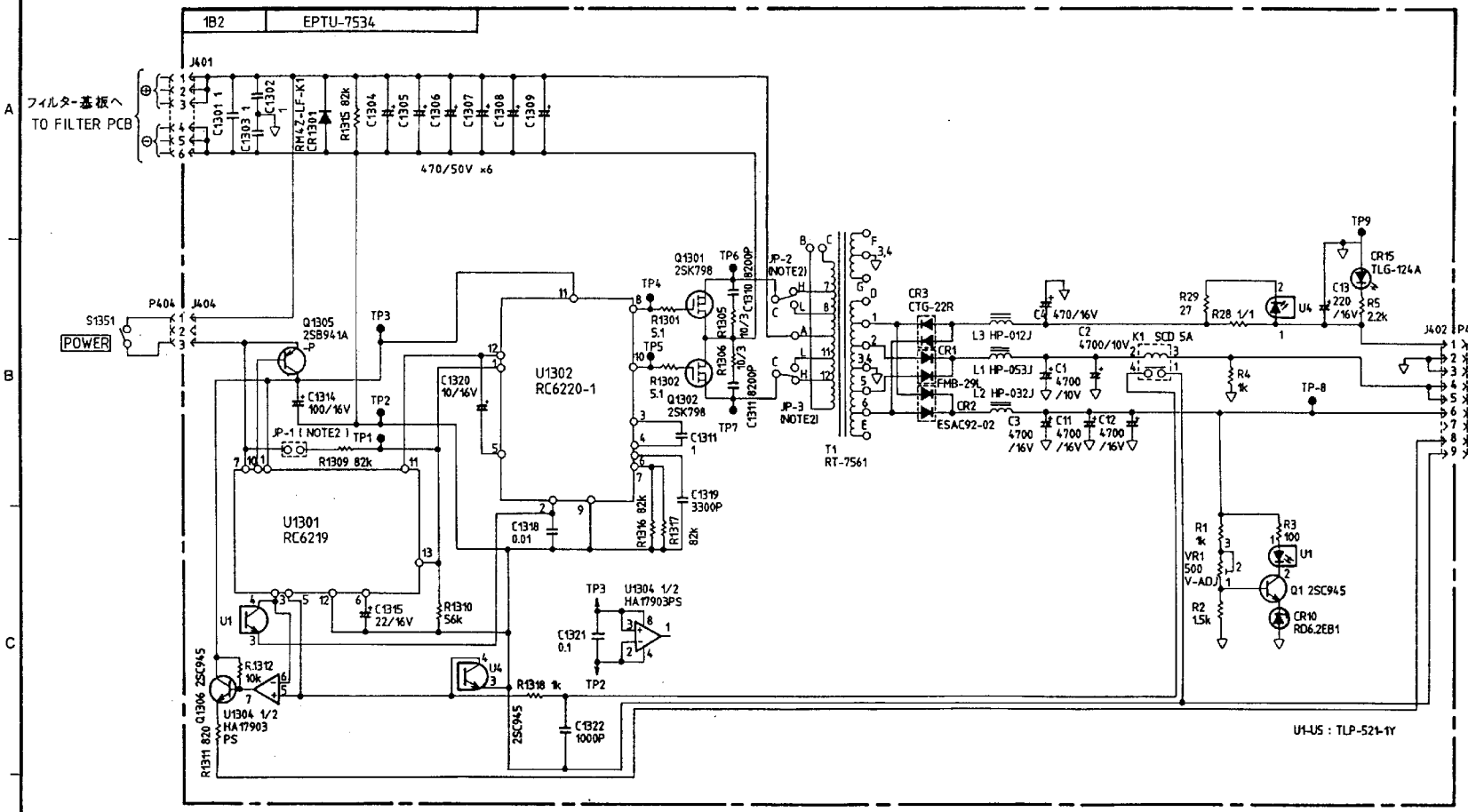

NOTE 1. 特記なき抵抗の単位は全てΩ,0.25W 又コンデンサはμF.
ALL RESISTANCE IN OHMS. 0.25W, CAPACITANCE IN MICRO FARADS UNLESS NOTED OTHERWISE.

