KODEN

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KODEN

INSTALLATION MANUAL

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COLOR RADAR

MDC-2240/2260/2210/2220

MDC-2540/2560/2510/2520

This product is specifically desingned to be installed on boats and other means of maritime transport. If your country forms part to the EU, please contact your dealer for advice before attempting to install elsewhere.

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Preface
[Precaution for safety issues]

Precaution for operation

- **Caution about rotating antenna:**

The radar antenna may start rotating without notice. Please keep away from the antenna for your safety.

- **Caution about health risks caused by radio wave:**

Powerful electromagnetic waves are emitted from the antenna during operation. These waves can cause ill effects on human bodies when exposed to continuous irradiation.
International criteria
Though the international regulation states that the electromagnetic waves with a high-frequency power density of not more than 100 W/m^2 do not have an ill effect on human bodies, medical devices such as a pace makers are sensitive to electromagnetic waves with minute electric power and their behavior may become unstable. In any event, any person with such a device must keep away from electromagnetic sources.

Specified power density and distance from antennas (according to the provision as specified in IEC 60945)

Transmission power / antenna length	100 W/m^2	10 W/m^2
4KW / 3 feet antenna	0.9 m	2.85 m
4KW / 4 feet antenna	1.01 m	3.2 m
6KW / 4 feet antenna	1.09 m	3.46 m
6KW / 6 feet antenna	1.3 m	4.10 m
12KW / 4 feet antenna	1.55 m	4.89 m
12 KW / 6 feet antenna	1.84 m	5.81 m
25KW / 6 feet antenna	2.82 m	8.91 m
25 KW / 9 feet antenna	3.35 m	10.6 m

Japan domestic criteria

In Japan, this criteria "radio-wave protection recommendation" was issued from the Ministry of Internal Affairs and Communications in 1997.
In the recommendation, for frequencies of 3GHz or more, such as radar system, the allowable electrical power that enters into eyes most restricted. According to it, in a generic environment (when living without knowing to be exposed to it) 2 mW/m^2 or less (mean value for 6 minutes) is considered as a safe value.
Figure 0-1 and 0-2 show examples in which the safety criteria are applied to radar antenna unit RB719A (25kW, 6ft).

The safe distance from the radiating aperture set to safety criteria 10 mW/cm^2 is 4.8 m (refer to Figure 0-2). However, as shown in the figure below, the antenna gain may is reduced by the depression angle and the safe distance declines as per the following figure.
It is necessary that an inhabited space such as a pilothouse or workroom, where human beings are residing be outside of the safe distance. If the antenna unit is installed in the location 0.6m above the top of an inhabited area, the distance from a radiating aperture of radar to a living space is outside than safe distance and the safety is ensured. Therefore, mast height is recommended to be 0.6m or more.

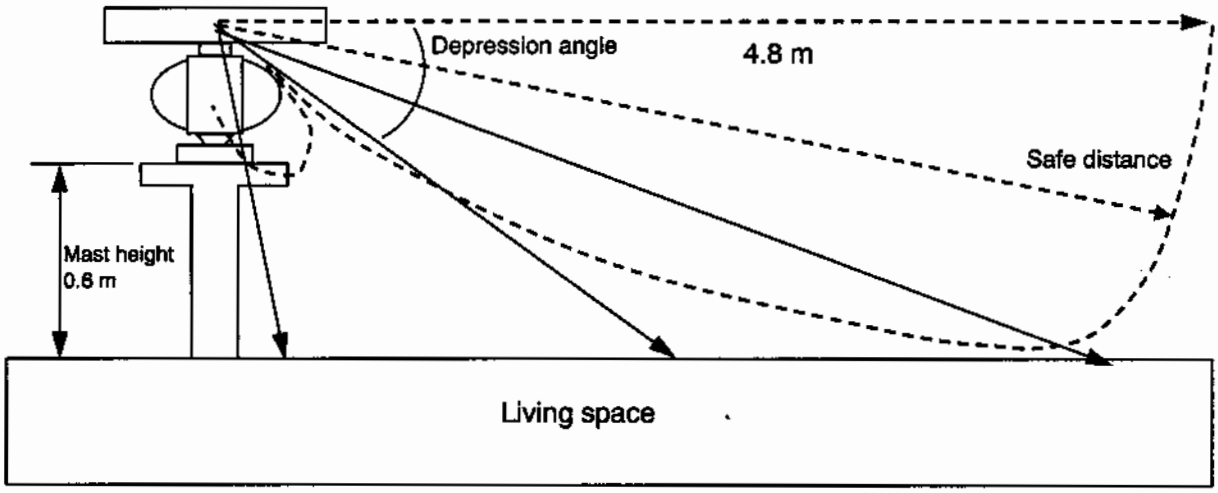


Figure 0-1 Antenna height and safety distance

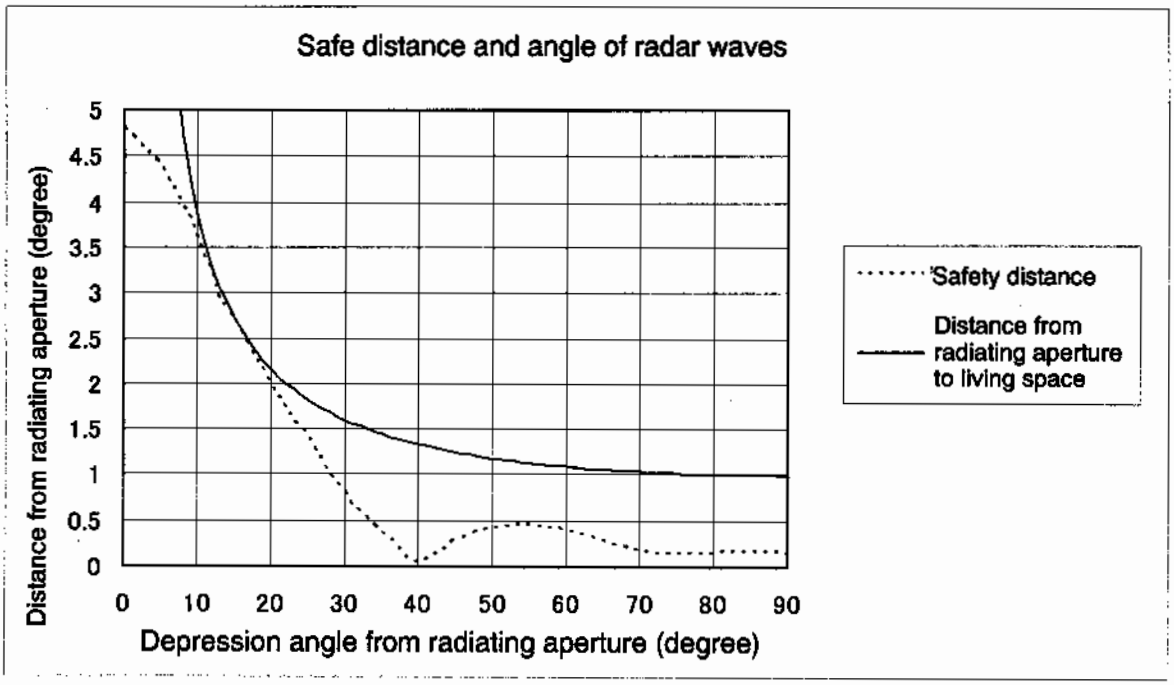


Figure 0-2 Safety distance and distance from radiating aperture to living space for mast height 0.6 m

• Caution about dangerous internal high voltage in the device:
High voltage that may cause risk of life is present in the antenna unit and the display unit of this radar. This high voltage can remain in the circuit after the switch has been turned off. The high-voltage circuit has a protective cover with a label "Caution against high voltage" so that no one will accidentally touch it. Please ensure for your safety that the power switch is turned off and residual voltage in the capacitor is discharged in a suitable manner when checking the inside of the antenna. Maintenance and inspection should be conducted by qualified engineers only.

Precautions for maintenance

• Caution against residual high voltage:
The capacitor used in the display unit and the modulator circuit of the transmission unit may keep high voltage for several minutes even after the power switch off. The maintenance and inspection of this part should be performed at least 5 minutes after powering off or applying the appropriate measure to discharge the residual electrical charge.

• Keep inboard power source "Off":
An electric shock is possible if the power switch is accidentally turned on during the maintenance operation. In order to prevent such an occurrence, please be sure to disconnect the power breaker of the onboard power source and the device. Furthermore, it is recommended to post the word-of-caution tag shown to be in a "working state" near the power switch of the device.

• Caution against the dust:
Dust can temporarily cause distress to the respiratory system. Take care not to inhale dust when cleaning the interior of the device. It is recommended you wear a safety mask.

• Measures against static electricity:
Static electricity occurring from carpet on the floor of the cabin, clothes made of synthetic fiber etc., may damage some electronic parts on the printed circuit board. Please deal with the printed circuit board only after taking any measures against static electricity.

Chapter 1 Prior to installation

1.1 Installation precautions

In order to obtain the maximum performance of radar systems: MDC-2240/2260/2210/2220/2540/2560/2510/2520, these systems should be installed by qualified engineers in charge of installation and maintenance. Installation procedures include the following:

(1) Unpacking of components;
(2) Inspection of composition units, spare parts, accessories and construction materials;
(3) Checking of supply voltage and current capacity;
(4) Determination of the location for installation;
(5) Installation of the antenna unit;
(6) Installation of the display unit;
(7) Attachment of accessories;
(8) Planning and implementation of cable laying and connection;
(9) Coordination after installation.

1.2 Unpacking of components

Unpack components and check that all items correspond with the description of the packing list. When a discrepancy or damage has been found, please contact the transportation insurance firm, and follow procedures for searching for loss items and claim of expense.

1.3 Appearance verification of each unit and accessories

Please check the appearance of each unit carefully, confirm that any dent and crack free. Moreover, please also check the interior of each unit and confirm that there is no electric or mechanical damage.

The illumination panel (back light) of the LCD module is made of glass. If the unit is dropped, damage may occur. Since the presence of damage might not be found by checking of the appearance, please confirm in the display screen after power turning on.

1.4 Selection of location for installation

In order to obtain the maximum performance of the units, it is necessary to install them in consideration of matters as described below.

1.4.1 Antenna unit

(1) The antenna unit should be located on a straight line connecting the bow and the stern without blockage that could prevent radar beam radiation.
(2) The antenna unit should be installed 0.6m above living quarters to prevent any electromagnetic wave effects on a human body. Installation in a high location also has an advantage to extend the detection range. However, it becomes difficult to detect close targets especially when using radar to dock. Also, the intensity of sea clutter becomes stronger if the location of the antenna is very high.
(3) Keep the surface of the antenna unit platform horizontal as much as possible.

(4) The antenna unit should be installed in front of large objects or exhaust stack to prevent a blind sector or the effects on the antenna by engine exhaust soot.
(5) Keep sufficient maintenance area.
(6) Keep safety distance from magnetic compass.

Table 1.1 Safety distance of compass from the transceiver unit

Driving unit type	Standard compass	Steering compass
RB716A	2.0 m	1.4 m
RB717A	1.4 m	0.95 m
RB718A	1.4 m	0.95 m
RB719A	1.2 m	0.65 m

1.4.2 Display unit and operating unit

(1) Select the location where it is easy to operate the radar controls
(2) The radar screen should be located the position easily observed by navigator officer or personnel on watch from their normal position.
(3) Choose the best location from humidity, spray, rain, and direct sunlight.
(4) Keep sufficient maintenance area. Especially sufficient space is required near the back panel where cables are concentrated.
(5) Keep as far as possible from other radio devices.
(6) Keep a safe distance from the magnetic compass.

Figure 1.2 Safety distance of compass from display unit

Display unit type	Standard compass	Steering compass
MRD-101	1.2 m	0.8 m
MRD-102	1.2 m	0.8 m

1.5 Cable wiring and interconnection

1.5.1 Antenna unit

(1) The connecting cable between the antenna unit and the display unit should run apart from any other radio antenna cable or power cables of the other devices. Do not lay the radar cable together with other cables. These considerations are effective to prevent random radio interference between systems. When these measures cannot be applied because of space limitations, use metal pipes for each cable or other another suitable way to shield.
(2) The cable length between antenna unit and the display unit and power cable should be as short as possible in nominal length to get the maximum performance of the radar system.
(3) Connect the shielded braided wire of the antenna cable to the grounding terminal inside the antenna unit.

1.5.2 Display unit

(1) Ground the braided wire of a cable firmly with the cable clamp fixing screw to the back panel.
(2) The display unit housing should be grounded to the ship ground.

Chapter 2 System configurations

2.1 Standard configuration list

MDC-2240

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-03/04	3 ft / 4 ft	5 kg / 6 kg	1
2	Transceiver unit	RB716A	4 kW	16 kg	1
3	Display unit	MRD-101.E		8.2 kg	1
4	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
5	Power cable	CW-259-2M	With a connector on the single side	2 m	1
6	Spare parts	SP-100			1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-22/25SER.OM.E	Operation manual		1
9	Document	MDC-22/25SER.IM.E	Installation manual		1

MDC-2260

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04/06	4 ft / 6 ft	6 kg / 8 kg	1
2	Transceiver unit	RB717A	6 kW	17 kg	1
3	Display unit	MRD-101.E		8.2 kg	1
4	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
5	Power cable	CW-259-2M	With a connector on the single side	2 m	1
6	Spare parts	SP-100			1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-22/25SER.OM.E	Operation manual		1
9	Document	MDC-22/25SER.IM.E	Installation manual		1

MDC-2210

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04/06	4 ft / 6 ft	6 kg / 8 kg	1
2	Transceiver unit	RB718A	12 kW	17 kg	1
3	Display unit	MRD-101.E		8.2 kg	1
4	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
5	Power cable	CW-259-2M	With a connector on the single side	2 m	1
6	Spare parts	SP-100			1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-22/25SER.OM.E	Operation manual		1
9	Document	MDC-22/25SER.IM.E	Installation manual		1

MDC-2220

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-06/09	6 ft / 9 ft	8 kg / 12 kg	1
2	Transceiver unit	RB719A	25 kW	21 kg	1
3	Display unit	MRD-101.E		8.2 kg	1
4	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
5	Power cable	CW-259-2M	With a connector on the single side	2 m	1
6	Spare parts	SP-100			1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-22/25SER.OM.E	Operation manual		1
9	Document	MDC-22/25SER.IM.E	Installation manual		1

MDC-2540

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-03/04	3 ft / 4 ft	5 kg / 6 kg	1
2	Transceiver unit	RB716A	4 kW	16 kg	1
3	Display unit	MRD-102		12.4 kg	1
4	Operating unit	MRO-102.E		2 kg	1
5	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
6	Power cable	CW-259-2M	With a connector on the single side	2 m	1
7	Spare parts	SP-100			1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-22/25SER.OM.E	Operation manual		1
10	Document	MDC-22/25SER.IM.E	Installation manual		1

MDC-2560

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04/06	4 ft / 6 ft	6 kg / 8 kg	1
2	Transceiver unit	RB717A	6 kW	17 kg	1
3	Display unit	MRD-102		12.4 kg	1
4	Operating unit	MRO-102.E		2 kg	1
5	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
6	Power cable	CW-259-2M	With a connector on the both sides	2 m	1
7	Spare parts	SP-100			1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-22/25SER.OM.E	Operation manual		1
10	Document	MDC-22/25SER.IM.E	Installation manual		1

MDC-2510

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04/06	4 ft / 6 ft	6 kg / 8 kg	1
2	Transceiver unit	RB718A	12 kW	17 kg	1
3	Display unit	MRD-102		12.4 kg	1
4	Operating unit	MRO-102.E		2 kg	
5	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
6	Power cable	CW-259-2M	With a connector on the single side	2 m	1
7	Spare parts	SP-100			1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-22/25SER.OM.E	Operation manual		1
10	Document	MDC-22/25SER.IM.E	Installation manual		1

MDC-2520

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-06/09	6 ft / 9 ft	8 kg / 12 kg	1
2	Transceiver unit	RB719A	25 kW	21 kg	1
3	Display unit	MRD-102		12.4 kg	1
4	Operating unit	MRO-102.E		2 kg	
5	Connecting cable	242J159098B-15M	With a connector on the both sides	15 m	1
6	Power cable	CW-259-2M	With a connector on the single side	2 m	1
7	Spare parts	SP-100			1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-22/25SER.OM.E	Operation manual		1
10	Document	MDC-22/25SER.IM.E	Installation manual		1

2.2 Spare parts list

SP-100

No.	Name	Specification	Comment	Type (Dimension)	Quantity	Usage
1	Fuse	F-1065-15A	Normal type	Tubular (· 6.3 x 32)	1	Main power
2	Fuse	MF51NN250V5A	Normal type	Tubular (· 5 x 25)	1	Motor power
3	Fuse	F-7142-0.3A	Normal type	Tubular (· 5 x 25)	1	High voltage power supply
4	Carbon brush	24Z125209B			1 set	Antenna motor

2.3 Installation material list

M12-BOLT.KIT

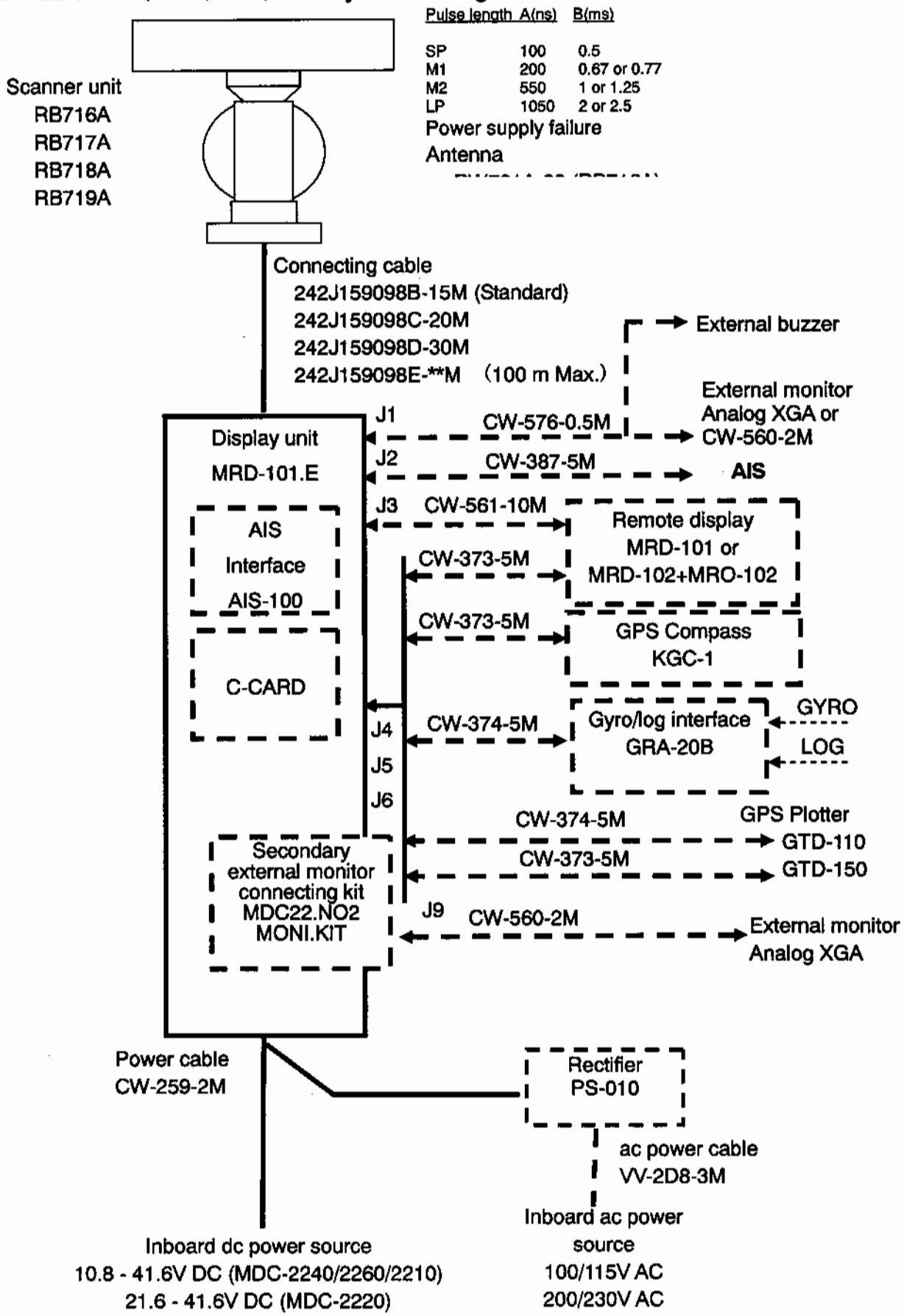
No.	Name	Specification	Quantity	Usage
1	Hexagon bolt	B12X55U	4	Antenna unit
2	Nut	N12U	8	Antenna unit
3	Plain washer	2W12U	8	Antenna unit
4	Spring washer	SW12U	4	Antenna unit

