FURUNO

INSTALLATION MANUAL

MARINE RADAR

MODEL FR-1505/1510/1525 MARK-3

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FR-1500 MARK-3 SERIES
(TENI)

SAFETY INSTRUCTIONS

⚠ WARNING

Radio Frequency Radiation Hazard

The radar antenna emits electromagnetic radio frequency (RF) energy which can be harmful, particularly to your eyes. Never look directly into the antenna aperture from a close distance while the radar is in operation or expose yourself to the transmitting antenna at a close distance.

Distances at which RF radiation levels of 100 and 10 W/m^2 exist are given in the table below.

Note: If the antenna unit is installed at a close distance in front of the wheel house, your administration may require halt of transmission within a certain sector of antenna revolution. This is possible. Ask your FURUNO representative or dealer to provide this feature.

Model	Radiator type	Distance to 100 W/m^2 point	Distance to 10 W/m^2 point	RF power density on antenna aperture
FR-1505 MARK-3 (X-band, 6 kW)	XN12AF (4')	None	2.1 m	75 W/cm^2
	XN20AF (6.5')	None	1.0 m	58 W/cm^2
FR-1510 MARK-3 (X-band, 12 kW)	XN12AF (4')	0.1 m worst case	3.5 m	150 W/cm^2
	XN20AF (6.5')		1.8 m	98 W/cm^2
FR-1525 MARK-3 (X-band, 25 kW)	XN20AF (6.5')	1.1 m worst case	9.0 m worst case	200 W/cm^2
	XN24AF (8')		7.5 worst case	

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Do not open the equipment unless totally familiar with electrical circuits and service manual.

Only qualified personnel should work inside the equipment.

Wear a safety belt and hard hat when working on the scanner unit.

Serious injury or death can result if someone falls from the radar scanner mast.

Construct a suitable service platform from which to install the scanner unit.

Serious injury or death can result if someone falls from the radar scanner mast.

Turn off the power at the mains switchboard before beginning the installation.

Fire, electrical shock or serious injury can result if the power is left on or is applied while the equipment is being installed.

Do not install the display unit where it may get wet from rain or water splash.

Water in the display unit can result in fire, electrical shock or equipment damage.

⚠ WARNING

Be sure that the power supply is compatible with the voltage rating of the equipment.

Connection of an incorrect power supply can cause fire or equipment damage. The voltage rating of the equipment appears on the label above the power connector.

Use only the specified power cable.

Fire or equipment damage can result if a different cable is used.

⚠ CAUTION

Ground the equipment to prevent electrical shock and mutual interference.

Observe the following compass safe distances to prevent deviation of a magnetic compass:

	Standard compass	Steering compass
Display unit	1.0 m	0.75 m
Scanner unit (6 kW)	1.65 m	1.25 m
Scanner unit (12 kw)	1.65 m	1.25 m
Scanner unit (25 kw)	2.15 m	1.60 m

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EQUIPMENT LISTS

Standard Supply

FR-1505 MARK-3

Name	Type	Code No.	Qty	Remarks	
Scanner Unit	XN12AF-RSB0074-067	–	1	24 rpm, 1200 mm, CP03-24201	
	XN20AF-RSB0075-067	–		42 rpm, 2000 mm, CP03-19101	
	XN12AF-RSB0074-067	–		24 rpm, 1200 mm, CP03-24201	
	XN20AF-RSB0075-067	–		42 rpm, 2000 mm, CP03-19101	
Display Unit	RDP-119	–	1		
Spare Parts	SP03-13000	000-089-451	1	SP03-13010 (Display unit), SP03-08902 (Scanner unit)	SEE PACKING LISTS
Installation Materials	CP03-20100	000-086-995	1 set	CP03-20101, CP03-19104, Signal cable S03-81-15 (15 m)	
	CP03-20110	000-086-994		CP03-20101, CP03-19104, Signal cable S03-81-20 (20 m)	
	CP03-20120	000-086-981		CP03-20101, CP03-19104, Signal cable S03-81-15 (30 m)	
Accessories	FP03-06900	000-894-770	1	FP03-02310 (hood)	

FR-1510 MARK-3

Name	Type	Code No.	Qty	Remarks	
Scanner Unit	XN12AF-RSB0074-062	–	1	24 rpm, 1200 mm, CP03-24201	
	XN12AF-RSB0075-062	–		42 rpm, 1200 mm, CP03-24201	
	XN20AF-RSB0074-062	–		24 rpm, 2000 mm, CP03-19101	
	XN20AF-RSB0075-062	–		42 rpm, 2000 mm, CP03-19101	
Display Unit	RDP-119	–	1		
Spare Parts	SP03-13000	000-089-451	1	SP03-13010 (Display unit), SP03-08902 (Scanner unit)	SEE PACKING LISTS
Installation Materials	CP03-20100	000-086-995	1 set	CP03-20101, CP03-19104, Signal cable S03-81-15 (15 m)	
	CP03-20110	000-086-994		CP03-19104, CP03-20101, Signal cable S03-81-20 (20 m)	
	CP03-20120	000-086-981		CP03-19104, CP03-20101, Signal cable S03-81-30 (30 m)	
Accessories	FP03-06900	000-894-770	1	FP03-02310 (hood)	

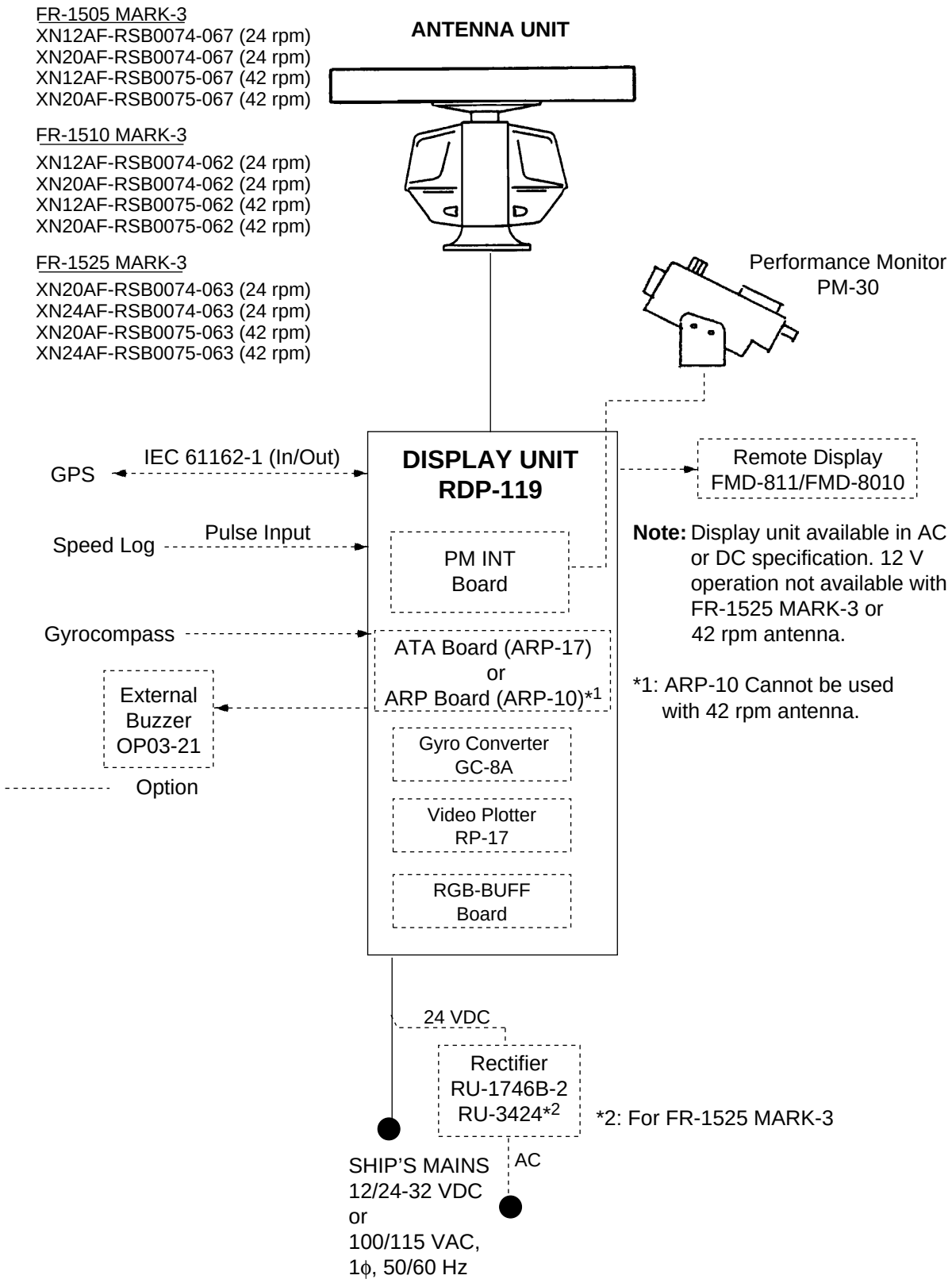
FR-1525 MARK-3

Name	Type	Code No.	Qty	Remarks	
Scanner Unit	XN20AF-RSB0074-063	–	1	24 rpm, 1200 mm, CP03-19101	
	XN20AF-RSB0075-063	–		42 rpm, 1200 mm, CP03-19101	
	XN24AF-RSB0074-063	–		24 rpm, 2000 mm, CP03-19101	
	XN24AF-RSB0075-063	–		42 rpm, 2000 mm, CP03-19101	
Display Unit	RDP-119	–	1		
Spare Parts	SP03-13000	000-089-451	1	SP03-12601 (Display unit), SP03-08902 (Scanner unit)	SEE PACKING LISTS
Installation Materials	CP03-20100	000-086-995		CP03-20101, CP03-19104, Signal cable S03-81-15 (15 m)	
	CP03-20110	000-086-994		CP03-19104, CP03-20101, Signal cable S03-81-20 (20 m)	
	CP03-20120	000-086-981		CP03-19104, CP03-20101, Signal cable S03-81-30 (30 m)	
Accessories	FP03-06900	000-894-770	1	FP03-02310 (hood)	

Optional Equipment (all models)

Name	Type	Code No.	Qty	Remarks
Rectifier	RU-3424	000-030-497	1	For FR-1525 MARK-3
	RU-1746B-2	000-030-439	1	
Remote Display	FMD-8010	–	1	
	FMD-811	–	1	
Performance Monitor	PM-30	–	1 set	
Auto Tracking Aid	ARP-17-2-E	008-488-840	1 set	To be installed in field
Auto Tracking Aid	ARP-10-A	000-086-996	1 set	To be installed in field
Video Plotter	RP-17-17E-2	000-086-989	1 set	To be installed in field
RGB BUFF Board	OP03-153	008-490-820	1	
PM INT Board	OP03-154	008-490-830	1	
Dust Cover	03-143-1701	100-266-720	1	
Filter	OP03-30	008-102-200	1	
Power Cable	CVV-S8X2C	000-560-634	1	15 m
External Buzzer	OP03-21	000-030-097	1	
Handle	OP03-70	008-423-420	1	
AD Converter	AD-100	000-040-108	1 set	
Signal Cable	S03-55-5(5P)	008-455-160	1	
	S03-9-5(8-8P)	008-206-640	1	
	S03-9-10(8-8P)	008-206-650	1	
	S03-9-15(8-8P)	008-209-160	1	
RAM Card (1)	OP03-115	008-451-170	1	For Video Plotter, 256 KB
RAM Card (2)	OP03-116	008-451-180	1	For Video Plotter, 512 KB

SYSTEM CONFIGURATION



MOUNTING

1.1 Scanner Unit

Mounting considerations

- The scanner unit is generally installed either on top of the wheelhouse or on the radar mast, on a suitable platform. Locate the scanner unit where there is a good all-round view.

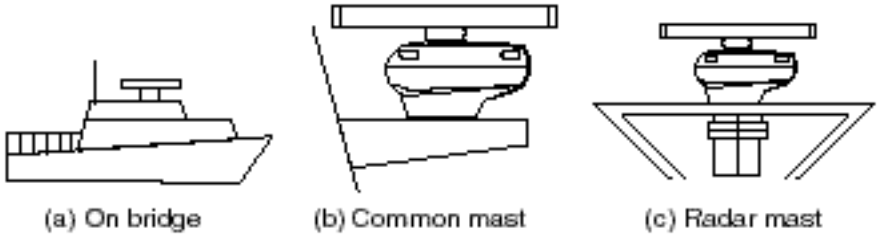


Figure 1-1 Mounting methods

- No funnel, mast or derrick should be within the vertical beamwidth of the scanner in the bow direction, especially zero degrees ±5°, to prevent blind sectors and false echoes on the radar picture.
- It is rarely possible to place the scanner unit where a completely clear view in all directions is available. Thus, you should determine the angular width and relative bearing of any shadow sectors for their influence on the radar at the first opportunity after fitting.
- Locate the antenna of a direction finder clear of the scanner unit to prevent interference to the direction finder. A separation of more than two meters is recommended.
- To lessen the chance of picking up electrical interference, avoid where possible routing the signal cable near other onboard electrical equipment. Also avoid running the cable in parallel with power cables.
- A magnetic compass will be affected if placed too close to the scanner unit. Observe the following compass safe distances to prevent deviation of a magnetic compass.

Equipment Unit	Standard Compass	Steering Compass
Antenna unit (6 kW)	1.65 m	1.25 m
Antenna unit (12 kW)	1.65 m	1.25 m
Antenna unit (25 kW)	2.15 m	1.60 m

- Do not paint the radiator aperture, to ensure proper emission of the radar waves.
- The signal cable run between the scanner and the display is available in lengths of 15 m (standard), 20 m, and 30 m. Whatever length is used it must be unbroken; namely, no splicing allowed.
- Deposits and fumes from a funnel or other exhaust vent can adversely affect the aerial performance and hot gases may distort the radiator portion. The scanner unit must not be mounted where the temperature is more than 70°C.
- Leave sufficient space around the unit for maintenance and servicing. See the scanner unit outline drawing for recommended maintenance space.

Assembling the scanner unit

The scanner unit consists of the scanner radiator and the scanner unit chassis, and they are packed separately. Fasten the scanner radiator to the scanner unit chassis as follows:

1. For the XN20AF, XN24AF, attach two guide pins to the underside of the scanner radiator.
2. Remove the waveguide cap from the radiator bracket. The cap may be discarded.
3. Coat the waveguide flange with anticorrosive sealant as shown in Figure 1-2.

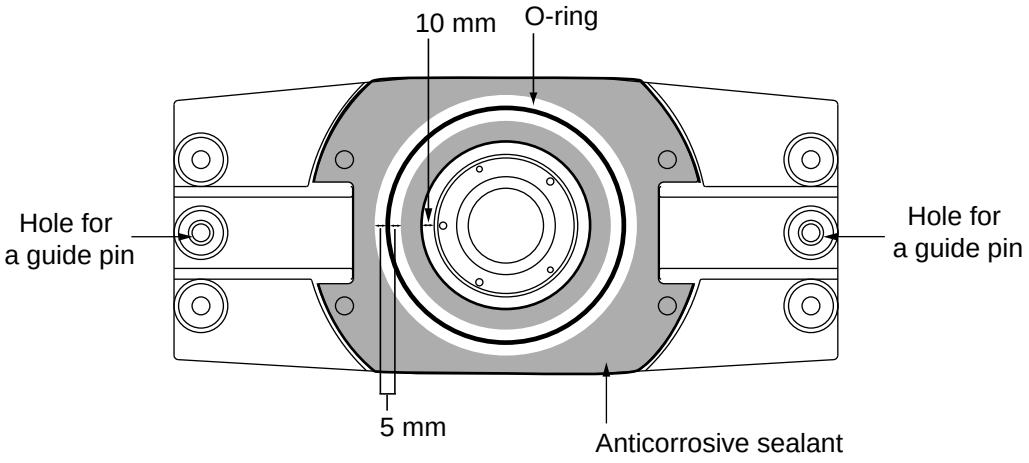


Figure 1-2 Coating the waveguide flange with anticorrosive sealant

4. Coat fixing holes for the scanner radiator with anticorrosive sealant.
5. Grease the O-ring and set it to the O-ring groove of the radiator flange.
6. Set the scanner radiator to the radiator bracket.
7. For the XN20AF, XN24AF, coat hex bolts (M8 x 40, slotted washerhead, 8 pcs.) with anticorrosive sealant and use them to loosely fasten the scanner radiator to the scanner unit chassis. For the XN12AF, coat hex bolts, flat washers and spring washers with anticorrosive sealant and use them to loosely fasten the scanner radiator to the scanner unit chassis.
8. Remove two guide pins (inserted at step 1), and then tighten fixing bolts.

CAUTION

Be sure to remove the guide pins.

Injury may result if the guide pins loosen and fall.

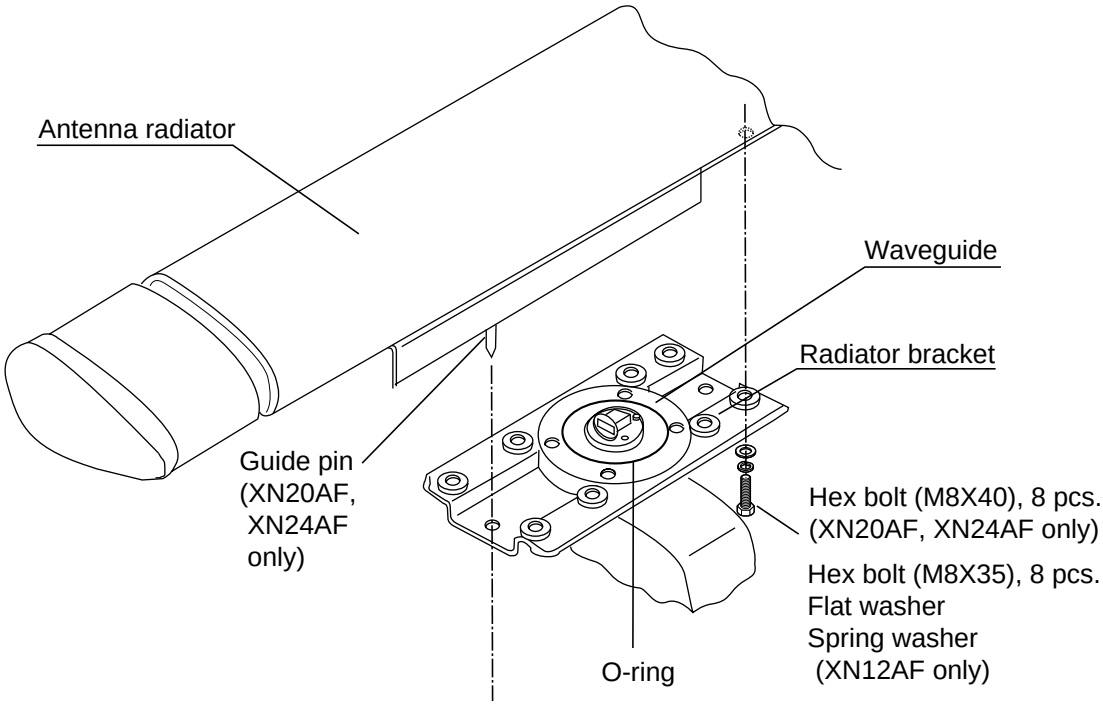


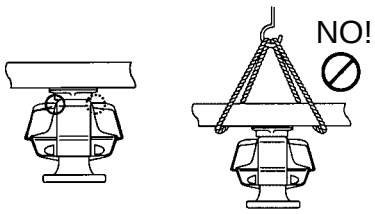
Figure 1-3 Fastening the radiator to the radiator bracket

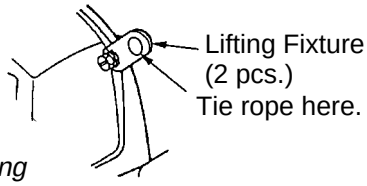
Fastening the scanner unit to the mounting platform

The scanner unit may be assembled before hoisting it to the mounting platform. However, do not lift the scanner unit by the radiator. Always hold the unit by its housing. When using a crane or hoist, lift the unit by the hoist rings which should be fastened to the bolt fixing covers of the scanner housing.

⚠ CAUTION

DO NOT lift the scanner unit by the radiator; attach rope to lifting fixtures on the chassis and hoist by crane. Be sure stress is not placed on the radiator when hoisting.





Remove lifting fixtures after installation.

1. Construct a suitable mounting platform referring to the outline drawing at the back of the manual.
2. Drill four mounting holes of 15 mm diameter and one cable entry hole of about 50 mm diameter in the mounting platform.
3. Lay the rubber mat (supplied) on the mounting platform.
4. Place the scanner unit on the rubber mat orienting the unit so the bow mark on its base is facing the ship's bow.

Figure 1-4 Scanner unit, front view

5. Fasten the scanner unit to the mounting platform with M12x60 hex bolts, nuts, flat washers and seal washers.
6. Using hex bolt (M6x25), nut (M6) and flat washer (M6) establish the ground system on the mounting platform as shown in Figure 1-5. The location should be within 370 mm of the ground terminal on the scanner unit. Connect the ground wire (RW-4747, 370 mm, supplied) between the grounding point and ground terminal on the scanner unit. Coat the entire ground system with silicone sealant (supplied).

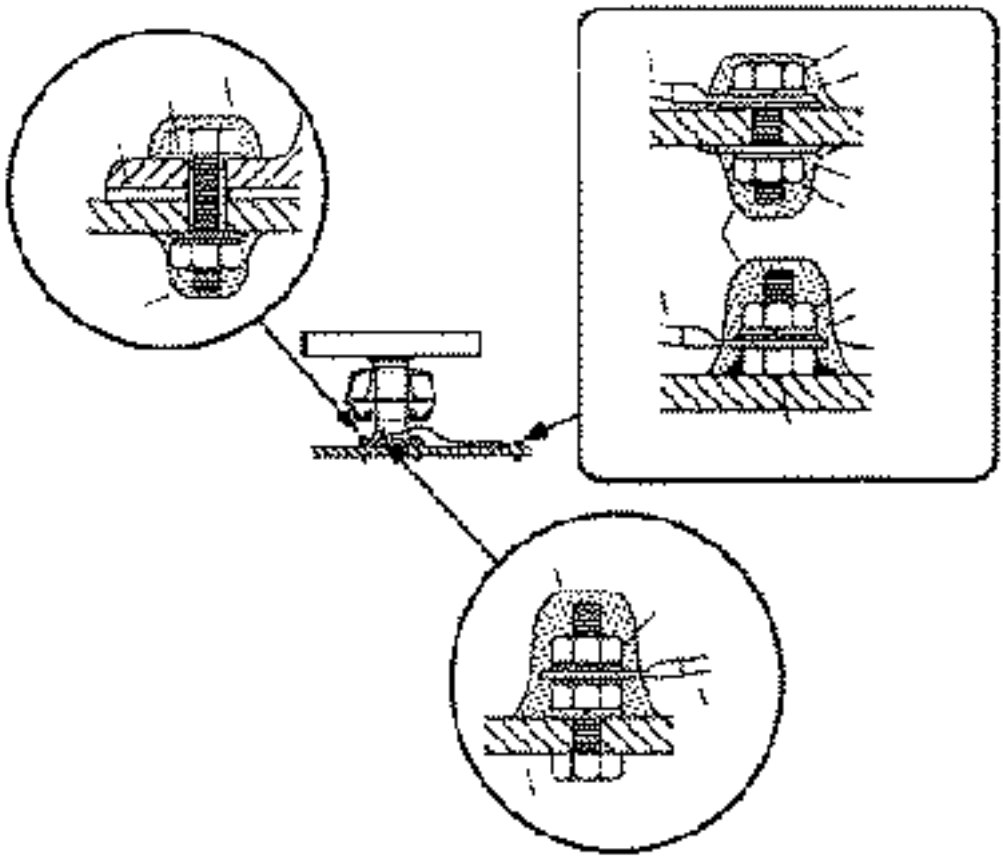


Figure 1-5 How to mount the scanner unit

1.2 Display Unit

Mounting considerations

The display unit can be mounted on a tabletop or a bulkhead. When selecting a mounting location, keep in mind the following points:

- Select a location where the display unit can be viewed and operated conveniently and where the screen can be viewed while facing towards the bow.
- Locate the unit out of direct sunlight and way from heat sources because of heat that can build up inside the cabinet.
- Locate the equipment away from places subject to water splash and rain.
- Be sure the mounting location is strong enough to support the weight of the unit under the continued vibration which is normally experienced on the ship. If necessary reinforce the mounting location.
- Determine the mounting location considering the length of the signal cable between the scanner unit and the display unit. (The signal cable comes in lengths of 15, 20 and 30 meters).
- Leave sufficient space on the sides and rear of the unit to facilitate maintenance. Also, leave a foot or so of “service loop” in cables behind the unit so it can be pulled forward for servicing or easy removal of connectors.
- A magnetic compass will be affected if placed too close to the display unit. Observe the following compass safe distances to prevent deviation of a magnetic compass: Standard compass, 1.0 m, Steering compass, 0.75 m.

Mounting procedure

Tabletop mounting

1. Loosen the two M8 x 40 bolts at the front of the display unit. Remove the mounting base.
2. Mark screw locations in the tabletop, using the mounting base as a template. For mounting by bolts, nuts and washers, drill four holes of 12 mm diameter in the tabletop.
3. Fasten the mounting base to the tabletop by tapping screws or M10, bolts, nuts and washers.
4. Lay the display unit on the mounting base. Fasten the display unit to the fixing plate with the two M8 x 40 bolts removed at step 1.

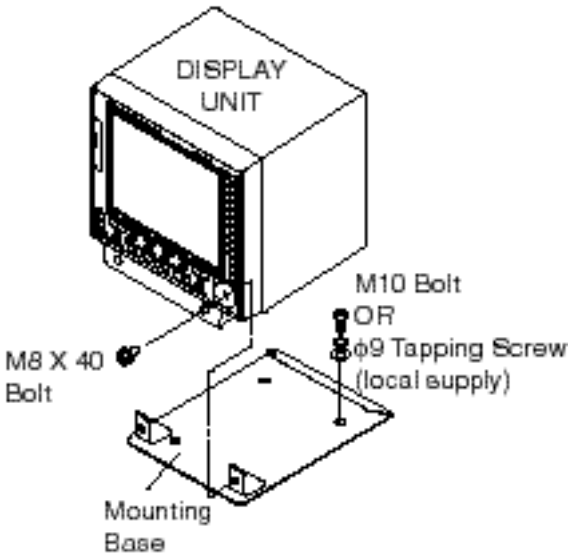


Figure 1-6 Tabletop mounting of display unit

bulkhead mounting

1. Remove the fixing plate, mounting base, bottom plate and cover.
2. Fasten the mounting base and bottom plate at the top of the display unit.
3. Fasten the cover at the bottom of the display unit.
4. Fasten the fixing plate to the bulkhead with M10 bolts, nuts and washers (local supply).
5. Fix the display unit to the fixing plate with two hex bolts M8 x 40.