NOTE 2. 電源仕様により右の様にジャンパーを変える.
CHANGE JUMPER CONNECTIONS ACCORDING TO SHIP'S MAINS VOLTAGE.

MAINS VTG	JP-1	JP-2 ~ JP-5
12VDC	SHORT	CONNECT TO "L"
24/32VDC	OPEN	CONNECT TO "H"

承認 APPROVED	MAR 14, '89 T.NAKANO	名称 TITLE	PTU-7534 電源基板 (EPTU) POWER SUPPLY
検図 CHECKED	Mar 12 '89 M.SHITO		
製図 DRAWN	MAR. 14 '89 I.AMANO	図番 DWG.NO.	C3324-006-B

FMD-8000

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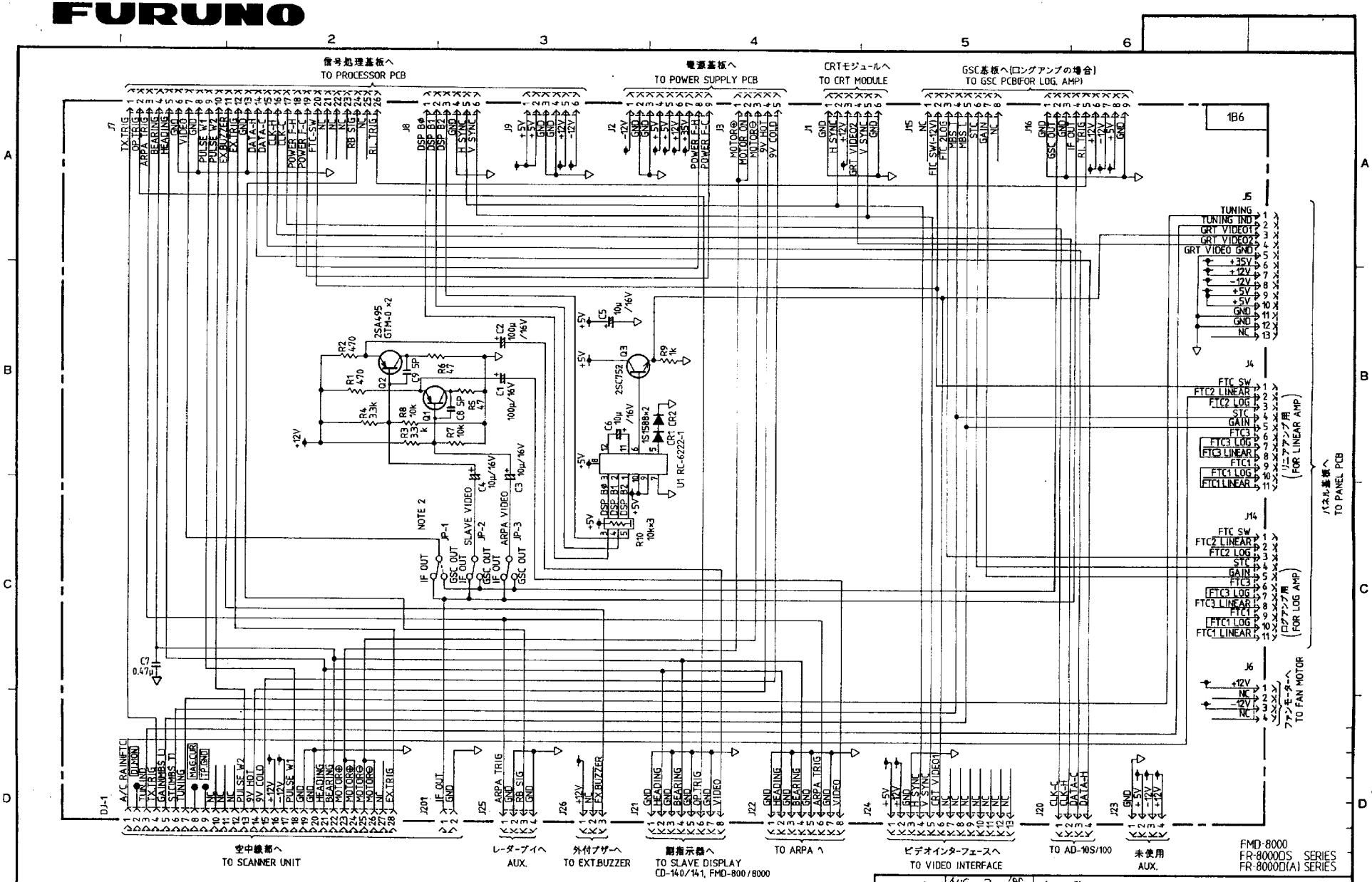