2.4 Options

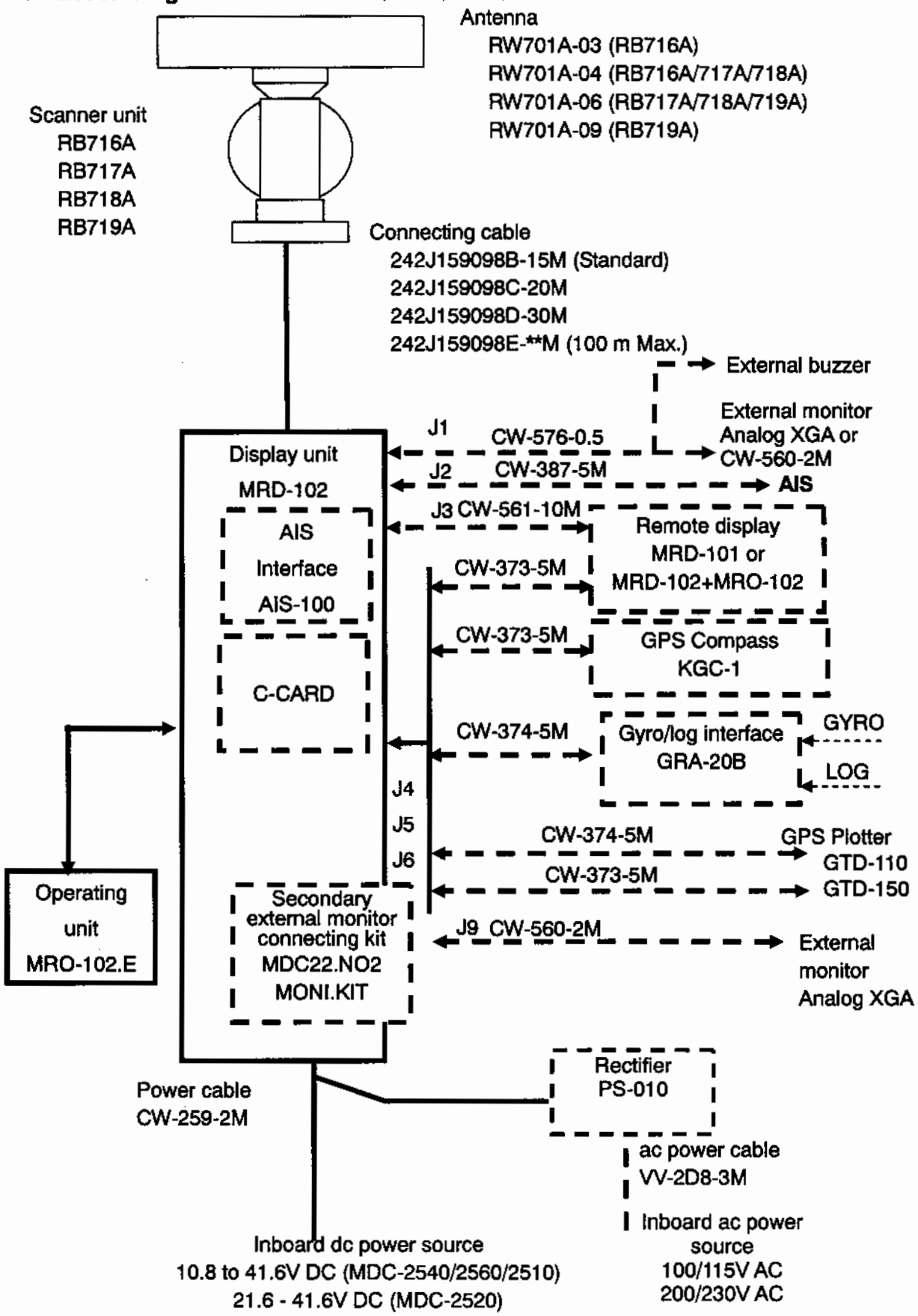
(Common)

No.	Name	Specification	Comment	Weight /Dimension /Quantity
1	Gyro/log Interface	GRA-20B		
2	AIS Interface	AIS-100	Built in the display unit	
3	Rectifier	PS-010	5A fuse attached	3.5 kg
4	ac power cable	VV-2D8-3M	Without a connector on the both sides	3 m
5	Connecting cable	CW-373-5M	With 6 pin-waterproof connector on the both sides (cable for data)	5 m
		CW-374-5M	With 6 pin-waterproof/6 pin （1006 series） (cable for data)	5 m
		CW-376-5M	6 pin-waterproof/left unattended (cable for data)	5 m
		CW-387-5M	8 pin-waterproof/left unattended (cable for AIS)	5 m
		CW-561-10M	With a connector on the both sides (connector for remote display)	10 m
		CW-576-0.5M	10 pin- waterproof /D-SUB(female) + external buzzer terminal	0.5 m
		CW-560-2M	With D-SUB on the both sides Cable for external display unit	2m
		MDC25.NO2MONI.KIT	Built in the display unit	
6	Secondary external monitor connecting kit	242J159098C-20M	With a connector on the both sides	20 m
7	Antenna unit – Display unit connecting cable	242J159098D-30M		30 m
		242J159098E-XM		100 m Max. (Designated)

2.5 MDC-2240/2260/2210/2220 system configuration



2.6 Block diagram for MDC-2540/2560/2510/2520 series



Chapter 3 Method of Installation

3.1 How to Install the transceiver unit

3.1.1 Installation of the transceiver unit

The transceiver unit is equipped to orient the notch of the attachment to stern as shown in Figure 3.1. Installation in this way eases maintenance work. Also refer to the consideration on equipment shown in 1.4.1.

(1) Four mounting hole 14mm in diameter are made in the attachment side on the platform with reference to Figure 3.1.

(2) The transceiver unit is put on the location secured with four 12mm stainless steel bolts contained in installation material.

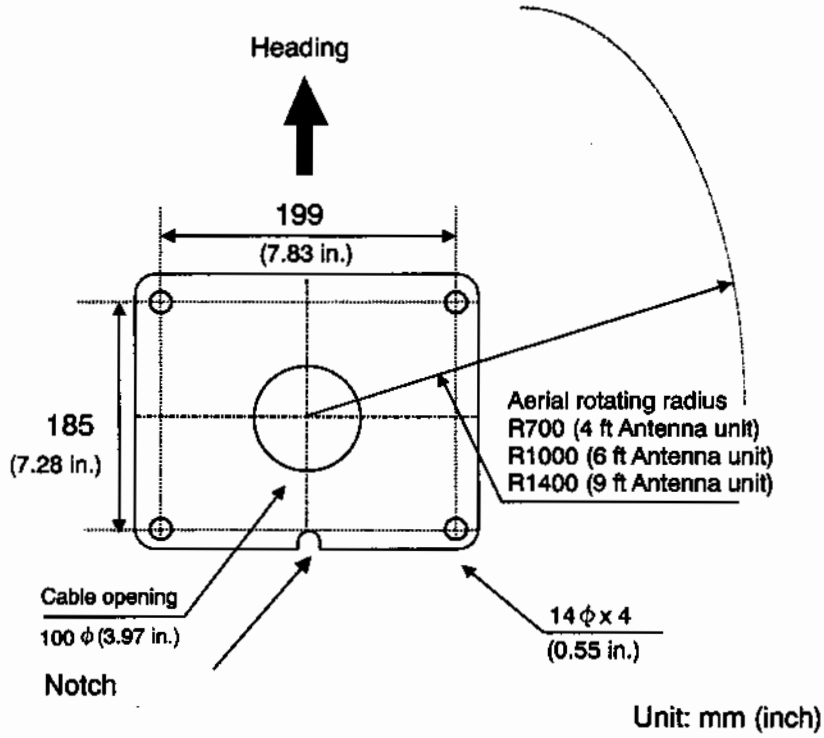


Figure 3.1 Plain view of mounting

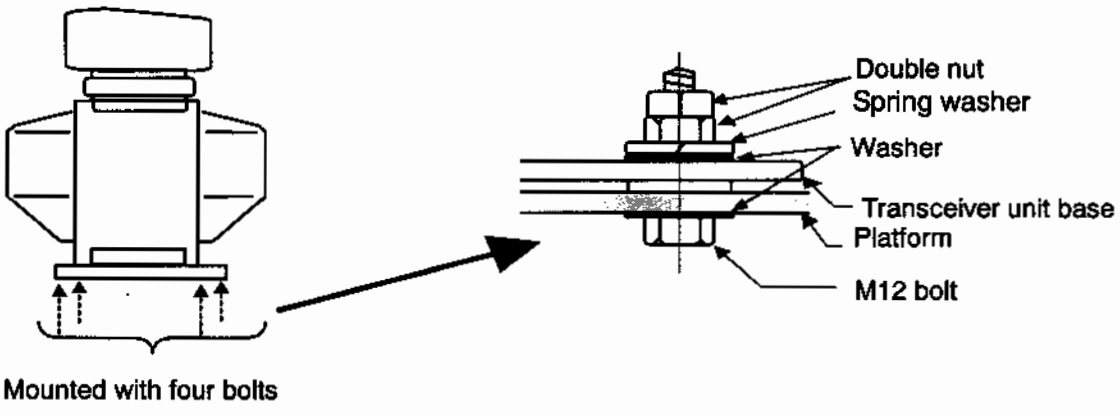


Figure 3.2 Assembly of transceiver unit

3.1.2 Mounting antenna

(1) Remove the protection cap put on the outlet of the rotating joint on the transceiver.

(2) Remove the four bolts temporarily fastened to the antenna base and attach the antenna to the rotating joint. Face the antenna aperture side (with the company logo) with the orientation of the directional arrow on the rotating shaft.

(3) Secure the antenna with four bolts removed above.

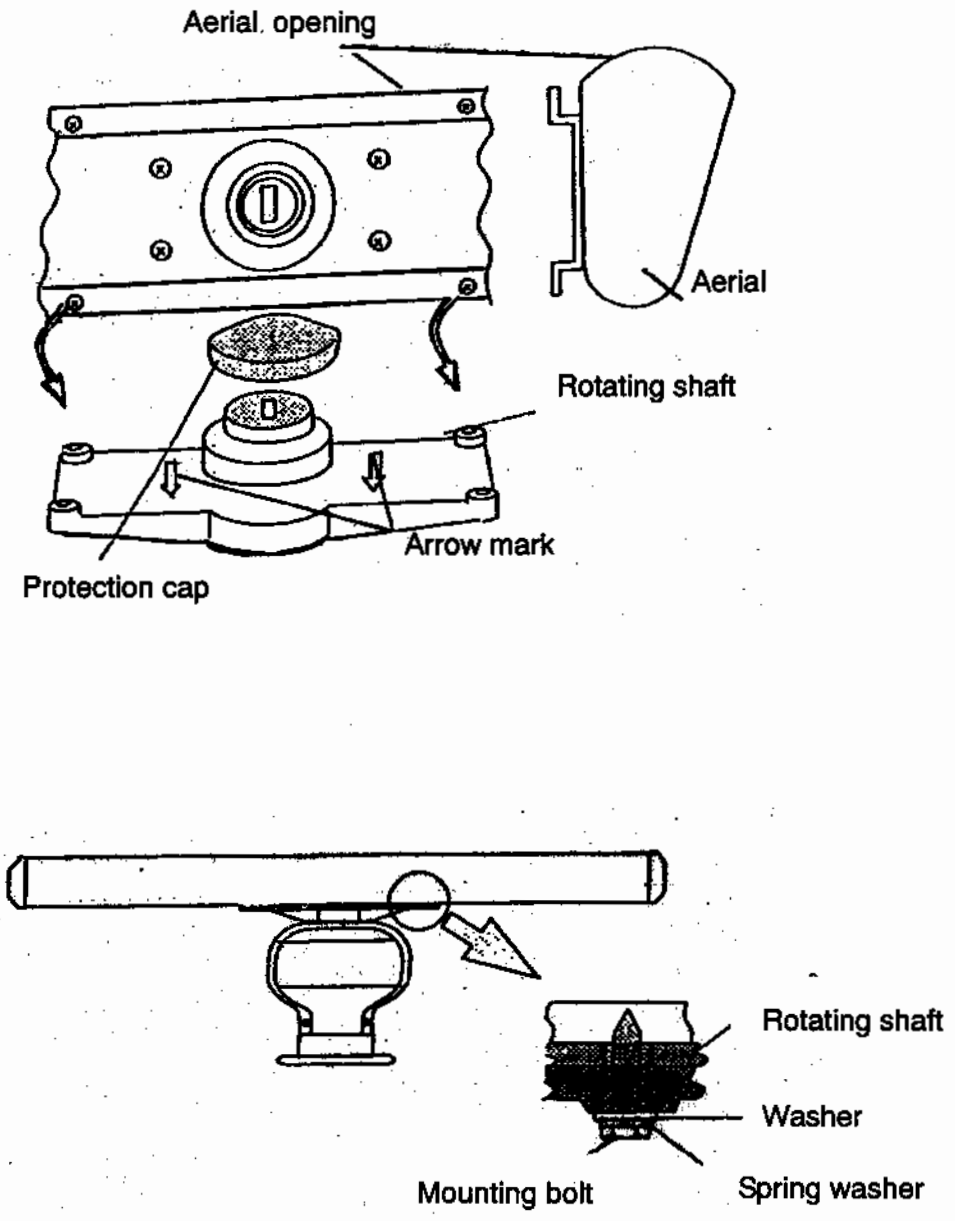


Figure 3.3 Antenna assembling to the rotating shaft

3.1.3 Connecting the cable

(1) Remove front and back covers of transceiver unit by loosing four mounting bolts.
(2) Pull out the transceiver unit by loosing two mounting bolts and disconnect each connector. Be careful not to lose metal parts to the magnetron magnet.
(3) Remove cable retainer (circular), washer and waterproof rubber gasket from the antenna cable.
(4) Route the interconnecting cable into the enclosure through the cable port of its bottom.
(5) Replace the cable retainer, washer and rubber gasket removed in (3) above, to the interconnecting cable in the order shown in Figure 3.4.
(6) Secure the cable with the retainer as follows. First secure only two clamps of the cable retainer, and then fasten the braided wire (with terminal) from the interconnecting cable together with the remaining bolts on the retainer.
(7) Secure the interconnecting cable with cable clamps on the transceiver chassis.
(8) Connect the interconnecting cable to the transceiver. (Refer to the connection diagram of Figure 3.5 for the further description of an interconnection)

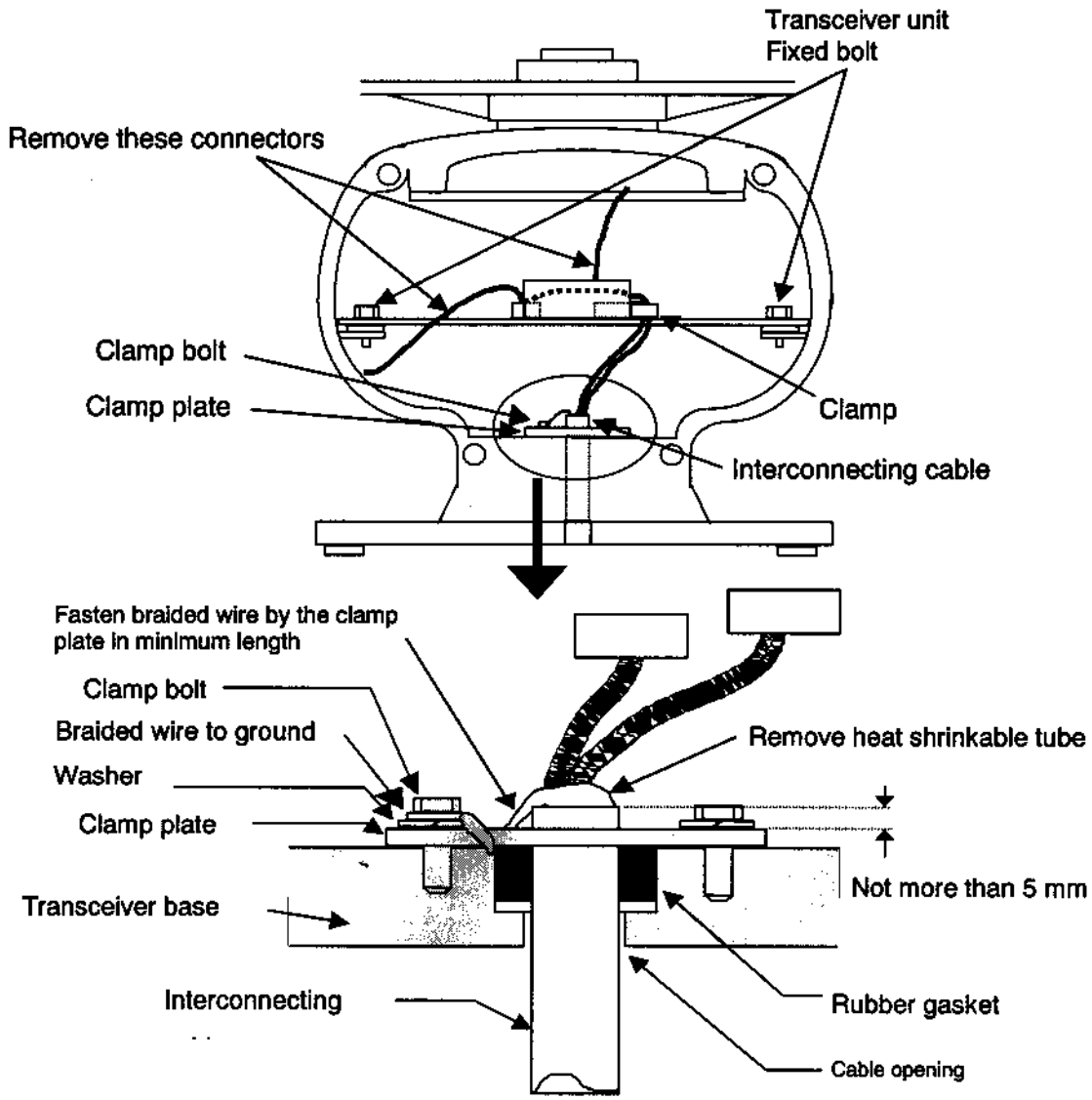


Figure 3.4 Connection of cable to antenna unit

3.2 Interconnection diagram of cable

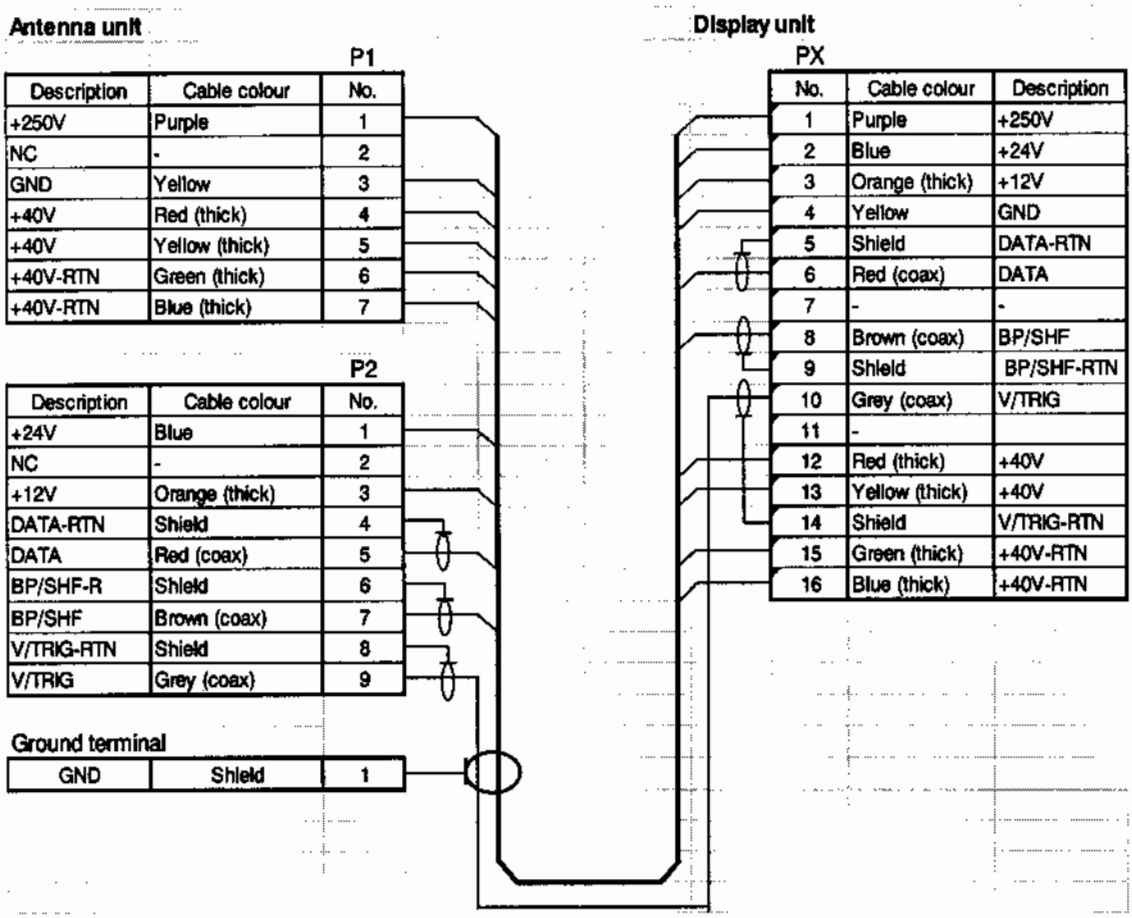


Figure 3.5 Interconnection of cable between antenna unit and display unit

3.3 Installation of the display unit

The display unit can be mounted on a table or a panel. The procedure is as follows.

3.3.1 Installation of MRD-101

3.3.1.1 Table mounting of MRD-101

(1) Remove two knob bolts from which the display unit is secured on the mounting bracket.

(2) Remove the display unit from the mounting bracket and put it on a stable flat place.

(3) Place the mounting bracket in the appropriate setting position and secure it with five 5 mm screws.

(4) Remount the display unit on the mounting bracket and secure it with knob bolts which were removed in (1).