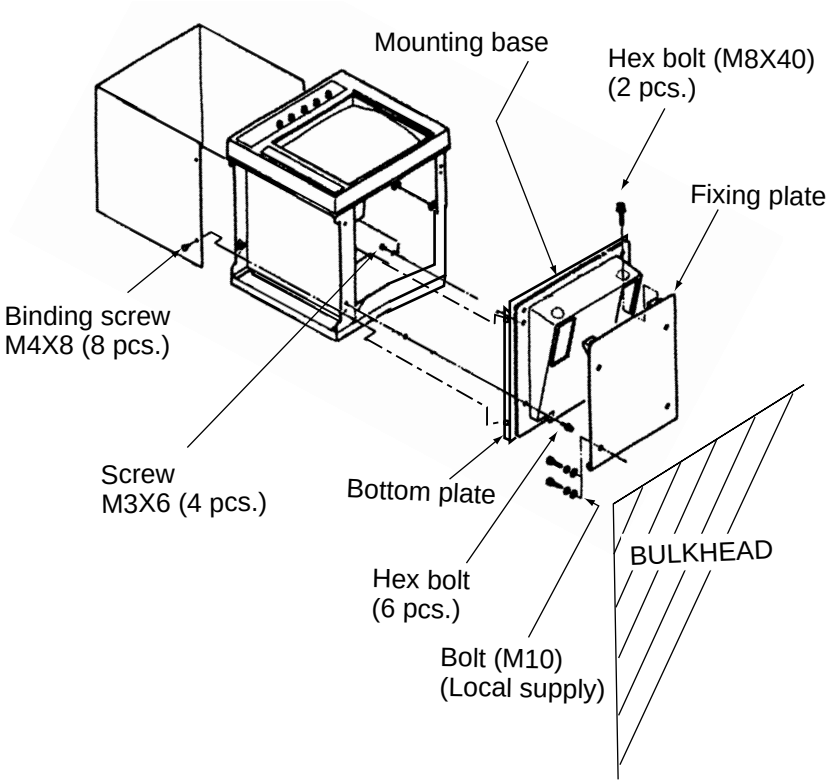


Figure 1-7 Bulkhead mounting of display unit

Handles (option)

1. Remove cosmetic caps at front of display unit.
2. Fasten the handles with rosette washers, spring washers and panhead screws.

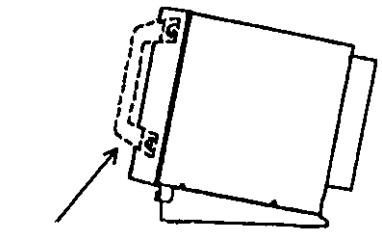
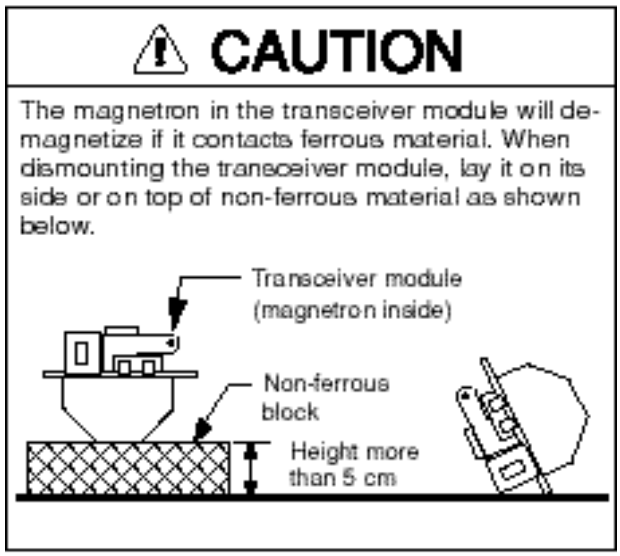


Figure 1-8 Attachment of handles

WIRING

2.1 Scanner Unit



1. Open the scanner unit cover.
2. Disconnect plugs P611, P801 and P821.
3. Unfasten the transceiver module (two bolts). Remove the transceiver module.

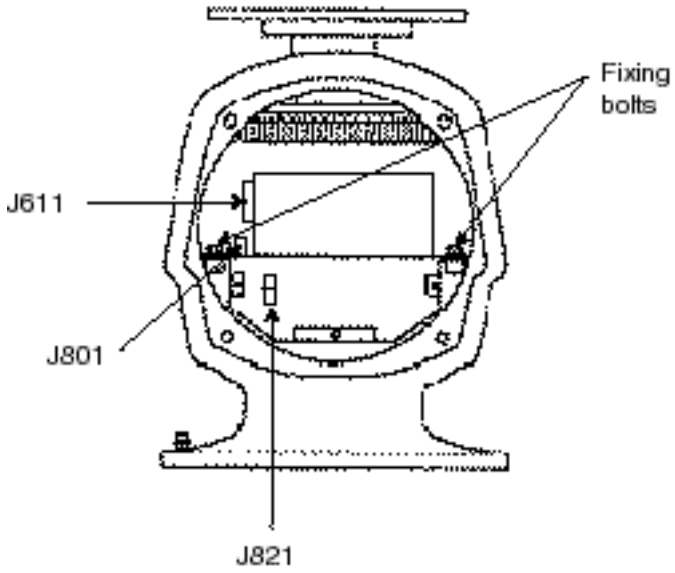


Figure 2-1 Scanner unit, front view

4. Unfasten the four fixing bolts on the cable gland at the base of the scanner unit. Remove clamping ring, rubber gasket and washers.

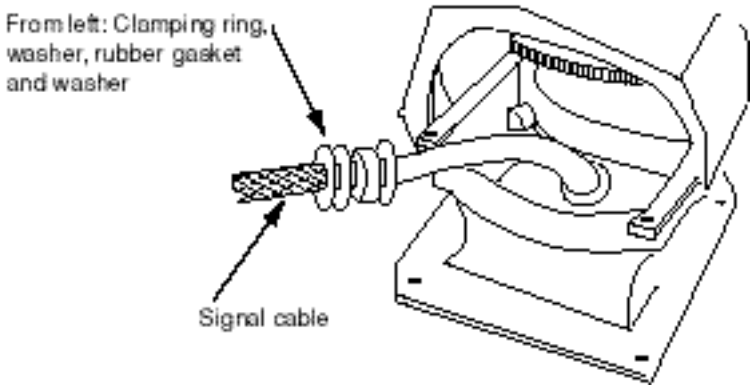


Figure 2-2 Scanner unit, front view, cover removed

5. Pass the signal cable through the cable entry hole in the scanner unit mounting platform. Trim the cable so about 80 cm of it protrudes past the cable gland.
6. Slide the clamping ring, washer, rubber gasket and washer onto the cable in that order.
7. Fabricate the signal cable as shown on page 2-4.
8. Referring to Figure 2-3, pass the outer and inner shields between the signal cable and the clamping ring. Fasten the cable gland.

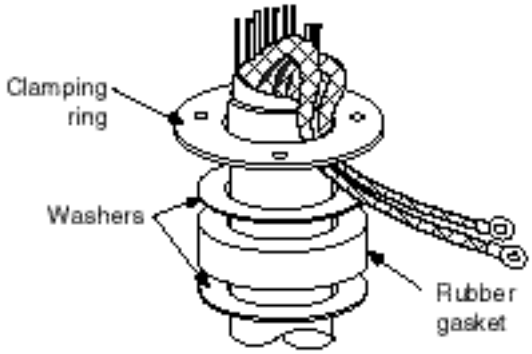


Figure 2-3 Passing cable shields between cable and clamping ring

9. Connect the signal cable to the terminal board RTB801 in the scanner unit by referring to the interconnection diagram. Leave “slack” in the coaxial wire to prevent breakage.
10. Bind cores of cables with cable ties.
11. Mount the transceiver module. Connect plugs P611, P801 and P821. Twist the shields of the signal cable together and fasten them to the ground terminal on the transceiver module.
12. If the scanner is mounted 2° or more left of ship’s bow, adjust the position of S901 so it becomes “on” (contact between #1 and #2 on pcb MP-3795). To access S901, open the bow side cover; S901 is above the drive gear.

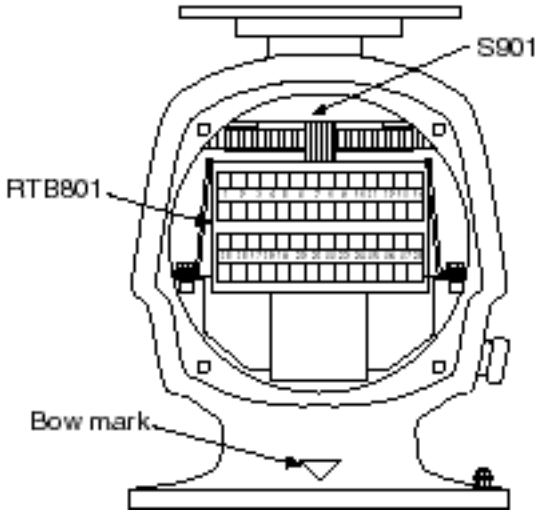


Figure 2-4 Scanner unit, front view

13. Confirm that all screws are tightened and all wiring is properly mode. Coat waterproofing gasket, bolts and tapping holes of scanner unit with silicone grease. Check that the waterproofing gasket is seated as shown in Figure 2-5. Close the scanner unit cover.

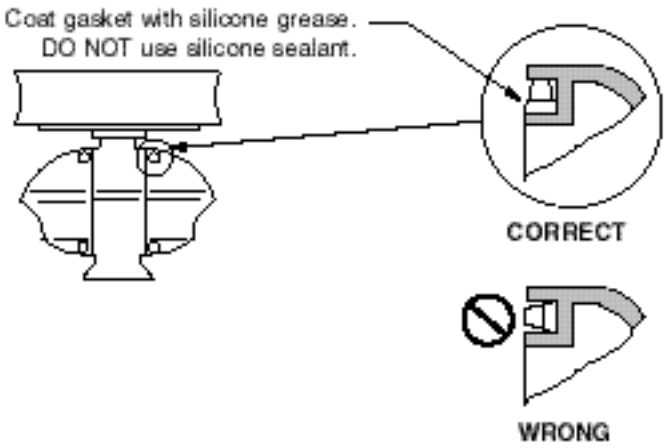


Figure 2-5 Correct seating of waterproofing gasket

Fabricating signal cable S03-81

1. Remove the vinyl sheath by 450 mm.
2. Slide the clamping ring, washer, rubber gasket and washer onto the signal cable in that order.
3. Unravel the outer shield to expose the cores in the outer layer. Then, unravel the inner shield to expose the cores in the inner layer. Label all inner cores to aid in identification.
4. Attach EMI cores to all inner cores and all outer cores, and tie them with cable ties, etc..

   Note: There are two types of the EMI core, thick and thin.

5. Trim each core (except coaxial wire) considering its location on the terminal board.
6. Trim the inner and outer shields leaving 500 mm each. Twist shields together and attach crimp-on lug FV5.5-4 (blue, ø4).
7. Remove insulation of each core by about 6 mm. Fix crimp-on lug FV1.25-M3 (red, ø3) to each core.
8. Fabricate the coaxial cable. Make the length 10 mm longer than the shield to prevent wire strain. Attach crimp-on lug FVD1.25-3 (red, ø3) to coaxial cable.

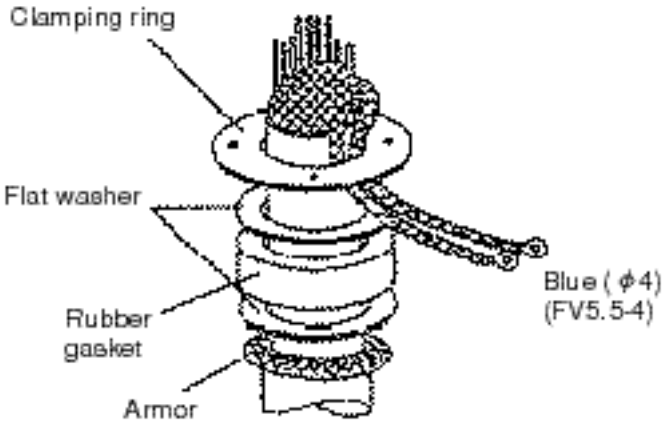


Figure 2-7 How to ground signal cable S03-81

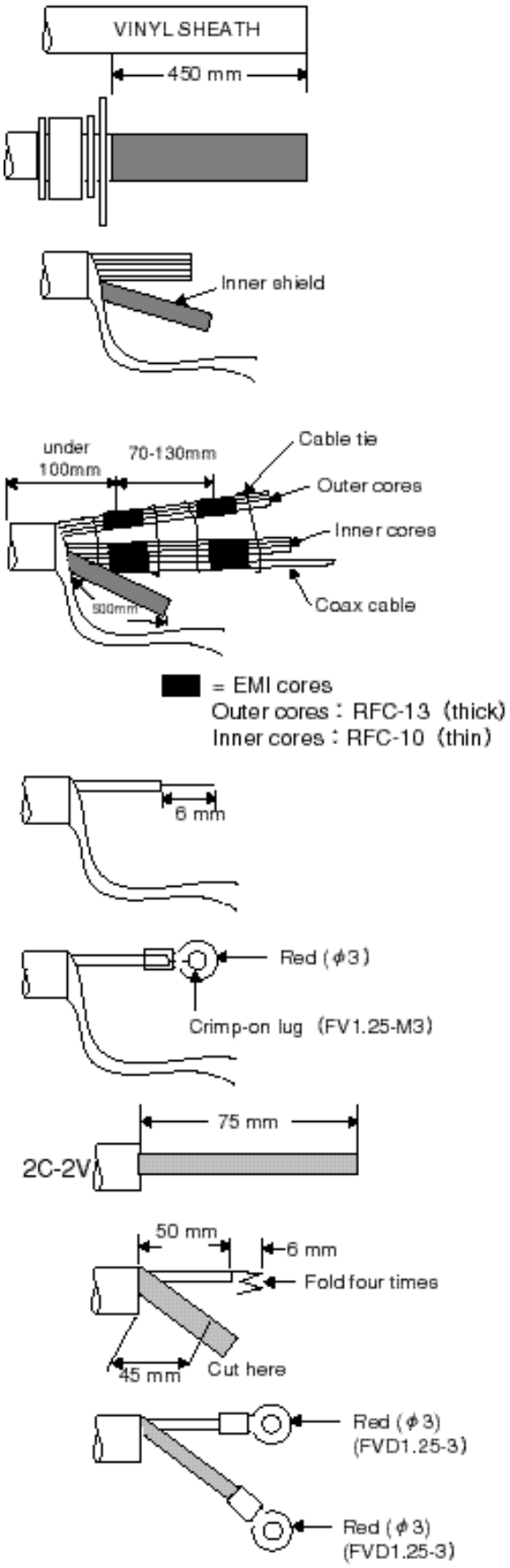
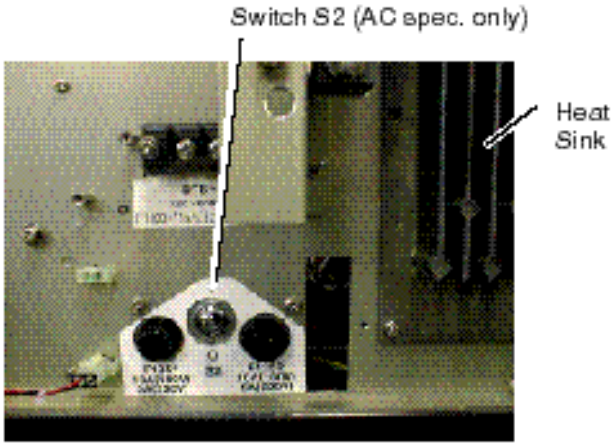


Figure 2-6 How to fabricate signal cable S03-81

2.2 Display Unit

At least two cables are terminated at the display unit: the signal cable S03-81 and the power cable. The signal cable comes with a connector preattached to it for connection to the display unit.

Switch S2



The display unit designed to run on AC power has a switch (S2) at its rear to cut off 100/200 VAC power to the display unit. To access the switch, unscrew two screws and then slide cover to remove it. **TURN THE SWITCH OFF WHENEVER ACCESSING INSIDE THE DISPLAY UNIT.**

Fabricating the DC power cable (CVV-S 8X2C, option)

1. Remove the vinyl sheath by 40 mm.
2. Unravel the jute tape in the braided shield.
3. Remove sheath of cores by 10 mm.
4. Attach crimp-on lugs to shield and cores.
5. Tape the cable as shown in the figure below.

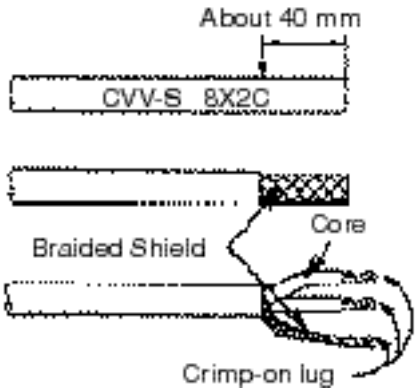


Figure 2-8 Fabricating power cable CVV-S 8X2C

Wiring

1. Remove the display unit cover.

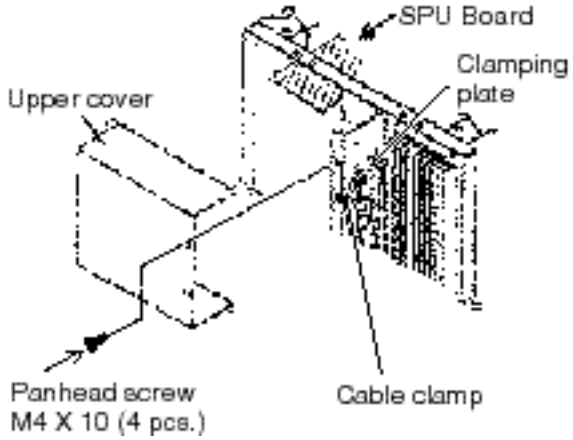


Figure 2-9 Display unit, rear view, cover removed

2. Dismount the clamping plate from the cable clamp by loosening two screws.
3. Lay the signal cable and power cable inside the cable clamp. Fasten the clamping plate to the cable clamp by using two M4x15 screws. If optional equipment are connected, secure the clamping plate by using two M6x35 bolts.
4. Connect the power cable and signal cable by referring to the interconnection diagram. Fasten shields to chassis.
5. Run a ground wire (IV-8 sq, or equivalent) from the ground terminal to nearest ground point.

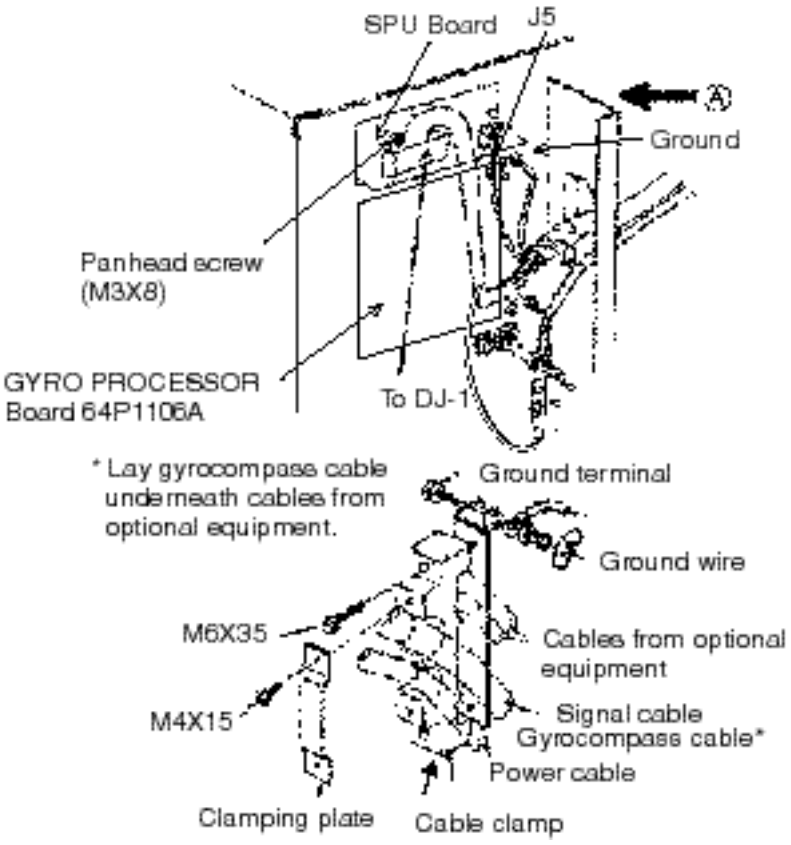


Figure 2-10 Display unit, rear view

6. It is recommended to seal the cable gland with aluminum tape or similar material to keep foreign objects out of the display unit.

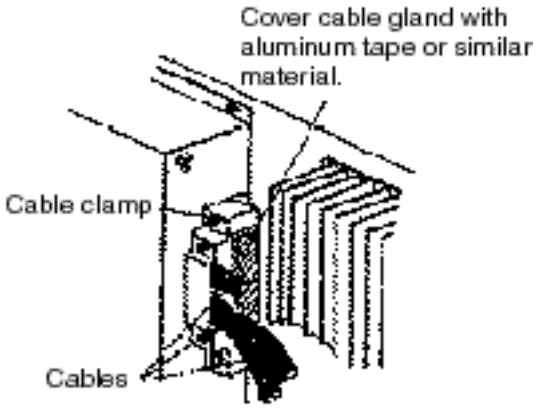


Figure 2-11 Display unit, rear view

Gyrocompass

1. Slip insulation tubing on VH connector assy. (2 pcs: 03-1763 (5P), 03-1764 (3P).
2. Solder VH connector assemblies to cable MPYC-5 (local supply) form the gyrocompass.

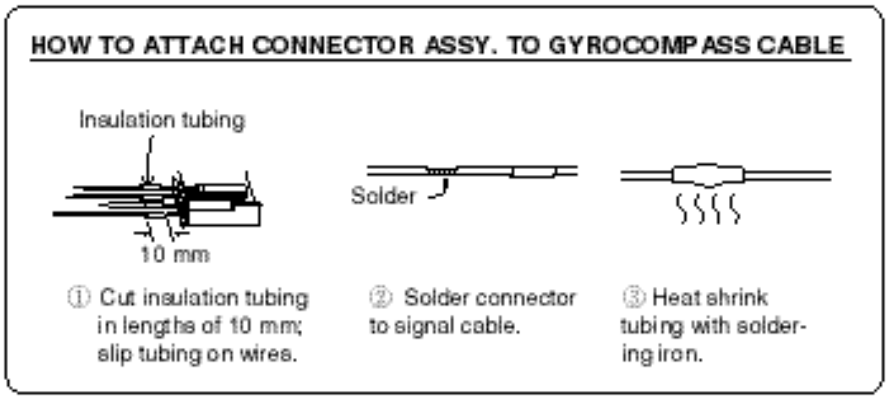


Figure 2-12 How to attach connector assy. to gyrocompass cable

Connector		Step Type	Synchro Type
J4	#1	S1	S1
	#2	S2	S2
	#3	S3	S3
	#4	-	-
	#5	-	-
J5	#1	-	R2
	#2	COM	R1
	#3	-	-

3. Connect VH connectors to GYRO PROCESSOR Board (64P1106A) as follows: J4 (5 pin), J5 (3 pin).

Ground

Connect a ground wire (IV-8sq or equivalent) between the earth terminal on the display unit and ship's superstructure.

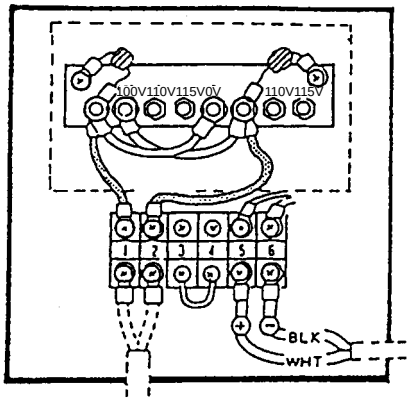
⚠ CAUTION

Ground the equipment to prevent mutual interference.

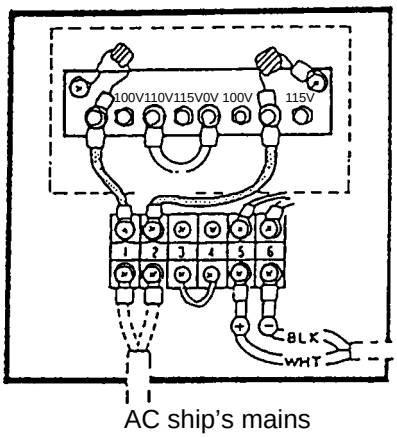
2.3 Rectifier

A rectifier (RU-3424, RU-1746B-2) is necessary when the set designed to run on DC power is connected to AC mains. Install the rectifier in any clean, well-ventilated location. For mounting dimensions and interconnections, see the drawings on pages D-4, D-5 and S-1.

Note: Use rectifier RU-3424 with the FR-1525 MARK-3 (42 rpm).



Connections for 100 VAC ship's mains



Connections for 220 VAC ship's mains

Figure 2-13 Rectifier connections

2.4 Change of DC Power Specifications

The power specification (12 V, or 24/32 V) of the DC POWER Board for the FR-1505 MARK-3 can be modified in the field to match ship's mains. Add or delete jumper wires, etc. as shown in the table below.