NOTE 1: 特記なき抵抗の単位は全てΩ, 0.25W 又 コンデンサはF.
ALL RESISTANCE IN OHMS, 0.25W, CAPACITANCE IN FARADS UNLESS NOTED OTHERWISE.
2: JP-1の設定は03P7530の場合……IF OUT側, A03P7530の場合……GSC OUT側.
CONNECTIONS OF JP-1: FOR 03P7530……IF OUT, FOR A03P7530……GSC OUT.
3: JP-2, JP-3の設定はそれぞれ接続する副指示器, ARPAの仕様に合わせる. IF OUT……ログ仕様の時. GSC OUT…リニア仕様の時.
SET JP-2 & JP-3 RESPECTIVELY FOR CONNECTED SLAVE DISPLAY & ARPA. IF OUT…FOR LOG SPEC. GSC OUT…FOR LINEAR SPEC.

承認 APPROVED	AUG. 2. '88 T. NAKAJO	名称 TITLE	03P7530 インターフェース基板 INTERFACE PCB
検図 CHECKED	Aug. 1. '88 I. AMANO		
製図 DRAWN	1ST. Aug. '88 Y. HATAI	図番 DWG. NO.	C3314-011-D

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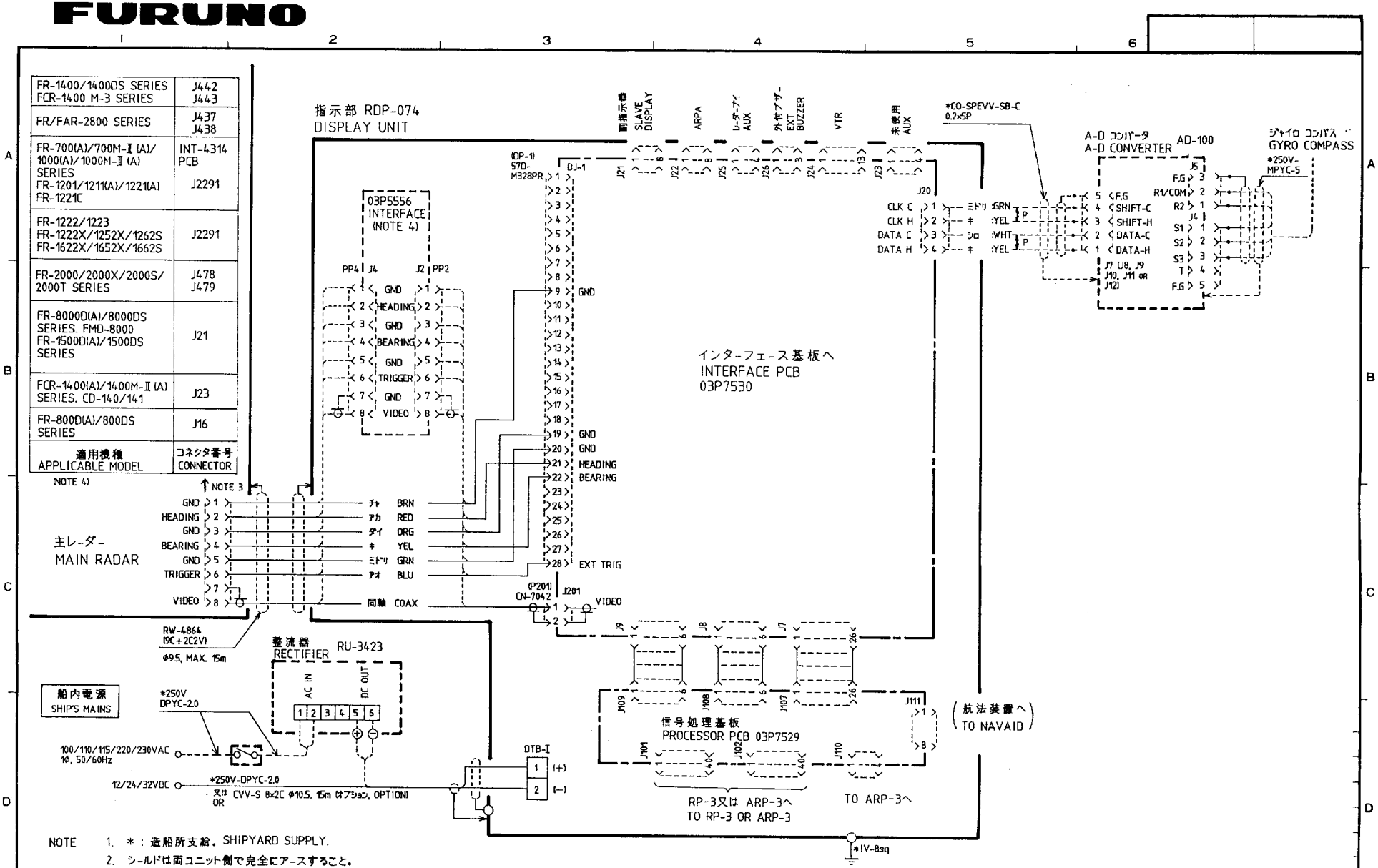