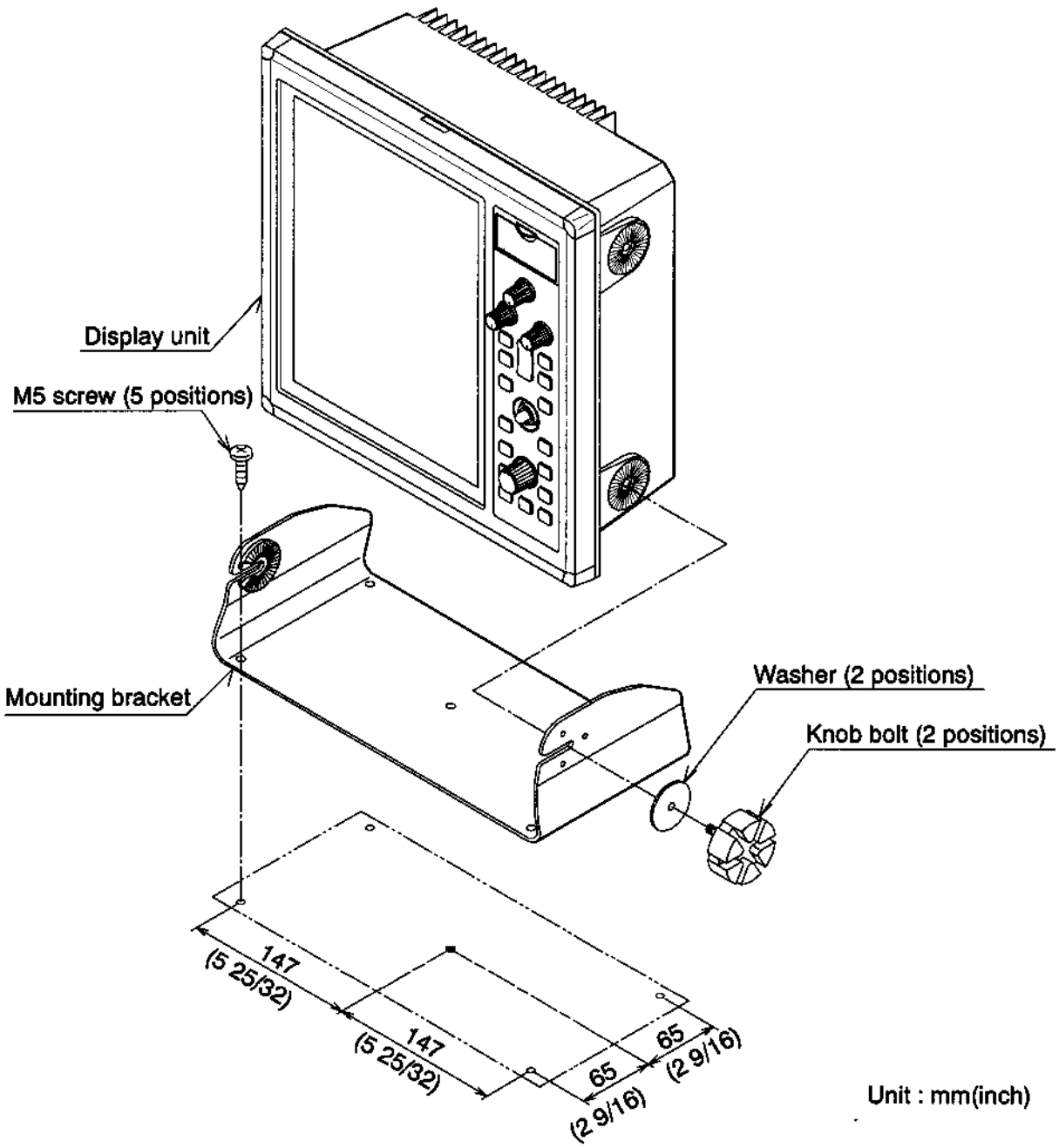
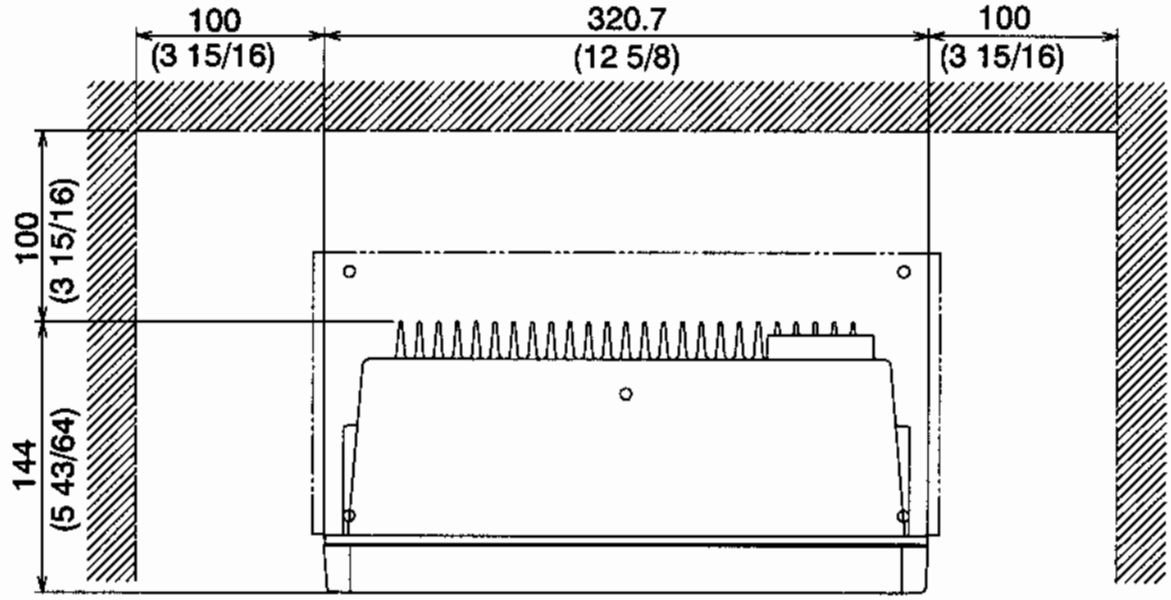


Figure 3.6 Diagram of installation procedure on the table

NOTE:: In the case of mounting the display unit on the table, some maintenance space is required for cabling, connector access, fuse replacement, fastening of bolts, etc. as shown in the following figure.



Unit : mm(inch)

Figure 3.7 Maintenance space necessary for tabletop display t

3.3.1.2 Flush Mounting for MRD-101

Preparation:

(1) Cut an opening and drill 4.5 mm (in the case of fixed nut) four nut-holes with the size shown in Figure 3.8, on the side for attachment of a display unit on a panel.

(2) Unscrew two knob bolts that hold the display unit to the mounting bracket.

(3) Remove the display unit from the mounting platform and put it on a level place.

(4) Detach four corner guard caps.

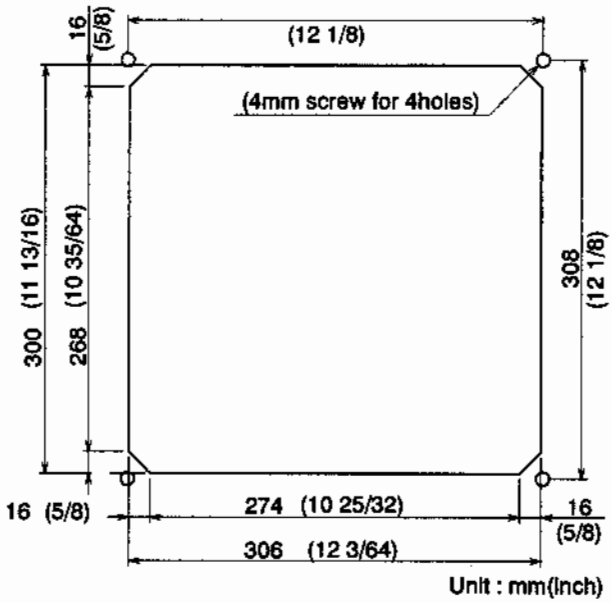


Figure 3.8 The opening and nut-holes for display unit

Installation:

(1) place the display unit in the precut opening on the panel.

(2) Secure the display unit with four corners fastened with 4 mm screw as shown in the following figure.

(3) Fit in four corner guard caps.

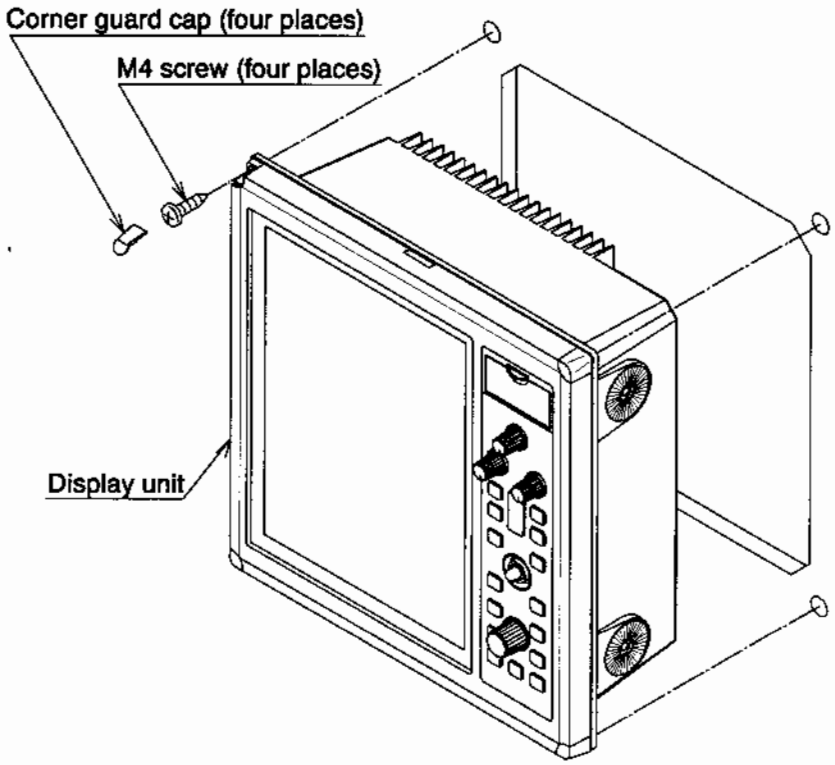


Figure 3.9 Mounting the display unit into place

3.3.2 Installation of MRD-102

3.3.2.1 Table mounting of MRD-102

(1) Remove four knobs that the display unit is secured on the mounting bracket.

(2) Remove the display unit from the mounting bracket and put it on a stable flat place.

(3) Place the mounting bracket in the appropriate position and secure it with five screws.

(4) Remount the display unit on the mounting bracket and secure it with knob bolts which were removed in (1).

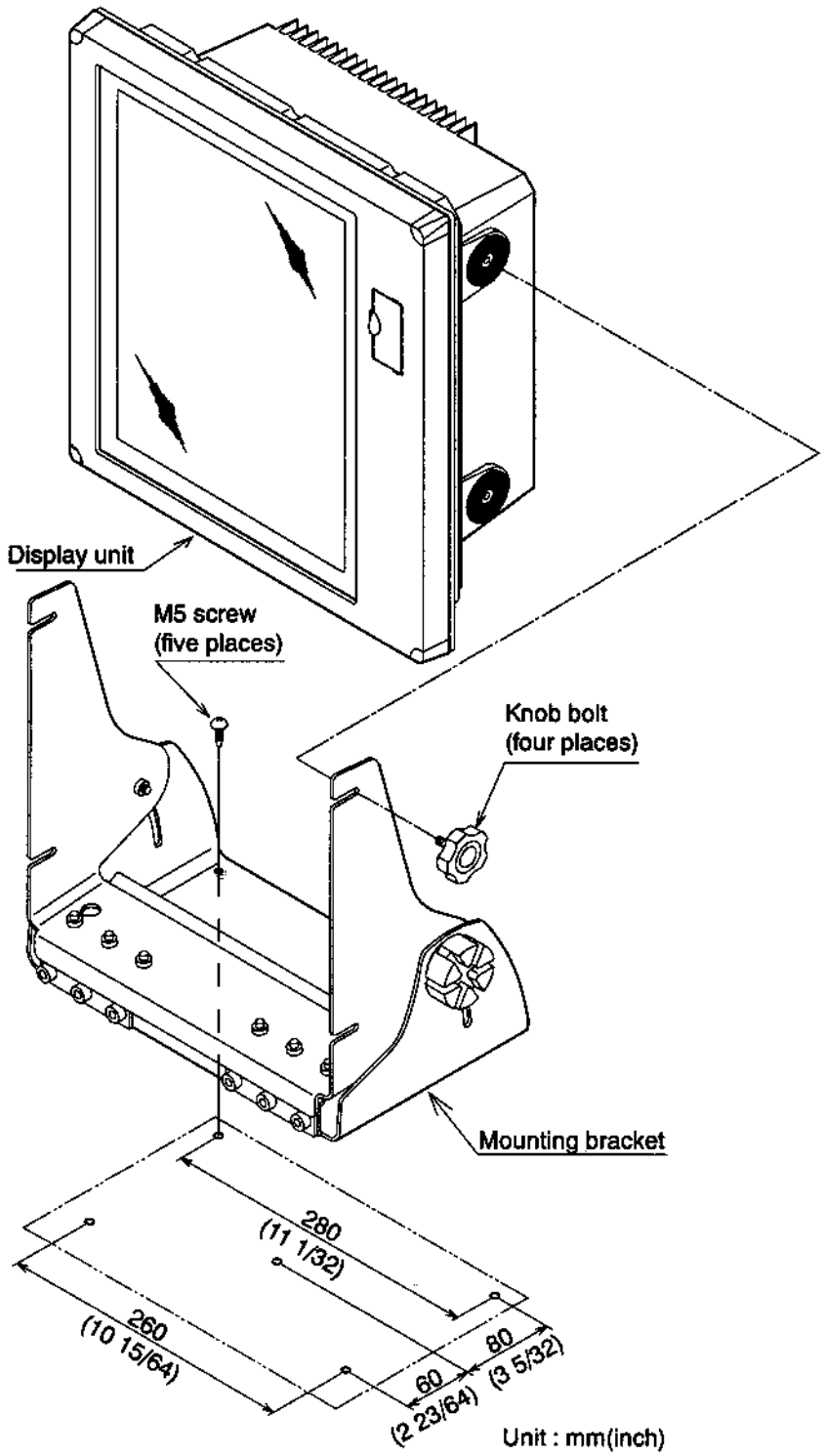
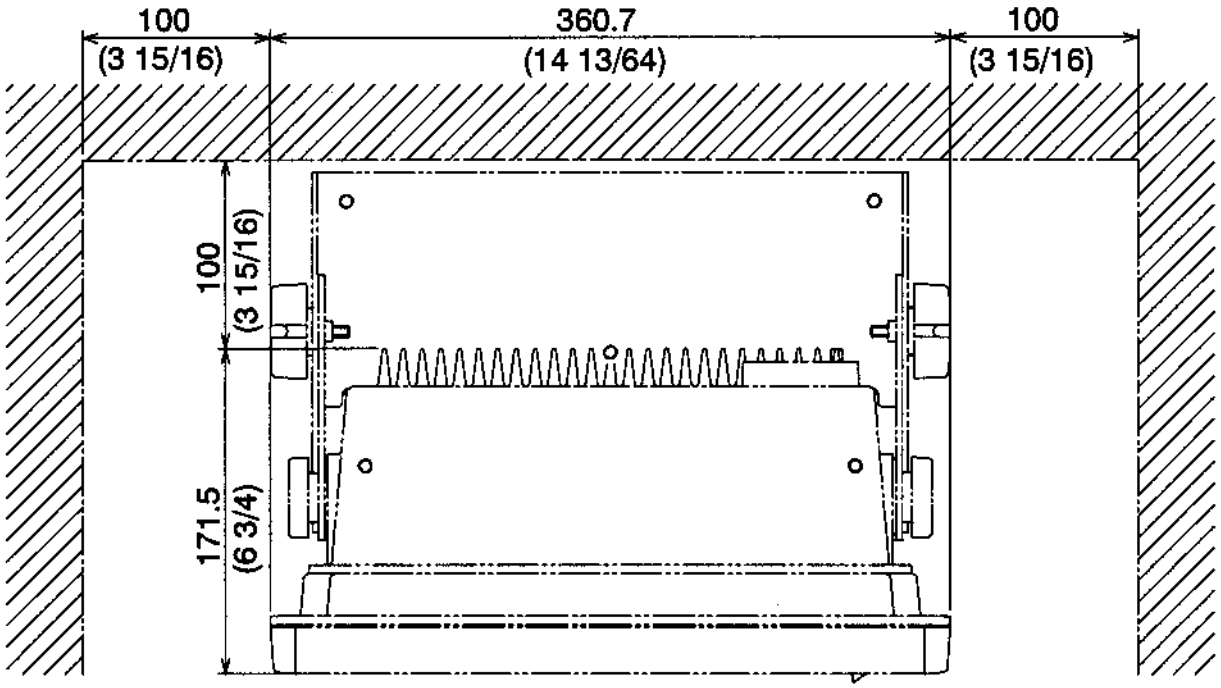


Figure 3.10 Diagram of installation procedure

NOTE: When mounting the display unit on the tabletop, some maintenance space is required for cabling, connector access, fuse replacement, fastening of bolts, etc. as shown in the following figure.



Unit : mm(inch)

Figure 3.11 Maintenance space requirements

Installation of operating unit

(1) Remove the corner guard caps (four places) on the operating unit. Insert the tip of a small flat-blade screwdriver carefully between a corner guard cap and the front bezel of operating unit to make a gap, and then pinch and pull up the corner guard cap with fingers. Take care not to damage the bezel of operating unit by the tip of flat-blade screwdriver.

(2) Remove M4 (4 mm) screws with which the operating unit is secured to the mounting bracket and remove the operating unit from the bracket.

(3) Mark the place as shown in the following figure, and then secure the mounting bracket with 5M (5 mm) tapping screws (at four places).

(4) Secure the operating unit to clamps with M4 (4 mm) screws that were removed in (2) and fit the corner guard caps of the four corners.

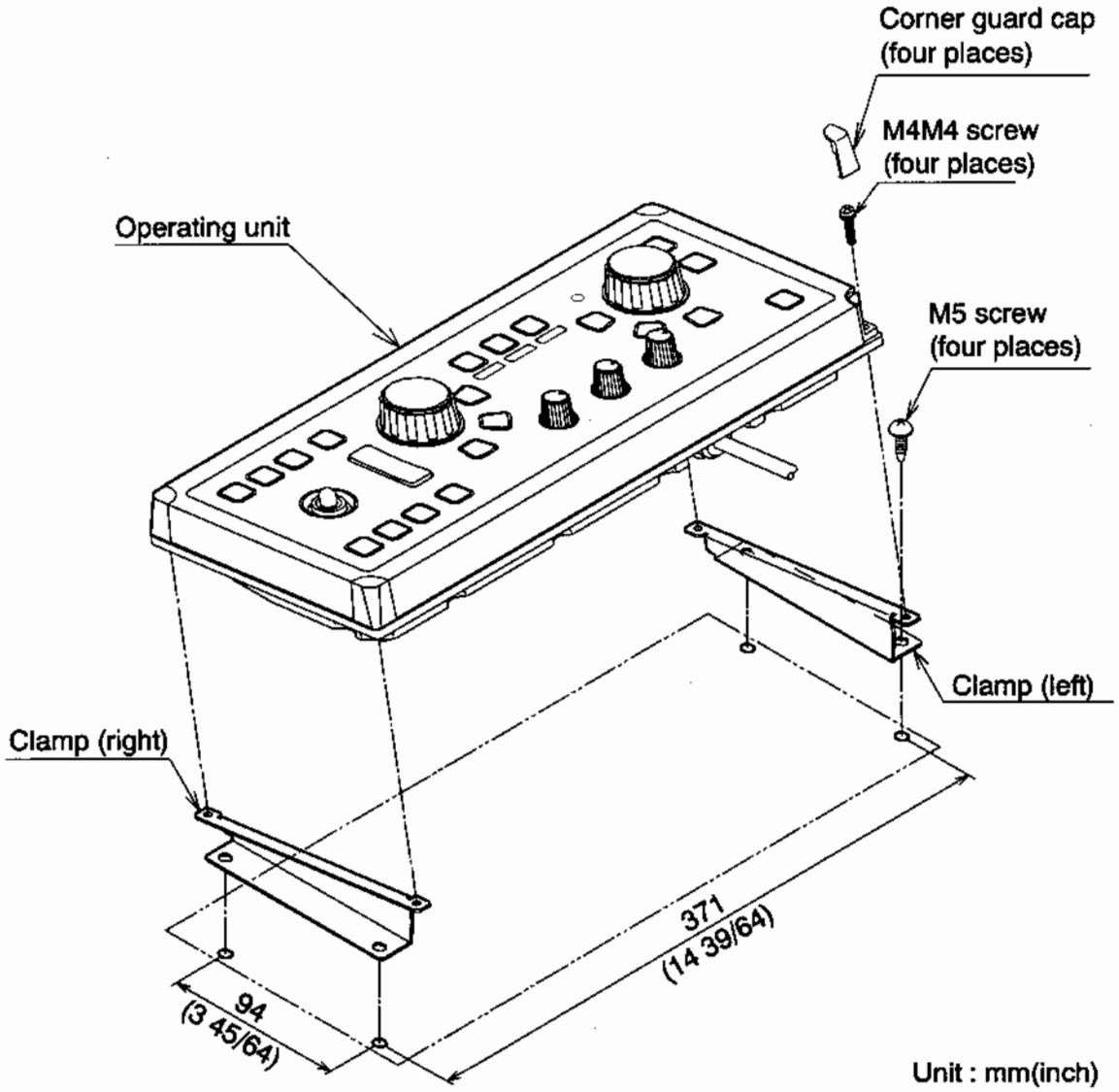


Figure 3.12 Mounting of operating unit

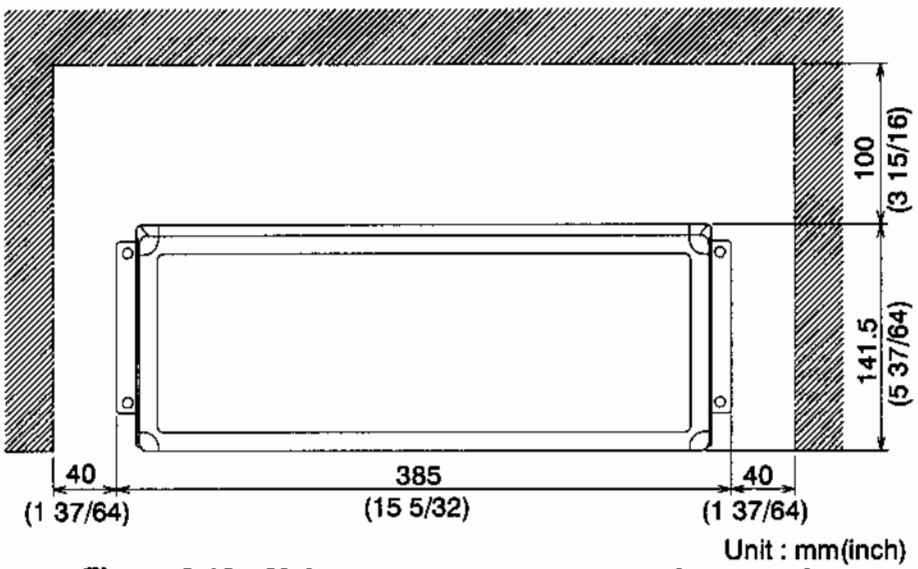


Figure 3.13 Maintenance space necessary for operation

3.3.2.2 Flush Mounting for MRD-102

Installation of display unit

Preparation:

(1) Cut an opening and drill four nut-holes with the size shown in Figure 3.14, on the side for attachment of a display unit on a panel.