	JP7	JP8	JP9	T1					
				11_A	A_12	12_13	14_15	15_C	C_16
PCB 03P2223C 12 V DC	No	No	No	Yes	No	Yes	Yes	No	Yes
PCB03P9223D 24/32 VDC	Yes	Yes	Yes	No	Yes	No	No	Yes	No

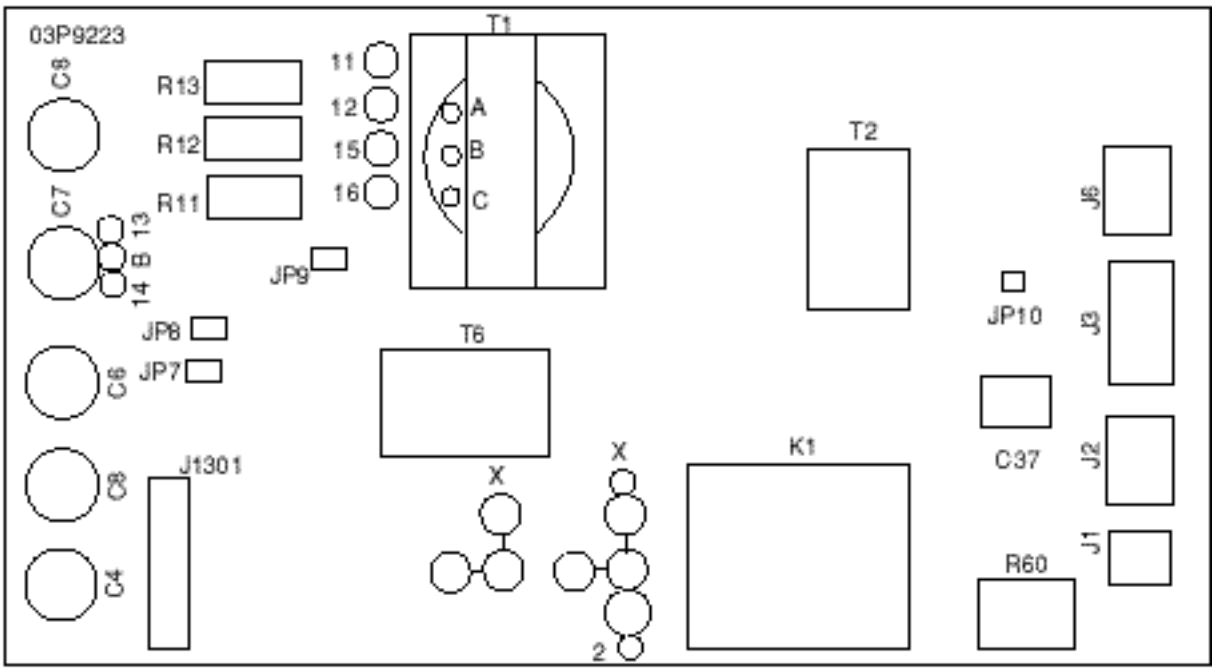
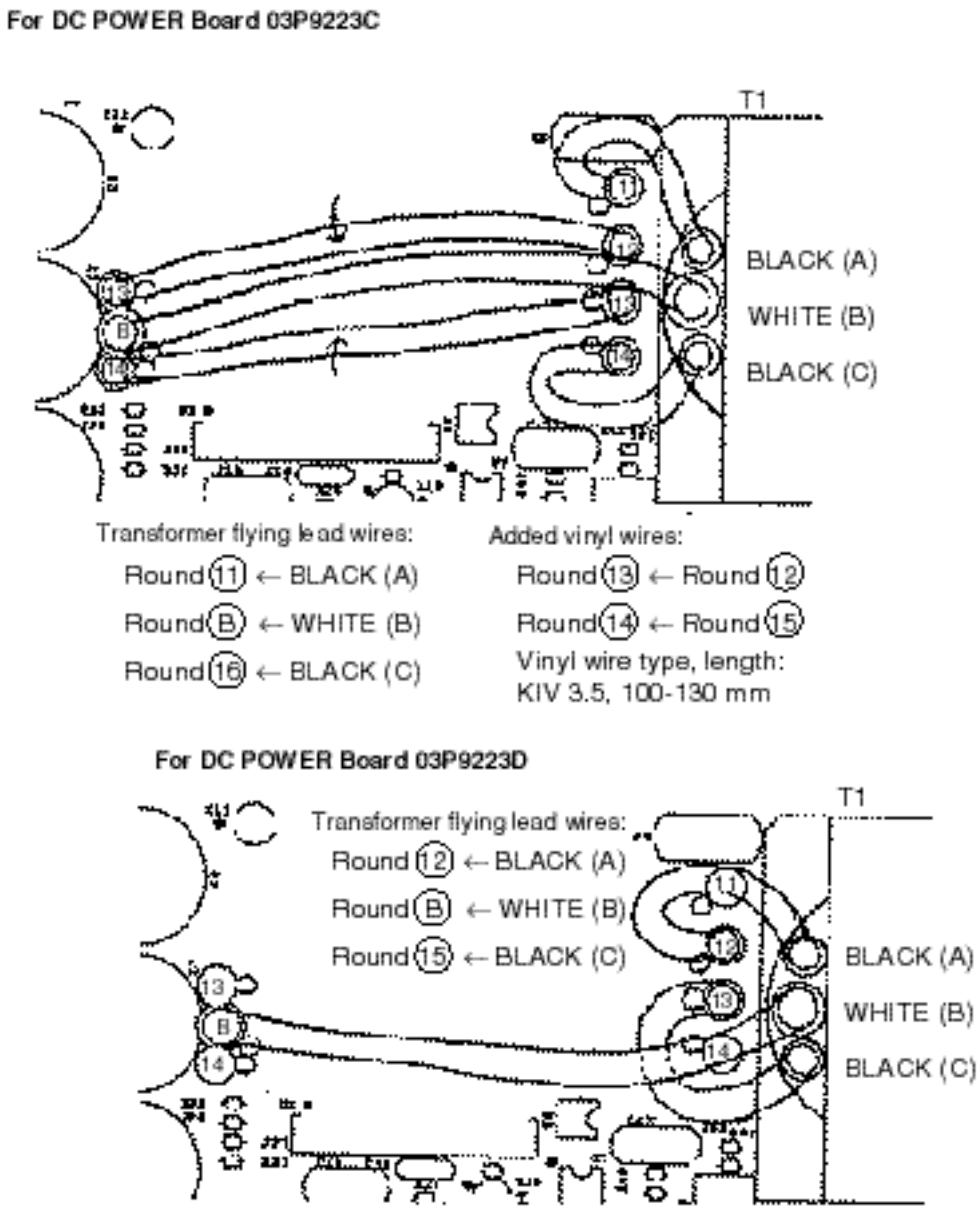


Figure 2-14 DC POWER Board 03P9223

Connections on transformer T1



Note: Make sure that the conductor of the transformer flying wire WHITE (B) does not not touch U1.

Figure 2-15 Connections on transformer T1

2.5 Change of AC Power Specifications

The AC display unit is shipped from the factory ready for connection to a 100 VAC power supply. To operate the display unit from 220 VAC, cut jumper wires on the AC POWER Board and change to fuse F1351 and F1352 to 5A.

1. Turn off the display unit and the switch S2 at the rear of the display unit.
2. Remove the display unit cover.

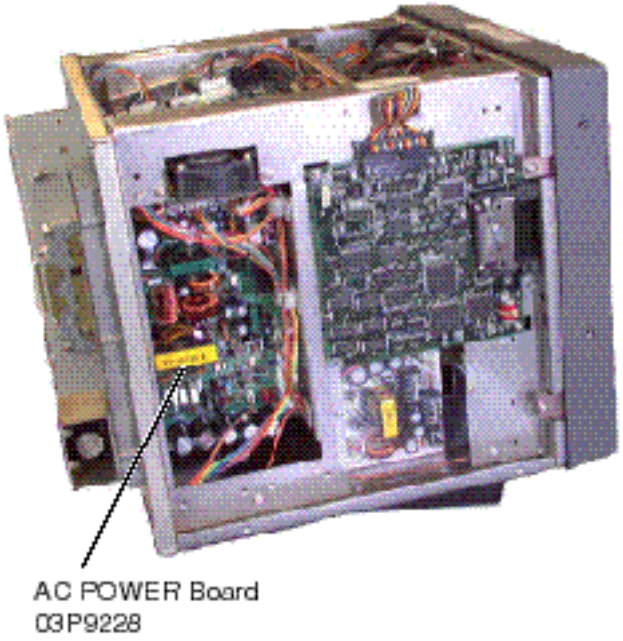


Figure 2-16 Display unit, right side view

3. Unfasten five screws fixing the heat sink.
4. Unfasten three screws fixing the AC POWER Board.
5. Unplug connectors from the AC POWER Board.
6. Pull out both the heat sink and the AC POWER Board.

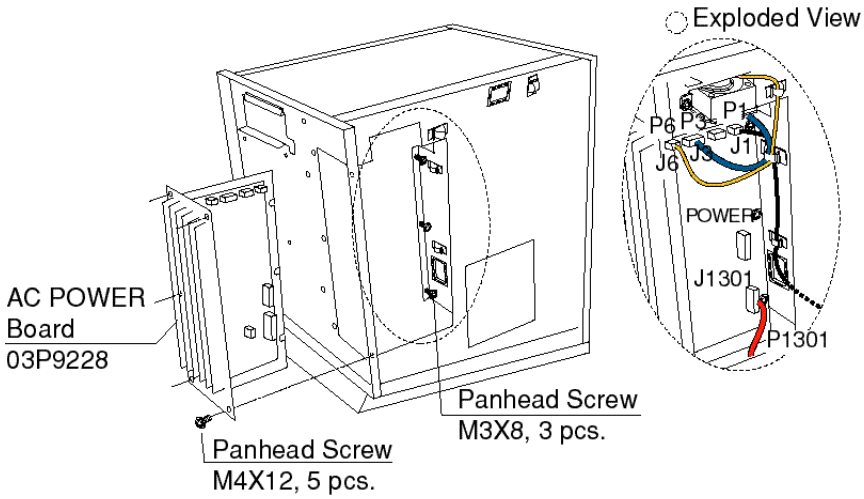
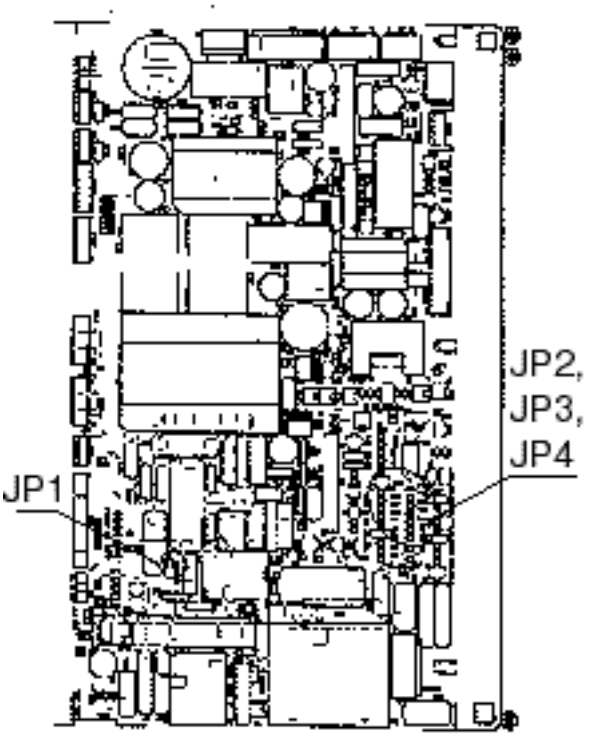


Figure 2-17 Display unit, AC POWER Board removed

7. Cut jumper wires JP1, JP2 and JP3. Solder jumper wire to JP4.



Ship's Mains	Jumper Wire			
	JP1	JP2	JP3	JP4
100 VAC	YES	YES	YES	NO
220 VAC	NO	NO	NO	YES

Figure 2-18 AC POWER Board

8. Mount the display unit cover.
9. Replace fuses as below.

Ship's Mains	F1351	F1352
100 VAC	10A	10A
220 VAC	5A	5A

EXTERNAL SIGNAL INPUT, OUTPUT

3.1 External Input

All external equipment and the antenna unit are connected to the SPU Board. Several connectors are of the XH-5P type., and these are marked with an asterisk in Figure 3-1. FURUNO can supply an XH-5P signal cable for those connectors.

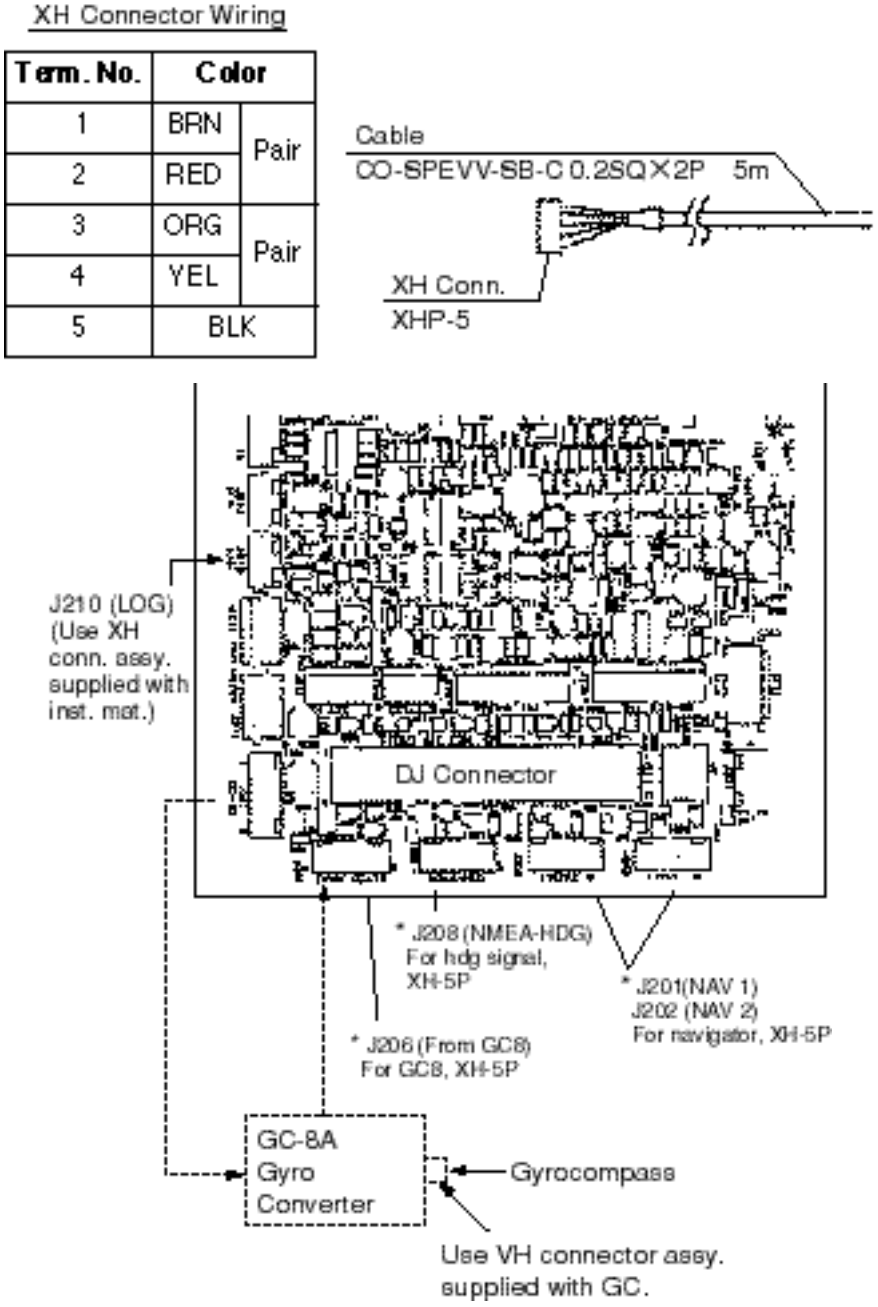


Figure 3-1 Location of input connectors on the SPU Board

Table 3-1 Input connectors on the SPU Board

Signal Name	Conn. Name	Conn. No.	Conn. Type	Connectable Equip.	Remarks
Slave display	–	J205	NH, 8 pin	Main radar	
BRG signal	from GC-10	J206	XH, 5 pin	GC-8A, AD-10S, AD-100	NMEA format
HDG signal	NMEA-HDG	J208	XH, 5 pin	C-2000	(Note 1)
Speed log signal	LOG	J210	XH, 3 pin	DS-30, DS-70, MF-220, CI-60	200 pulses/nm, etc.
Nav data (L/L. WP, Time, TDs, Course, Depth, Water Temperature)	NAV 1	J202	XH, 5 pin	GP-3100M2, GP-50M2, GP-188, FCV series, T-2000, TI-20	
Depth, Water temp.	NAV 2	J203	XH, 5 pin		
Radar Buoy	R.BUOY	J209	XH, 4 pin		

Note 1: HDT, VHW, HDG, HDM. NMEA-HDG connector also accepts, water temperature and water depth data (in lieu of heading signal).

3.2 Output to External Equipment

The figure below shows the location of output connectors on the SPU Board. See Table 3-2 for output connector description.

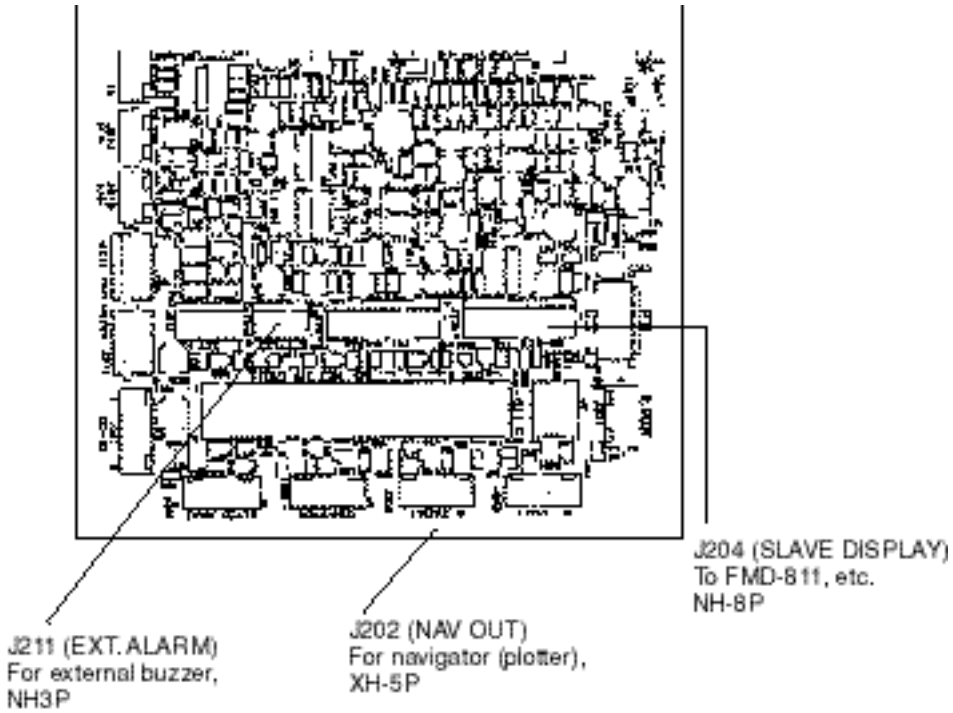


Figure 3-2 Location of output connectors on the SPU Board

Table 3-2 Output connectors on the SPU Board

Signal **Name**	**Conn. Name**	**Conn. No.**	**Conn. Type**	**Connectable Equip.**	**Remarks**
Slave display	EXT RADAR	J204	NH, 8 pin	FMD-811, FMD-8010 (Note 1)	Heading, bearing video, true trigger
Buzzer signal	EXT ALARM	J211	NH, 3 pin	OP03-21-3	Buzzer drive signal
				Speaker w/amp	Signal for speaker
Target signal (serial data)	NAV 1	J202	NH, 5 pin	To GPS, navigator	NMEA0183 $ RATLL $ RARSD

Note 1: Display unit of FR-1505 MARK-3 series, FR-7041, FR-7111 may also be used as a slave display.

3.3 Connection of External Buzzer

AAn external speaker or buzzer can be connected to this radar via an amplifier circuit (local supply), as shown in the figure below. Because connector J211 is used for the internal speaker unplug it and connect the connector from the external speaker to J211. Ground the amplifier to nearby connector's ground terminal.

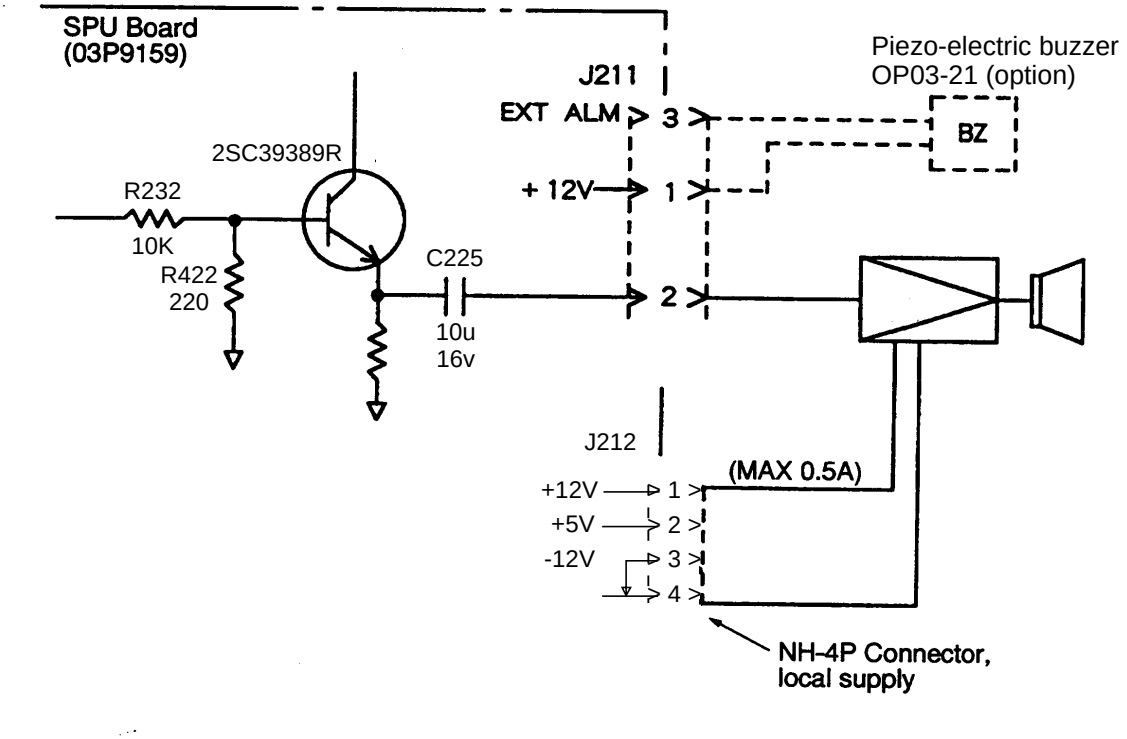


Figure 3-3 Connection of external buzzer

3.4 Data Sentences

Table 3-3 NMEA-0183 input sentences

Item	Receive Sentence
Speed (knots only)	RMA>RMC>VTG>VHW
Heading (true)	HDT>HDG(*)>HDM(*)>VHW>VHW(*)
Heading (magnetic)	HDM>HDG(*)>HDT(*)>VHW>VHW(*)
Course (true)	RMA>RMC>VTG>RMA(*)>RMC>(*)VTG(*)
Course (magnetic)	VTG>RMA(*)>RMC(*)>VTG(*)
Waypoint (range, bearing)	RMB>BWC>BWR
Position	GGA>RMA>RMC>GLL
TD	RMA>GLC>GTD
Time	ZDA
Water Temperature	MDA>MTW
Water Depth	DPT>DBK>DBS>DBT
Magnetic Variation	HDG
Magnetic Deviation	HDG>RMA>RMC

*: Calculated alternately in true and magnetic using magnetic variation data.

Table 3-4 Tx NMEA-0183 output sentences

	Receive Sentence
Target Position (Cursor latitude, longitude)	RATLL
Radar system data*	RARSD

*: Range and bearing of origin mark, EBL bearing, VRM range, range and bearing of cursor, etc.

INSTALLATION OF OPTIONAL EQUIPMENT

⚠ WARNING

Turn off the radar before installing optional equipment.

The display unit contains high voltage components which can shock, burn or cause death. Allow residual charge to subside (2-3 min.) in display unit before opening the cover.

⚠ CAUTION

Check that the radar display unit is properly connected.

The ARP-17 cannot peform its intended functions unless the radar display unit is proper connected. Also, be sure the radar is not being interfered by other equipment and is not giving interference to other equipment.

4.1 Gyro Converter GC-8A

The GYRO CONVERTER GC-8A mainly consists of the GYRO CONVERTER Board, which is installed at the rear of the radar display unit.

Necessary parts

Table 4-1 Contents of GC-8A installation kit

Name	Type	Code No.	Qty
GYRO CONVERTER Board	64P1106	004-412-200	1
Spacer	SQ-10	000-801-678	4
Washerhead Screw	M3 x 8	008-456-404	4
PH-XH Connector	03-1761(14P-6P)	008-456-130	1
NH-XH Connector	03-1762(5P-5P)	008-456-140	1
Label	64-014-2021-1	100-132-701	1
VH Connector Assy.	03-1763(5P)	008-456-150	1
VH Connector Assy.	03-1764(3P)	008-456-160	1
Fuse	FGMB 2A 250V	000-122-000	4

Note: Other parts may be contained in the installation kit; use only the parts listed in the table above. Unrelated parts may be discarded.

Mounting, connection

1. Remove the rear cover.
2. Attach four spacers as shown below.

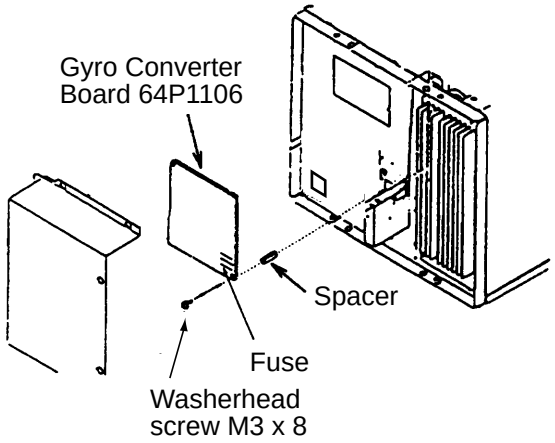


Figure 4-1 Display unit, rear view

3. Fasten the GYRO CONVERTER Board to the spacers with four washerhead screws.
4. Connect the GYRO CONVERTER Board to the SPU Board as follows:

GYRO CONV. Board		**SPU Board**
J1 (14P)	↔	J207 (6P)
J7 (5P)	↔	J206 (5P)

5. Set DIP switches and jumper wires on the GYRO CONVERTER Board according to gyrocompass connected.
6. Solder the connection cable from the gyrocompass to the VH connector assembly. Connect the VH connector assembly to the GYRO CONVERTER Board as follows:

Connector		**Step type**	**Synchro type**
J4	#1	S1	S1
	#2	S2	S2
	#3	S3	S3
	#4		
	#5	F. G.	F. G.
J5	#1	—	R2
	#2	COM	R1
	#3	F. G.	F. G.

7. Attach instruction label (supplied) to rear side of the cover for the GYRO CONVERTER Board.

Connection of external power supply

An external power supply is necessary when the repeater signal is step-by-step type and the step voltage is below 20 V or output voltage is less than 5 W.

1. Cut jumper wire JP1 on the GYRO CONVERTER Board when an external power supply is used.
2. Connect gyro cable and power cable as shown below.

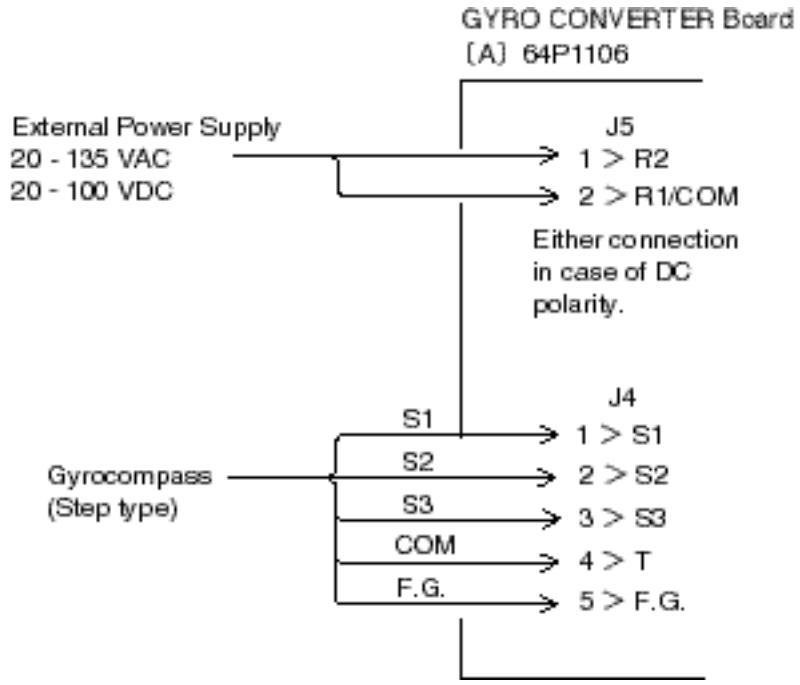


Figure 4-2 Connection of external power supply to GYRO CONVERTER Board

DIP switch, jumper wire settings

Default setting

The default setting of all DIP switches is off and all jumpers wire are set to "#1." (Note that jumper wire JP1 is set at #1, #2, and #3.) In those settings the gyrocompass having the following characteristics can be directly connected; modification of the GYRO CONVERTER Board is not necessary.

AC synchronous signal: 50/60 Hz
Rotor voltage: 60 V to 135 V AC
Stator voltage: 60 V to 135 V AC
Gear ratio: 360x
Supply voltage: 30 V to 135 V AC

If the specifications of the gyrocompass differ from those mentioned above, change jumper wire and DIP switches settings on the GYRO CONVERTER Board. Settings may be changed according to gyrocompass specifications or make and model of gyrocompass (see page 4-5). For the location of DIP switches and jumper wires, see page 4-6.