NOTE
1. ＊：造船所支給。SHIPYARD SUPPLY.
2. シールドは両ユニット側で完全にアースすること。
   SHIELD SHOULD BE EFECTIVELY GROUNDED AT BOTH UNIT ENDS.
3. コネクタプラグ取付済。 CONNECTOR PLUG FACTORY-WIRED.
4. 他社レーダー等、明記されていないレーダーに接続時、インターフェース基板(03P5556)が必要な場合がある。
   INTERFACE PCB(03P5556) MAY BE REQUIRED WHEN CONNECTING TO OTHER MAKES OF RADAR.

承認 APPROVED	FEB・2・'89 T.NAKANO	名称 TITLE	FMD-8000 相互結線図 INTERCONNECTION DIAGRAM
検図 CHECKED	FEB・2・'89 N. SAITO		
製図 DRAWN	FEB・2・'89 I. AMANO	図番 DWG.NO.	C3324-005-C

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S-4

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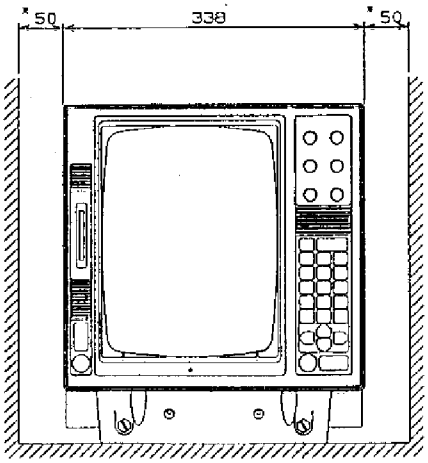
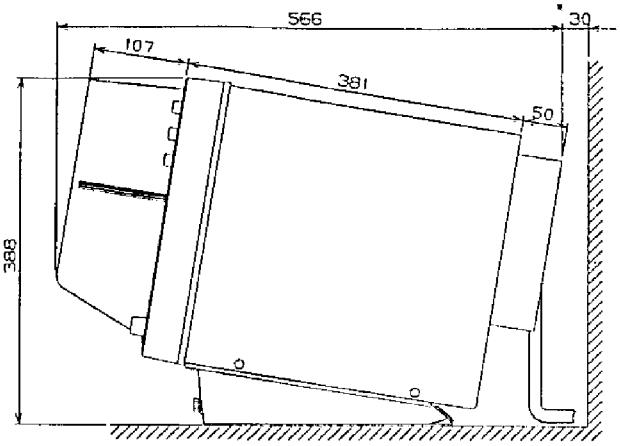
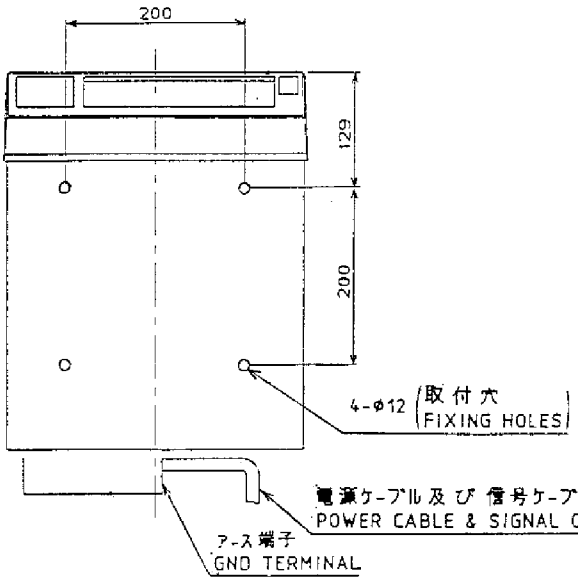
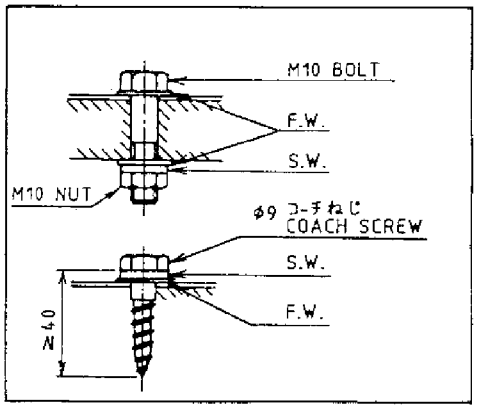
D - 1