(2) Remove four knobs that hold the display unit to the mounting bracket.

(3) Remove four corner guard caps.

(3) Remove the display unit from the mounting bracket and set it on the level place.

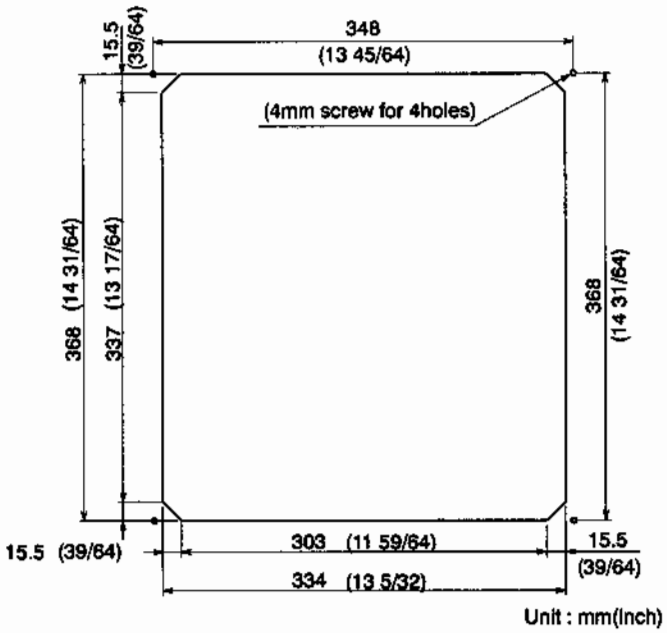


Figure 3.14 Opening and holes for mounting a display unit

Installation:

(1) Fit the display unit in the precut opening of the panel.

(2) Secure the display unit with four corners fastened with 4 mm screw as shown in the following figure.

(3) Replace the four corner guard caps.

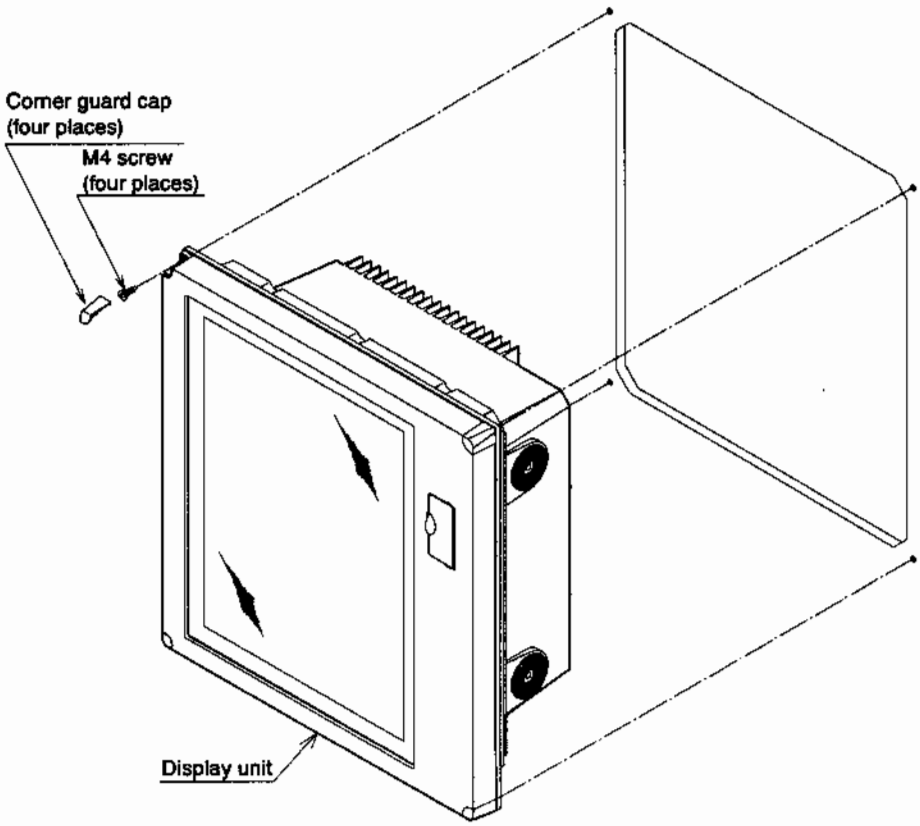
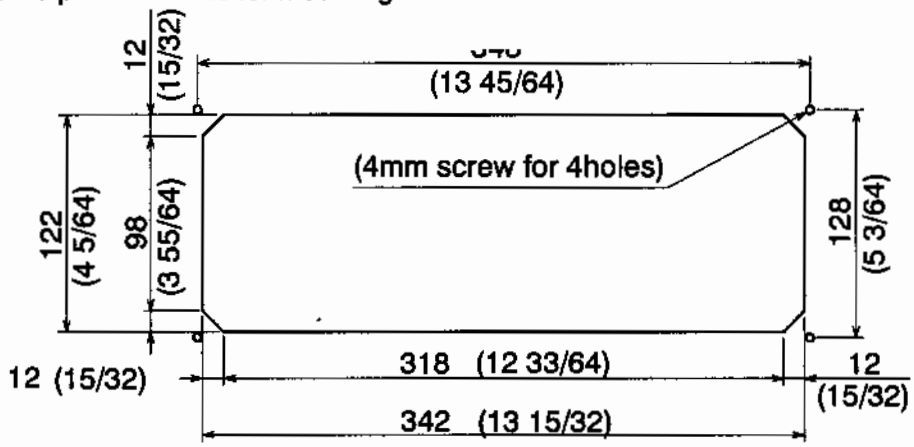


Figure 3.15 Flush Mounting the display unit

Flush mounting the operating unit

Preparation:

(1) Cut an opening with the size as shown in Figure 3.16 on the side for mounting a display unit on the panel.
(2) Mark the place of holes for mounting.



Unit : mm(inch)

Figure 3.16 Diagram of processing holes for mounting an operating unit

Installation:

(1) Remove corner guard caps of four corners of the operating unit enclosure.
(2) Insert the operating unit and its connecting cable into the opening and adjust the operating unit parallel to the mounting face (Figure 3.17).
(3) Secure the operating unit to the panel with 4 mm tapping screw (4 places).
(4) Return corner guard caps removed in (1) to the original places.

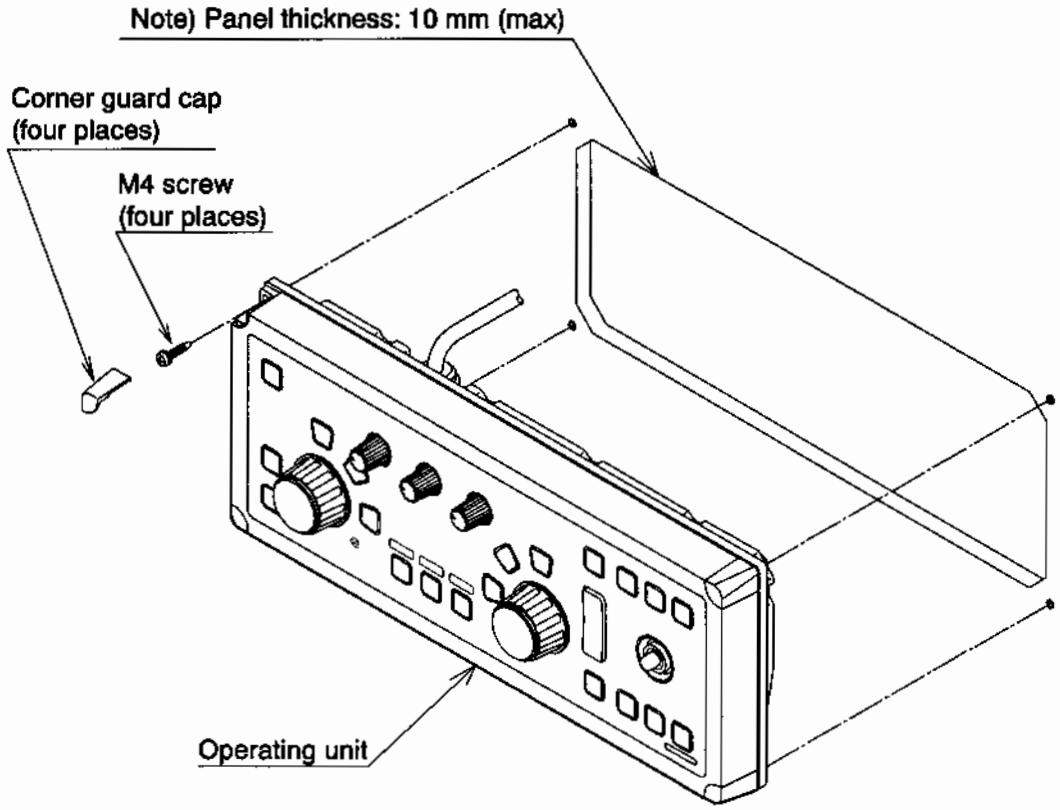
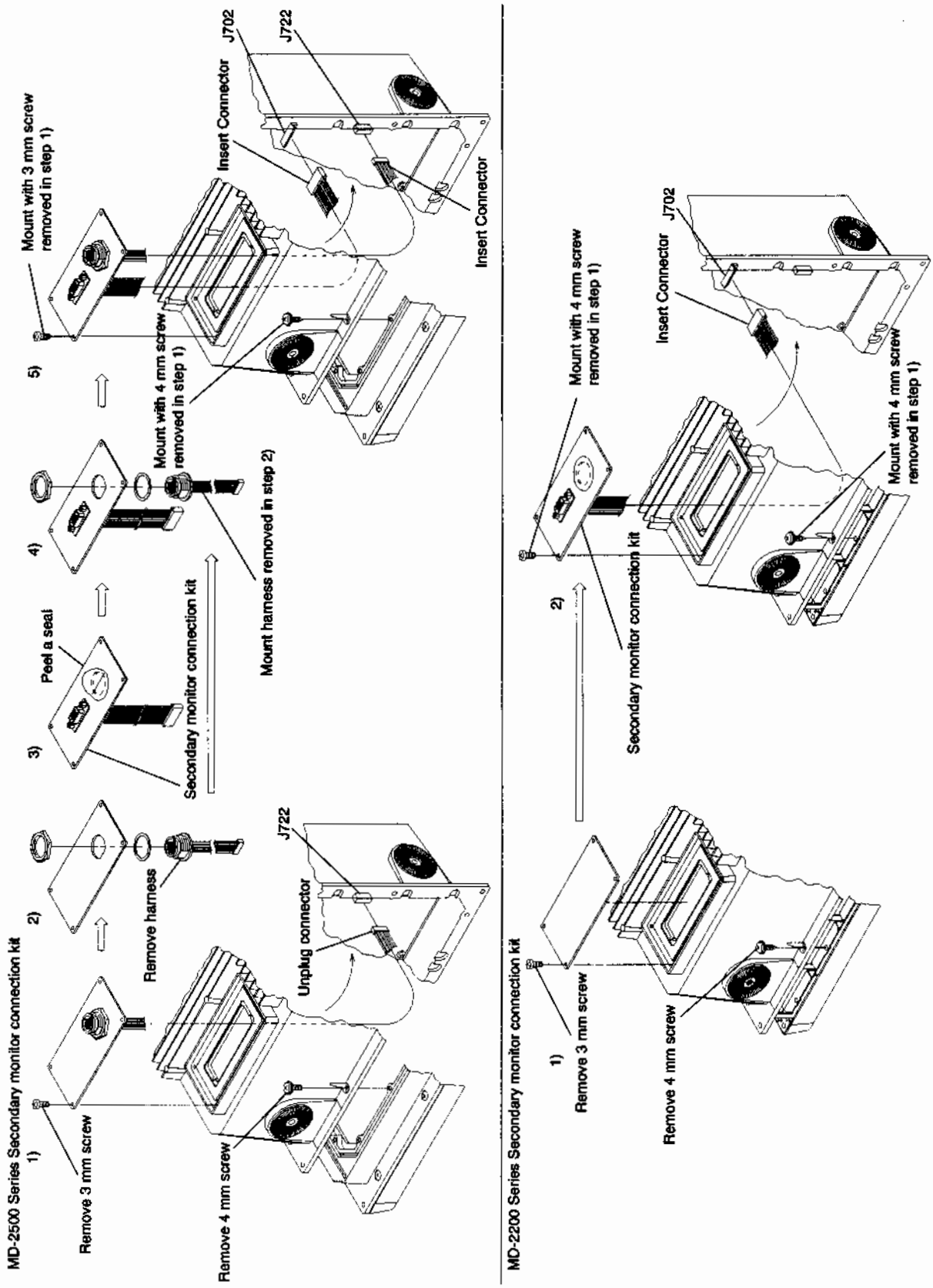


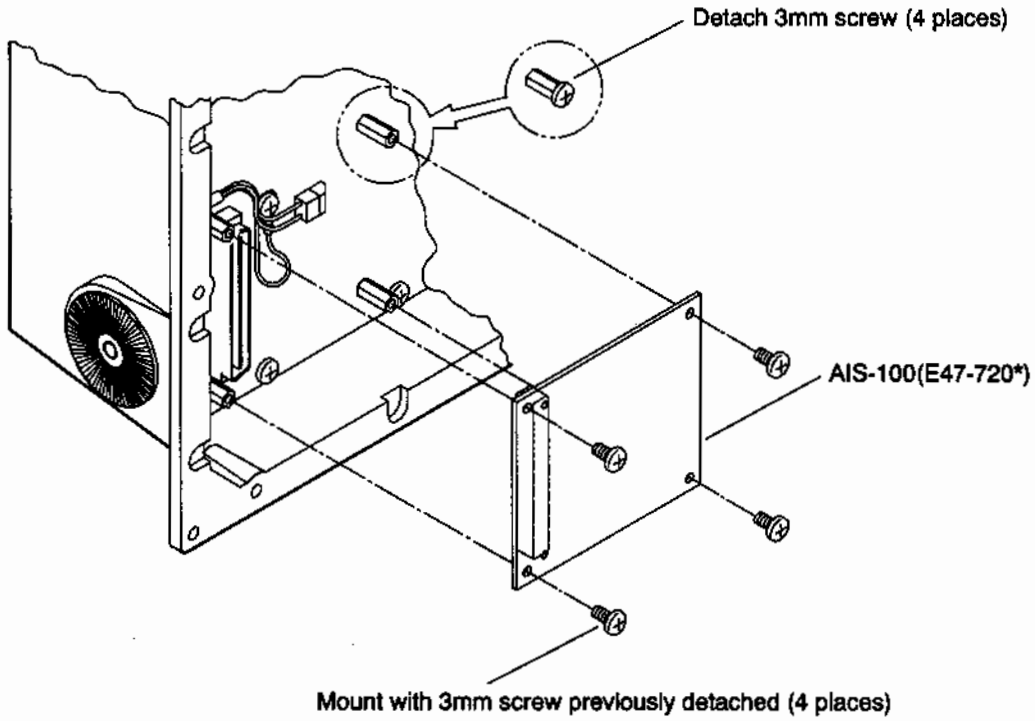
Figure 3.17 Flush Mounting the operating unit

3.4 Installing the optional PCB

3.4.1 Installing the secondary monitor connection kit



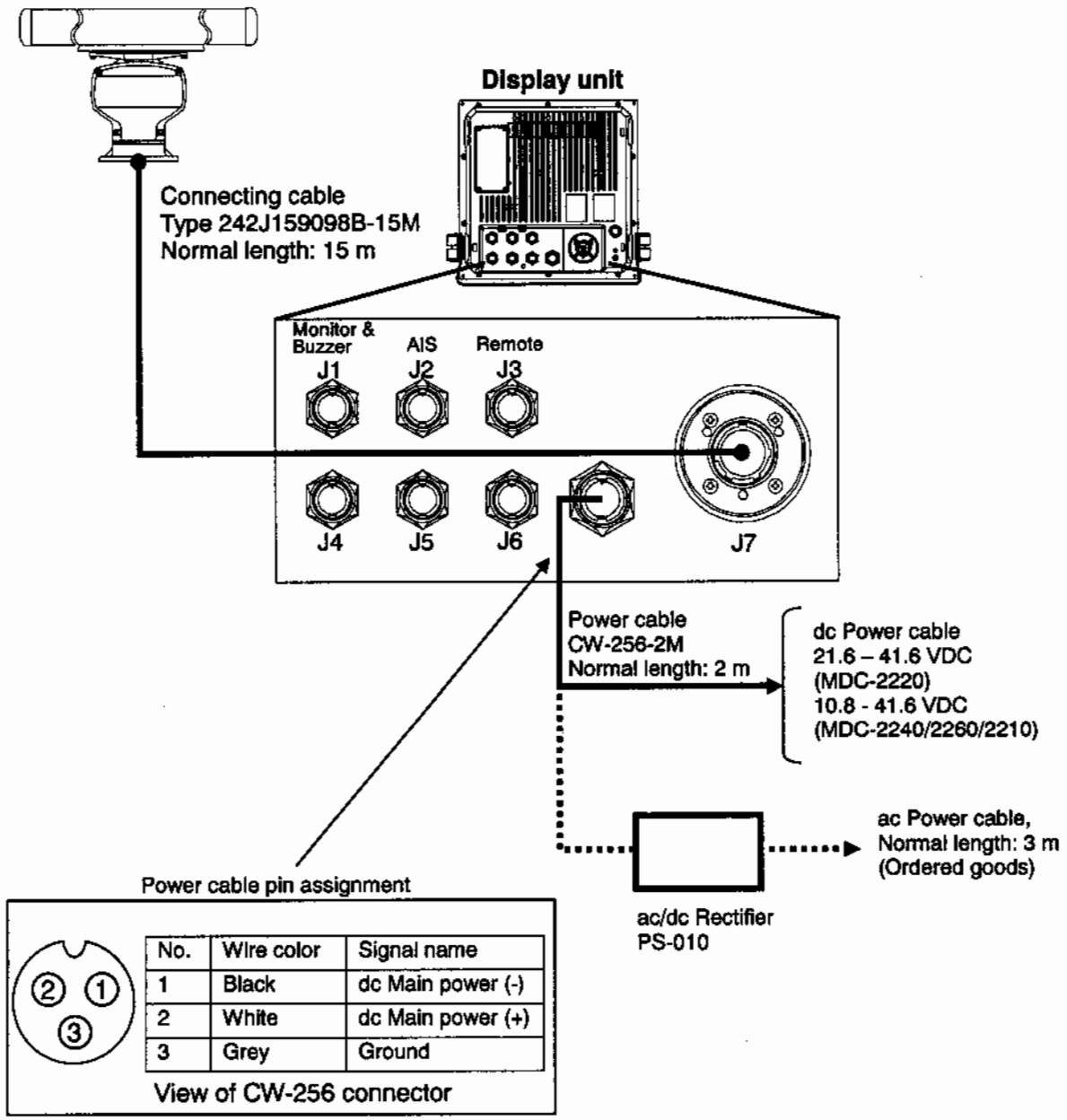
3.4.2 Installing the AIS PCB



3.5 Cable connection to a display unit

3.5.1 Cable connection for MRD-101

Attach the connectors of cables from an antenna unit, power source and operating unit, to corresponding receptacles as shown in Figure 3.19.

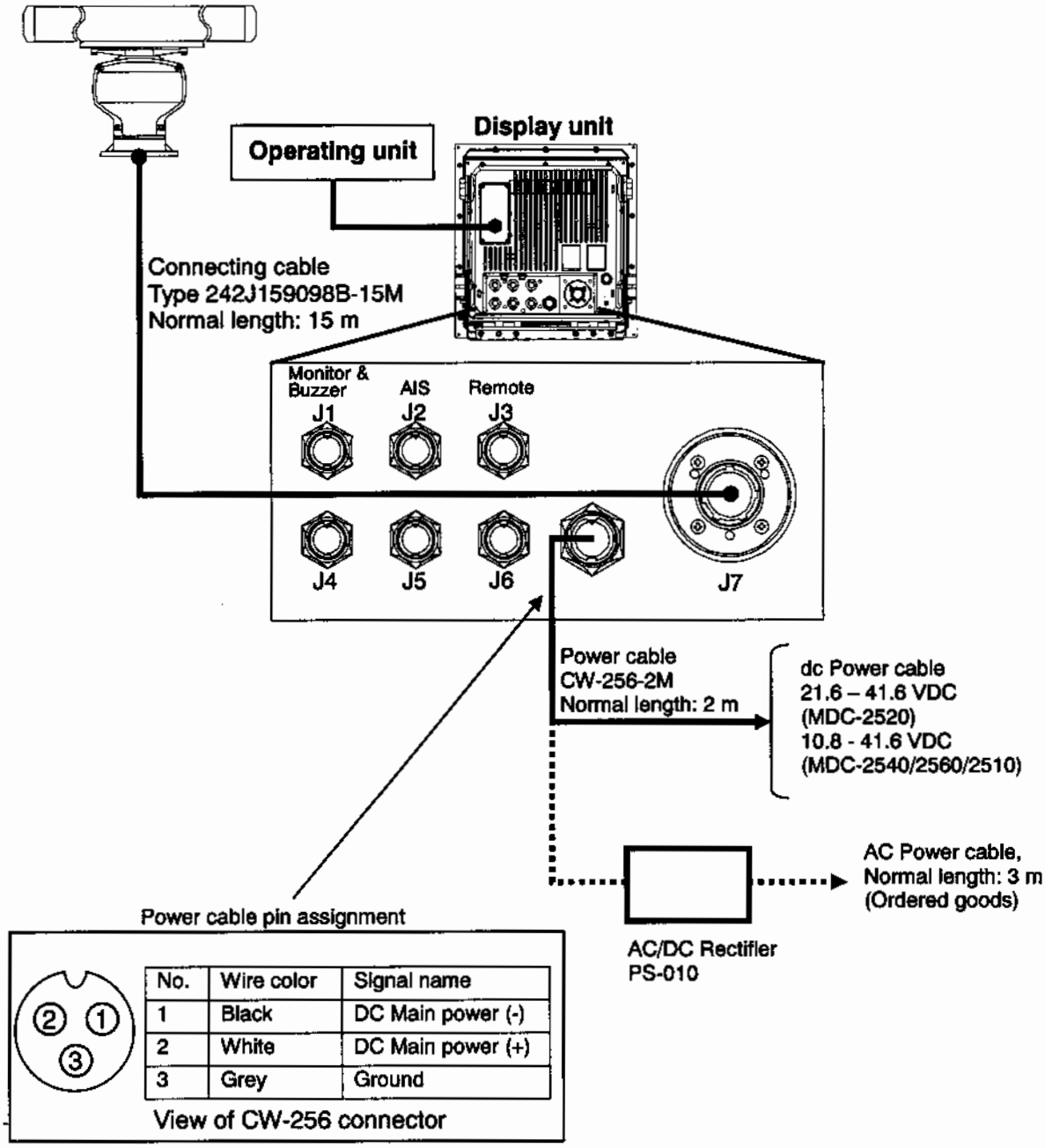


No.	Wire color	Signal name
1	Black	dc Main power (-)
2	White	dc Main power (+)
3	Grey	Ground

Figure 3.19 Cable connection for standard configuration of MRD-101 display unit

3.5.2 Cable connection for MRD-102

Attach the connectors of cables from an antenna unit, power source and operating unit, to corresponding receptacles as shown in Figure 3.20.