Setting method 1: by gyrocompass specifications

1) Gyrocompass type

Gyrocompass type	SW 1-4	SW 1-5	SW 1-6	JP1
AC synchronous	OFF	OFF	OFF	#1, #2, #3
DC synchronous	OFF	OFF	OFF	#2, #3, #4
DC step	ON	OFF	OFF	#4, #5, #6
Full-wave pulsating current	OFF	ON	OFF	#4, #5, #6
Half-wave pulsating current	ON	ON	OFF	#4, #5, #6

2) Frequency

Frequency	SW 1-7	SW 1-8	Remarks
50/60Hz	OFF	OFF	AC synchronous pulsating current
400Hz	ON	OFF	AC synchronous pulsating current
500Hz	OFF	ON	AC synchronous pulsating current
DC	ON	ON	DC synchronous DC step

3) Rotor voltage (between R1 & R2)

Rotor voltage	SW 2-1	JP3
20V to 45V AC	ON	#2
30V to 70V AC	OFF	#2
40V to 90V AC	ON	#1
60V to 135V AC	OFF	#1

4) Stator voltage (between S1 and S2)

Stator voltage	SW 2-2	SW 2-3	JP2
20V to 45V AC, or 20V to 60V DC	ON	OFF	#2
20V to 45V AC, or 20V to 60V DC	OFF	OFF	#2
40V to 90V AC	ON	OFF	#1
60V to 135V AC	OFF	OFF	#1

5) Ratio

Ratio	SW1-1	SW 1-2	SW1-3
360x	OFF	OFF	OFF
180x	ON	OFF	OFF
90X	OFF	ON	OFF
36X	ON	ON	OFF

6) Supply voltage

Supply voltage	JP4	JP5
20V to 45V AC, or 20V to 60V DC	#2	#2
30V to 135V AC, or 40V to 100V DC	#1	#1

7) AD-10 format data Tx interval

Select data transmitting interval for ports 1 to 6 by jumper wires JP6 and JP7.

Note: The Tx interval is available in 25 msec or 200 msec. 25 msec is for radar; 200 msec is for all other equipment.

8) NMEA-0183 Tx interval

Tx interval	SW2-4
2 seconds	ON
1 second	OFF

Setting method 2: by make and model of gyrocompass

Maker	Models	Specification	SW 1-1	SW 1-2	SW 1-3	SW 1-4	SW 1-5	SW 1-6	SW 1-7	SW 1-8	SW 2-1	SW 2-2	SW 2-3	JP1	JP2	JP3	JP4	JP5
FURUNO	GY-700	DC step 100V 180x 5-wire, open collector	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	OFF	OFF	#4, #5,#6	#2	-	#1	#1
Anschutz	Standard 2,3	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 22V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	#1, #2,#3	#2	#2	#1	#1
	Standard 4,6	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 90V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#2	#1	#1	#1
	Standard 20	DC step 35V 180x COM(-) ,3-wire(+)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	–	#2	#2
Yokogawa Navtec (Plaith type)	C-1/1A/2/3 A-55, B-55	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 22V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	#1, #2,#3	#2	#2	#1	#1
	CMZ-700	DC step 24V 180x COM(+),3-wire(-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	Remo-ve	#2	–	*	*
	CMZ-250X/ 300X/500	DC synchronous 360x	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	-	ON	OFF	Remo-ve	#2	–	*	*
		DC step 35V 180x COM(+),3-wire(-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	–	#2	#2
	CMZ-100/200/ 300 C-1Jr,D-1Z/1/3 IPS-2/3	AC synchronous 50/60Hz Rotor voltage: 100V Stator voltage: 90V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	CMZ-50 Note	step 35V 180x COM(+),3-wire(-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	–	ON	OFF	Remo-ve	#2	–	*	*
Plaith	NAVGAT II/III	AC synchronous 50/60Hz Rotor voltage: 50/60V Stator voltage: 68V 360x	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#2	#2	#1	#1
Tokimec (Sperry type)	ES-1/2/11 GLT-101/102/ 103/106K/107	AC synchronous 50/60Hz Rotor voltage: 100/110V Stator voltage: 90V 36x	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	ES-11A/110 TG-200 PR222R/2000 PR237L/H GM 21	AC synchronous 50/60Hz Rotor voltage: 100/110V Stator voltage: 22V 90x	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	MK-14 MOD-1/2/T NK-EN,NK-EI	DC step 70V 180x COM(-), 3-wire(+)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	–	OFF	OFF	#4, #5,#6	#2	–	#1	#1
	SR-130/140	DC step 70V 180x 5-wire, open collector	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	–	OFF	OFF	#4, #5,#6	#2	–	#1	#1
	TG-100/5000 PR-357/130/ 140, ES-17 GLT-201/202 /203	DC step 70V 180x COM(+), 3-wire(-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	–	OFF	OFF	#4, #5,#6	#2	–	#1	#1
	TG-6000	DC step 24V 180x	ON	OFF	OFF	ON	OFF	OFF	ON	ON	-	ON	OFF	#4, #5,#6	#2	–	#2	#2
	GM-11	AC synchronous 50/60Hz Rotor voltage: 100V Stator voltage: 90V 90x	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
	SR-120,ES-16 MK-10/20/30	DC step 35V 180x	ON	OFF	OFF	ON	OFF	OFF	ON	ON	–	ON	OFF	#4, #5,#6	#2	–	#2	#2
Kawasaki	GX-81	AC synchronous 50/60Hz Rotor voltage: 100/110V Stator voltage: 90V 90x	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	#1, #2,#3	#1	#1	#1	#1
Armabrown	MK-10,MKL-1 SERIES1351, MOD-4	DC step 50V 180x COM(+), 3-wire(-)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	–	OFF	OFF	#4, #5,#6	#2	–	#1	#1
Robertson	SKR-80	DC step 35V 180x COM(-), 3-wire(+)	ON	OFF	OFF	ON	OFF	OFF	ON	ON	–	ON	OFF	#4, #5,#6	#2	–	#2	#2

* : Set JP4 and JP5 according to the voltage of the external power supply.
Note : If CMZ-50 has 35VDC, set JP1 to #4,#5,#6.

Location of DIP switches, jumper wires on the GYRO CONVERTER Board

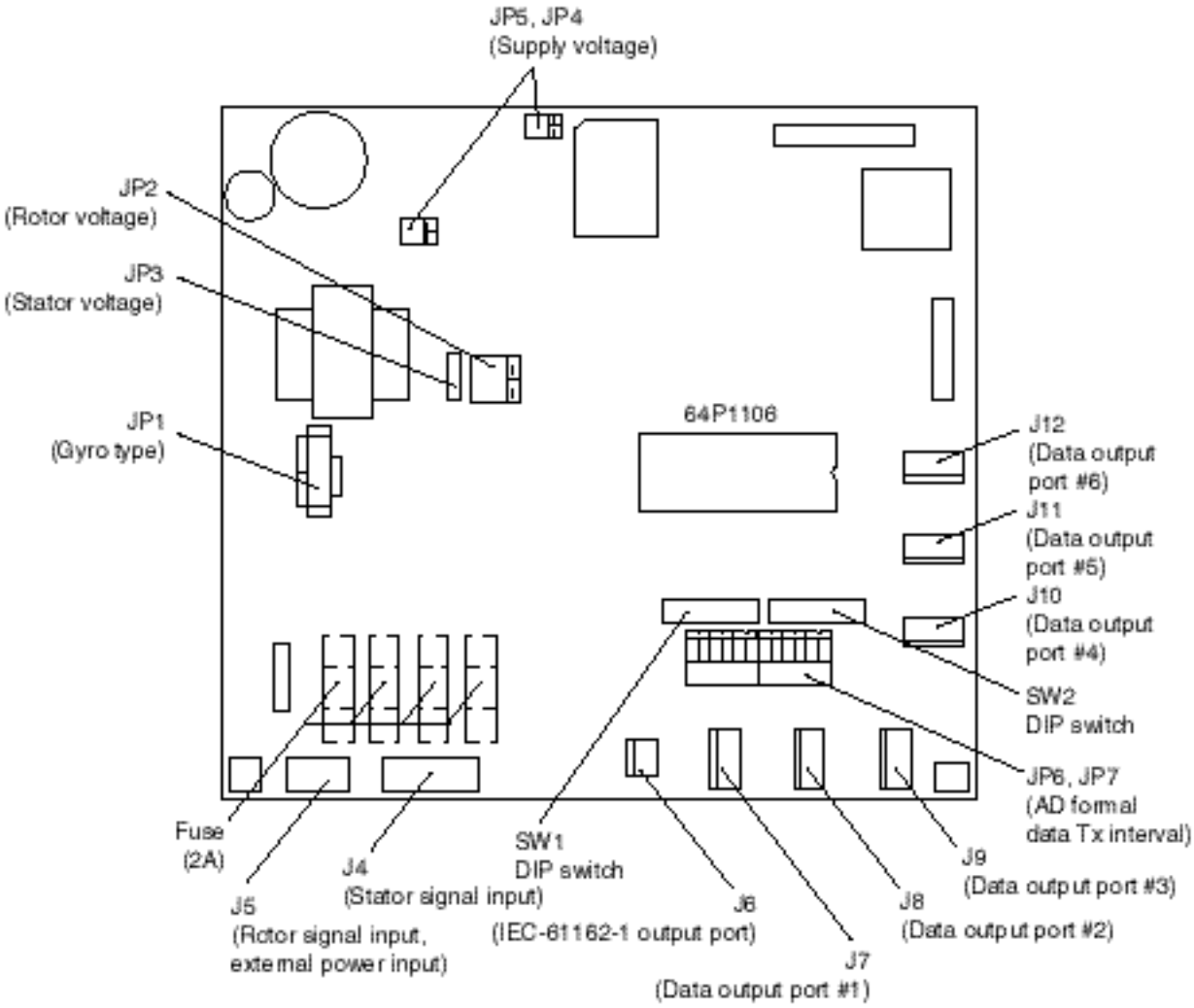


Figure 4-3 GYRO CONVERTER Board

Setting the bearing on the radar display

Confirm that the gyrocompass is giving reliable bearings. Then, set bearing on the radar display as follows:

1. Press the]MENU] key.
2. Press the [0] key twice to display the OTHER menu.
3. Press the [1] key twice to select the HDG ADJ option.
4. Rotate the EBL control to adjust the radar's gyrocompass reading.
5. Press the [ENTER/SELECT] key to register the setting and the [MENU] key to close the menu.

4.2 Automatic Tracking Aid ARP-17

Necessary parts

Table 4-2 Contents of ARP-17-2-E installation kit (Code No. 008-488-840)

Name	Type	Code No.	Qty
ATA Board ARP-17	18P9004A	008-490-940	1
Cable Assy.	80-0633		1
Spacer	SQ-10	000-801-678	8
Toroidal Core	TFC-25-25-2	000-129-693	1
Cable Tie	CV-150	000-570-325	1
Operator's Manual	ARP-17	000-808-575	1

Mounting

1. Unfasten eight screws to remove the cover.
2. Fasten eight spacers to the locations shown in Figure 4-4.
3. Fasten the ARP-17 Board to the spacers with eight panhead screws.
4. Attach the cable assy. between J1 on the ARP-17 Board and J1107 on the SPU Board. Attach toroidal core to cable assy. and fasten cable assy. with cable tie.

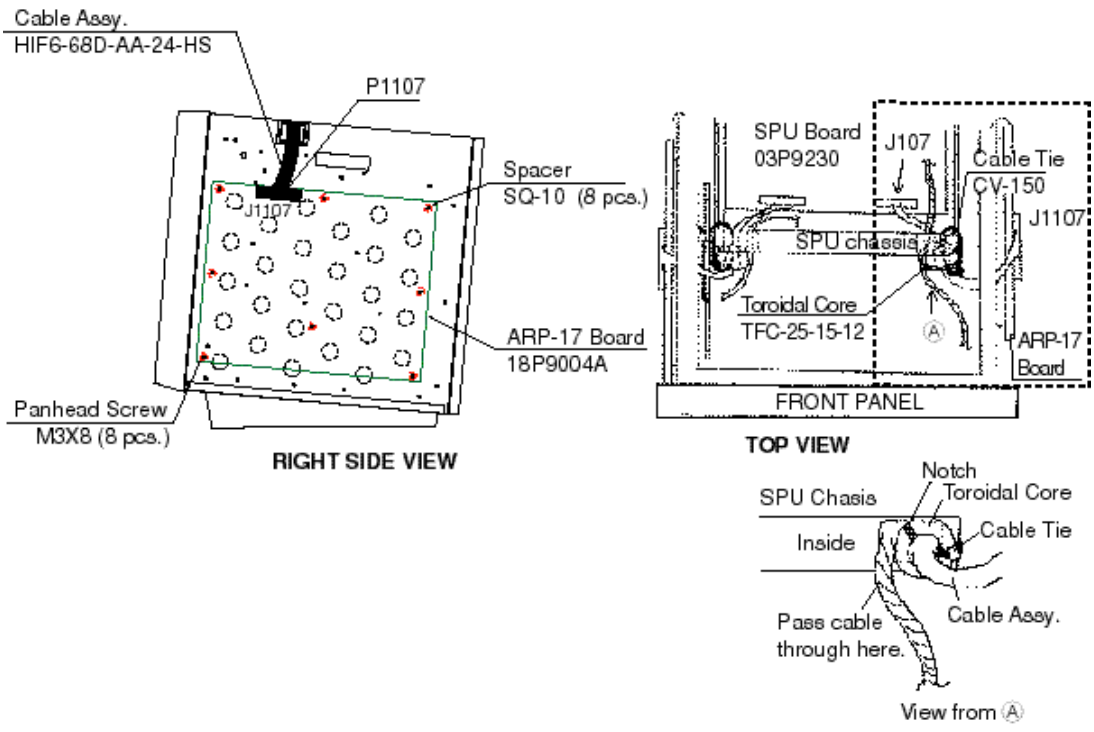


Figure 4-4 Display unit, right side view

Adjustment

1. Set the controls on the radar as follows:

   Range: 6 nm
   A/C SEA, A/C RAIN, GAIN: fully counterclockwise

2. Connect a digital multimeter, set to 10 VDC range, to the following points on the ARP-17 Board: (+), TP11 (VS+), (-), TP10 (VS-).

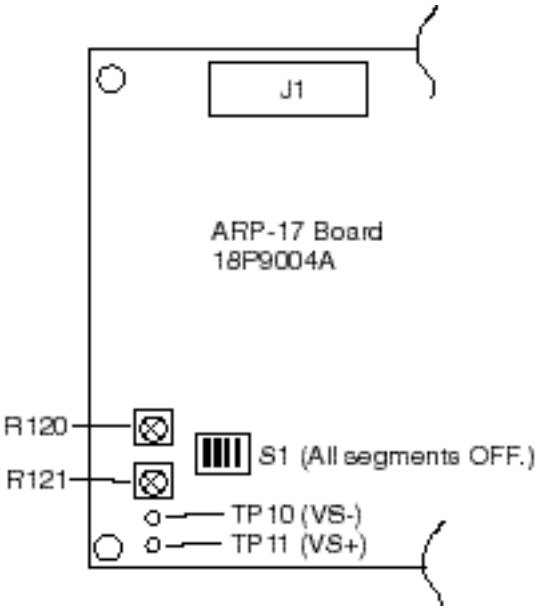


Figure 4-5 ARP-17 Board

3. Adjust potentiometer R121 (“OFFSET”) on the ARP-17 Board to show +0.09 to 0.13 V.

4. Set the radar controls and switches as follows:

   Range: 24 nm
   A/C SEA, A/C RAIN, GAIN: fully counterclockwise
   Interference rejector: OFF
   Echo stretch: OFF

5. Turn on the power while pressing the GAIN control. Press [MENU] [0] [0] [0] [0] [6] [6] [0] [0] to display the SET UP 2 menu.

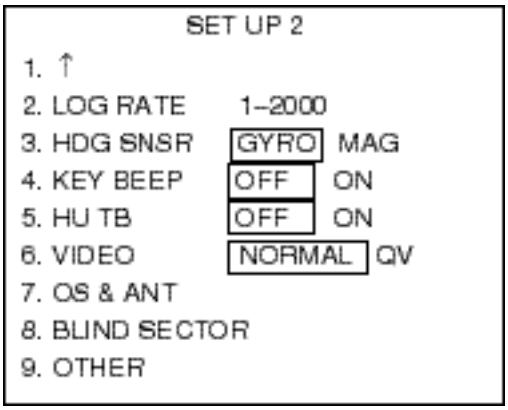


Figure 4-6 SET UP 2 menu

6. Press the [6] key several times to select QV from the VIDEO field and press the [ENTER /SELECT] key.
7. Adjust potentiometer R120 (“LEVEL”) on the ARP Board so that random noise faintly appears.

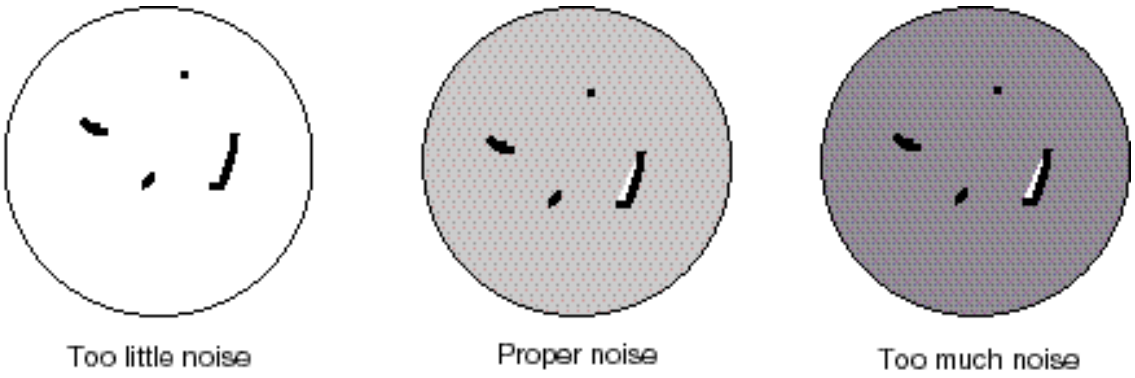


Figure 4-7 How to adjust noise

8. Press the [6] key to select NORMAL from the VIDEO field.
9. Press the [ENTER/SELECT] key followed by the [MENU] key.

Input signal check

Connect speed log and gyrocompass and place the radar in transmit condition. Confirm that all red LEDs, CR1, CR2, CR3, CR7, CR10, CR11 are off, provided that the ship's speed is not zero. If a signal is absent the corresponding LED lights.

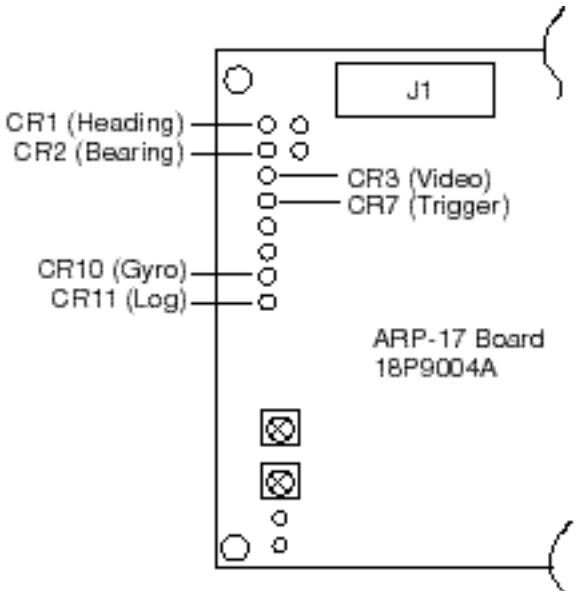


Figure 4-8 ARP Board

Video signal check

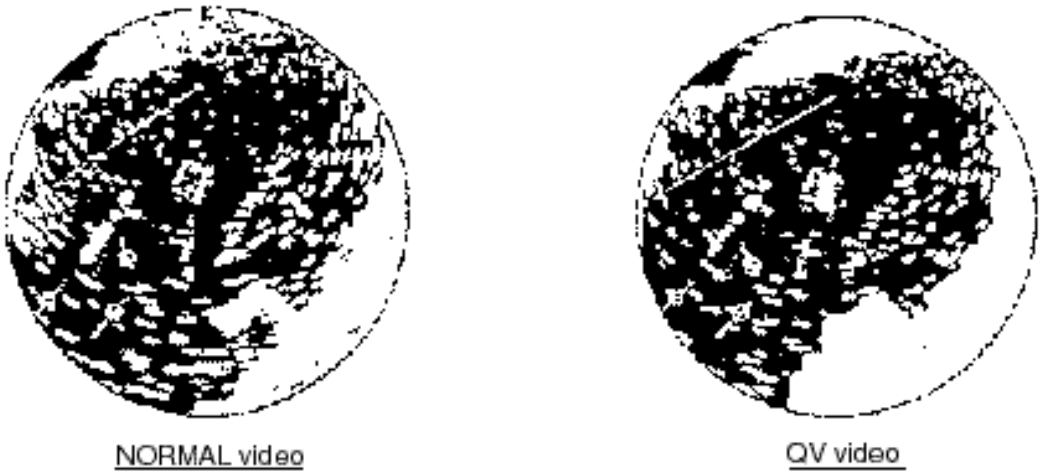


Figure 4-9 Video signal check

Diagnostic test

Conduct the diagnostic test (keying sequence: [MENU] [0] [0] [0] [0] [2] [2] to conduct the self test. If NG appears for any ARP item recheck connections on the ARP-17 Board. After confirming the diagnostic test close the cover.

```
FR-1505 SERIES TEST
Program No.            03591521**
ROM Check              OK
RAM Check              OK
Antenna Rotation       24RPM
Tx Trigger Frequency   3000Hz
Video Level            000
Video Signal           OK


ARP TEST
1. Program No.     18590411** 18590421**
2. ROM Check       OK         OK
3. RAM Check       OK
4. Speed Log       OK  0.0 KT
5. Course          OK
6. Trigger         OK
7. Video Signal    OK
8. Bearing Pulse   OK
9. Heading Pulse   OK
10. Minimum        0003
11. Scan Time      0274
12. Manual Acq.    00
13. Auto Acq.      00
14. FE-Data 1      0000
15. FE-Data 2      0000

Press MENU key to escape.
Press ENTER to check CRT.

** Program No.
```

Figure 4-10 ARP test results

4.3 Automatic Tracking Aid ARP-10

Necessary parts

Table 4-3 Contents of ARP-10 installation kit ARP-10-A (Code No.: 000-086-996)

Name	Type	Qty	Code No.
ARP-10 Board	18P9007	1	008-478-300
Cable Assy.	80-0633	1	
Spacer	SQ-10	4	000-801-678
Toroidal Core	TFC-25-25-12	1	000-129-693
Cable Tie	CV-150	1	000-570-325
Panhead Screw	M3X8	4	000-881-404

1. Unfasten eight screws to remove the cover.
2. Fasten four spacers to the locations shown in Figure 4-11.
3. Fasten the ARP-10 Board to the spacers with four panhead screws.
4. Attach the cable assy. between J1 on the ARP-10 Board and J1107 on the SPU Board. Attach toroidal core to cable assy. and fasten cable assy. with cable tie.
5. Fasten the cover.

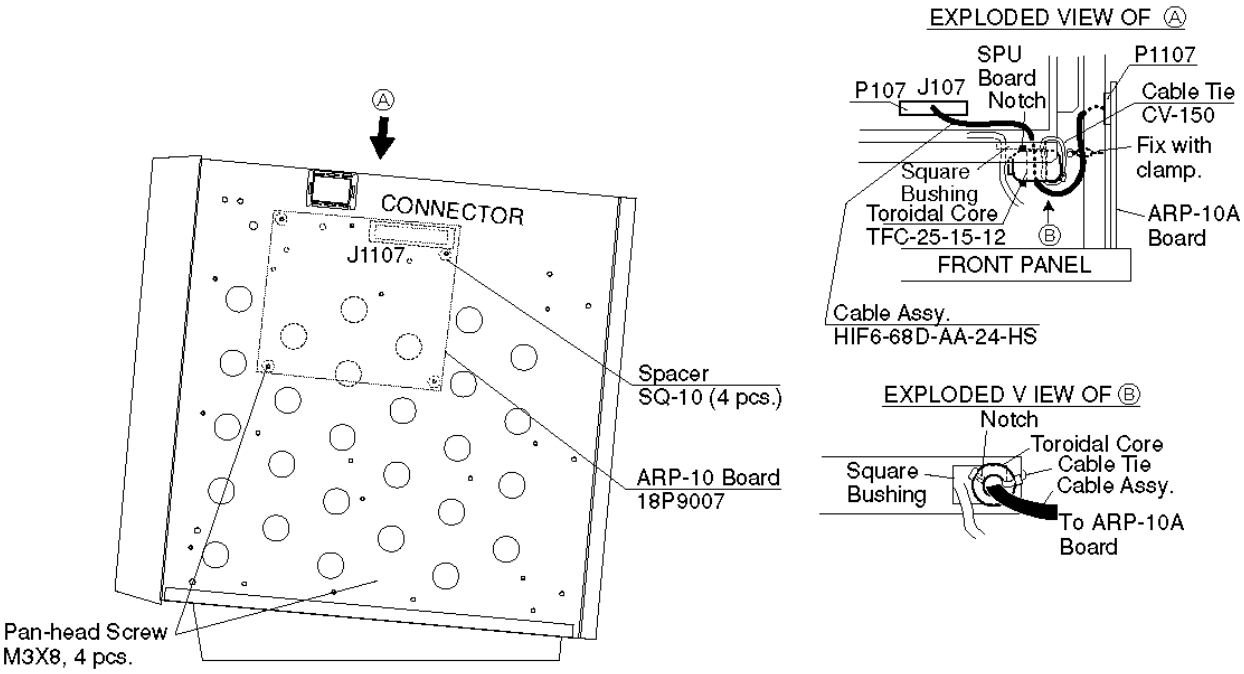


Figure 4-11 Display unit, right side view

4.4 Video Plotter RP-17

Necessary parts

Table 4-4 Contents of RP-17-15E-2 Installation kit (Code No. 000-086-993)

Name	Type	Qty	Code No.
Floppy Disk	NO.03591521XX	1	008-493-950
RP-17 Board	03P9259C	1	008-494-056
Cable Assy.	03S9456	1	000-142-369
Label (plotter)	14-034-8401	1	100-108-100
Label (M-card)	03-134-9106	1	100-235-230
Panhead Screw	M3X8 C2700W	5	000-881-404
Operator's Manual	RP-17-E	1	008-492-840
XH Connector Assy.	03-1796(5P)	1	008-462-830
Toroidal Core	TFC25-15-12	1	000-129-693
Cable Tie	CV-150	1	000-570-325
Clamp	CK-05H	1	000-570-247
Shrink TubingF(Z)	3X0.25 0.1 m	1	000-105-874

1. Turn off the display unit power switch and the switch S2 (AC set) at the rear of the display unit.
2. Turn off all equipment connected to the radar.
3. Remove card slot cover at the top of the display unit.
4. Attach labels as shown below.

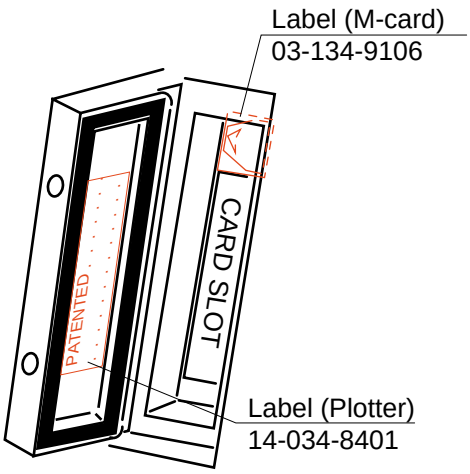


Figure 4-12 Attachment of labels

5. Unfasten eight screws to remove the cover.
6. Fasten the RP-17 Board with five panhead screws.
7. Connect the cable assy. between J106 on the SPU Board and J4 on the RP Board. Attach toroidal core to cable assy. and fasten cable assy. with cable tie.