NOTE 1 * : 推奨サービス空間.
RECOMMENDED SERVICING CLEARANCE.

NOTE 2 : 装備ケーブルはサービス時、指示部を前方に十分引き出せるよう余裕をもたせること.
SUFFICIENT EXTRA CABLINGS SHOULD BE ALLOWED AT THE BACK OF THE UNIT SO THAT THE UNIT CAN BE DRAWN OUT WITH THE CABLES CONNECTED FOR MAINTENANCE.

コンパス安全距離
COMPASS SAFE DISTANCE

標準コンパス STANDARD COMPASS	1.30m
操舵コンパス STEERING COMPASS	0.75m

FR-8050D(A)/8100D(A)
8250D(A)

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

承認 APPROVED	June·21·'88 M.Tefuta	三角法 THIRD ANGLE PROJECTION		名称 TITLE	レーダー指示部外寸図 RADAR DISPLAY UNIT
検図 CHECKED	June·21·'88 I. AMANO	尺度 SCALE	1/8		
製図 DRAWN	14TH·June·'88 T. HATAI	重量 WEIGHT	19 kg	図番 DWG. NO.	C3314-007-A

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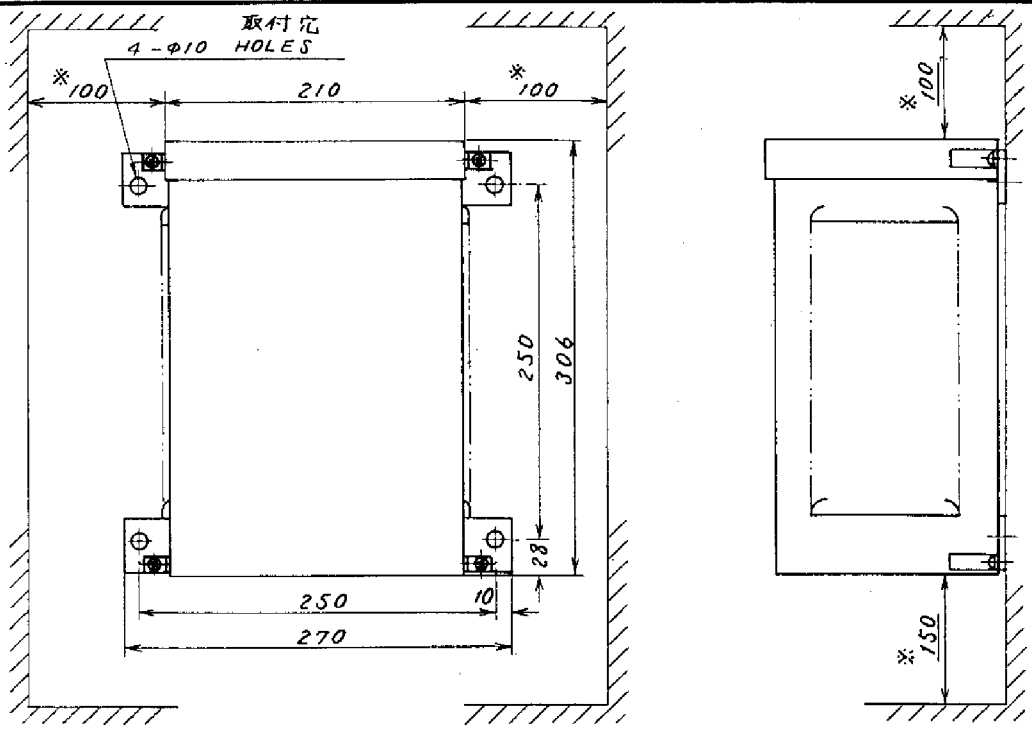
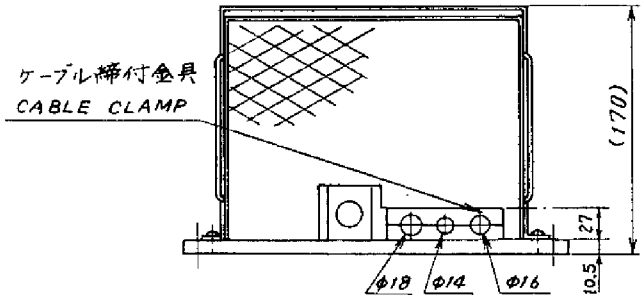
D - 2

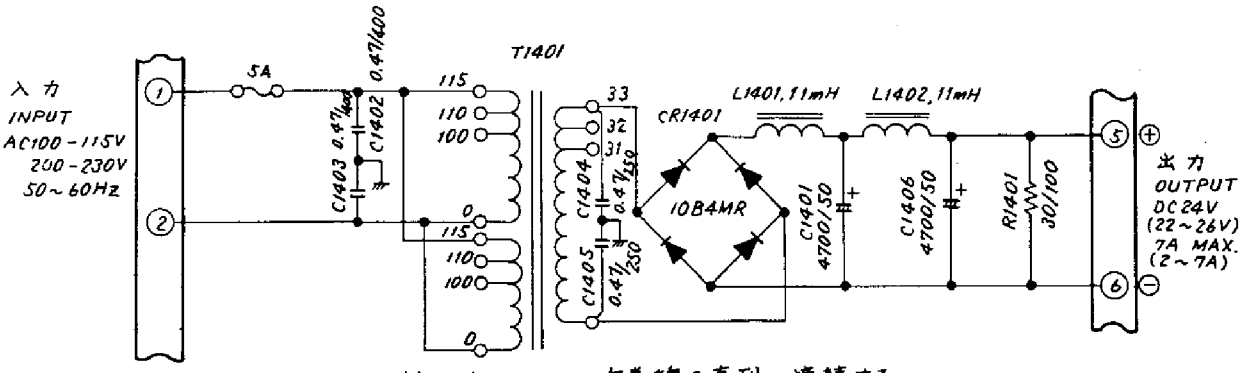




NOTE 1. ※: 推奨サービス空間。
RECOMMENDED SERVICING CLEARANCE.

2. コンパス安全距離
COMPASS SAFE DISTANCE.

スタンダード STANDARD	2.1M
ステアリング STEERING	1.5M



注. AC220V 入力に対しては T1401 の一次巻線を直列に接続する。

NOTE FOR 220VAC INPUT, CONNECT T1401 PRIMARY WINDINGS IN SERIES.

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

承認 APPROVED	Jan 18 '79	三角法 THIRD ANGLE PROJECTION		名称 TITLE	RU-3423 整流器 RECTIFIER UNIT
検図 CHECKED	JAN·17·'79	尺度 SCALE	1/5		
製図 DRAWN	Jan 16 79	重量 WEIGHT	16.5kg	図番 DWG.NO.	C3002-005-H

REV.: 8/85

FURUNO ELECTRIC CO., LTD.