No.	Wire color	Signal name
1	Black	DC Main power (-)
2	White	DC Main power (+)
3	Grey	Ground

Figure 3.20 Cable connection for standard configuration of MRD-102 display unit

3.5.3 Connecting the display unit to GPS Compass (KGC-1)

When using the GPS Compass (KGC-1), connect the J6 port of the display unit to DATA2 connector of KGC-1. This connection allows high data speed.

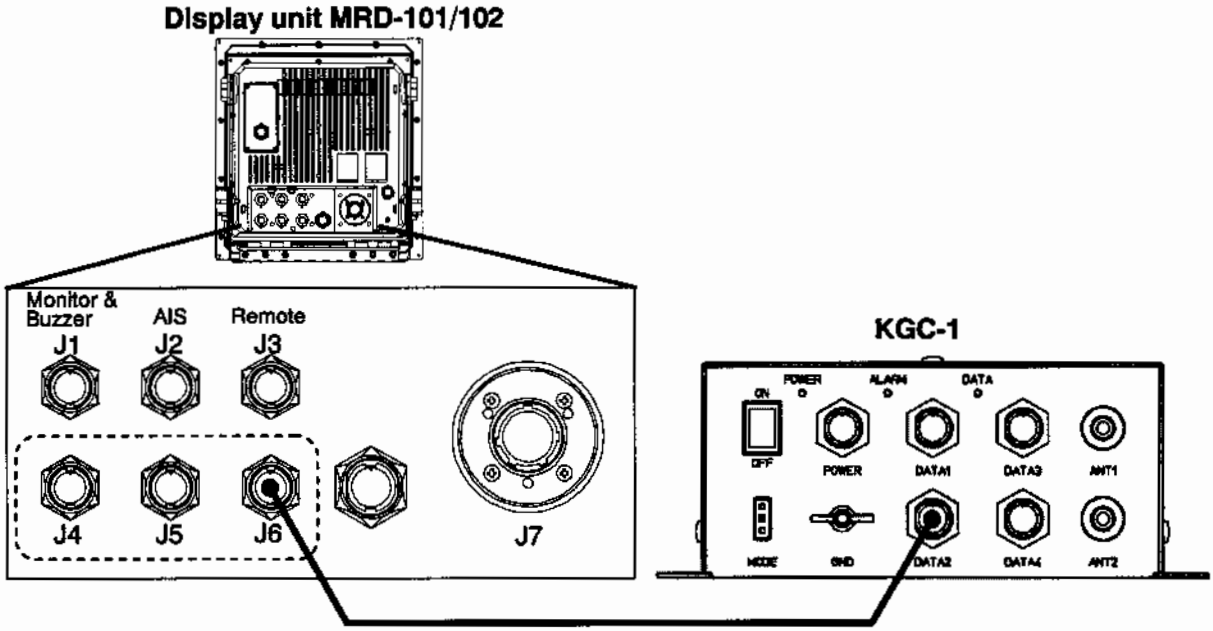


Figure 3.21 Cable connection between display unit and KGC-1

The procedure to Switch to high-speed communication mode

(1) Press [MENU] key to display "Menu".

(2) Place a cursor on DATA DISP and move the joystick to the right to display the sub-menu.

(3) Place the cursor on PROTECT CANCEL and press [ENTER] key. "Menu" display will disappear.

(4) Press [MENU] key to display "Menu".

(5) Place the cursor on I/O, move the joystick to the right, select HDG => KGC-1 SET => INITIAL, place the cursor on START and then press [ENTER] key. The communication baud rate is set to 38400 bps for both display unit and KGC-1. Start the KGC-1 to output HDT, GGA, and VTG signals.

NOTE: The KGC-1 DATA2 port (connecting port to radar) is set as 38400 bps, signal duration 50 ms, signal type: HDT, GCA, VTG by this initialization. When this DATA2 port is used for another device that cannot handle this baud setting, connect this device to DATA1 port or do not perform initialization.

3.5.4 Connecting the KGC-1 and GTD-110/150 to a display unit

Note: Refer to each operation manual for the connections to other devices.

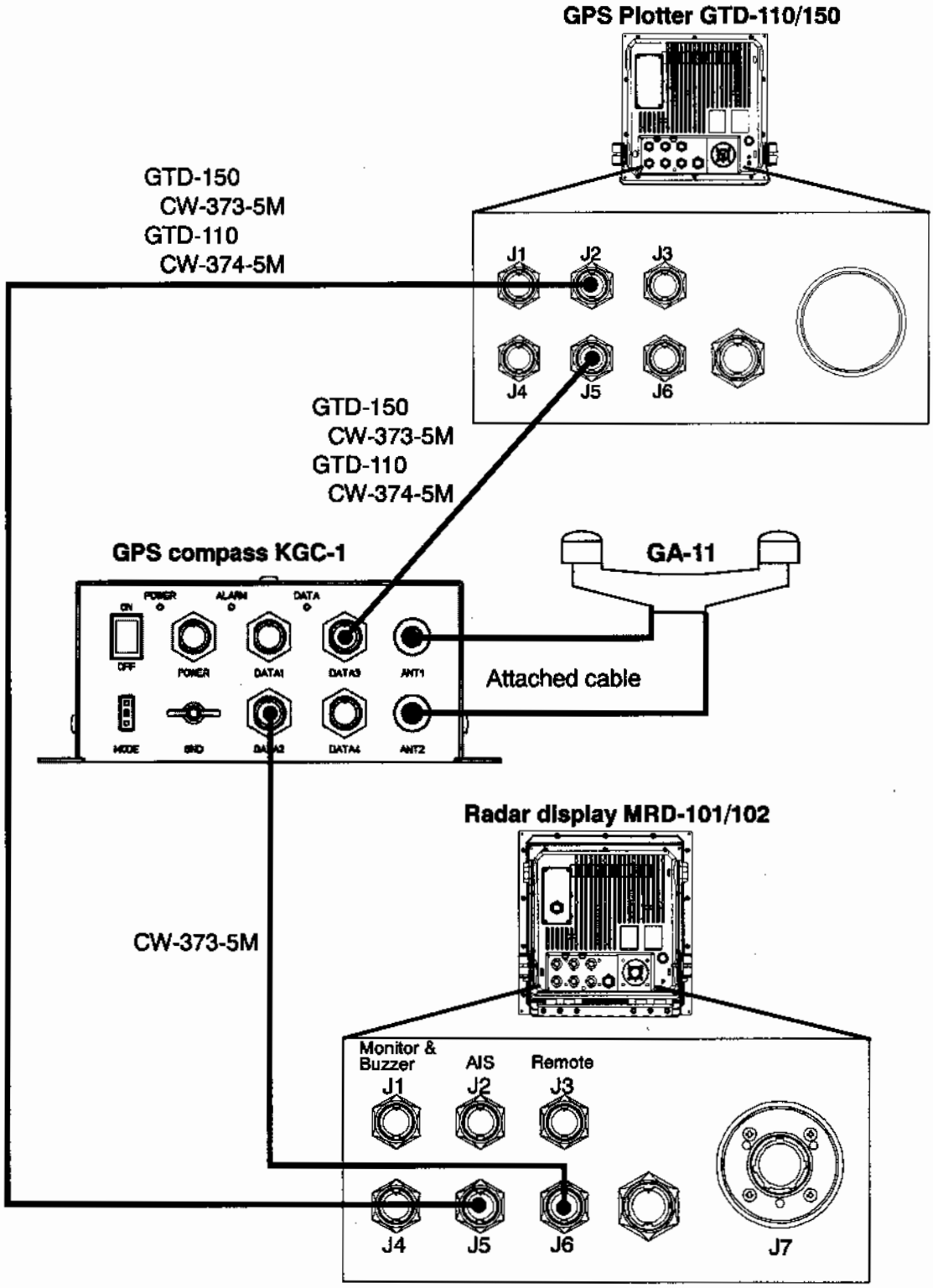


Figure 3.22 Cable connection of control unit, KGC-1 and plotter

3.5.5 Connecting a display unit to KGC-1, GTD-110/150 and KGB-2/3

Note: Refer to each operation manual for the other devices.

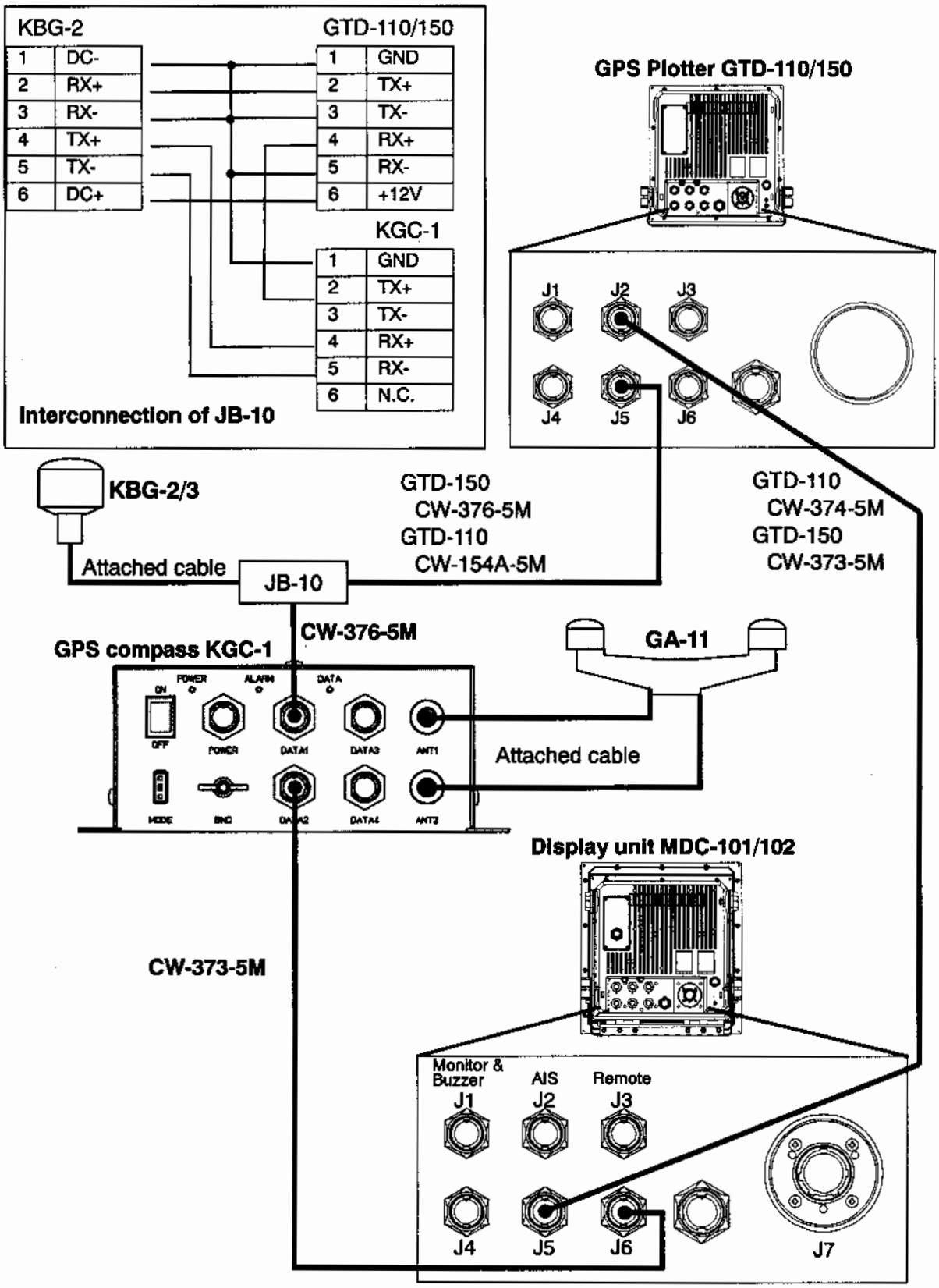


Figure 3.23 Cable connection of control unit to KGC-1, Plotter and KBG-2/3

3.5.6 Connecting an external buzzer and external monitor

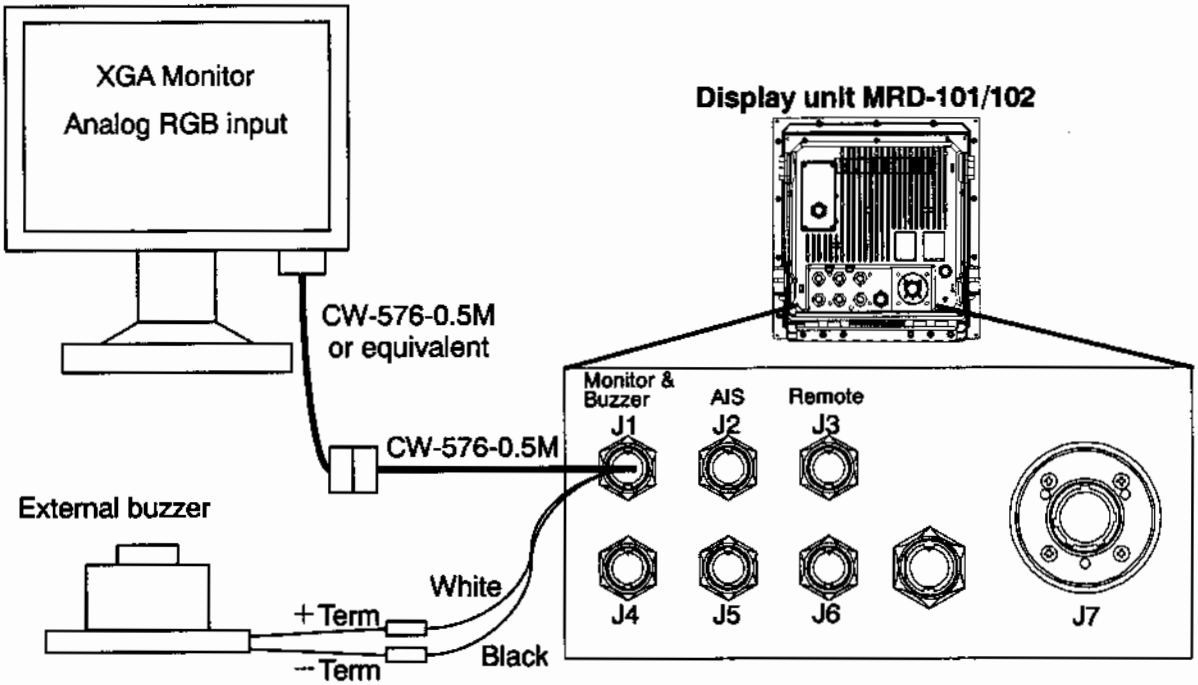
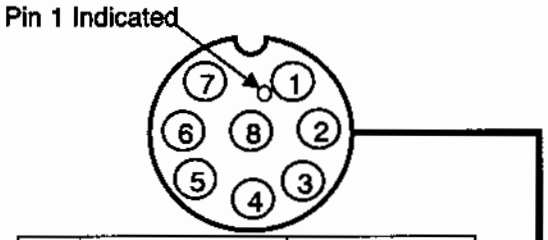


Figure 3.24 Cable connection of a display unit to ext. buzzer & monitor

Note: For the rated voltage of the external buzzer, use the same voltage with the rated voltage of inboard dc power supply to which the radar display unit is connected.

3.5.7 AIS cable connection

AIS cable connector pin assignment



Pin No.	CW-387 Wire color	Signal name
1	Shield	Frame ground
2	Orange Red 1	IN-B
3	Orange Black 1	IN-A
4	White Red 1	OUT-B
5	White Black 1	OUT-A
6	Grey Black 1	GND
7	Pink Red 1	AIS Alarm
8	Pink Black 1	AIS Alarm

Note:
In the case of pin7 and pin8 of connector being connected to AIS alarm, they may be short-circuited.
AIS alarm will be sounding if this circuit is left open.

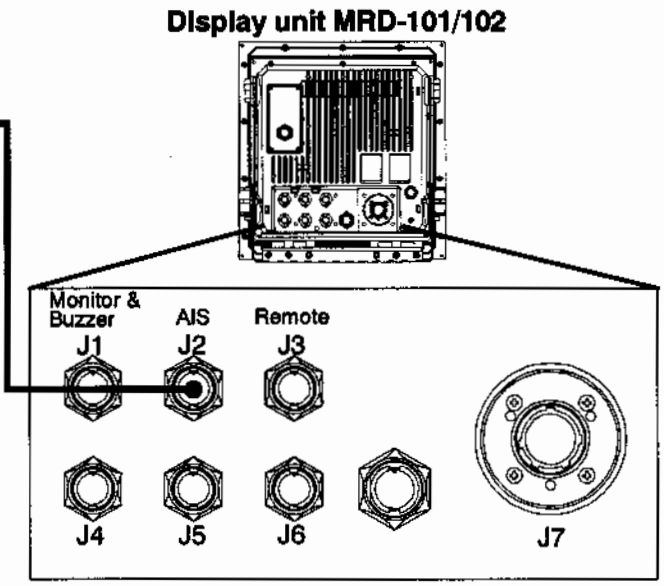


Figure 3.25 AIS cable connection

3.5.8 Cable connection for interswitch

3.5.8.1 Cable connection instructions for cross-over, parallel and independent connection

In the case of a dual, crossover, or master/slave connection using two sets of radar system or display unit, the remote cable and data cable are connected as shown in the figure.

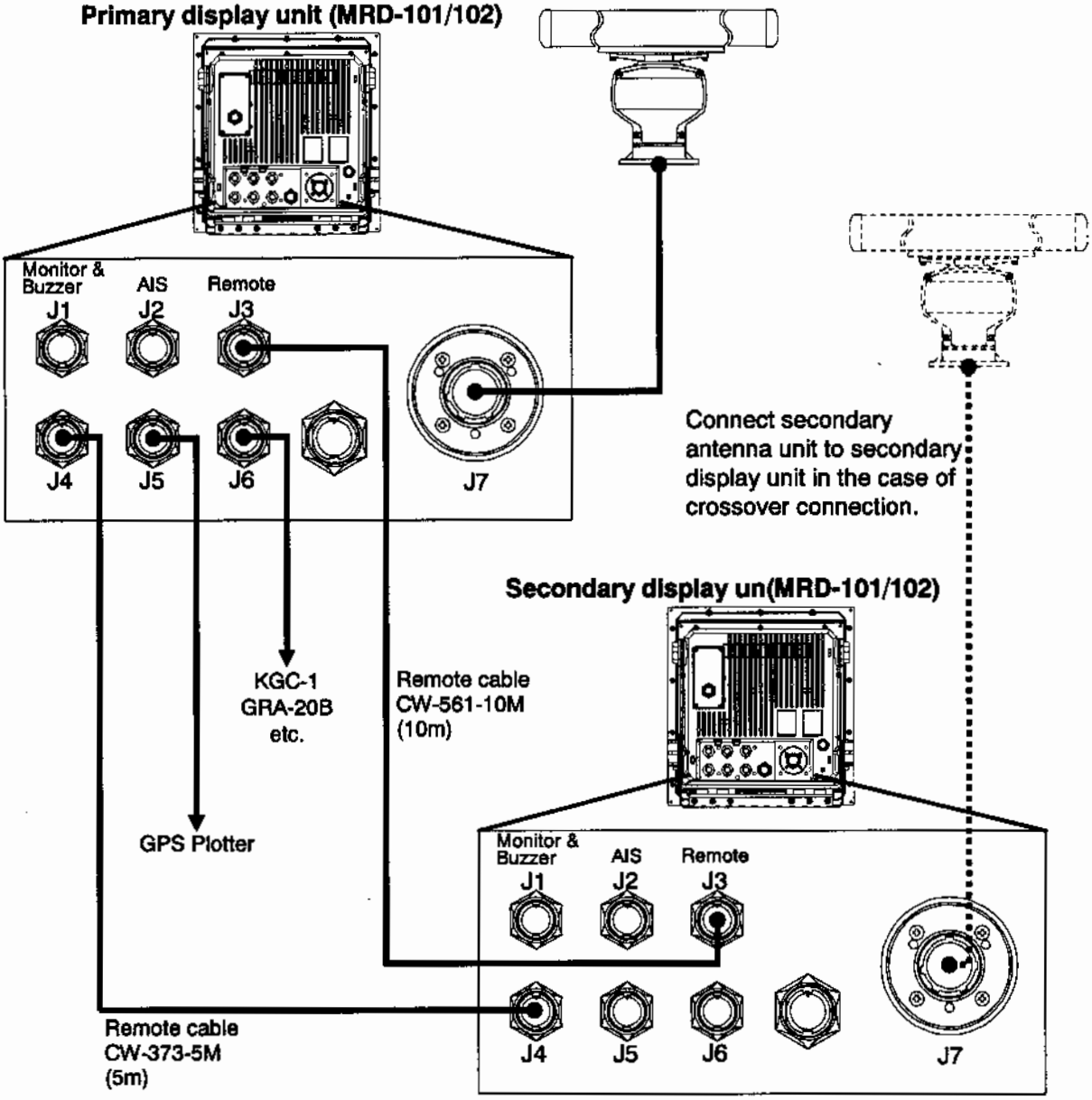


Figure 3.26 Connecting a secondary display unit on Crossover, parallel and independent connection

(1) The heading, speed and latitude/longitude signals input to the data connector of primary display unit and are supplied to the secondary display unit via remote cable. The secondary display unit can also use ATA and chart option functions in the same way as the primary one.
(2) Connect the secondary transceiver unit to the secondary display unit in a crossover connection.
(3) Operating unit (MRO-102) is required for MRD-102.