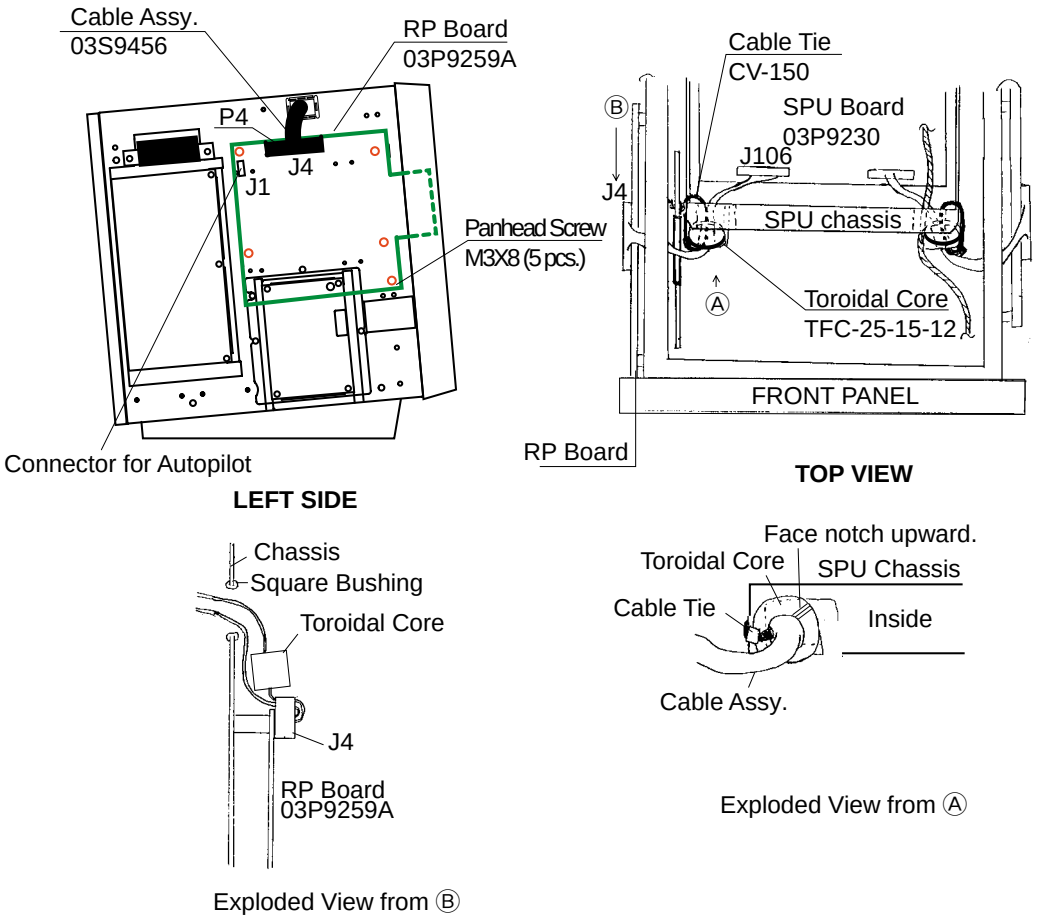


Figure 4-13 Display unit, left side view

8. If applicable, connect autopilot to J1 with an XH connector (5P). Solder and wire the cable as shown in Figures 4-14 and 4-15.

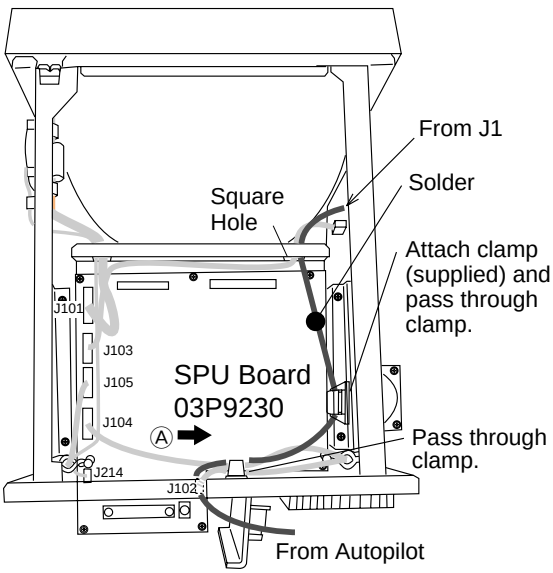


Figure 4-14 Display unit, top view

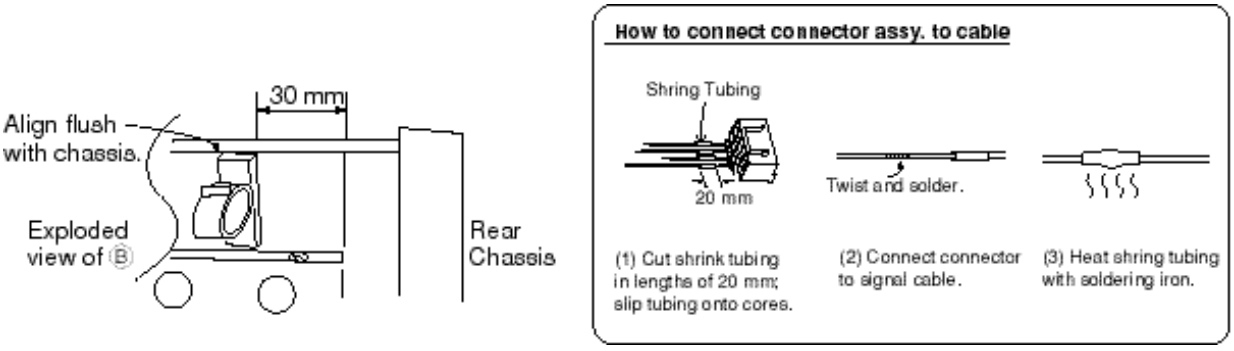


Figure 4-15 How to wire and solder the autopilot cable

8. Reattach the display unit cover.
9. Referring to the Operator's Manual, conduct the self test. Confirm program number. If the program number is younger than the number recorded on the floppy disk (supplied), the program should be updated. If updating is not required this concludes the installation of the RP-17.
10. Connect a PC to the display unit as shown below. (Remove rubber cap under front panel and connect XH4P connector.)

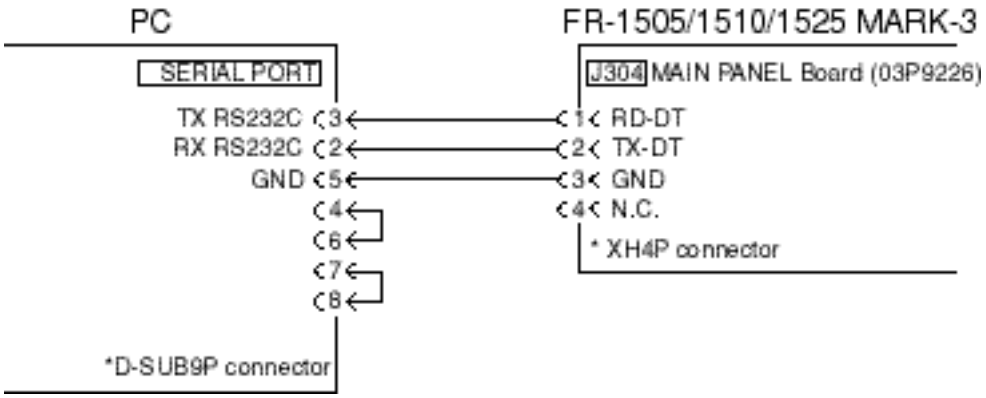


Figure 4-16 Connection of PC to display unit

11. Insert program update floppy disk in drive of the PC. Execute file (FR1500.bat) for version update. TARGET POWER ON appears on the screen of the PC.
12. Turn on the radar. LOADER RX, MAIN PROG appear successively on the screen of the PC. "Finish Version up. ted" appears on the screen of the PC when the updating has been completed.("FINISH Ver up" appears on the radar display.) It takes from 5-6 minutes to complete the updating.
13. Disconnect the PC from the radar.
14. Press and hold down the GAIN control while pressing the [MENU] key five times.
15. Press the [4] key, and then press the [ENTER/SELECT] key three times. This clears previous program.
16. Turn the power off and on.
17. Press [MENU], [0], [0], [0], [0], [2], [2] to confirm program version of radar.
18. Turn on the switch S2 (AC set). Turn off the radar.

4.5 RGB BUFFER (External Monitor Interface)

The RGB BUFF Kit provides for connection of an external monitor, and mainly consists of the RGB BUFF Board. Install the kit as shown below.

Table 4-5 Contents of RGB BUFF Kit OP03-153 (Code no. 008-490-820)

Name	Type	Qty	Code No.
RGB-BUFF Board (VIDEO INTERFACE Board)	03P9229	1	006-551-050
Coach Clip	VJR-3	1	000-111-284
XH Connector Assy.	03-1988 (13-13P)	1	008-490-840
RGB Board Fixing Plate	03-141-1901	1	100-266-730
Panhead Screw	M3X8 C2700W	4	000-881-404

1. Unfasten eight screws to remove the cover.
2. Unfasten two screws at the right side of the SPU Board. See the figure below for location.

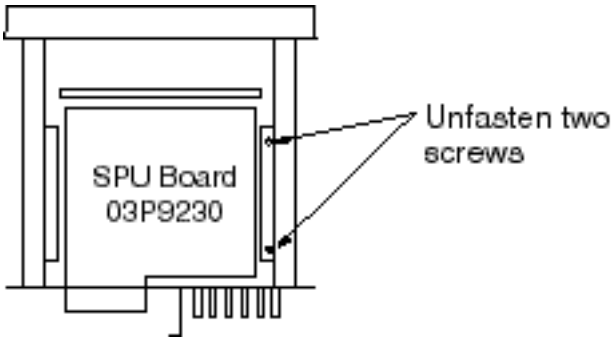


Figure 4-17 Display unit, top view

3. Fasten the RGB BUFF Board (supplied) to the fixing plate (supplied) with four screws (supplied).

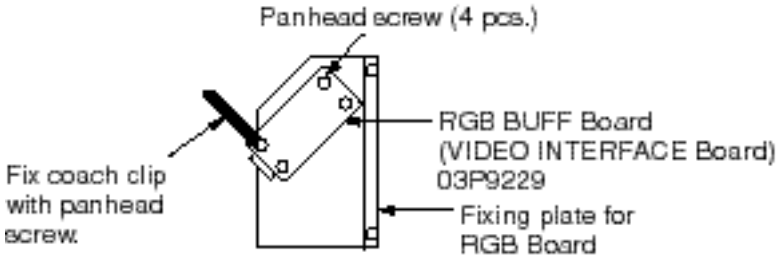


Figure 4-18 Attachment of fixing plate

4. Fasten the fixing plate with RGB BUFF Board to the chassis with the screws removed at step 2.

5. Connect the XH connector assembly (supplied) between J501 (13P) on the RGB BUFF Board and J108 (13P) on the SPU Board.
6. Bind XH connector with coach clip (supplied).
7. Connect a monitor cable (D-SUB15P connector cable, local supply) between the RGB BUFF Board and the external CRT.

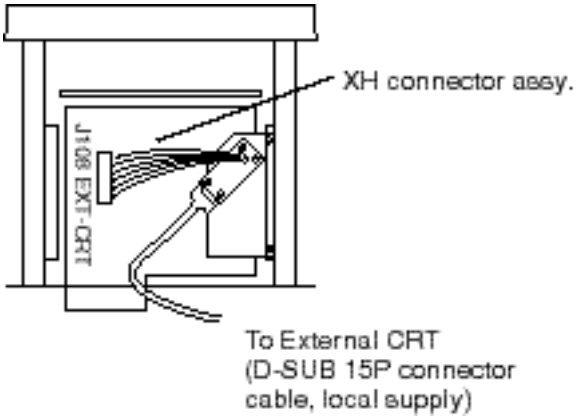


Figure 4-19 Connection of external monitor to RGB BUFF board

8. Close the rear cover.

4.6 Performance Monitor PM-30

The PM installation kit provides power switching for the Performance Monitor PM-30 and mainly consists of the PM-INT circuit board. Install the kit as follows:

Table 4-6 Contents of PM installation kit OP03-154 (Code no. 000-849-083)

Name	Type	Qty	Code No.
PM-INT Board (PM INTERFACE Board)	03P9225	1	008-487-620
Connector Assy.	VH3P-L300-AA	2	000-141-014
Spacer	SQ-10	3	000-801-678
XH Connector Assy.	03-1974 (3-3P)	1	008-490-850
Panhead Screw	M3x8 C2700W	3	000-881-404

1. Unfasten eight screws to remove the cover.
2. Remove the top cover.
3. Attach three spacers to the bottom of the GYRO PROCESSOR Board (64P1106A). Fasten the PM-INT Board (03P9225) to the spacers with panhead screws (supplied).
4. Solder the VH connector assy. (supplied) to the power line (100/220 VAC) and connect the line to J402 on the PM-INT Board.

5. Solder the VH connector (supplied) to the line from the PM-30 and connect it to J403 on the PM-INT Board.
6. Connect the XH connector (supplied) between J401 (3P) on the PM-IN Board and J213 (3P) on the SPU Board.

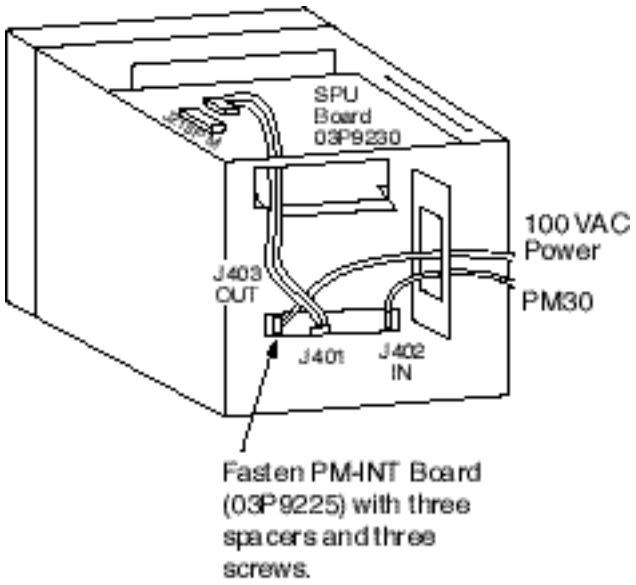


Figure 4-20 How to install the PM-INT Board

7. Close the covers.

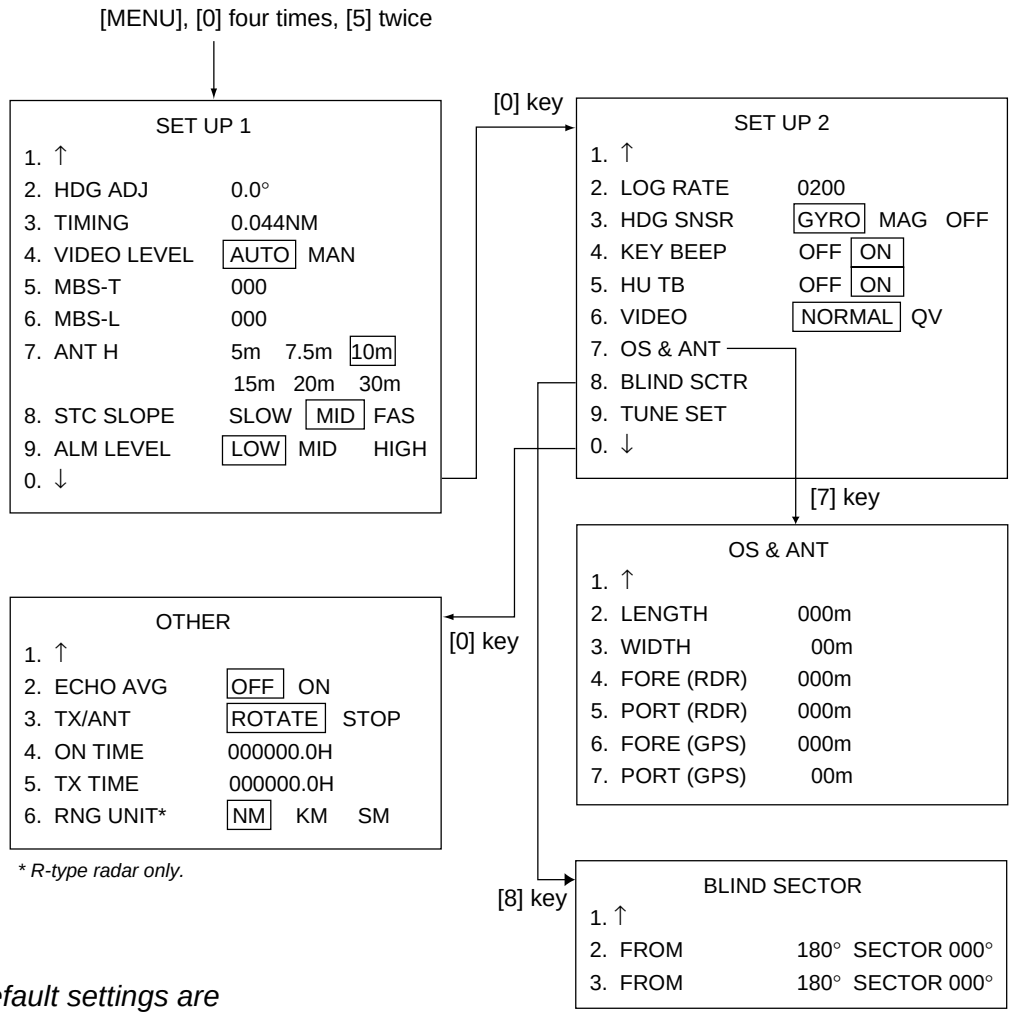
INITIALIZATION AND ADJUSTMENT

5.1 Opening the Installation Menus

The display unit RDP119 can be used as a sub display. If the sub display is installed, set heading alignment, sweep timing, video signal level, antenna height and STC slope for each display unit. Most adjustments are done on the INSTALLATION SETUP menu. This menu is normally locked to prevent adjustment. Open the menu as follows:

1. Turn off the power.
2. Turn on the power while pressing and holding down the GAIN control.
3. Press the [MENU] key to display the main menu.
4. Press the [0] key four times.
5. Press the [5] key twice to select INSTALL.
6. Press numeric keys to select item and set option.

The complete installation menus appear below.



Default settings are cir/cumscribed.

Figure 5-3 Installation menus

5.2 Tuning

1. Press [MENU] [0] [0] [0] [0] [5] [5] [0] [0] to display the SET UP 2 menu.
2. Press the [9] key to select TUNE SET.
3. Press the [ENTER/SELECT] key to tune. When tuning is completed a beep sounds (R-type only).

5.3 Heading Alignment

You have mounted the scanner unit facing straight ahead in the direction of the bow. Therefore, a small but conspicuous target dead ahead visually should appear on the heading marker (zero degrees).

Set heading alignment for both main display and sub display (if installed).

In practice, you will probably observe some small bearing error on the display because of the difficulty in achieving accurate initial positioning of the scanner unit. The following adjustment will compensate for this error.

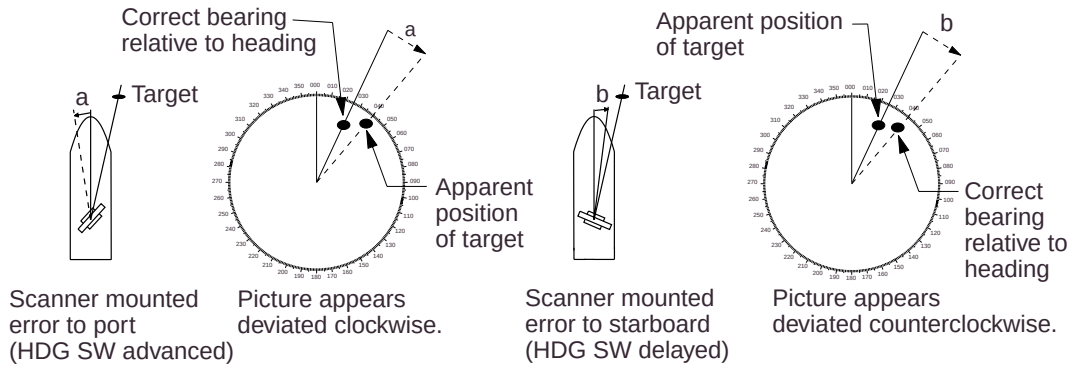


Figure 5-4 Heading alignment

1. Press [MENU] [0] [0] [0] [0] [5] [5] [2] to select HDG ADJ from the SET UP 1 menu.
2. Select a target echo (by gyrocompass, for example) at a range between 0.125 and 0.25 nm, preferably near the heading marker.
3. Operate the EBL control to bisect the target echo with the heading line. (The value shown on the display is scanner position in relation to ship's bow.)
4. Press the [ENTER/SELECT] key to finish.

5.4 Sweep Timing

Sweep timing differs with respect to the length of the signal cable between the scanner unit and the display unit. Adjust sweep timing for both main display and sub display. Adjust sweep timing for both main display and sub display (if installed). Adjust sweep fiming at installation to prevent the following symptoms:

- The echo of a "straight" target (for example, pier), on the 0.25 nm range, will appear on the display as being pulled inward or pushed outward. See Figure 5-5.
- The range of target echoes will also be incorrectly shown.

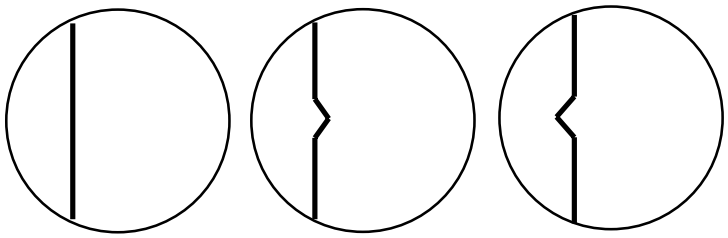


Figure 5-5 Examples of correct and incorrect sweep timings

1. Press [MENU] [0] [0] [0] [0] [5] [5] [3] to select TIMING from page 1 of the SET UP menu.
2. Transmit on the 0.25 nm range.
3. Adjust radar picture controls to display picture properly.
4. Select a target echo which should be displayed straightly.
5. Adjust the VRM control to straighten the target echo. (The figures to the right of "TIMING" are the amount in nautical miles the target is "straightened.")
6. Press the [ENTER/SELECT] key to register.

5.5 Adjusting Video Signal Level

When the signal cable is very long, the video amplifier input level decreases, shrinking target echoes. To prevent this, adjust the video level, either automatically or manually. Adjust it after adjusting tuning and sweep timing and do it on long range. Adjust video signal level for both main display and sub display.

Automatic adjustment

1. Turn off the A/C AUTO control.
2. Transmit on long range.
3. Display page 1 of the SET UP 1 menu.
4. Press the [4] key to select AUTO from the VIDEO LVL field.

5. Press the [ENTER/SELECT] key to automatically adjust the video level. When the adjustment has been completed a beep sounds (R-type only).
6. Connect an oscilloscope to TP6 on the pcb 03P9230 display unit) and measure main bang signal level. It should be 4.0 Vpp ±0.2 V. If it is not, within that range redo steps 4 and 5 above.

Manual adjustment

If the video signal level could not be adjusted automatically, adjust it manually as follows.

1. Do steps 1-3 in automatic tuning.
2. Press the [4] key to select MAN from the VIDEO LVL field.
3. Press the [ENTER/SELECT] key.
4. Connect the oscilloscope to TP6 on the pcb 03P9230. Operate the EBL rotary control while pressing and holding down the HL OFF control so the main bang level is 4.0 Vpp ±0.2 V.

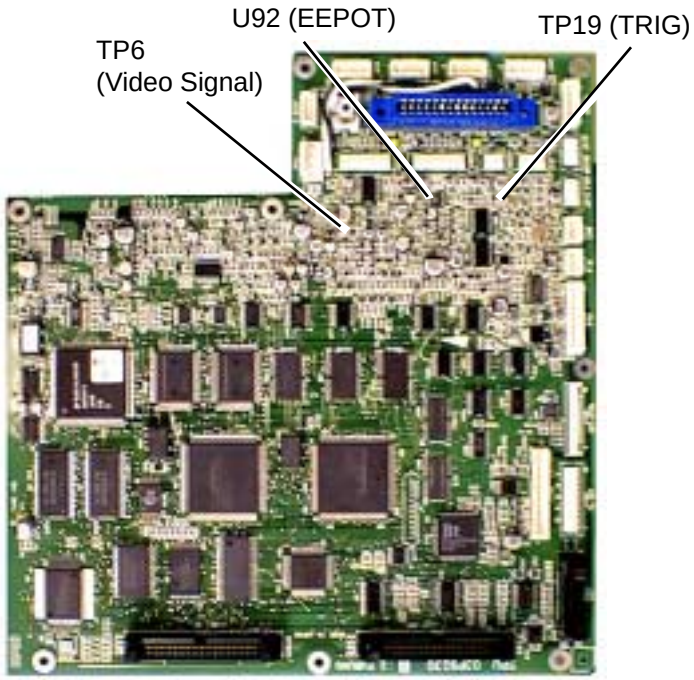


Figure 5-6 pcb 03P9230

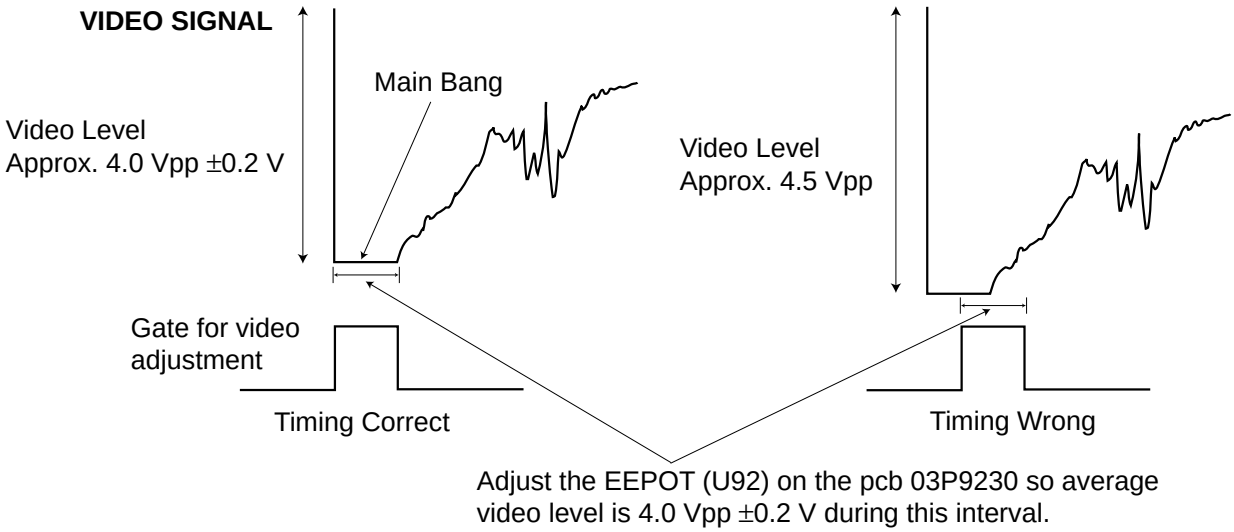


Figure 5-7 Video signal timing

5.6 Suppressing Main Bang

If main bang appears at the screen center, suppress it as follows:

1. Transmit on a long range and then wait ten minutes.
2. Adjust the GAIN control to show a slight amount of noise on the display.
3. Select the 0.25 nm range. Adjust the A/C SEA control to suppress sea clutter.
4. Press [MENU] [0] [0] [0] [0] [5] [5] [5] to select MBS-T from the SET UP 1 menu.
5. Adjust the VRM control to adjust MBS timing (Adjustable range: 0-127).
6. Press the [ENTER/SELECT] key.
7. Press the [6] key to select MBS-L (MBS-Level).
8. Adjust the VRM control to adjust MBS level (Adjustable range: 0-127).
9. Press the [ENTER/SELECT] key.

5.7 Confirming Magnetron Heater Voltage

Magnetron heater voltage is adjusted at the factory. However, confirm that it is within the prescribed rating as follows:

1. [MENU] [0] [0] [0] [0] [5] [5] [0] [0] [0] [0] to display the OTHER menu.

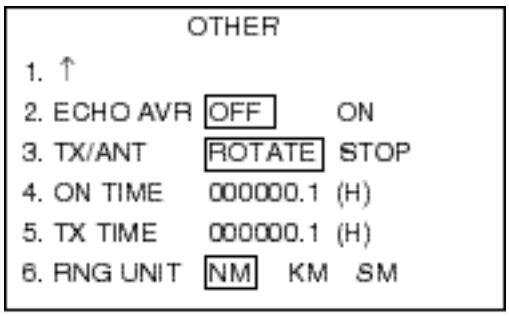


Figure 5-8 OTHER menu

2. Press the [3] key to select STOP from the TX/ANT field and press the [ENTER/SELECT] key.
3. Disconnect connector P821 from the scanner unit.
4. Measure on the 0.125 nm and 48 nm range scales, the voltage between pins #12(+) and #5(-) on connector P801 on the RFC Board (03P9243) in the scanner unit.
5. If the voltage is not within the rating shown in Table 5-2, adjust potentiometer VR1 on the RFC Board.

Table 5-2 Magnetron ratings

Rating	FR-1505 MK3 (6 kw)	FR-1510 MK3 (12 kW)	FR-1525 MK3 (25 kW)
0.125 nm	7.4 - 7.6 V	7.4 - 7.6 V	8.2 - 8.4 V
48 nm	7.4 - 7.6 V	7.4 - 7.6 V	6.5 - 7.5 V

6. Set ROTATE from the TX/ANT field and press the [ENTER/SELECT] key.

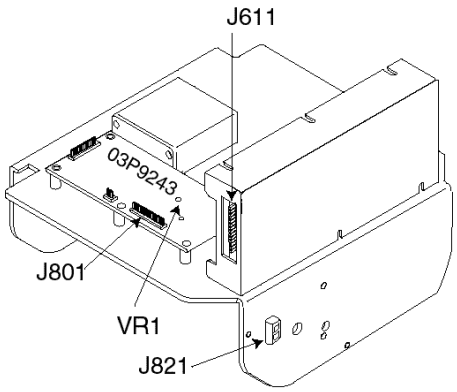


Figure 5-9 RFC Board

5.8 Other Items on the Installation Menus

SET UP 1 menu

Keying sequence: [MENU] [0] [0] [0] [0] [5] [5]

2. HDG ADJ: Aligns heading.

3. TIMING: Adjusts sweep timing.

4. VIDEO LEVEL: Adjusts video amplifier level automatically or manually.

5., 6. MBS-T, MBS-L: Suppresses main bang in level and timing

7. ANT H: Enter height of scanner above water. Select from 5 m, 7.5 m, 10 m, 15 m, 20 m, or more than 30 m. Set height of scanner for both main display and sub display (if installed).

8. STC SLOPE: Selects level of STC affect; Slow, Medium or Fast. Set STC slope for both main display and sub display (if installed).

9. ALM LEVEL: Select echo strength which triggers the guard zone alarm.

SET UP 2 menu

Keying sequence: [MENU] [0] [0] [0] [0] [5] [5] [0] [0]

2. LOG RATE: Enter speed log's pulse rate.

3. HDG SNSR: Select source of heading data; gyrocompass, magnetic compass or OFF (no heading data).

4. KEY BEEP: Turns key beep on/off.

5. HU TB: Enables/disables the heading up true bearing presentation mode.

6. VIDEO: Set to NORMAL (analog signal) for normal use. Select QV (Quantized Video) to adjust ATA (Automatic Tracking Aid ARP-17 required).

7. OS & ANT: See OS & ANT menu.

8. BLIND SCTR: Sets area (up to 2) where no radar pulses will be transmitted. For example, set the area where an interfering object at the rear of the scanner would produce a dead sector (area where no echoes appear) on the display. To enter an area, select ON and enter relative bearing range of the area.

9. TUNE SET: Tunes the radar receiver.

OTHER menu

Keying sequence: [MENU] [0] [0] [0] [0] [5] [5] [0] [0] [0]

2. ECHO AVG: Echo averaging can be turned on without gyrocompass connection.

3. TX/ANT: Set to ROTATE in normal use. STOP enables transmission state without scanner rotation.

4. ON TIME, 5. TX TIME: Shows number of hours the radar has been turned on and transmitted, respectively. Value can be changed.

6. RNG UNIT: Selects unit of range measurement; nm, km, sm.

OS & ANT menu

Keying sequence: [MENU] [0] [0] [0] [0] [5] [5] [0] [0] [7] [7]

2. LENGTH: Enter ship's length.

3. WIDTH: Enter ship's width.

4. FORE (RDR): Enter distance from radar scanner to fore.

5. PORT (RDR): Enter distance from radar scanner to port.

6. FORE (GPS): Enter distance from GPS antenna to fore.

7. PORT (GPS): Enter distance from GPS antenna to port.

Note: When radar antenna distances are entered, the same values are copied to the distances for the GPS antenna. Change the GPS antenna distances if necesary.

5.9 Selecting Radar Type

The FR-1500 MARK-3 series radar is available in the Regular type (R-type) or IMO type. The R-type satisfies the IMO and IEC standards but includes more flexibility of functionality. The default type is the IMO type. To select the R-type do the following:

1. Press the [MENU] key five times while pressing and holding down the GAIN control. The following menu appears.

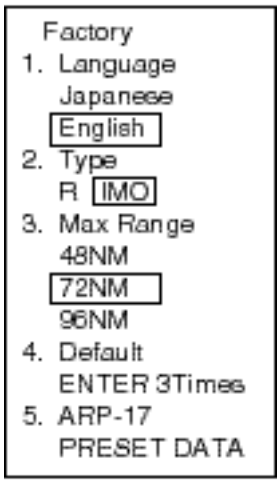


Figure 5-10 Factory menu

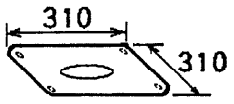
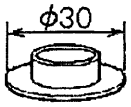
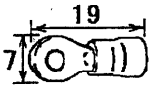
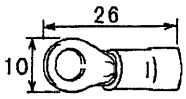
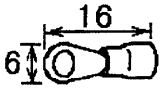
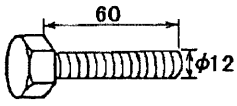
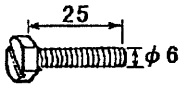
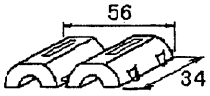
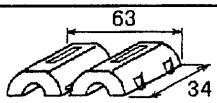
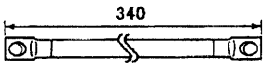
2. Press the [2] key to select R.
3. Press the [ENTER/SELECT] key followed by the [MENU] key.

FURUNO

CODE NO.	008-493-160	03FS-X-9404 -7
TYPE	CP03-19104	1/2

工事材料表

INSTALLATION MATERIALS

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	防蝕ゴム.1. CORROSION-PROOF RUBBER MAT		03-001-3001-0 CODE NO. 300-130-010	1	空中線部用 FOR ANTENNA UNIT
2	ｼｰﾙﾜｯｼｬ SEAL WASHER		03-001-3002-0 CODE NO. 300-130-020	4	空中線部用 FOR ANTENNA UNIT
3	圧着端子 CRIMP-ON LUG		FV1.25-M3 ｱｶ CODE NO. 000-538-110	26	空中線部用 FOR ANTENNA UNIT
4	圧着端子 CRIMP-ON LUG		FV5.5-4 CODE NO. 000-538-123	2	空中線部用 FOR ANTENNA UNIT
5	圧着端子 CRIMP-ON LUG		FVD1.25-3 CODE NO. 000-116-634	1	空中線部用 FOR ANTENNA UNIT
6	六角ﾎﾞﾙﾄ（全ﾈｼﾞ） HEX. BOLT		M12X60 SUS304 CODE NO. 000-862-191	4	空中線部用 FOR ANTENNA UNIT
7	六角ﾎﾞﾙﾄ HEX.BOLT		M6X25 SUS304 CODE NO. 000-862-180	1	空中線部用 FOR ANTENNA UNIT
8	EMIｺｱ EMI CORE		RFC-10 CODE NO. 000-141-085	2	空中線部用 FOR ANTENNA UNIT
9	EMIｺｱ EMI CORE		RFC-13 CODE NO. 000-141-084	2	空中線部用 FOR ANTENNA UNIT
10	ｱｰｽ線 GROUNDING WIRE		RW-4747-1 03S4747 CODE NO. 000-566-000	1	空中線部用 FOR ANTENNA UNIT

DWG NO.
C3464-M05- G

FURUNO ELECTRIC CO ., LTD.

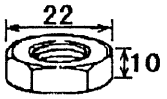
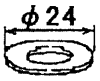
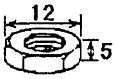
（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

FURUNO

CODE NO.	008-493-160	03FS-X-9404 -7
TYPE	CP03-19104	2/2

工事材料表

INSTALLATION MATERIALS

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
11	六角ナット 1種 HEX. NUT		M12 SUS304 CODE NO. 000-863-112	4	空中線部用 FOR ANTENNA UNIT
12	ミガキ平座金 FLAT WASHER		M12 SUS304 CODE NO. 000-864-132	4	空中線部用 FOR ANTENNA UNIT
13	バネ座金 SPRING WASHER		M12 SUS304 CODE NO. 000-864-263	4	空中線部用 FOR ANTENNA UNIT
14	六角ナット 1種 HEX. NUT		M6 SUS304 CODE NO. 000-863-109	1	空中線部用 FOR ANTENNA UNIT
15	ミガキ平座金 FLAT WASHER		M6 SUS304 CODE NO. 000-864-129	3	空中線部用 FOR ANTENNA UNIT
16	バネ座金 SPRING WASHER		M6 SUS304 CODE NO. 000-864-260	1	空中線部用 FOR ANTENNA UNIT

DWG NO.
C3464-M06- G

FURUNO ELECTRIC CO ., LTD.

（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

FURUNO

CODE NO.	008-493-230	03FY-X-9401 -2
TYPE	CP03-20101	1/1

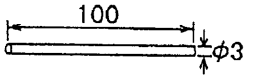
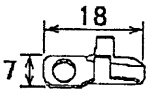
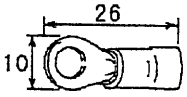
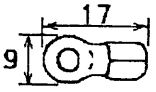
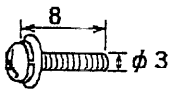
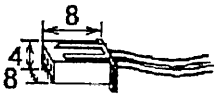
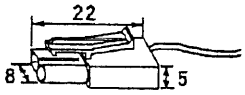
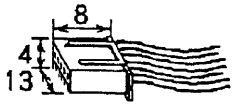
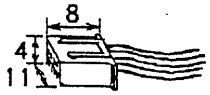
工事材料表

INSTALLATION MATERIALS

FR-1505MARK-3
FR-1510MARK-3
FR-1525MARK-3

船舶用ﾚｰﾀﾞ

MARINE 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	ｽﾐﾁｭｰﾌﾞ F(Z) HEAT-SHRINK TUBE		3X0.25 ｸﾛ ＊0.10M＊ CODE NO. 000-105-874	2	
2	特殊ﾗｸﾞ LUG		ｱﾅｸｲ4 ｽｽﾞ CODE NO. 000-536-100	2	
3	圧着端子 CRIMP-ON LUG		FV5.5-4 CODE NO. 000-538-123	2	
4	圧着端子 CRIMP-ON LUG		8NK4 CODE NO. 000-538-180	4	
5	ﾅｰﾅﾍﾞｾﾑｽﾈｼﾞ B WASHER HEAD SCREW		M3X8 C2700 MBNI2 CODE NO. 000-881-404	2	
6	XHｺﾈｸﾀ XH CONNECTOR		03-1768(3P) CODE NO. 008-459-090	1	指示部用 FOR DISPLAY UNIT
7	MLｺﾈｸﾀ ML CONNECTOR		03-1769(P2P) CODE NO. 008-461-510	1	指示部用 FOR DISPLAY UNIT
8	XHｺﾈｸﾀ XH CONNECTOR		03-1796(5P) CODE NO. 008-462-830	4	指示部用 FOR DISPLAY UNIT
9	XHｺﾈｸﾀ XH CONNCTOR		03-1798(4P) CODE NO. 008-463-400	1	指示部用 FOR DISPLAY UNIT

DWG NO.
C3450-M01- B

FURUNO ELECTRIC CO., LTD

（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

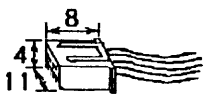
FURUNO

CODE NO.	008-489-850	03FU-X-9401 -3
TYPE	CP03-19402	2/2

工事材料表

INSTALLATION MATERIALS

FR-1710/1725
FR-1510MARK-3
FR-1525MARK-3
船舶用ﾚｰﾀﾞ
MARINE RADAR

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
11	XHｺﾈｸﾀ XH CONNCTOR		03-1798(4P) CODE NO. 008-463-400	1	指示部用 FOR DISPLAY UNIT

DWG NO.
C3453-M02- C

FURUNO ELECTRIC CO., LTD

（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

FURUNO

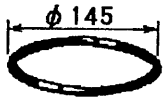
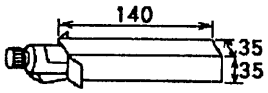
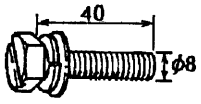
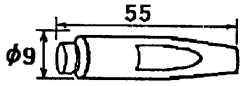
CODE NO.	008-487-130	03FS-X-9403 -2
TYPE	CP03-19101	1/1

工事材料表

INSTALLATION MATERIALS

FR-2115/2125/2125W　船舶用ﾚｰﾀﾞ

MARINE 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	Oﾘﾝｸﾞ O-RING		JISB2401-P135 CODE NO. 000-808-309	1	
2	ｽﾘｰﾎﾞﾝﾄﾞ ADHESIVE		1211 50G CODE NO. 000-854-118	1	
3	六角ｾﾑｽB　ｽﾘﾜﾘ HEX. BOLT (SLOTTED, WASHER HEAD)		M8X40 SUS304 CODE NO. 000-882-071	8	
4	ﾋﾟﾝ PIN		03-141-0301-2 CODE NO. 100-266-882	2	

DWG NO.
C3464-M04- C

FURUNO ELECTRIC CO., LTD

（略図の寸法は、参考値です。　DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

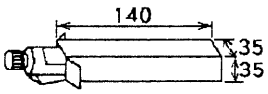
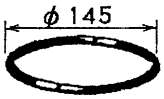
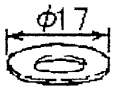
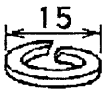
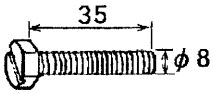
A-4A

FURUNO

CODE NO.	008-485-250	03FS-X-9409 -0
TYPE	CP03-24201	1/1

工事材料表

INSTALLATION MATERIALS

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ｽﾘｰﾎﾞﾝﾄﾞ SEALANT		1211 50G CODE NO. 000-854-118	1	
2	Oﾘﾝｸﾞ O-RING		JISB2401-P135 CODE NO. 000-808-309	1	
3	ﾐｶﾞｷ平座金 FLAT WASHER		M8 SUS304 CODE NO. 000-864-130	8	
4	バネ座金 SPRING WASHER		M8 SUS304 CODE NO. 000-864-262	8	
5	六角ﾎﾞﾙﾄ ｽﾘ割り HEX.BOLT (SLOTTED HEAD)		M8X35 SUS304 CODE NO. 000-862-153	8	

DWG NO. C3450-M02- A

FURUNO ELECTRIC CO., LTD.

（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

FURUNO

CODE NO.		03FU-X-9403 -2
TYPE		1/1

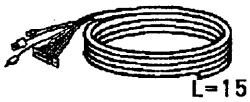
工事材料表

INSTALLATION MATERIALS

FR-1710/1725 船舶用ﾚｰﾀﾞ
FR-1510MARK-3
FR-1525MARK-3

MARINE RADAR

ANTENNA 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	信号ｹｰﾌﾞﾙ SIGNAL CABLE	 L=15M	S03-77-15(HK) (RW-6895)		1	選択 TO BE SELECTED
			CODE NO.	008-489-820		
2	信号ｹｰﾌﾞﾙ SIGNAL CABLE	 L=20M	S03-77-20(HK) (RW-6895)		1	選択 TO BE SELECTED
			CODE NO.	008-489-830		
3	信号ｹｰﾌﾞﾙ SIGNAL CABLE	 L=30M	S03-77-30(HK) (RW-6895)		1	選択 TO BE SELECTED
			CODE NO.	008-489-840		
4	信号ｹｰﾌﾞﾙ SIGNAL CABLE	 L=15M	S03-81-15(K1) (RW-4873)		1	選択 TO BE SELECTED
			CODE NO.	008-490-500		
5	信号ｹｰﾌﾞﾙ SIGNAL CABLE	 L=20M	S03-81-20(K1) (RW-4873)		1	選択 TO BE SELECTED
			CODE NO.	008-490-510		
6	信号ｹｰﾌﾞﾙ SIGNAL CABLE	 L=30M	S03-81-30(K1) (RW-4873)		1	選択 TO BE SELECTED
			CODE NO.	008-490-520		

DWG NO.
C3453-M03- B

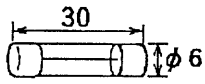
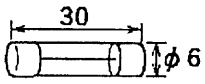
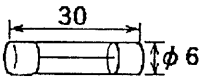
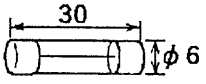
FURUNO ELECTRIC CO., LTD

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	008-490-790	03FY-X-9301 -0
TYPE	SP03-13010	BOX NO. P

SHIP NO.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL
	FR-1505MARK-3 FR-1510MARK-3 FR-1525MARK-3 船舶用ﾚｰﾀﾞ MARINE RADAR	FOR DISPLAY UNIT	

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	ﾋｭｰｽﾞ FUSE		FGBO 20A AC125V	1		2	000-549-015
2	ｶﾝｲﾘﾋｭｰｽﾞ FUSE		FGBO 25A AC125V	1		2	000-549-016
3	ﾋｭｰｽﾞ FUSE		FGBO 5A AC250V	2		4	000-549-022
4	ﾋｭｰｽﾞ FUSE		FGBO 10A AC125V	2		4	000-549-065

MFR'S NAME	FURUNO ELECTRIC CO., LTD	DWG NO.	C3450-P01- A	1/1

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	008-418-920	03DX-X-9303 -6
TYPE	SP03-08902	BOX NO. P

SHIP NO.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL
	FR-1400/2100 ｼﾘｰｽﾞ 船舶用ﾚｰﾀﾞ FR-1700/1500 ｼﾘｰｽﾞ FCR-1400 ｼﾘｰｽﾞ FR/FAR-2825/2855 MARINE RADAR	FOR ANTENNA UNIT	

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	ｶｰﾎﾞﾝﾌﾞﾗｼ CARBON BRUSH		MG120-5X6X11 D8G	2		2	000-631-716

MFR'S NAME	FURUNO ELECTRIC CO., LTD	DWG NO.	C3352-P04- G	1/1

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

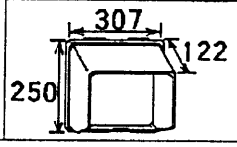
CODE NO.	008-102-930	03CI-X-9503 -4
TYPE	FP03-02310	1/1

付属品表

ACCESSORIES

FR-1500ｼﾘｰｽﾞ　船舶用ﾚｰﾀﾞｰ
FR-1500MARK-2ｼﾘｰｽﾞ　ｶﾗｰﾋﾞﾃﾞｵﾌﾟﾛｯﾀ
FR-1500MARK-3ｼﾘｰｽﾞ　ｶﾗｰGPSﾌﾟﾛｯﾀ
GD-380
GP-380

MARINE RADAR
COLOR VIDEO PLOTTER
COLOR GPS PLOTTER

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ﾌｰﾄﾞ組品 HOOD ASSY.		FP03-02310 CODE NO. 008-102-930	1	

DWG NO. C3396-F01- D

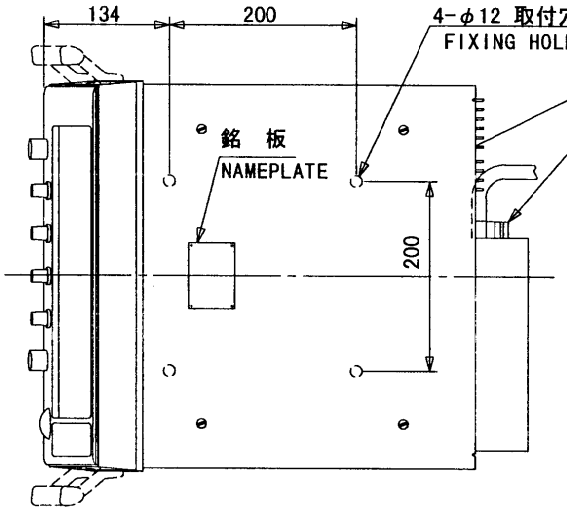
FURUNO ELECTRIC CO., LTD

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

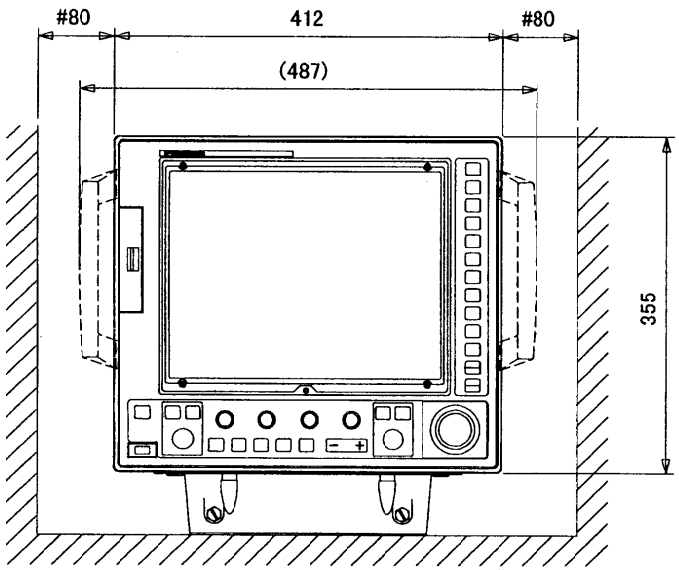
注　記　1) 装備ケーブルはサービス時、指示部を前方に充分引き出せるよう
余裕を持たせること。
2) 装備ケーブルの端末処理は装備要領書参照のこと。
3) 取付用ネジはＭ１０ボルトまたはコーチボルト呼び径９を使用のこと。
4) #印寸法は最小サービス空間寸法とする。
5) 指定外の寸法公差は表１による。

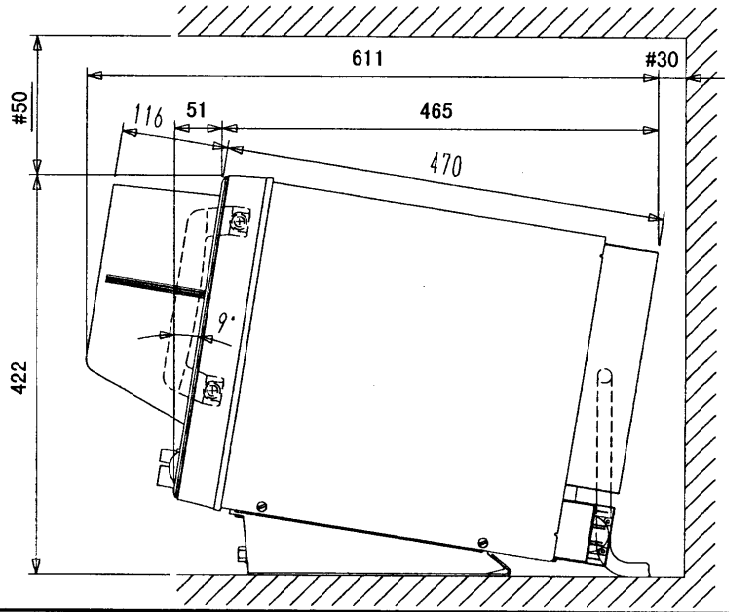
NOTE　1. KEEP ENOUGH CABLE LENGTH BEHIND DISPLAY.
2. REFER TO INSTALLATON INSTRUCTIONS FOR FABRICATION OF CABLE ENDS.
3. USE M10 BOLTS OR φ9 CORCH SCREWS FOR FIXING UNIT.
4. #: RECOMMENDED SERVICE CLEARANCE.
5. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.