3.5.8.2 Cable connection for secondary display unit used as a monitor

When the secondary display unit for a radar is used as monitor, the remote cable is connected as follows.

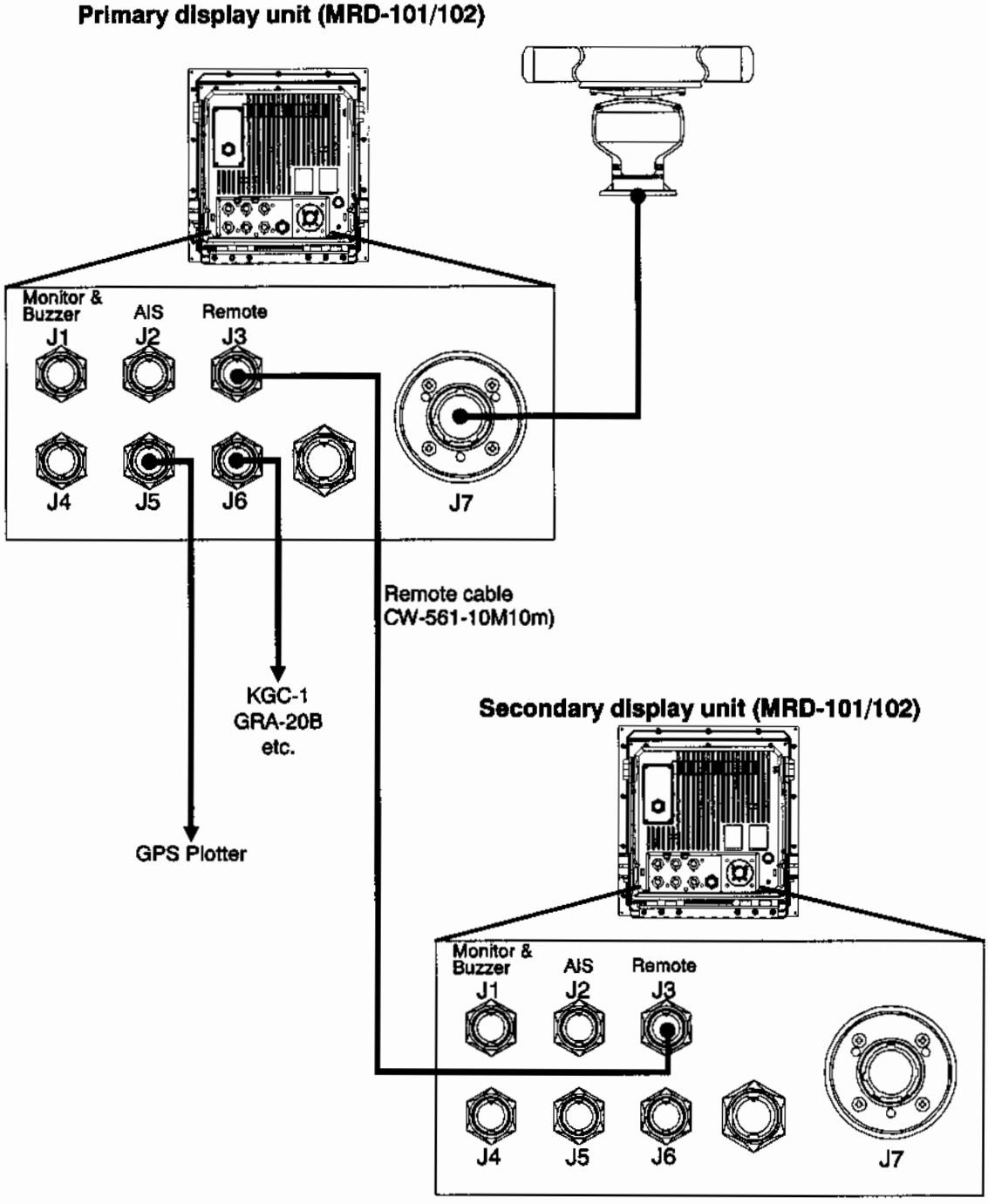


Figure 3.27 Connecting a secondary display unit as a monitor

(1) When used as a monitor, the secondary display unit cannot control the transceiver unit. The monitor (secondary display unit) will display its range in accordance with the primary one.

(2) Operating unit (MRO-102) is required for MRD-102.

Chapter 4 Setup after installation

Some setup procedures are required after system installation. Before performing the setup procedures, please check the following items for normal operation:

(1) The onboard power supply powering the radar system is the specified voltage.

(2) No one is in the area around the antenna unit or the mast. The indication "Under the radar coordination. Do not touch the operating unit." is marked on the display unit.

Notice: The STARTUP menu described below is protected and does not appear in normal operation. Please release the menu protection by the following key presses.
Press [MENU] key on the transmission display, select DATA => PROTECT CANCEL and press [ENTER] key, and the protection will be released and the menu will close. When [MENU] key is pressed again, the previously protected items for adjustment are added in each menu. This protect cancel status is effective until power off.

4.1 Setup of menu items at installation

4.1.1 Adjustment of transmitting delay time (Trigger Delay)

This adjustment is intended to match the picture on the radar display with the distance of an actual target by the adjustment of the transmission delay time. For the most accurate adjustment, find a close, hard, long, straight object such as a quay wall. Steam within 100yards of this for the best result. Transmitting delay time is adjusted in accordance with the following procedures.

(1) Change the range scale to 0.125 NM by pressing "+" (or "-") key on the transmission display.

(2) Press [MENU] key, select STARTUP => TX DELAY ADJ => VALUE will show the current setting of the input value by highlighting it.

(3) Move a joystick up or down to adjust the value to get a straight picture of the straight object in the screen as shown in Figure 4.1.

(4) Press [ENTER] key to save the adjustment result.

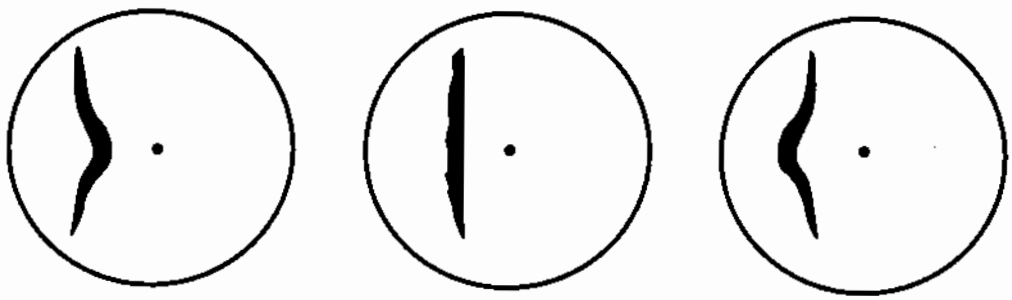


Figure 4.1 Picture display of Trigger Adjustment

4.1.2 Display bearing adjustment

The bearing of a target on the radar screen can be adjusted.

(1) Change the range scale to 1 NM or more by pressing "+" (or "-") key on the transmission display.
(2) Select a visible fixed object as far as possible and measure its bearing using magnetic compass or equivalence. Measure the bearing of the same target on the radar screen. Adjust it according to the following procedures when both values differ 1 degree or more.
(3) Press [MENU] key, select STARTUP => BRG ADJ => VALUE will show the current setting of the input value by highlighting it. Move joystick up or down to adjust the value to match the bearing value of the target picture to the compass value.
(4) Press [ENTER] key to save the adjustment result.

4.1.3 Adjustment of automatic tune

In order to achieve best performance, adjustment of the automatic tune is required at the time of a new installation or a magnetron exchange.
It may be impossible to obtain optimum sensitivity without adjusting the automatic tune.

(1) Change the range scale to 12 NM or more by pressing "+" (or "-") key on the transmission display. Find the stable object such as the mountain or the island of 6 NM or more as far as possible. Adjust "GAIN" knob to decrease up to the gain where the object can be slightly observed.
(2) Press [MENU] key, select STARTUP => TUNE SELECT and set it to AUTO.
(3) Select STARTUP => TUNE AUTO => VALUE will show the current setting of the input value by highlighting it.
(4) Move joystick up or down to change the value, and obtain the maximum magnitude of the target in the screen. When a target becomes too strong to find the peak, lower a gain with "GAIN" knob once again adjust the tune to obtain the maximum magnitude of target.
(5) Press [ENTER] key to save the result of the maximum magnitude of target.

4.1.4 Assigning any functions to function keys

Several functions in common use can be assigned directly to the specific function key to provide short cuts and one key operation.
The following keys are used as the function key.
MRD-101 F1, F2, RAIN, SEA, GAIN
MRD-102 F1, F2, F3, RAIN, SEA, GAIN
The anti-rain clutter, anti-sea clutter, gain knobs are variable with a push button. The push button function is assigned the function key.

The following function can be assigned to the function key.

RANGE RINGS	BRG TRUE/REL	DAY/NIGHT	MODE
TRAILS	IR	PROCESS	ZOOM
TM RESET (Reset true motion)	HOLD	VECT TRUE/REL	ALARM1
GUARD ZONE	ACQ	DELETE	ALL DELETE
AUTO DETECT	TARGET	UPDATE	CHART
MARK OWN (Mark own ship position input)	MARK CURSOR (Mark cursor position input)	UPPER DISP (Data upper display)	VIDEO MODE
SHORT CUT			

Assigning procedure

Press [MENU] key, select STARTUP => F1 sub menu using a joystick and display the specified function to be assigned by highlighting it and press [ENTER] key to set.
The F2 key, RAIN key, SEA key, and GAIN key can be assigned in the same way.
Assigned function can be released by selecting OFF to each setup in the same way.
Short cut menu: It has the same function as the shortcut key on a personal computer.
Use attached labels on the switches for assigned function. (MRO-102)

4.2 Setup of preset menu items

4.2.1 Setting gain/anti-sea clutter /STC curve

Although the gain and manual STC maximum value has been adjusted from the factory, it is possible to readjust according to user's preference, installation conditions, and utilization area. Changes should be applied by the following steps:
This change is memorized after power down.
Setting should be applied in following order:

(1) Setup of gain;
(2) Setup of STC characteristic;
(3) Setup of manual STC maximum point.

4.2.1.1 Setup of manual gain

(1) Change the range scale to 12 NM or more by using "+" (or "-") key on the transmission display.
(2) Set RAIN, and SEA knob to 0, GAIN knob to 8 in scale, brilliance to the maximum position.
(3) Confirm that IR is set to 3. If not, set IR to 3 according to following procedures. Press [MENU] key, select ECHO => IR => VALUE and the current value will be highlighted. Move joystick up or down to set the value to 3. Press [ENTER] key to save.
(4) Select PRESET => GAIN MAN => VALUE and the current value will be highlighted
(5) Move joystick up or down to change the set value of gain while observing noise (snow) on the display, stop moving the joystick at the optimum position, and then press [ENTER] key to save.

This setup value is applied for all ranges.

4.2.1.2 Setup of STC curve

The anti-clutter sea effect varies according to the antenna height. In that case the STC curve should be adjusted according to the position where the antenna has been mounted and the adjustment should be carried out in accordance with the following procedures.

Note: STC curve adjustment procedure should be done after the gain adjustment. STC curve tuning should be done in open sea where sea clutter can be observed on the radar screen.

(1) Set the gain knob to 8, sea knob to 0, and rain knob to 0 and noisy sea clutter as shown in Figure 4.2 will appear in the center of the screen.

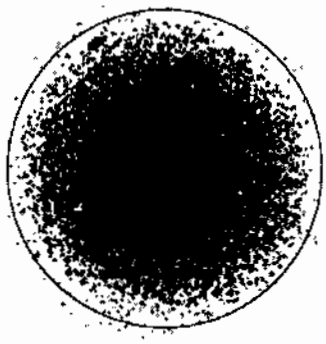
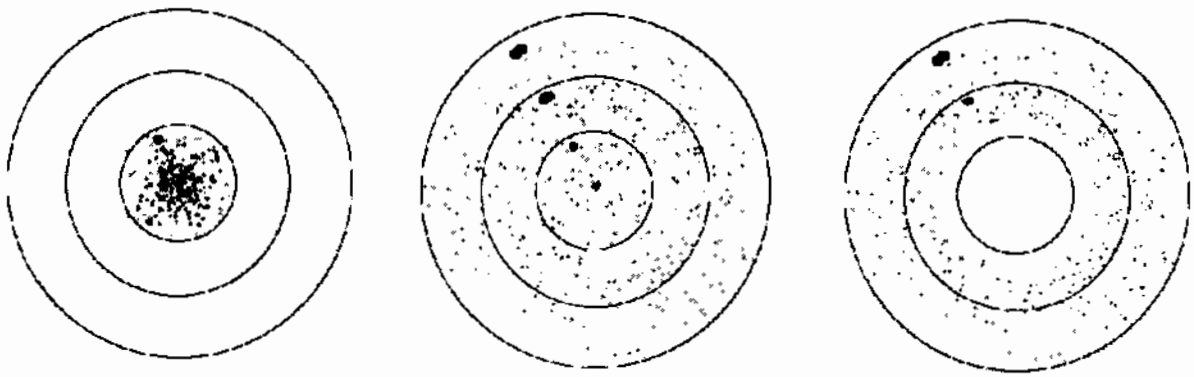


Figure 4.2 Picture of sea clutter echo

(2) Select the range so that all of sea clutter echo can be shown on the screen.

(3) Adjust SEA knob and stop the operation of the knob just before the sea clutter echo has completely suppressed (in the status under which sea clutter echo is scattered). As shown in Figure 4.3 "Proper", when sea clutter echo is uniformly in the screen and start fading, the setup value of STC curve is proper. When sea clutter echo in short-range area starts fading at the beginning as shown in Figure 4.3 "Too large", or when sea clutter echo in long-range area starts fading at the beginning as shown in figure 4.3 "Too small", STC curve adjustment should be carried out to set at the proper value by the steps below:



STC curve value too small STC curve value proper STC curve value too large

Figure 4.3 Example of adjusting STC curve value

(4) Press [MENU] key, select STARTUP => STC CURVE 1 => VALUE using a joystick highlight the last digit.
(5) Move a joystick up or down to modify STC curve value. Decrease the value if sea clutter echo in the short-range area fades at the beginning or increase the value if sea clutter echo in the long-range area fades at the beginning.
(6) After changing the STC curve value, readjust with the STC knob so that sea clutter echo fades out uniformly from the short-range area to the long-range area as shown in Figure 4.3 "Proper". Press [ENTER] key to save.

The STC curve setup value is applied to all of the ranges.

NOTE:: Setting of STC characteristics should be carried out at open sea. Set STC curve value to 10, if adjusting it in the harbor for some reason.

4.2.1.3 Setup of manual STC maximum value

(1) Set range to 12 NM, RAIN knob to 0, SEA knob to 0, GAIN knob to 8, and brilliance to maximum.
(2) Set VRM1 on, and adjust VRM to 8.0 NM.
(3) Press [MENU] key, select ECHO => IR => OFF using joystick, and then press [ENTER] key to remove IR effects. Even though noise will appear on the display, retain the gain setting 8.
(4) Set sea knob to 10 in scale (maximum) position.
Select PRESET => STC MAN MAX => VALUE using a joystick to highlight the last digit.
(5) Move the joystick up or down while noticing the noise on the screen and increase the maximum setup value of the manual STC from 0. Stop changing the STC when the noise on the screen has disappeared from zero to 8 NM area from the center and press [ENTER] key to set.
(6) Reset IR value to 3 after all of the setup operation has completed.

This manual STC maximum setup value is applied for all the ranges.

4.2.1.4 Setup of manual STC minimum value

Setup STC value. This setting reduces anti-clutter sea effect of STC to minimum value. This setting is applied to all the ranges. Adjustment should be carried out in calm sea.

(1) Set the range to 0.75 NM, RAIN setting to 0, SEA setting to 0, GAIN setting to 8, and brilliance to maximum respectively.

(2) Select PRESET => STC MAN MIN => VALUE to highlight the last digit.
(3) Move joystick up or down to change the value. Press [ENTER] key to save.

4.2.2 Setup of MBS value (Main Bang Suppression)

This setting is utilized to suppress eliminate the center spot signal at the middle of the picture as shown in Figure 4.4.

(1) Set range to 0.125 NM, RAIN knob to 0, SEA knob to 0, GAIN knob to 8, and brilliance knob to 10 (maximum) respectively.
(2) Press [MENU] key, select STARTUP => MBS => to highlight the last digit value, using the joystick.
(3) Turn sea knob to display center spot in the middle of the picture.
(4) Move a joystick up or down to increase MBS value from 0 with observing the center circle. Press [ENTER] key to save the setting as the circle just fades out.

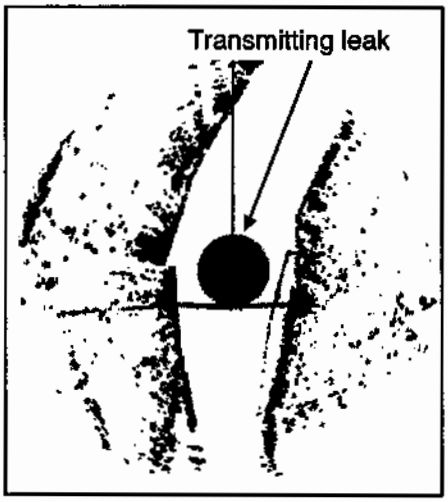


Figure 4.4 Center spot

4.2.3 Setup of ATA threshold

Setup the ATA target detection level.
The lower the setting value increases the gain and its capability to acquire weak echo targets. Higher setting values decrease the gain and will not acquire on weak echoes such as noise. This threshold value defines discriminating level of the target signal. Too little a value may cause target to be lost when the target is surrounded by strong sea clutter. Too large a value may cause you to lose targets with varying signal strength. The default value is 23.

4.2.4 Changing the radar picture expression

This function modifies expression of target picture such as target intensity, allows neutral colors to take out a sea clutter and rain can be displayed as a different color from a target. Since it becomes easy to distinguish sea clutter or rain from the target because the difference in a color especially if neutral colors are used but weak signals are expressed weaker and it appears the sensitivity worsens. However, it is suitable for stormy weather.

Setting procedure

(1) Press [MENU] key, select PRESET => VIDEO MODE => VALUE, using a joystick highlight the last digit.
(2) Move a joystick up or down to select desired value between 0 to 3 and then press [ENTER] key to save. The picture varies according to the value 0 to 3, small value for "Soft picture using many neutral colors" and large value for "Sharper picture".

4.3 Setting MAP chart (At the time of using C-map card)

4.3.1 Display of C-map chart

Insert the card to be displayed and set "CHART" => CHART => ON, and press [ENTER] key

4.3.2 Setup of chart details to be displayed

Each item such as LAND, PLACE NAME, LIGHTHOUSE, BOUY, FISH HAVEN /WRECK, TRACKS/ROUTE, CAUTION AREA, FISHERY, and CABLE can be selectively displayed on/off.

Example of setting

Select CHART => CHART DISP SET => PLACE NAME => ON and press [ENTER] key to save.

4.3.3 Alignment of chart position

Align chart position to coincide with the radar picture in the event of misalignment.

Example of alignment

Set CHART => NAV ALIGN MODE => ON.

(7) Select CHART => NAV ALIGN LAT => VALUE using a joystick highlight the last digit. and then select alignment value by moving joystick and press [ENTER] key to save.

(8) Select CHART => NAV ALIGN LON => VALUE using a joystick highlight the last digit and then select alignment value by moving the joystick and press [ENTER] key to save.

4.4 Setup of serial input

The input of heading data and speed data from the other devices is required to display EPA/ATA, true trail, and own trail. Also, latitude and longitude position of own ship is required for functions such as AIS, chart, display of own ship information and position display. Set the following menu items after connecting an interface cable to the specified device according to the procedures as specified in "3.5 Cable connection to the display unit".

4.4.1 Using system without input connection

The basic radar functions (except navigation, chart, data display, ATA, EPA, AIS, etc.) are available without connecting any other device. You could see an error message "Error: Heading and Speed error displayed on the screen with an alarm sound. Set heading and speed to off position to use the radar without navigation inputs.

Setting procedure:

Press [MENU] key and set up using joystick as follows:

I/O => HDG => HDG => OFF

I/O => SPD => SPD => OFF

4.4.2 Adjustment of heading

4.4.2.1 Adjustment of heading with KGC-1

HDG input: When connecting KGC-1 via data connector
Select I/O => HDG => HDG => ON,
then select I/O => HDG => MODE => AUTO.

The KGC-1 is optimized for the radar application when setup.
Select I/O => HDG => KGC-1 SET => INITIAL => RESET by highlighted character and then press [ENTER] key.
NOTE: The DATA2 port of the KGC-1 (connecting to the radar system) is changed to 38400 bps baud rate, signal duration 50 ms, and message type: HDT, GGA, VTG are set through this initialization. If DATA2 port is used for another device (not KGC-1) and not supporting this baud, connect those devices to DATA1 or do not perform this initialization step..

The KGC-1 bearing can be corrected.
When there is any deviation between KGC-1 OUTPUT signal and heading, the deviation of HDT signal output from the KGC-1 can be corrected.
Select I/O => HDG => KGC-1 SET => BRG CORR => VALUE using a joystick highlight the last digit.
Move joystick up or down to match the value to bearing difference and then press [ENTER] key to save.

4.4.2.2 Adjustment of heading with GRA-20B or GPS compass made by other manufacturer

HDG input: Connecting the GPS gyro or GRA-20B via data connector
Select I/O => HDG => HDG => ON,
then I/O => HDG => MODE => AUTO.

Bearing correction.
If there is any deviation in the input heading, you can correct for it.
Select I/O => HDG => CORR => VALUE, Highlight the selection and then move joystick up or down to match the value of the bearing difference and press [ENTER] key to save.

4.4.3 Setup of own-ship speed

Set up the speed from the KGC-1, GRA-20B, or GPS via data connector.
Select I/O => SPD => SPD => ON,
then I/O => SPD => MODE => AUTO.

4.4.4 Setup of selected bearing and selected speed using ground stabilization

Select I/O => COG/SOG => AUTO.

4.4.5 Selection of signal for ground stabilization

I/O => GND STAB MODE => AUTO.