範 囲 DIMENSION	公差 TOL.
L≦５０	±１mm
５０<L≦１００	±２mm
１００<L≦５００	±３mm
５００<L≦１０００	±４mm
１０００<L≦２０００	±５mm
２０００<L≦４０００	±７mm
４０００<L≦８０００	±１０mm
８０００<L	±１５mm

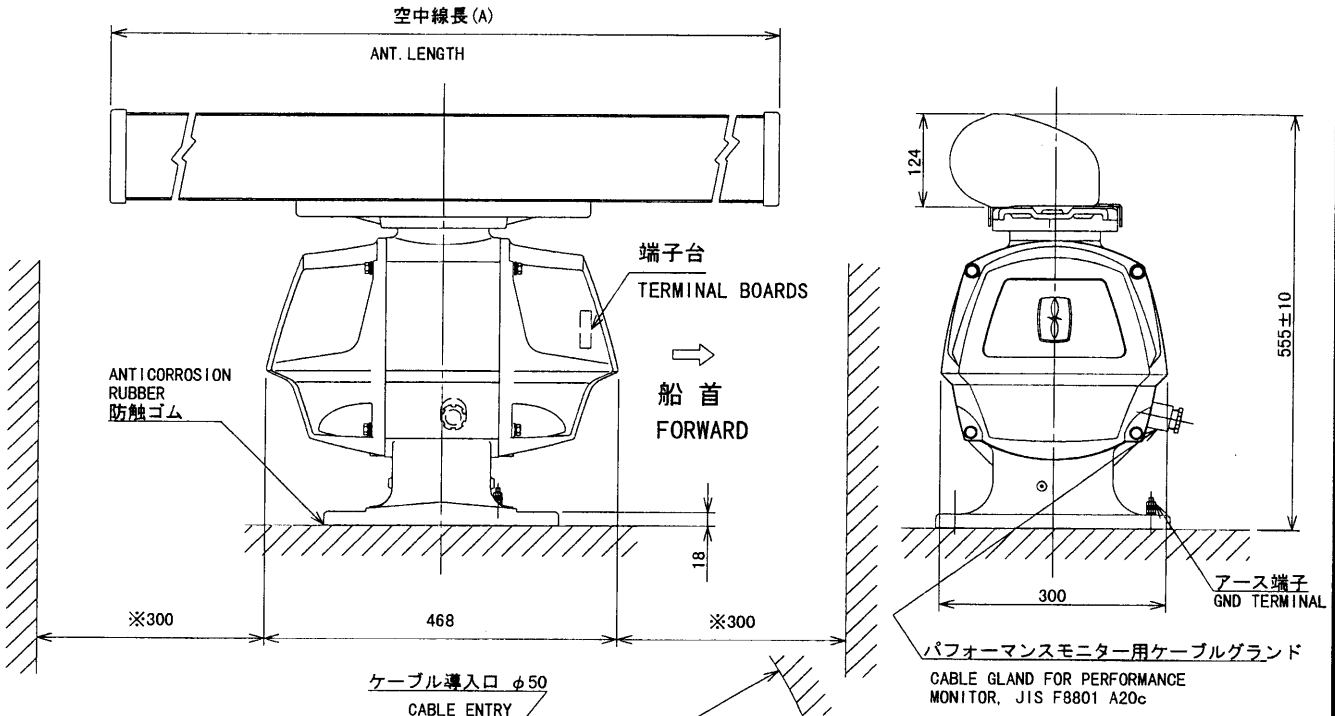
表１　TABLE 1

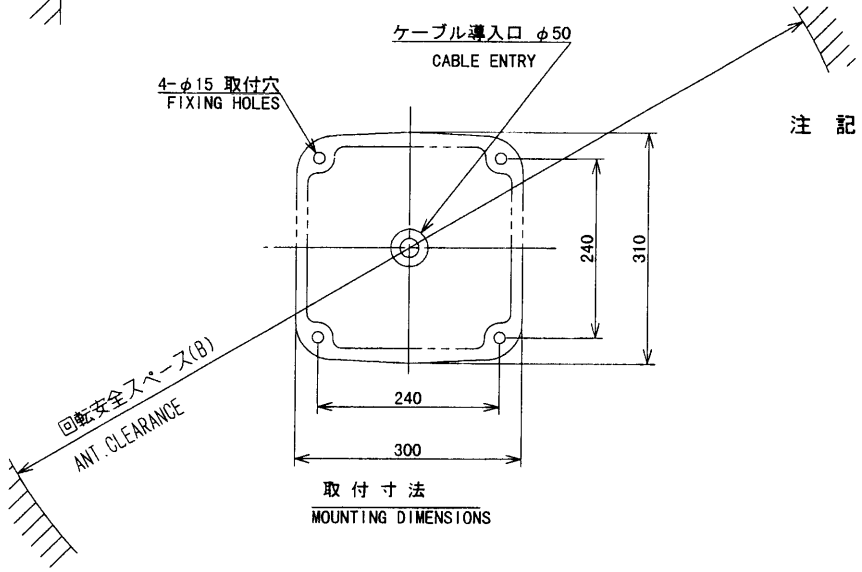




DRAWN Jun 24 '98 T. YAMASAKI			TITLE RDP-119
CHECKED Jun 24 '98 K.Kusunoki		FR-1525M3	名称 指示部
APPROVED Jun 24 '98 K.Kusunoki		FR-1510M3 FR-1505M3	外寸図
SCALE 1/8	MASS 29 kg		NAME DISPLAY UNIT
DWG. No. C3449-G01- A		03-141-1000-G0	OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.





取 付 寸 法
MOUNTING DIMENSIONS

注 記

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

NOTE 2.

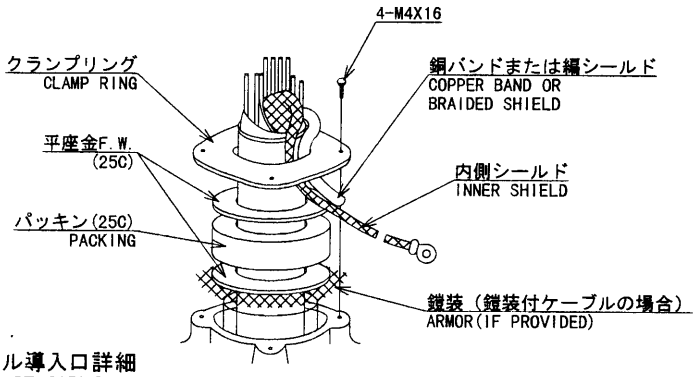
種類 ** ANT. TYPE	120cm型TYPE (XN-12AF)
空中線長(A) ANT. LENGTH	1,260±10 mm
回転安全スペース(B) ANT. CLEARANCE	1,400 mm
質 量 MASS	33 kg

**選択可能な空中線部種類は、レーダー型式により異なる。各仕様を参照のこと。
SELECTABLE ANTENNA TYPE DEPENDS ON RADAR MODEL. SEE INDIVIDUAL SPECIFICATIONS.

NOTE 3. 指定外の寸法公差は表１による。
REFER DIMENSION TOLERANCE TO TABLE 1.

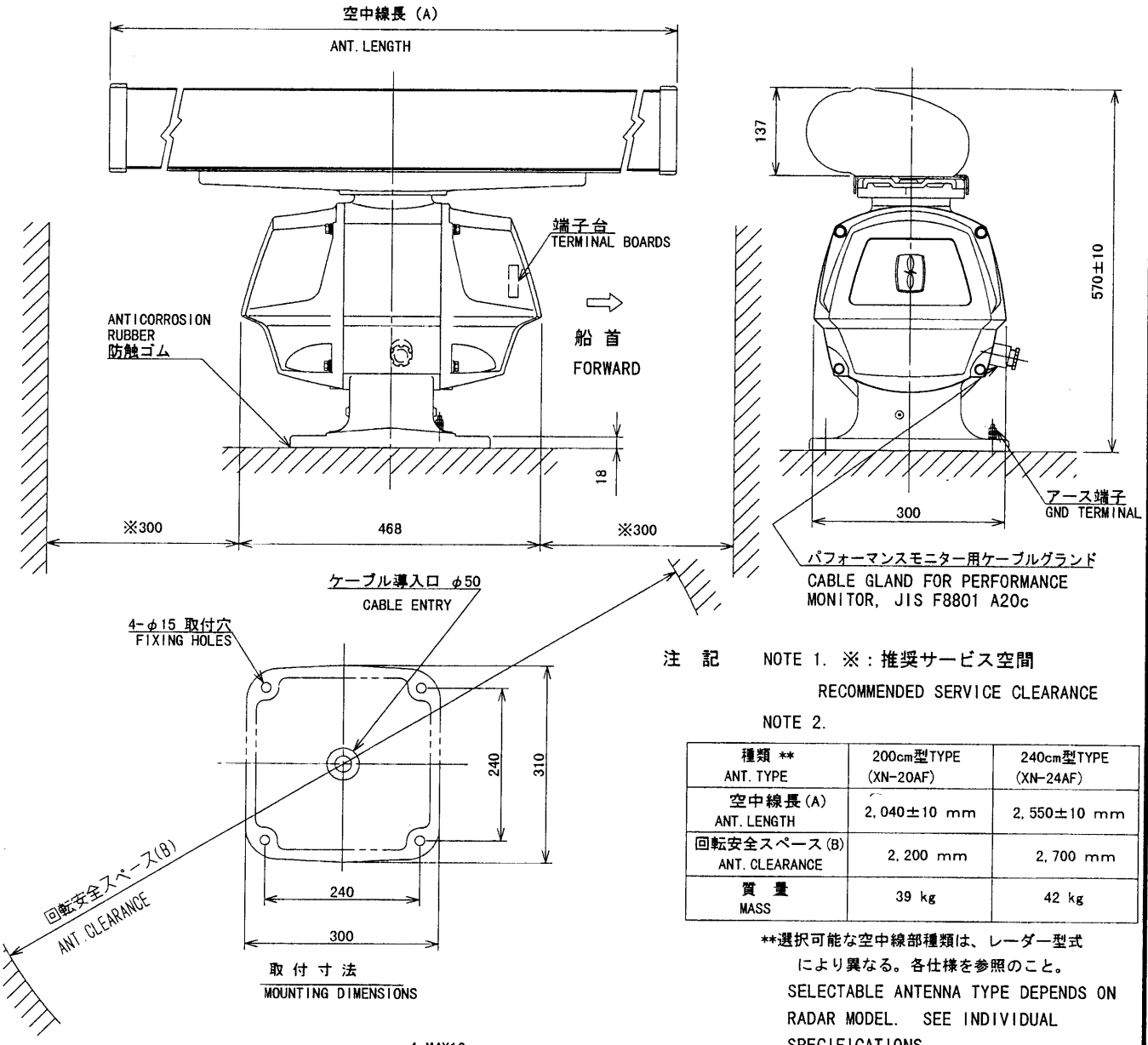
範 囲 DIMENSION	公差 TOL
0＜L≦50	±1.5mm
50＜L≦100	±2.5mm
100＜L≦500	±3mm
500＜L≦1000	±4mm
1000＜L≦2000	±5mm
2000＜L≦4000	±7mm
4000＜L≦8000	±10mm
8000＜L	±15mm

表 1
TABLE 1

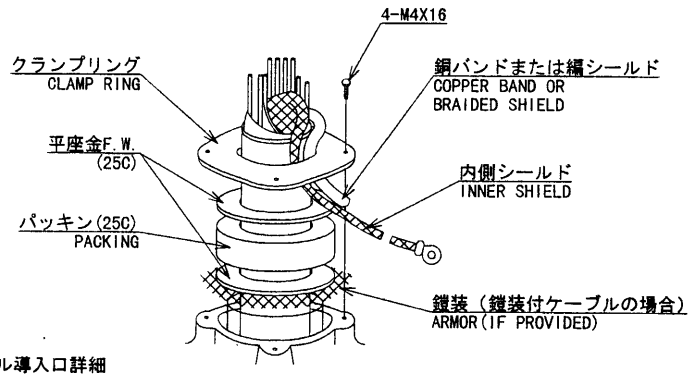


ケーブル導入口詳細
DETAIL OF CABLE ENTRY

DRAWN Aug 31 '99 T.YAMASAKI		TITLE RSB-0074/0075-12AF
CHECKED Aug 31'99 K.KOSUNOKI	OTHERS FR-1500 SER.	名称 空中線部
APPROVED Aug 31'99 K.KOSUNOKI	FR-1700 SER. FR-2115/2125	外寸図
SCALE 1/10 MASS kg		NAME ANTENNA UNIT
DWG. No. C3464-G04- E	03-144-3000-G2	OUTLINE DRAWING



取付寸法
MOUNTING DIMENSIONS



ケーブル導入口詳細
DETAIL OF CABLE ENTRY

注 記

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

NOTE 2.

種類 ** ANT. TYPE	200cm型TYPE (XN-20AF)	240cm型TYPE (XN-24AF)
空中線長(A) ANT. LENGTH	2,040±10 mm	2,550±10 mm
回転安全スペース(B) ANT. CLEARANCE	2,200 mm	2,700 mm
質量 MASS	39 kg	42 kg

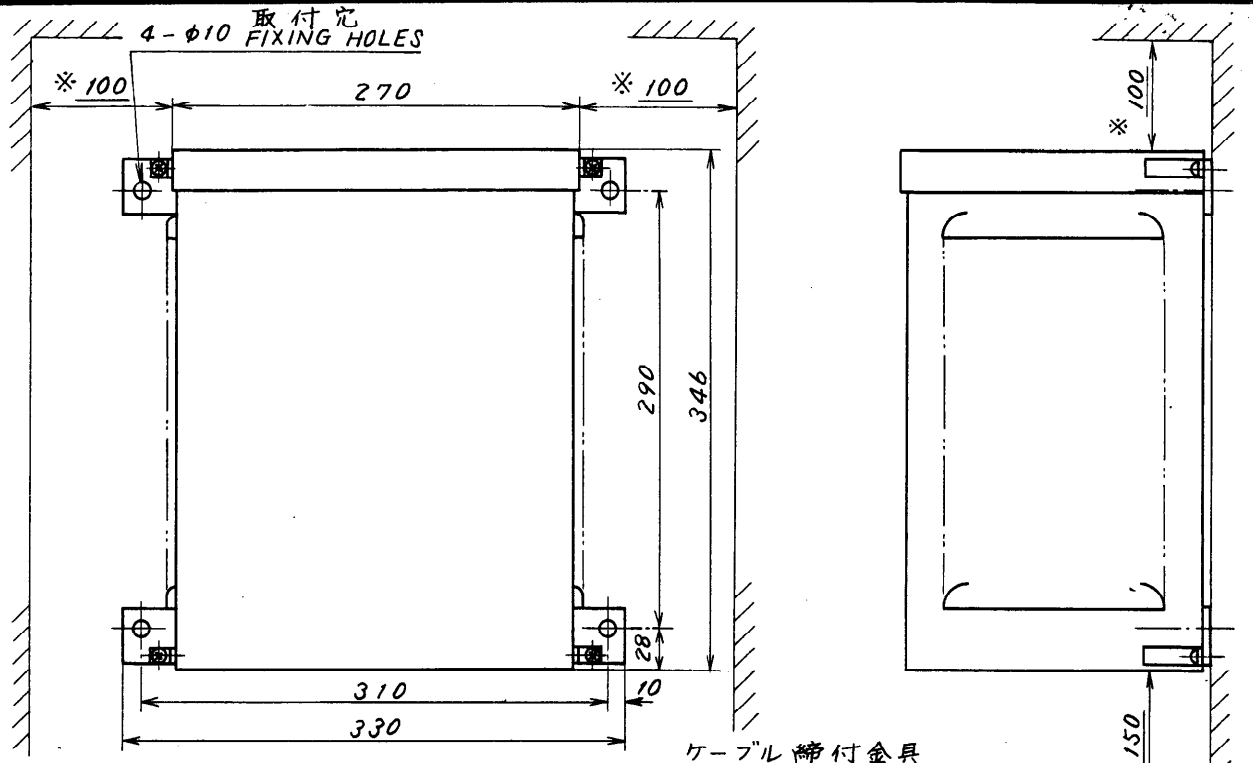
**選択可能な空中線部種類は、レーダー型式により異なる。各仕様を参照のこと。
SELECTABLE ANTENNA TYPE DEPENDS ON RADAR MODEL. SEE INDIVIDUAL SPECIFICATIONS.

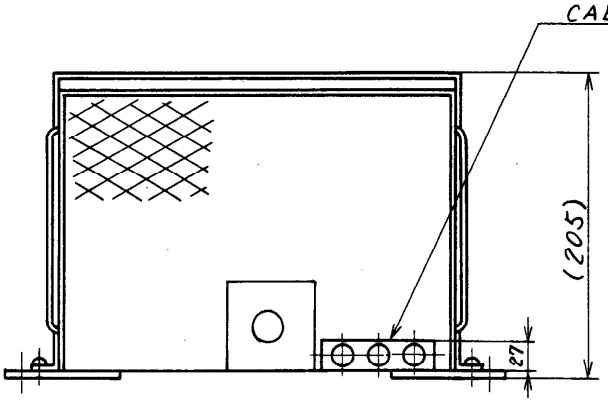
NOTE 3. 指定外の寸法公差は表1による。
REFER DIMENSION TOLERANCE TO TABLE 1.

範囲 DIMENSION	公差 TOL
0＜L≦50	±1.5mm
50＜L≦100	±2.5mm
100＜L≦500	±3mm
500＜L≦1000	±4mm
1000＜L≦2000	±5mm
2000＜L≦4000	±7mm
4000＜L≦8000	±10mm
8000＜L	±15mm

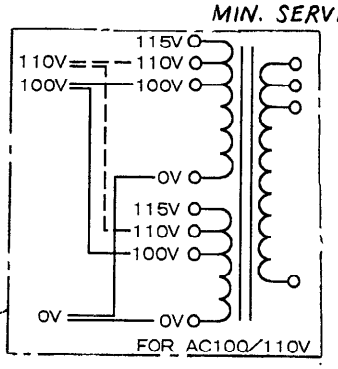
表 1
TABLE 1

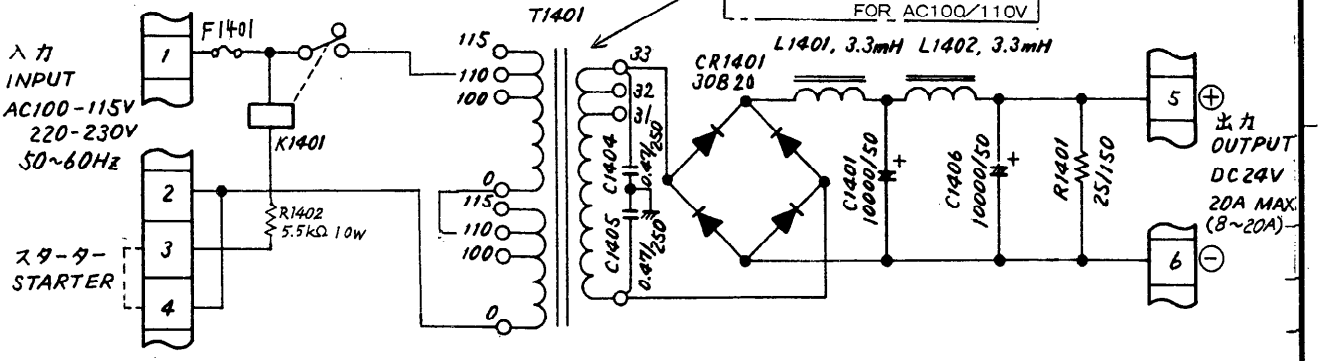
DRAWN Aug 20 '99 T.YAMASAKI		TITLE	RSB-0074/0075-20/24AF
CHECKED Aug 20 '99 K.Kusumoto	OTHERS FR-1500 SER.	名称	空中線部
APPROVED Aug. 20 '99 K.Kusumoto	FR-1700 SER. FR-2115/2125		外寸図
SCALE 1/10 MASS kg		NAME	ANTENNA UNIT
DWG. No. C3464-G02- D	03-143-3000-G2		OUTLINE DRAWING





※：最小サービス空間
MIN. SERVICING CLEARANCE





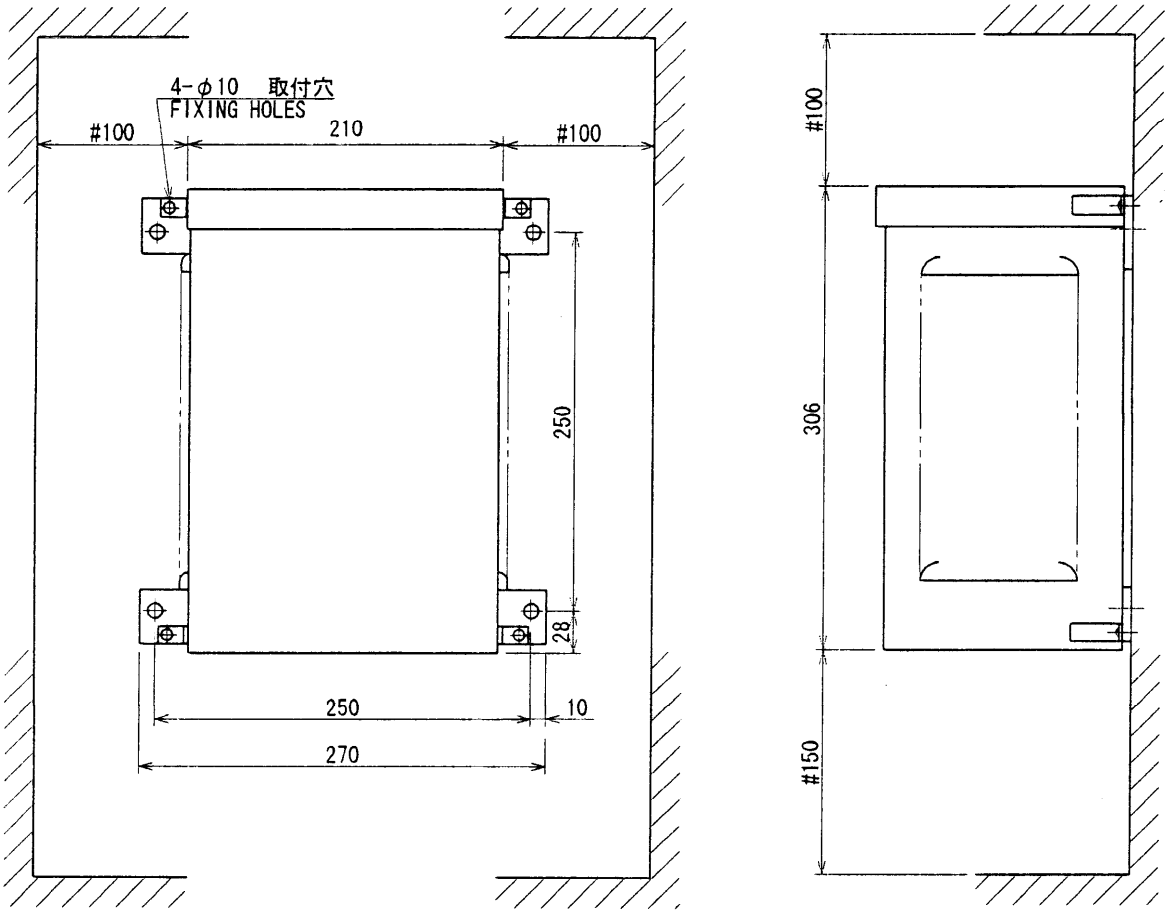
注記　AC100V 入力に対しては T1401 の一次巻線の接続を変更し、
リレー抵抗 R1402 の両端をジャンパーで短絡する。

NOTE: FOR 100VAC INPUT, CHANGE T1401 PRIMARY WINDINGS CONNECTIONS AND PUT JUMPER ACROSS R1402.

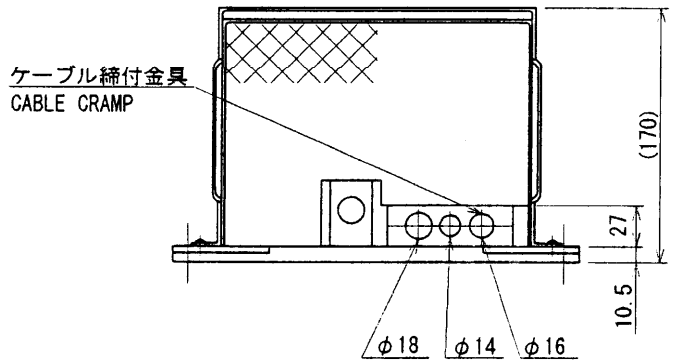
DRAWN Apr. 11 '97 T. YAMASAKI			TYPE RU-3424
CHECKED APR. 17 '97 K. Kusunoki			名称 整流器
APPROVED			外寸図
SCALE 1/5	MASS 25 kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME RECTIFIER UNIT
DWG NO. C3002-004- H				OUTLINE DRAWING

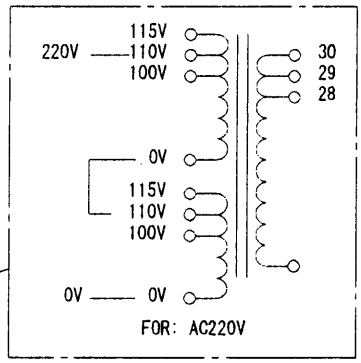
FURUNO ELECTRIC CO., LTD.

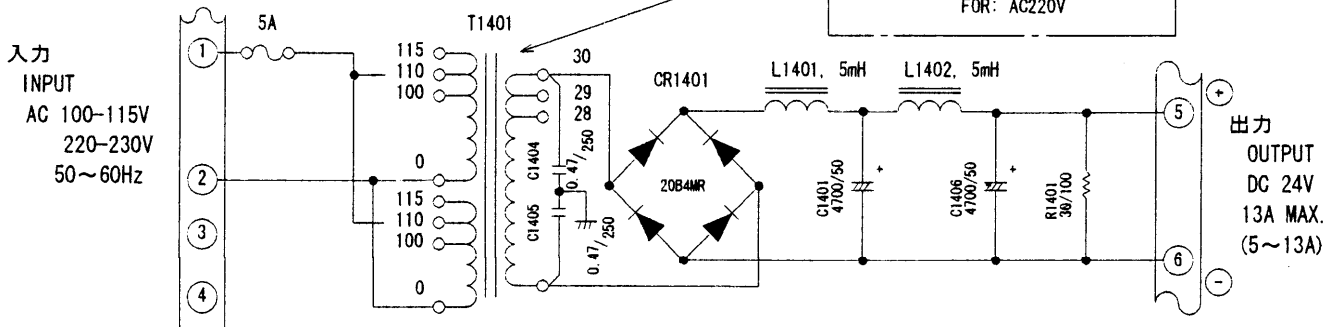
FURUNO



NOTE 1. #：推奨サービス空間
RECOMMENDED SERVICE CLEARANCE.

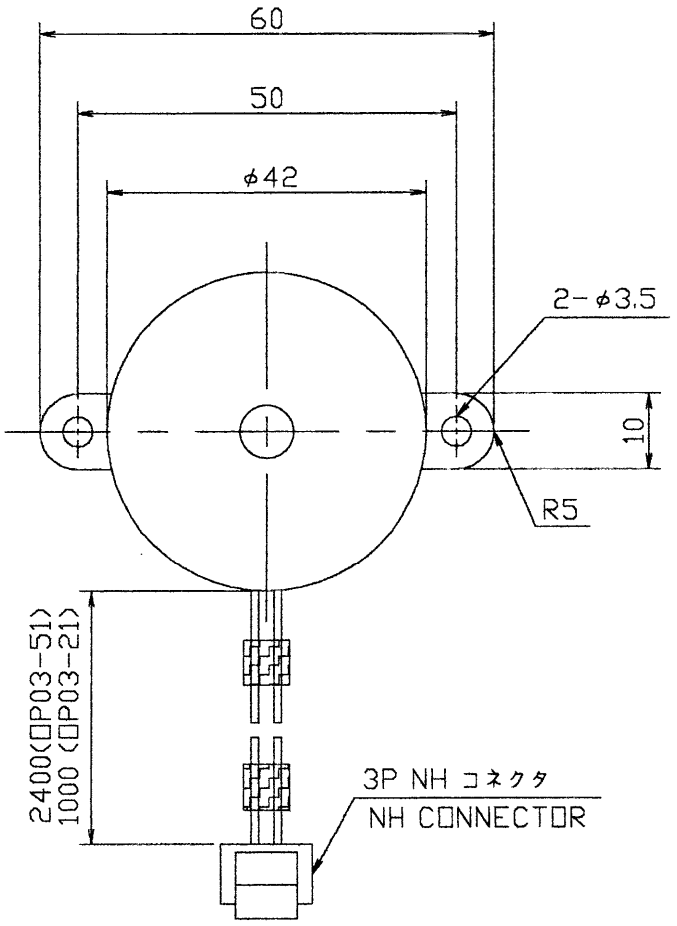


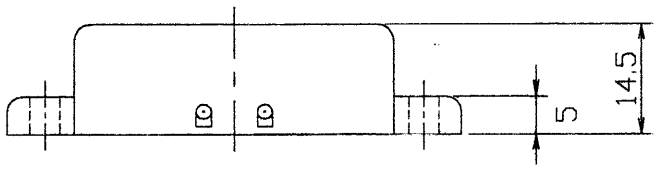




注記　AC220V入力に対しては T1401の一次巻線を直列に接続する。
NOTE　FOR 220V AC INPUT, CONNECT T1401 PRIMARY WINDINGS IN SERIES.

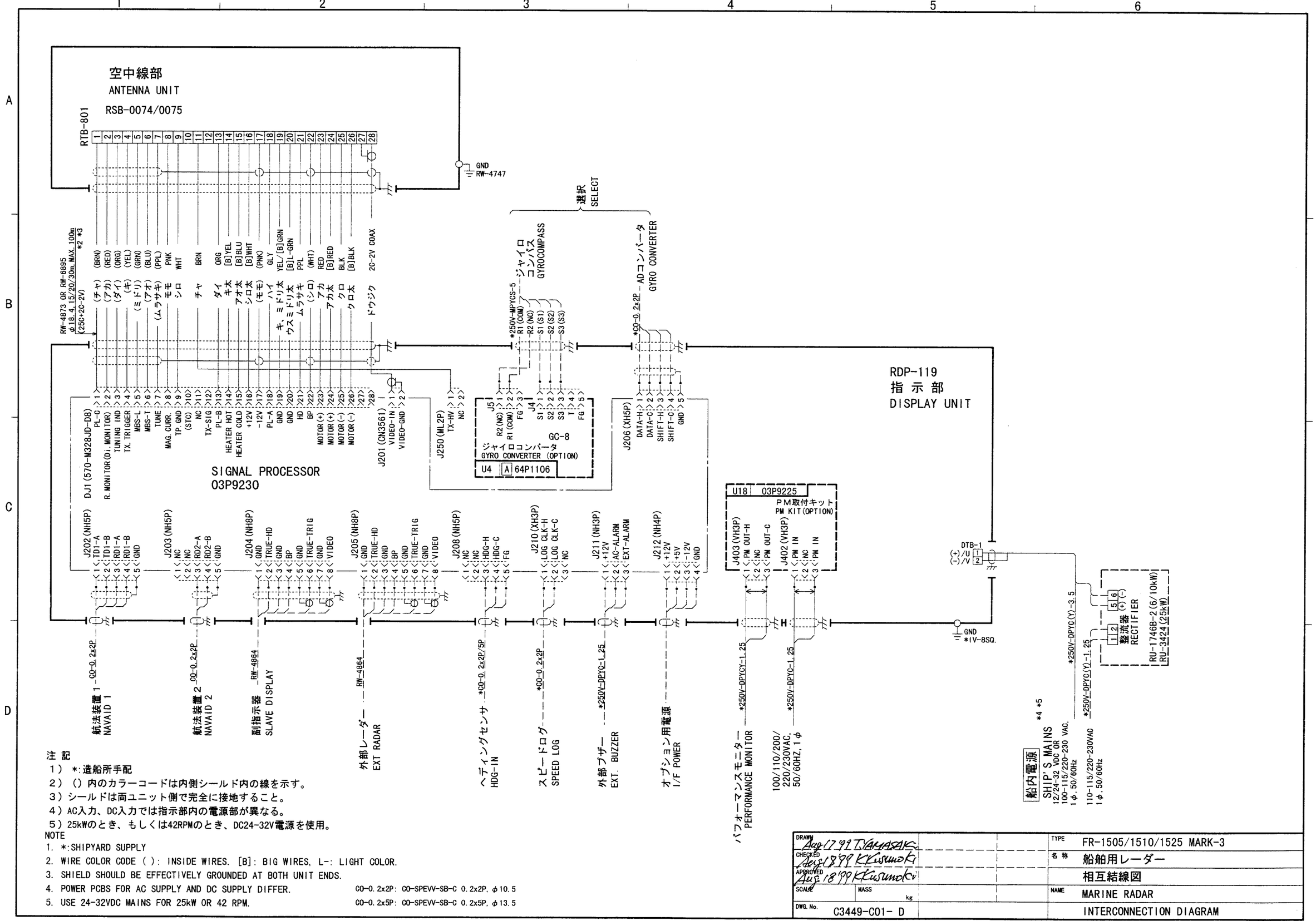
DRAWN Aug 16'00 T.YAMASAKI		TITLE	RU-1746B-2
CHECKED Aug 17'00 T.K		名称	整流器
APPROVED Aug 17'00 T.K			外寸図
SCALE 1/5	MASS 17 kg ±10%	NAME	RECTIFIER UNIT
DWG. No. C3002-002- N			OUTLINE DRAWING





DRAWN Jun. 27 '01 T. YAMASAKI			TITLE □P03-21 □P03-51
CHECKED Jun. 27 '01 Y. KIMURA			名称 外付ブザー
APPROVED Jun. 27 '01 Y. KIMURA			外寸図
SCALE 1/1	MASS ±10% kg		NAME EXTERNAL BUZZER
DWG.No. C5094-008-C			OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.



注 記

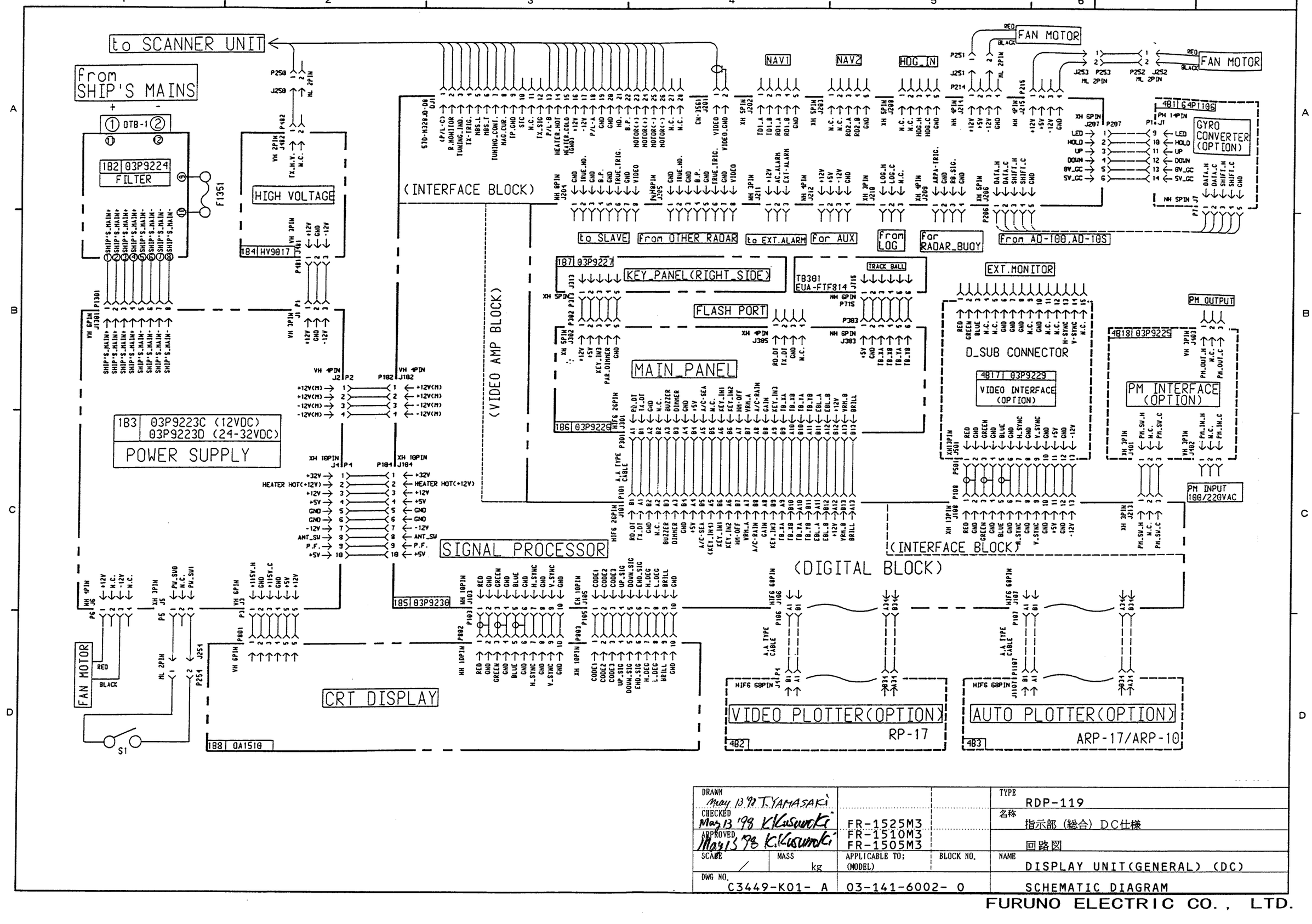
1）*:造船所手配
2）( ) 内のカラーコードは内側シールド内の線を示す。
3）シールドは両ユニット側で完全に接地すること。
4）AC入力、DC入力では指示部内の電源部が異なる。
5）25kWのとき、もしくは42RPMのとき、DC24-32V電源を使用。

NOTE

1. *:SHIPYARD SUPPLY
2. WIRE COLOR CODE ( ): INSIDE WIRES. [B]: BIG WIRES, L-: LIGHT COLOR.
3. SHIELD SHOULD BE EFFECTIVELY GROUNDED AT BOTH UNIT ENDS.
4. POWER PCBS FOR AC SUPPLY AND DC SUPPLY DIFFER.
5. USE 24-32VDC MAINS FOR 25kW OR 42 RPM.

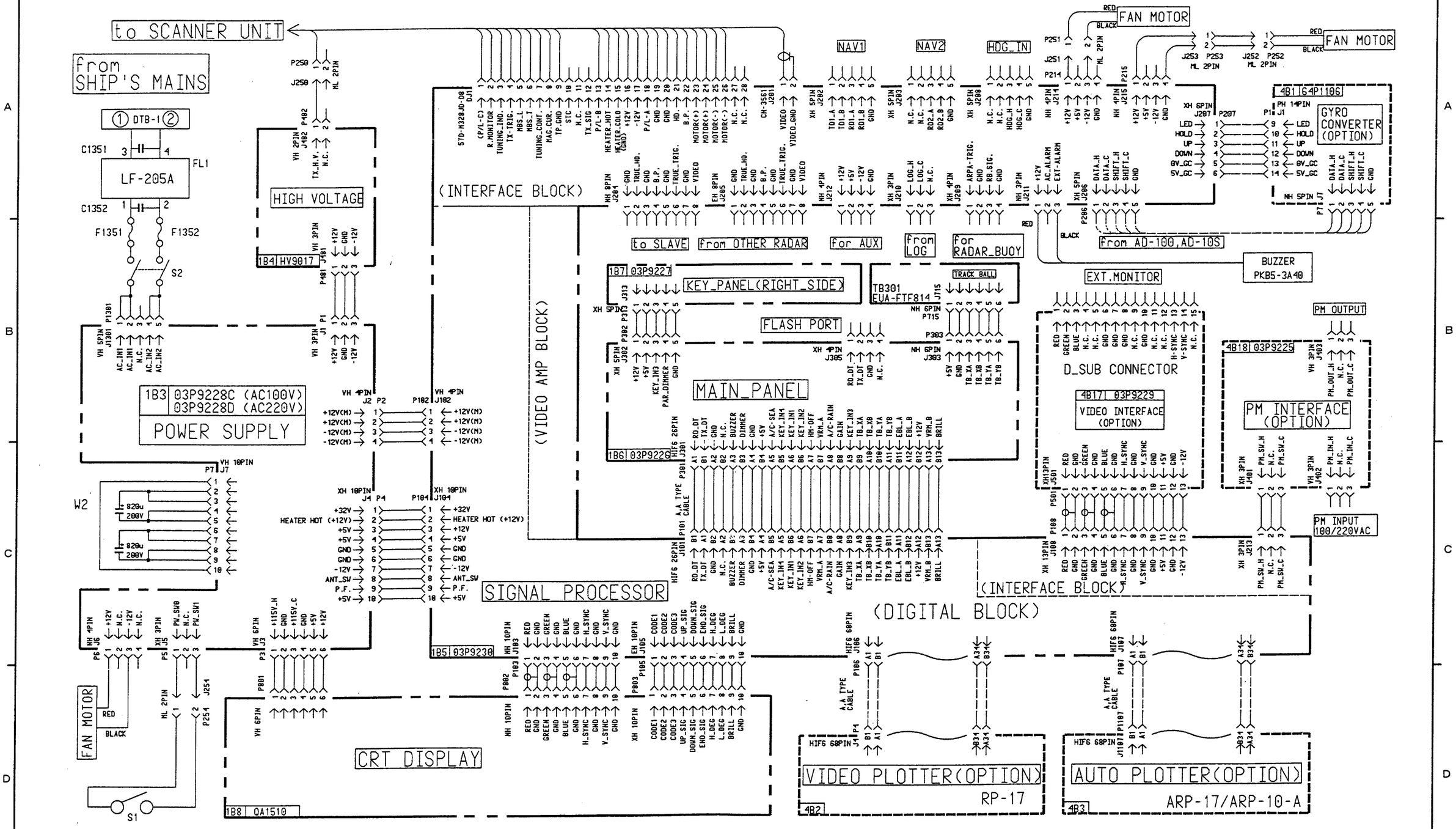
CO-0.2x2P: CO-SPEVV-SB-C 0.2x2P, φ10.5
CO-0.2x5P: CO-SPEVV-SB-C 0.2x5P, φ13.5

DRAWN	Aug 17 '99 T.YAMASAKI	TYPE	FR-1505/1510/1525 MARK-3
CHECKED	Aug 18 '99 K.Kusunoki	名称	船舶用レーダー
APPROVED	Aug 18 '99 K.Kusunoki		相互結線図
SCALE	MASS kg	NAME	MARINE RADAR
DWG. No.	C3449-C01- D		INTERCONNECTION DIAGRAM



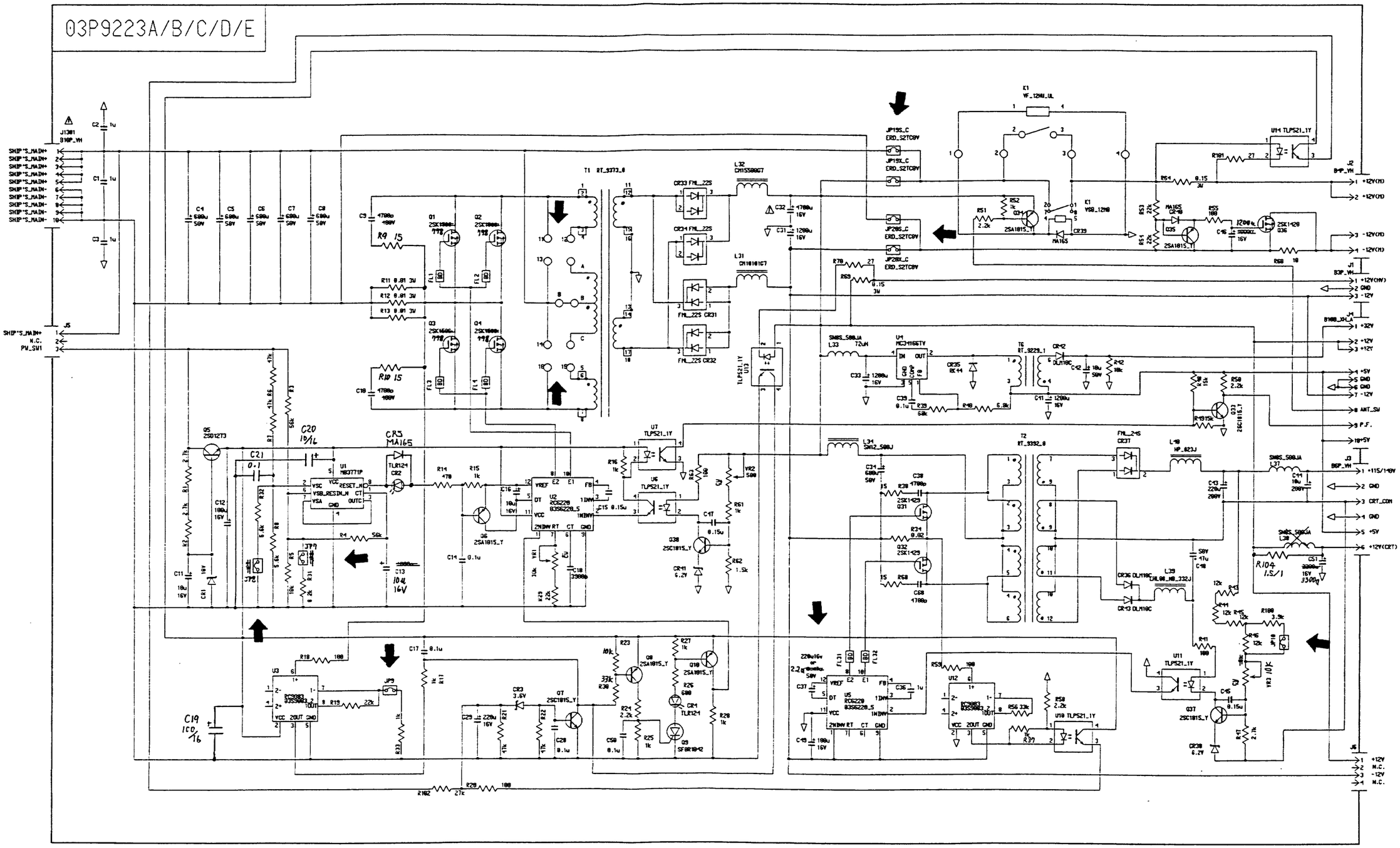
DRAWN May 13'98 T.YAMASAKI			TYPE RDP-119
CHECKED May 13 '98 K.Kusunoki	FR-1525M3 FR-1510M3 FR-1505M3		名称 指示部（総合）DC仕様
APPROVED May 13 '98 K.Kusunoki			回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISPLAY UNIT(GENERAL) (DC)
DWG NO. C3449-K01- A	03-141-6002- 0		SCHEMATIC DIAGRAM

FURUNO



DRAWN Oct 12'98 T.YAMASAKI			TYPE RDP-119
CHECKED Oct 13'98 K.Kusunoki	FR-1525M3		名称 指示部総合（AC仕様）
APPROVED Oct 13'98 K.Kusunoki	FR-1510M3 FR-1505M3		回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DISPLAY UNIT GENERAL (AC)
DWG NO. C3449-K02- C	03-143-6004- 2		SCHEMATIC DIAGRAM

03P9223A/B/C/D/E

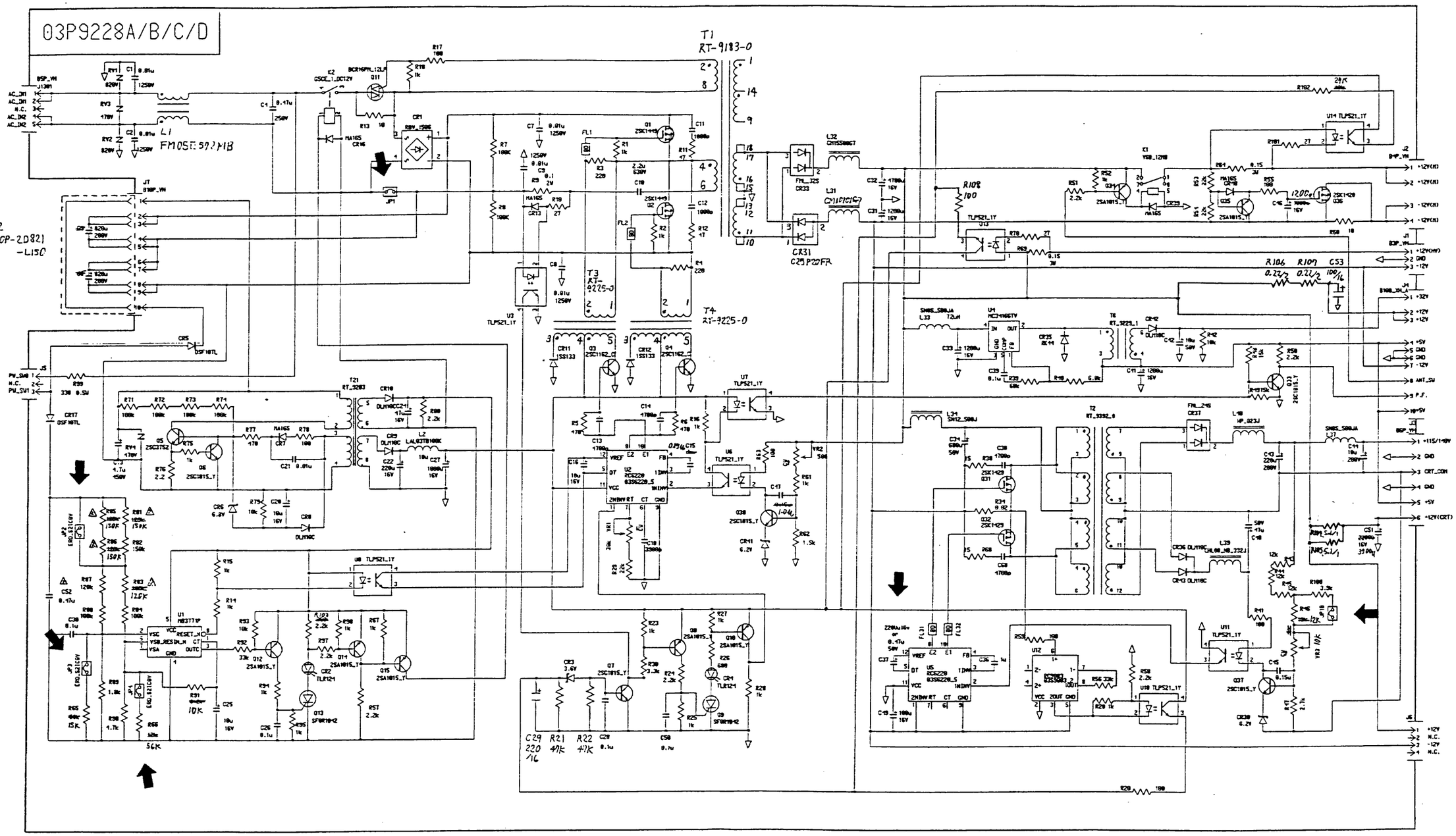


MODEL	SHIP'S_MAIN	P.C.B.	JP7	JP8	JP9	11_A	A_12	12_13	14_15	15_C	C_16	JP19	JP20	K1	C37	JP18
FR_1710/25	DC24_32V	03P9223A	○	○	○	×	○	×	×	○	×	X_C	X_C	VSB	~~0.47u~~ 0.47u	×
FR_1760DS	DC24V	03P9223B	○	○	○	×	○	×	×	○	×	S_C	S_C	VF	~~2.2u~~ ~~0.47u~~	×
FR_1505/10M3	DC12V	03P9223C	×	×	×	○	×	○	○	×	○	X_C	X_C	VSB	220u	○
FR_1505/10/25M3	DC24_32V	03P9223D	○	○	○	×	○	×	×	○	×	X_C	X_C	VSB	220u	○

DRAWN Jan. 26'99 E. Kishino	FR-1525M3		TYPE 03P9223
CHECKED Jan 26 '99 K Okamoto	FR-1510M3 FR-1505M3		名称 DC電源基板
APPROVED Jan 26'99 M. Yamamoto	FR-1725 FR-1710	1B 1 1B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME DC POWER BOARD
DWG NO. C3453-K04- C	03-141-6005- 4		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

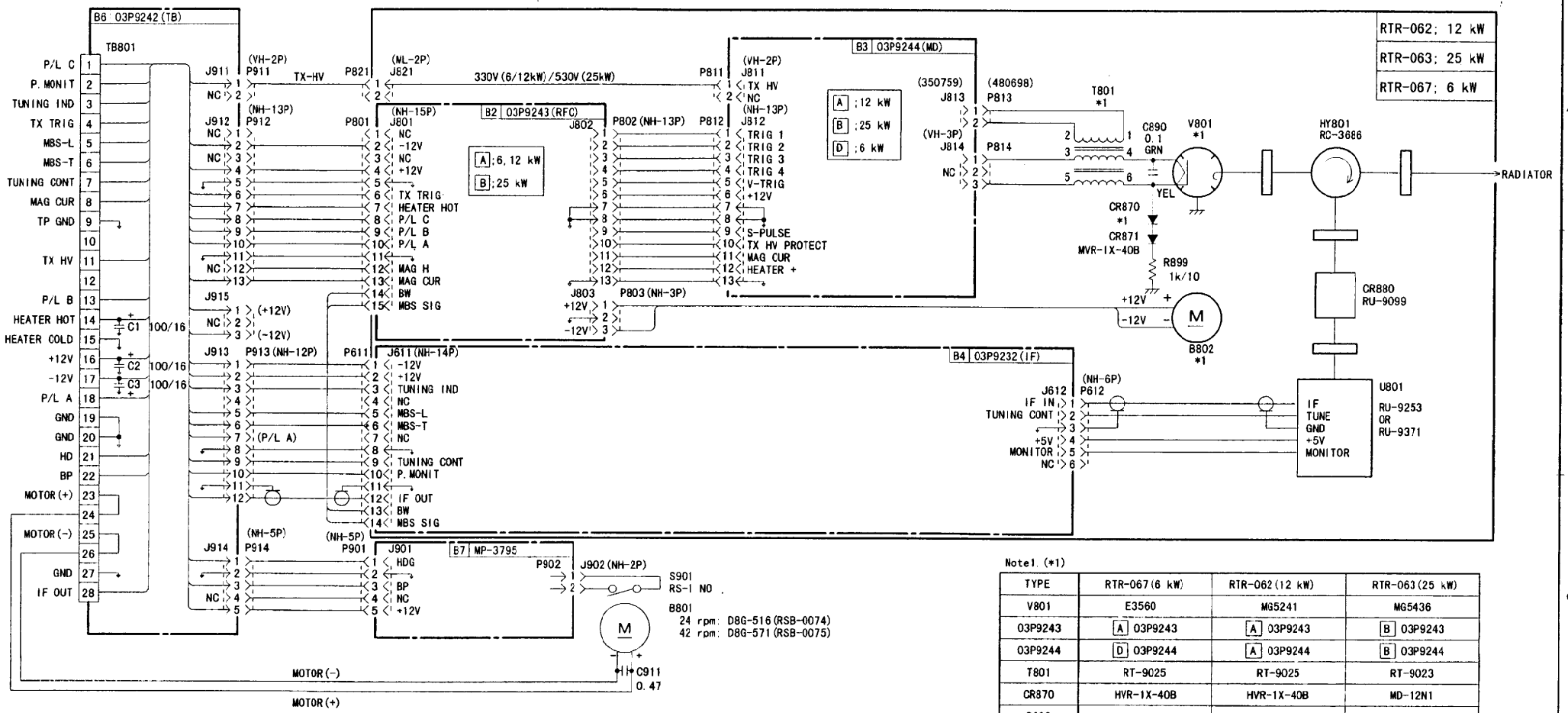


MODEL	SHIP'S_MAIN	P.C.B.	JP1	JP2	JP3	JP4	JP10	C37
FR_1700	AC100V	03P9228A	○	○	○	×	×	0.47u
	AC220V	03P9228B	×	×	×	○	×	0.47u
FR_1500M3	AC100V	03P9228C	○	○	○	×	○	220u
	AC220V	03P9228D	×	×	×	○	○	220u

DRAWN Jan 26 '99 E. Kuribara	FR-1525M3		TYPE 03P9228
CHECKED Jan 26 '99 K. Okamoto	FR-1510M3 FR-1505M3		名称 AC電源基板
APPROVED Jan 26 '99 M. Yamamoto	FR-1725 FR-1710	1B 1 1B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME AC POWER BOARD
DWG NO. C3453-K05- B	03-141-6006- 4		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO



Note1. (*1)

TYPE	RTR-067(6 kW)	RTR-062(12 kW)	RTR-063(25 kW)
V801	E3560	MG5241	MG5436
03P9243	A 03P9243	A 03P9243	B 03P9243
03P9244	D 03P9244	A 03P9244	B 03P9244
T801	RT-9025	RT-9025	RT-9023
CR870	HVR-1X-40B	HVR-1X-40B	MD-12N1
B802	——	——	109P0824H602

DRAWN	Sep 4'98 T.YAMASAKI	TYPE	RSB-0074/0075
CHECKED	Sep 4'98 K.Kusunoki	NAME	ANTENNA UNIT
APPROVED	Sep 4'98 K.Kusunoki		SCHEMATIC DIAGRAM
DWG No	E3464-K02- F	FR-1505/1510/1525N3 FR-1710/1725 FR-2115/2125	03-144-6021- 1