4.4.6 Changing the baud rate of I/O port J4, J5 and J6

Each I/O port serial baud rate can be modified to the speed of the connected device. Selectable rate is 4800, 9600, 19200, or 38400 while default value is 4800. The J6 port speed is changed to 38400 after initialization of the KGC-1.

Example of setting
Select I/O => BAUDRATE => J4 => 4800 and then press [ENTER] key to save.

4.4.7 Restriction of signal type of specific input port

In the case where multiple navigation devices are connected to the radar system, some data like HDT might be provided from several sources. This can cause a problem such as sudden changes in heading. Limiting of the signal type to a specific port is an effective way to prevent this problem.

Example of setting
Select I/O => INPUT => HDT => J4 and then press [ENTER] key to save.

4.5 Controlling the brilliance of the marker, radar echoes, etc. independently

This function enables to change brilliance of the marker and other items surrounding the screen, radar echo, menu, ATA and AIS symbol, trails, etc. independently.

Setting example
(1) Press [MENU] key and then select CONTRAST => ECHO => VALUE Use joystick to highlight character.
(2) Move the joystick up or down to select desired value by watching the picture and then press [ENTER] key to save.

Setting items

Item	Description
ALL	Alter brilliance of all objects uniformly.
ECHO	Alter brilliance of the radar echo picture.
TRAILS	Alter brilliance of the trails.
BACK	Alter brilliance of the radar picture screen back color.
CHART	Alter brilliance of the chart.
CURSOR	Alter brilliance of the cursor.
MARKER1	Alter brilliance of the heading line, the stern line, EBL, VRM, Parallel index together.
MARKER2	Alter brilliance of the range rings.
ATA/EPA	Alter brilliance of the ATA/EPA/AIS
DATA	Alter brilliance of character around the screen
MENU	Alter brilliance of the menu

4.6 System setup

4.6.1 Changing of language from Japanese to English

The radar language can be changed from Japanese to English
If current language used is Japanese,

(1) Press [MENU] key and select SYSTEM => LANG => English using a joystick by highlighted character.
(2) Press [ENTER] key to save. Press [MENU] key to confirm the menu in English.

*** Changing the language to English can be also accomplished by holding "-" key while turning the power on.**

4.6.2 Turning-off the alarm buzzer

This function is used for turning-off/on the alarm buzzer with on/off switch.

Setting example

(1) Press [MENU] key and then select SYSTEM => BUZZER => OFF using a joystick by highlighted character.
(2) Press [ENTER] key to save.

Note: As the setting of ALARM => ATA BUZZER => OFF or ALARM => AIS BUZZER => OFF overrides this setting and ATA or AIS alarm sound is muted in such status.

4.6.3 Change of sound volume of buzzer

This function can change the audio volume of buzzer by changing the frequency of the buzzer sound. Select frequency from 1 to 7 steps.

Setting example

(1) Press [MENU] key while the alarm is sounding, select SYSTEM => BUZZER FREQ => VALUE using a joystick highlight the last digit.

(2) Move the joystick up or down to change value desired and then press [ENTER] key to save.

4.6.4 Turning-on/off of key-click sound

This function is used to mute key-click.

Setting example

(1) Press [MENU] key, select SYSTEM => KEY CLICK => OFF using a joystick and indicate the last digit of the input value by highlighted character.
(2) Press [ENTER] key to save.

4.6.5 Turning-on/off alarm sound for an external alarm

An external buzzer can be connected to the connector J1 on the back panel of the device for alarm sound. The alarm sound type is selectable from off, continuous, or intermittent.

Setting example

(1) Press [MENU] key, select SYSTEM => EXT BUZZER => CONTINUE using a joystick and indicate the last digit of the input value by highlighted character.
(2) Press [ENTER] key to save.

4.7 Setup of Inter-switch functions

Two radar systems or two display units can be combined with switch system to extend availability. Refer to 3.5.8 for cable connection.

4.7.1 Crossover connection (Please refer to Figure 4.5)

This system consists of two antennas and two display units combined with a crossover switch. The crossover switch method enables observing the display of either antenna located at different positions on the ship i.e. front or back, left and right.

For example,

(1) Watching the picture of the front antenna unit because of approaching port, the display unit connected to the back antenna unit is to be switched to the front antenna.
(2) In order to judge if observed picture is real or false at the time of antennas installed at the right and left positions of the vessel, each antenna is switched to the different display use. (In case of antenna installed at right and left, false pictures sometimes could be shown due to multi-path phenomenon.)

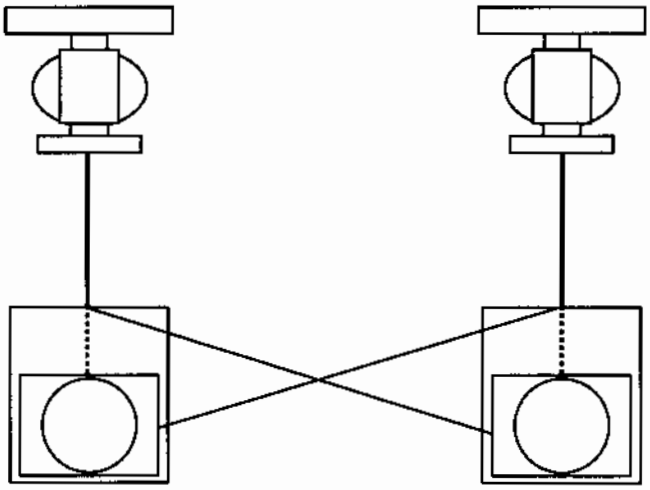


Figure 4.5 Crossover connection

Setting method

(1) Press [MENU] key, select OPTION => INTERSWITCH => CROSS: use the joystick to highlight the last digit.
(2) Press [ENTER] key to save. When one display unit designates crossover connection, the other connection is automatically set to crossover. In crossover status, both of the system can mutual independently control the antenna. The input data from the external sensor such as heading, speed, latitude/longitude may be shared by both display unit. The display unit without external sensor may offset the bearing of picture and heading.

Setting procedure

Press [MENU] key, select OPTION => ECHO OFFSET => VALUE using a joystick highlight the last digit.

(1) Press [ENTER] key to save.
(2) Determination of heading is executed by the same way.

4.7.2 Parallel connection

This connection is intended to control one antenna with two display units.
Two radars are installed and either antenna unit can be watched on both of the display units. When one antenna unit is unavailable due to poor performance, this connection is effective.
Two radar display units connecting to one antenna unit are used even when they are located in a different position, respectively.
The use of this function is when two display units are displaying the same image. For example, when the range on one-display unit changes, the same range also changes on the other unit due to this cooperating function. Other functions such as ATA, AIS, gain, anti-sea clutter, anti-rain clutter and markers independently operate in each unit.

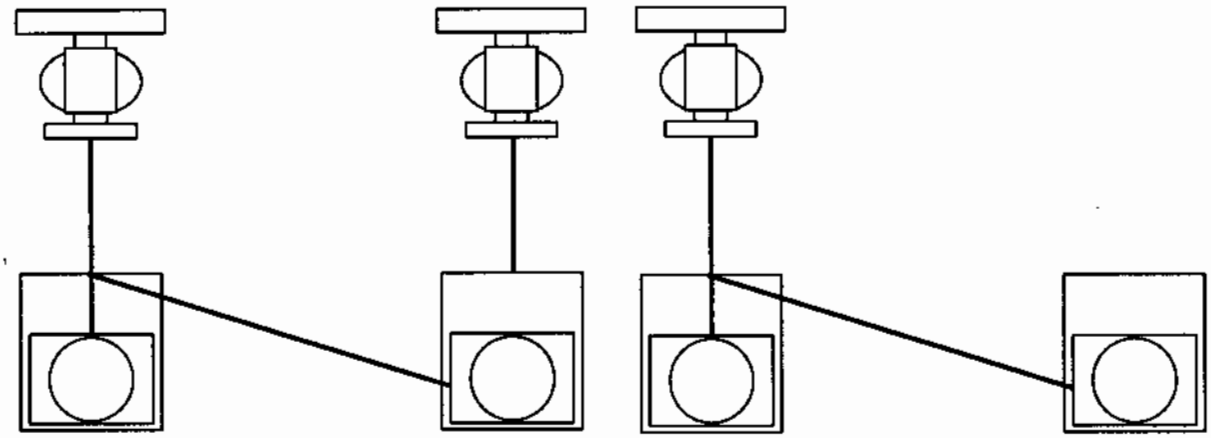


Figure 4.6 Example of parallel connection

Setting example

(1) Press [MENU] key, select OPTION => INTERSWITCH => PARALLEL (M) using joystick and indicate them by highlighted character.
(2) Press [ENTER] key to save. If one display unit is set to the inter-switch connection as parallel (master) master, then the other display unit is automatically set to be parallel (slave). In addition, the input data from the external sensor such as heading, speed, latitude/longitude are shared by both display units. The display unit without external sensor may offset the bearing of picture and heading.

Setting method

(1) Press [MENU] key, select OPTION => ECHO OFFSET => VALUE using joystick and then indicate the last digit of the input value by highlighted character with observing the picture.
(2) Press [ENTER] to save.
(3) Offset of heading is executed in the same way.

4.7.3 Independent connection

This connection method allows the monitoring of an antenna unit with two display units as with the parallel connection, however only the master display unit can control the antenna and the slave display unit cannot control it.
For example, when the captain operates the master display unit and does not want any changing of pulse length from the other display unit without permission, this connection is used. However, as the slave display unit cannot control an antenna unit, its range setting should be set up in accordance with the pulse length used for the range of master display unit to obtain a correct picture.
Functions such as a range, ATA, AIS, gain, anti-sea clutter, anti-rain clutter, and marker can be operated independently for the slave display unit.
The master and slave role can be exchanged in Figure 4.7.

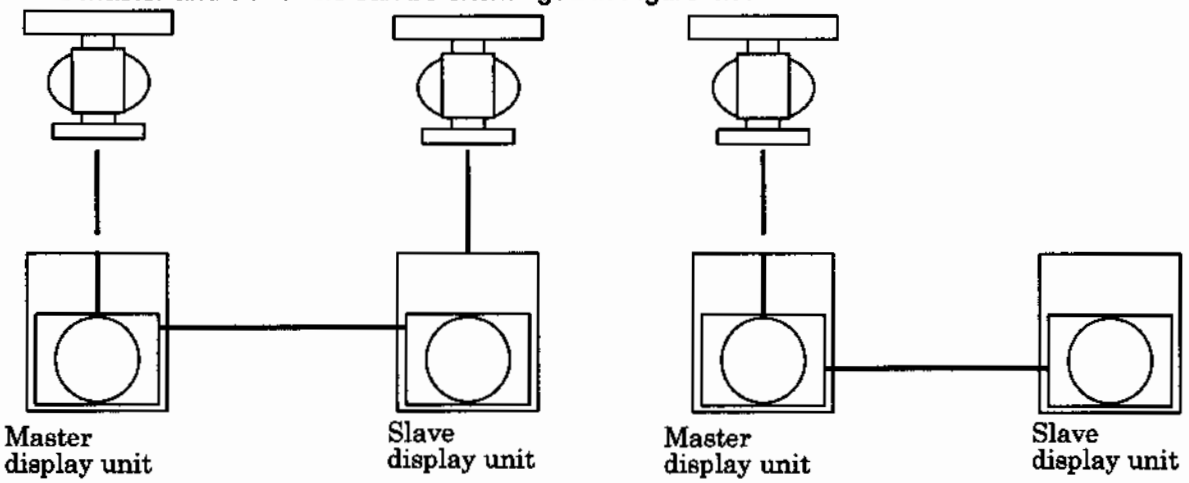


Figure 4.7 Example of independent connection

Setting example

(1) Press [MENU] key of the display unit to be master, select using joystick as follows: OPTION => INTERSWITCH => INDEPENDENT MASTER and then highlight it.
(2) Press [ENTER] key to save. When one display unit is set by the inter-switch connection as parallel (master), the other display unit is automatically set to be parallel (slave). Also, any input data from an external sensor such as heading, speed, latitude/longitude will be shared by both display units. The display unit without external sensor may offset the bearing of picture and heading.

Setting method

Press [MENU] key, select OPTION => ECHO OFFSET => VALUE using a joystick highlight the last digit while observing the picture.

(1) Press [ENTER] to save.
(2) Offsetting of heading is performed in the same way.

4.7.4 Monitor connection

A Remote monitor displays the radar image by receiving the picture data, heading and bearing data from the main display unit. The monitor acts the same as that of the slave display unit of independent connection system. Note: when functions such as chart overlay, ATA, AIS, stabilization criteria, TM and True trails are used, it is necessary that speed, heading and latitude/longitude data are inputted into the monitor.

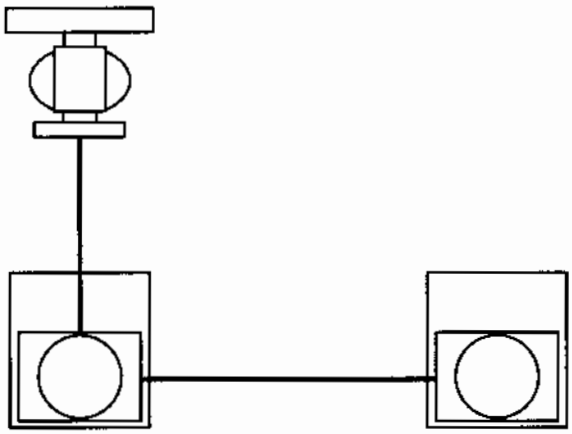


Figure 4.8 Example of monitor connection

Setting example

(1) Press [MENU] key, select OPTION => INTERSWITCH => MONITOR using joystick and indicate it by highlighted character.
(2) Press [ENTER] key to save.

4.7.5 Displaying antenna location on the screen

This displays the current location of antenna unit. The purpose is to identify the antenna unit being displayed when inter-switch system is used with two radar systems.

Setting example

(1) Press [MENU] key, select OPTION => ANTENNA POSI => Upper using joystick and indicate it by highlighted character.
(2) Press [ENTER] key to save.
"Upper" character string is displayed on the screen.
The locations such as PORT, STBD, FWD, MID, AFT, FWD PORT, FWD STBD, MID PORT, MID STBD, AFT PORT, AFT STBD, UPPER, LOWER are selectable.

4.8 Switching antenna rotation speed, high/low

This function changes the antenna rotation to high speed (48 rpm) or low speed (24 rpm). Note: the high-speed rotation is only available for ranges using the pulse length S pulse or M1 pulse. The rotation speed should be set to low (24 rpm) in the other ranges.

Setting example

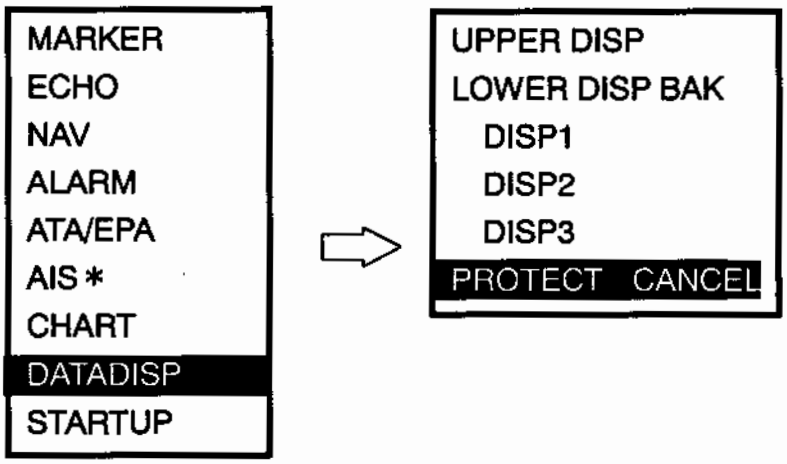
(1) Press [MENU] key, select OPTION => MOTOR SPEED => ON using a joystick and indicate it by highlighted character.
(2) Press [ENTER] key to save.

(The antenna rotation speed high (48 rpm) only in S pulse range and M1 pulse range.)

Chapter 5 Detailed setup and additional menu

Since this device has many functions, the "Setup" menu display is protected (restricted) to avoid confusion by having too many setup items of menus all together on the screen.

This protection (restriction) can be canceled by the following procedures.
Push [Menu] key to display "Menu".
Select [DATADISP] => [PROTECT CANCEL] and then press [Enter] key.



* : AIS menu is displayed only at the time of installation of optional AIS.

List of detailed setup items with protection off

MARKER	VRM1 UNIT	NAV	BLOCK CLEAR
	VRM2 UNIT		DETECT
	PI UNIT		SET UP
	STERN MRK	ALARM	DETECT LVL
	CURSOR SHAPE		AREA
	HU MOVE		ALARM 2 DISP
	VRM / EBL CROSS		BLOCK NO
	SCALE		BLOCK CLEAR
	CHARA		DETECT
	CHARA POSI		DETECT LVL
	CHARA TUPE		SETUP
	HL BRINK	CHART	SETUP
	GUARD LINE		CHART SELECT
	SHIP'S PROFILE		CHART DISP SET
ECHO	RANGE KEEP		NAV ALIGN MODE
	DETECT LVL		NAV ALIGN LAT
	TM RESET POSI		NAV ALIGN LON
	HOLD		WPT / ROUTE ID
	SECTOR		
	RANGE UNIT		
	ROTATION MARGIN		
	ROTATION SPEED		
	ALL PPI		
	OFF CENT POINT		

Additional setup menus with protection off

MARKER		BITE	ALARM TEST
ECHO			ATA TEST
NAV			TOTAL HOURS
ALARM			TX HOURS
ATA/EPA			PANEL TEST
AIS*			MONITOR
CHART			MONI NO SEL
DATADISP			DIAGNOSE ATA
STARTUP			DIAGNOSE AIS*
I / O	HDG		VERSION
	SPD	ANTENNA	HIGH VOLTAGE
	COG / SOG		MAG CURRENT
	LAT / LON		MAG HEATER
	GND STAB MODE		TUNE VOLTAGE
	OUTPUT(J4, J5)		TYPE
	BAUDRATE	OPTION	INTER SWITCH
	INPUT		ANT POSI
SYSTEM	言語		ECHO OFFSET
	BUZZER		HDG OFFSET
	BUZZER FREQ		MOTOR SPEED
	KEY CLICK	INITIAL	SETUP LOAD
	EXT BUZZER		SETUP SAVE
PRESET	GAIN MAN		USER SET LOAD
	STC MAN MAX		USER SET SAVE
	STC MAN MIN		EXT LOAD
	STC CURVE 1		EXT SAVE
	FTC MAN		SYS PRG LOAD
	MBS		ATA PRG LOAD
	TARGET LVL		
	VIDEO MODE		
CONTRAST	ALL		
	ECHO		
	TRAILS		
	BACK		
	CHART		
	CURSOR		
	MARKER 1		
	MARKER 2		
	ATA / EPA		
	DATA		
	MENU		

* : Displayed at installation of AIS unit (optional).

5.1 Detailed setup Items

5.1.1 Marker

5.1.1.1 VRM1 range unit, VRM2 range unit and PI range unit

This function selects a range unit.

You may select desired range unit.

Setting choices : NM, Km, Sm, Coupled

NM : About 1.8 km

SM : About 1.6 km

Coupled : Use the same unit coupled with range.

Refer to "Range unit" (page 5-8) for range unit setting.

5.1.1.2 Stern line

This is used to display the stern line originated from the stern.

This stern line is used to confirm direction and position of the stern.

Setting value: Off, On

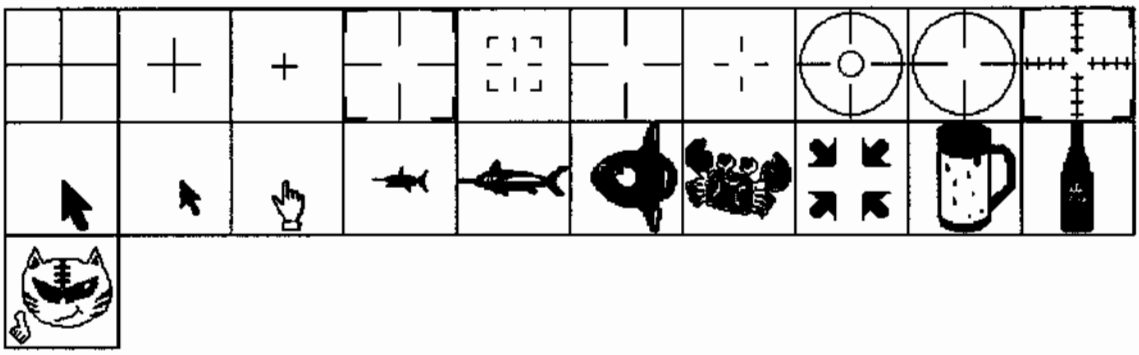
5.1.1.3 Cursor shape

This is used to change the shape of the cursor.

You may specify a desired shape from the following list.

Setting value: 21 symbols, cross hair cursor

Symbols



Cross hair cursor consists of "+" shape expanded each lines to the end of the screen.

5.1.1.4 HU cursor and bearing cooperation

This specifies cooperation function of cursor and bearing of own ship in H-Up mode.

A target can be acquired easily by using a rotation function, etc. even when heading of own ship is changed during acquisition.

Setting value: Off, On

5.1.1.5 VRM/EBL Intersection

This is used to display the intersection of EBL and VRM.

This intersection can be visually confirmed.

Setting value: Off, On

When this is set on, a small circle marks appears at the intersections of EBL1 and VRM1, and EBL2 and VRM2, respectively.

• is displayed at the selected intersection of EBL, while ○ on the unselected intersection.

5.1.1.6 Bearing scale

This is intended to display or hide the bearing scale.

Bearing scale can be seen easily when displayed.

Setting value: Off, On

The 0 scale denotes heading in "Relative" of bearing mode and true north in "True" of bearing mode.

Mark • is displayed at the intersection of heading line and bearing scale.

5.1.1.7 Bearing display

This is used to set the display or hide the bearing in the bearing scale.

The display of bearing scale is easy-to-use.

Setting value: Off, On

5.1.1.8 Position of bearing display

This is used to place the bearing inside or outside in the bearing scale.

The bearing scale display is easy-to-use.

Setting value: Inside, Outside

5.1.1.9 Display type

This is used set the type of bearing display in the bearing scale.

The bearing scale display is easy-to-use.

Setting value: Figure value, Symbol

Symbol is displayed with "E", "W", "S" or "N" to denote the geometrical direction of East, West, South and North, respectively.

Heading orientation shows "N" at the time of "Relative" of bearing mode.

5.1.1.10 Head line blink

This used to blink the heading line and stern line.

Blinking makes it easier to see the heading line and stern line on the target.

Setting value: Off, On

5.1.1.11 Guard line

This is used to draw two lines in parallel at both right and left sides of the own ship for safety navigation.

Setting value: Off, On

Left: 0 – 1000 m

Right: 0 – 1000 m

Since the guard lines are a sort of guide reference, no alarm sound is provided.

5.1.1.12 Own ship's profile display

This is used to set up and display your ship's profile.

Up to 50 types of lines can be used for the configuration of profile.

Setting items: Display of own ship's profile, Design of own ship's profile

Display of own ship's profile: Off, On

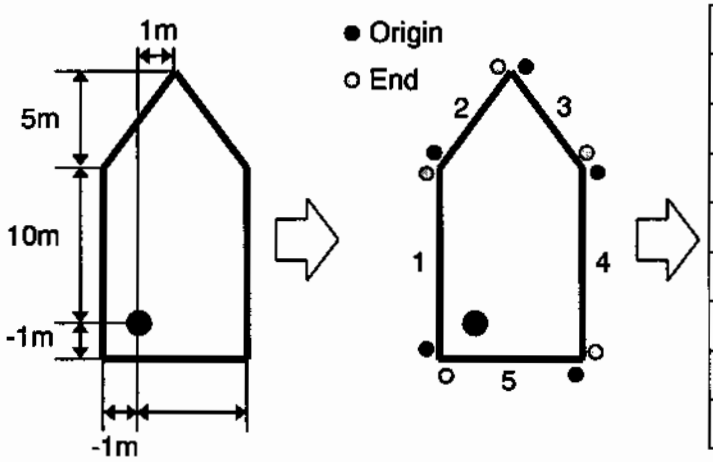
Design of own ship's profile:

Y1 : -1000 – 1000 m

X2 : -1000 – 1000 m

Y2 : -1000 – 1000 m

Each line is designated by origin and end points based on the location of antenna unit.



	X1	Y1	X2	Y2
1	-1	-1	-1	10
2	-1	10	1	15
3	1	15	3	10
4	3	10	3	-1
5	3	-1	-1	-1
6	0	0	0	0
・	・	・	・	・
50	0	0	0	0

X1 ・ Y1 denote origin points.
X2 ・ Y2 denote end points.

5.1.2 Echo

5.1.2.1 Keeping range

This is used to save trails that were recorded from a previous range after the range has been changed.

This function makes it easier to confirm motion of targets since past trails remains after range changes.

Setting value : Off, On

Note : The trail is displayed in a course font and difficult to view when the range is changed from distant range to close range.

5.1.2.2 Detection level

This is used to set echo strength to be recorded as trails.

Only an echo (target) with the specified strength or higher is recorded as trails.

Setting value : 1 to 6

Note : Even noise can be recorded as trails if the setting is too low.

5.1.2. 3 Position of true motion reset

This is used to set the position after true motion reset.

Setting value : To stern, Course, Center

To stern : Reset in the stern direction.

Course : Reset in the inverse direction of course over ground.

Center : Reset in the center of the screen.

5.1.2.4 Holding picture

This is used to stop echo picture redrawing temporarily.

It is used to locate targets during holding the echo picture redrawing.

Transmission will stop and go into standby mode if hold time is set too long.

5.1.2.5 Sector scan

This is used suppress echo display in certain areas.

Setting value : Off, 1, 2

Setting #1 Blank out radar returns without stopping transmission to antenna unit. This mode is used to avoid false targets caused by reflections from structures near the antenna location.

Setting #2 : Stop transmission at certain angles.

Used to prevent radar radiation exposure of people working near the antenna.

5.1.2.6 Range unit

This is used to choose range unit for range and cursor range display.

Setting value : NM, Km, Sm, Coupled with range

NM : About 1.8 km

SM : About 1.6 km

Refer to page (5-4) for range unit setting of VRM1, VRM2 and PI (Parallel Index line).

5.1.2.7 Rotation margin (angle)

At H-up mode, this is used to set the picture rotation angle per registered bow turning angle of the ship.

Setting value : 0 to 30°

The picture moves at all turns with a low setting value.

Set a large value to rotate the picture only at a large turn.

5.1.2.8 Rotation speed

At H-up mode, this is used to set the picture rotation speed to follow at the time of the bow turning.

Setting value : 0 to 50

A larger value, a higher rotation speed.

5.1.2.9 ALL PPI

This is used to choose to display the radar picture in full screen.

Setting value : Off, On

This value should be "Off" to confirm the figures such as range easily.

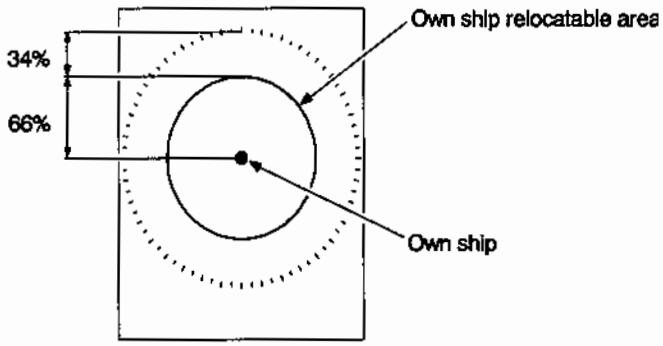
5.1.2.10 Off centering position

This is used to choose the position to move the vessel's position in off centering mode.

Setting value : Cursor position, Stern direction

Cursor position: Move vessel to cursor position. The off center position should be within the area shown below.

Stern direction: Relocate stern direction within the area shown below.



5.1.3 Navigation

5.1.3.1 Block clear

This is used to clear the block specified by "Block number".

Setting value : CANCEL, DELETE

5.1.3.2 Detection

This is used whether or not the obstacles crossing over navigation line (NAVLINE) shall be identified. It is useful to identify if hazardous obstacles are on the navigation line (NAVLINE) of own ship.

Setting value : OFF, ON

5.1.3.3 Latitude and longitude input

This is used to input nave line with latitude and longitude.

You may design desired nave line.

Min. two points input is necessary to identify nave line.

5.1.4 Alarm

5.1.4.1 Detection level

This is used to specify the intensity level of target to be detected with Alarm1.

Larger value and level of signal is set for target with strong return.

Setting value : 1 to 7

Noise can cause alarm if value is set too low.

Note: Be careful because too high a setting value may not alarm targets with weak return.

5.1.4.2 Area

Alarm 1 is easier setting method of the area.

Setting value : VARIABLE, FIXED

Variable : Start area setting => COMPLETE

Fixed : Start area setting area 1 (90°) => area 2 (180°) => area 3 (360°) => COMPLETE

Remarks : This function is only effective when "Alarm1 area setting" is assigned to F (function) key.

For Alarm2

Alarm1 is desired a pie-shaped or circled area setting. Alarm2 is designed area setting by designating the points with (LAT-LON input).

(At least three points should be specified for the area setting.)

Up to 20 polygon blocks of each maximum 50 points designation are provided.

Vertex (50 points) each block can further be divided into desired blocks.

Up to 20 areas (1 block with 1 range) to 320 areas (1 block with 16 areas) can be set.

This function is also used at the time of drawings by setting "OFF", the function of alarm detection function.

5.1.4.3 Alarm2 display

This is used to set whether or not Alarm2 is displayed. Only one block out of 20 blocks set in item "5.1.4.4 Block number" is displayed.

Setting : OFF, ON

Min. 3 points shall be set, since alarm2 function is to set the alarm area.

5.1.4.4 Block number

This is used to select the block number for Alarm2 operation.

Alarm area blockings are effective to identify individual alarm natures such as the place, time, etc.

Setting : 1 to 20

No block operation is possible unless registered in this item.

5.1.4.5 Block clear

This is used to clear registered "BLOCK NO".

Setting : CANCEL, CLEAR

To clear each point in the area shall be done by "Setup latitude and longitude input".

5.1.4.6 Detection

This is used to select alarm detection methods for the blocks set in "BLOACK NO".

Setting mapping : OFF, IN, OUT

In case of "OFF" mode, it can be used for the mapping.

5.1.4.7 Detection level

This is used for signal level setting of target to be detected for the blocks set in "BLOCK NO".

Larger value and higher signal level, the targets become stronger.

Setting : 1 to 7

In case of the setting is too small, it reacts noise, too.

In case of the setting is too higher, it does not react weaker targets.

5.1.4.8 Latitude and longitude input

This is used to ser points for the area setting in the block registered in "BLOCK NO".

Setting value : Latitude, Longitude, Divided, Delete

Divide : In order to divide into multiple (up to 16) ranges, a division is set to "ON" after specification of the last point of a range. Multiple areas (up to 16) can be divided in 1 block. It can be completed when the last point in a area sets divide "ON".

Since Alarm2 is to set the alarm area, Min.3 points shall be set.

Remarks : In case of Alarm2 display "OFF" or "BLOCK NO" between input "BLOCK NO" and current "BLOCK NO" being different, Lat-Long does not indicate.

5.1.5 Chart

5.1.5.1 Latitude and longitude input

This is used to register the "Mark" in the block set in "BLOCK NO".

Setting value : Shape, Latitude, Longitude, Delete

Shape : Select desired shape in 18 types of shape.

Remarks : In case of "MARK DISPLAY" – "OFF" or "BLOCK NO" between input "BLOCK NO" and current "BLOCK NO" being different being different, Lat-Long does not indicate.

5.1.5.2 Chart selection

This is used to select the chart used in map display.

Setting value : Japan, Global

Note: no detail Japan map is displayed even if the "Koden map card for MDC series" is inserted with setting value of "Global".

5.1.5.3 Chart display setup

This is used to specify items to be displayed on the chart.

Setting items are shown in the following list.

Item	Default	Setup value
Land	Color	No color, Color
Place name	Off	Off, On
Light house	Off	Off, On
Buoy	Off	Off, On
Fish heaven /Wreck	Off	Off, On
Traffic routes /Restricted	On	Off, On
Caution area	On	Off, On
Fishery	Off	Off, On
Cable	Off	Off, On

5.1.5.4 Navigation align mode

This is used to correct the position of the chart display.

It is used to correct any deviance between the position data received from GPS and the current position on the chart.

Setting value : Off, Manual, Serial

Serial : Correction using DTM

5.1.5.5 Navigation align latitude

This item is used to input the latitude correction value for manual input.

Setting value : -1.000 to 1.000

5.1.5.6 Navigation align longitude

This item is used to input the longitude correction value for manual input.

Setting value : -1.000 to 1.000

5.1.5.7 Identification display of waypoint/route

This device provides automatic waypoint/route display facility by connecting with the plotter and inputting waypoint/route information.

Setting value : Off, On

5.2 Additional menu

5.2.1 Input/output

5.2.1.1 Heading

5.2.1.1.1 Heading

This is used to choose ("On") or not use ("Off") heading information. Heading display disappears with "Off" selection.

Setting value : On, Off

5.2.1.1.2 Input mode

This is used to specify selection of heading input sentence.

Setting value : Auto, HDT, HDG, HDM, VTG, RMC, RMA, Manual

5.2.1.1.3 Manual setting

This is used to specify a manual value when "Manual" is selected with "input mode".

Setting value : 0.0°to 359.9°

5.2.1.1.4 Correction

This is used to specify manual correction value when "Manual" is selected in "input mode" above.

Setting value : 0.0°to 359.9°

5.2.1.1.5 KGC-1 setting

This is used to specify setting value of KGC-1 (GPS Compass) at the time of connection.

Setting item : Initialize, Correction

Initialize : Cancel, Execute

Correction : 0.0°- 359.9°

5.2.1.2 Speed

5.2.1.2.1 Speed

This is used to specify connection to a speed input device (GPS Compass, etc,).

Setting value : Off, On

5.2.1.2.2 Input mode

This is used to specify selection of speed input sentence.

Setting value : Auto, VHV, VHW, VBW, VTG, RMC, RMA, Manual

5.2.1.2.3 Manual setting

This is used to specify manual setting value when "Manual" is selected in "Input mode" above.

Setting value : 0.0KT - 100.0KT

5.2.1.3 COG/SOG

This is used to specify selection of COG/SOG input sentence.

Setting value : Auto, VTG, RMC, RMA

5.2.1.4 Latitude/longitude

5.2.1.4.1 Input mode

This is used to specify selection of latitude/longitude input sentence.

Setting value : Auto, GNS, GGA, GLL, RMC, RMA, Manual

Manual setting

This is used to specify setting value when "Manual" is selected in "input mode" above.

Setting value : 90°00.000N to 90°00.000S、180°00.000E to 180°00.000W

5.2.1.5 Ground stabilization mode

This is used to specify selection of the sentence for ground stabilization of heading and speed display.

Setting value : Auto, VDR, VBW, COG/SOG, Manual

Manual : Setting is carried out with "Navigation" => "Manual Set" and "Manual Drift"

5.2.1.6 Output (J4, J5)

This is used to specify transmit interval of each sentence from J4 and J5 interface port.

It is required when transmitting interval is specified for connecting device.

Setting items : RSD, OSD, TTM

Setting value : 0 – 10 s

Transmission is suppressed when value 0 second is specified.

5.2.1.7 Baud rate

This is used to specify baud rate of serial interface for J4 to J6 connector.

It is used when a specific rate is required for connecting a serial device.

Setting items : J4, J5, J6

Setting value : 4800, 9600, 19200, 38400

5.2.1.7 Input

This is used to specify input sentence for input from J4 to J6 connector.

This function prioritizes the input of designated J connector number when the same sentence arrived from more than one input sources.

Setting items : BWC, DBT, DPT, DTM, GGA, GLC, GLL, GNS, HDG, HDT, HDM, MTW, MWD, MWV, RMA, RMB, RMC, RTE, VBW, VDR, VHM, VTG, XTE, WCV, WPL, ZDA, ZTG
Setting value : J4, J5, J6

5.2.2 System

5.2.2.1 LANG

This is used to specify language to be used.

Setting value : ENGLISH, Japanese

5.2.2.2 Buzzer sound

This is used to specify buzzer sound for alarm.

Setting value : Off, On

5.2.2.3 Buzzer frequency

This is used to specify tonal scale (frequency) of buzzer sound.

Setting value : 1 to 7

The higher the tone, the larger the value.

5.2.2.4 Key click

This is used to specify to sound response when any key is pushed.

Setting value : Off, On

5.2.2.5 External buzzer

This is intended to specify output method of voltage for external buzzer synchronized with buzzer sound.

Setting value : Off, Continue, Interval

Continue : Continuously output buzzer signal during the buzzer sound

Interval : Periodically output buzzer signal during the buzzer sound

Output voltage is provided with supplied voltage of this device by connector J1 (Pin 9 +, Pin 10 -).

5.2.3 Preset

Refer to "4.2 PRESET menu item setting" (4-3).

5.2.4 Contrast

Refer to "4.5 Setup brilliance of marker, data, etc. independently" (4-9).

5.2.5 Self diagnosis

5.2.5.1 Alarm test

This item is performs an alarm test.

Pseudo alarm display and sound appear when this item is set to "On".

Setting value : Off, On

5.2.5.2 ATA test

This is used to perform an ATA functional test.

Two types of "X" symbol are displayed during test.

A large "X" symbol denotes that test is ongoing.

Pseudo echo appears under the small "X" symbol. Press [Acquire] key to start acquisition operation. ATA normal operation is confirmed if acquisition operation is observed in stable state.

5.2.5.3 Total operation hours

This is used to display total operating time of the display unit.

5.2.5.4 Total transmission hours

This is used to display total transmission time of the radar unit.

This value is used as a guide as to when to replace the magnetron tube.

5.2.5.5 Panel test

This is used to perform a keyboard test of the display unit.

A picture of the operating unit is displayed and each key is highlighted when the key is pressed.

The test is completed by pressing "Menu" key.

5.2.5.6 Monitor

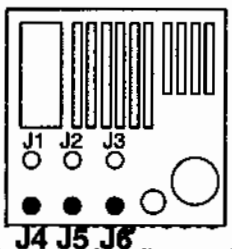
This item is used to confirm data input from the connector specified in "5.2.5.7 Monitor number select".

It is utilized to confirm data input.

5.2.5.7 Monitor number select

This is used to specify back panel connector number for monitoring in " 5.2.5.6 Monitor".

Refer to the following figure for back panel connector number.



5.2.5.8

This item is used for diagnosis of the operation of ATA print circuit board.

5.2.5.10 AIS diagnosis

This item is used to diagnose of the operation of AIS printed circuit board.

5.2.5.10 Version

This item is used to display version of this device software, operation panel software, ATA software and AIS (optional) software.

5.2.6 Option

Refer to "4.7" Use inter-switch functions" (4-11).

Chapter 6 Troubleshooting and on-board repair

In this chapter we provide troubleshooting procedures to find malfunction parts on a ship.

6.1 Necessary information at the time requesting repairs

Please note the following items:

(1) Ship name and phone number of the satellite communication system if equipped

(2) Device type name

(3) Product number of the device

(4) Software version name described in the operation manual and [Startup Menu] screen.

(5) A following port of call, arrival schedule, and agency name

(6) Status of malfunction and results of diagnosis on a ship

6.2 Provided self diagnostic facilities

The alarm display on the display and lamp for internal status is provided for self-diagnosis of this device.

6.2.1 Error display and its delete

Error display may appear at the upper right of the radar screen as shown in Figure 6.1 when a malfunction or operation error has been detected in the device.

Abnormalities are categorized as [Error], [Alarm] and [Warning]. When [Error] display actually appears and there is something is wrong with antenna unit, record the error details by type, location and status and push [DELETE] button. The alarm sound and error display will disappear. Multiple errors may be displayed one by one. Record all errors and push [DELETE] button for every error. The types of error, alarm and warning are shown in Table 6.1, Table 6.2 and Table 6.3.

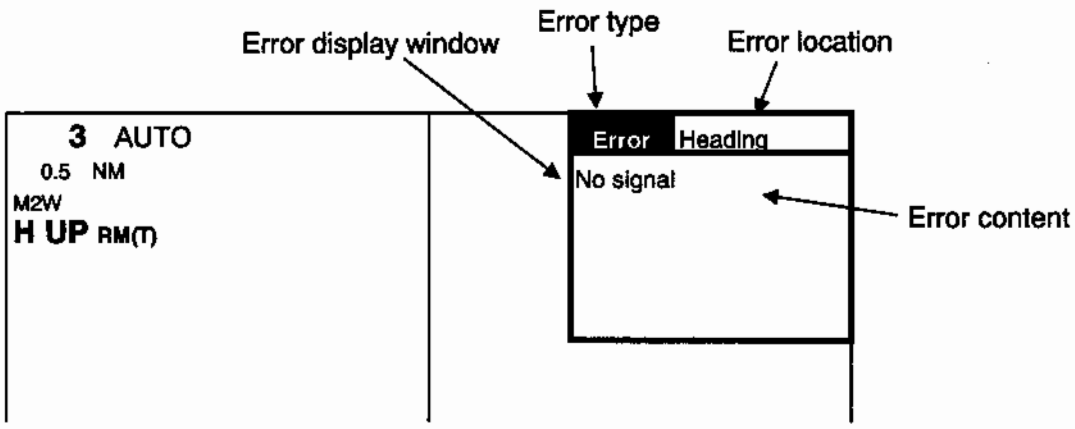


Figure 6.1 Example of Error display

6.2.1.1 Error display list

Table 6.1 Error display list

Error location	Error status	Cause
Antenna	Not connected	Antenna connecting cable is disconnected.
	Magnetron high voltage	TXHV fuse blown, Transmitter PCB malfunction
	Magnetron current	TXHV fuse blown, Magnetron end of life
	Magnetron heater current	Magnetron malfunction, Transmitter PCB malfunction
Echo	No azimuth signal	Motor fuse blown, Transmitter PCB malfunction
	No heading line signal	Motor fuse blown, Transmitter PCB malfunction
	No trigger signal	Transmitter PCB malfunction
	No video signal	Front-end malfunction, IF Amp. malfunction
	No ARPA signal	
Heading	No signal	HDT, HDG, HDM, VTG, RMC, or RMA signal is not received.
Speed	No signal	VHV, VHW, VBW, VTG, RMC, or RMA signal is not received.
Panel	Not connected	Operating unit connector is not connected.
	Checksum	There is strong noise source near the operation table.
ATA	Not connected	Integrated ATA PCB is not connected.
AIS	Not connected	Integrated AIS PCB is not connected.
Inter-switch	Not connected	The data cable between two display units is not connected.
Preset	No data	No setup value was found in INITIALIZE=> USER SET LOAD or EXT LOAD.
Memory	Flash memory writing	Setup value could not be saved normally to flash memory in INITIALIZE=>SETUP SAVE.
Serial port	Download	External load operation failed in Menu INITIALIZE=> EXT
	Upload	External save operation failed in Menu INITIALIZE=> EXT SAVE.
	Checksum	Checksum error occurred in NMEA received data (displayed in maintenance).

6.2.1.2 Alarm display list

Table 6.2 Alarm list

Error location	Error status	Cause
Alarm 1	Detection	Target entered in (left from) the Alarm 1 zone.
Stabilization	Changed to sea stabilization. Please confirm heading, speed, set, drift, and COG/SOG input.	Speed over ground failed to be input under use of ground stabilization. This appears when error has occurred in a sensor of speed over ground such as GPS, or when depth becomes too large to input a speed over ground by Doppler log.
Display mode	Changed to head up mode, Please confirm heading, and speed input.	Heading related signals such as HDT, HDG, HDM, VTG, RMC, RMA cannot be input in display mode except H-UP.
Bearing	Changed to relative bearing. Please confirm heading input.	Heading related signals such as HDT, HDG, HDM, VTG, RMC, RMA can not be input in EBL true bearing mode.
Vector	Changed to relative. Please confirm heading input.	Heading related signals such as HDT, HDG, HDM, VTG, RMC, RMA cannot be input in EPA/ATA [True] vector mode.
Chart	No own ship information. Please confirm heading, and latitude/longitude input.	Heading, speed and latitude/longitude signal cannot be input during chart display.
ATA/EPA	CPA/TCPA	Both CPA/TCPA values of a tracked target dipped from specified CPA/TCPA value.
	Guard zone	Tracked target entered into guard zone.
	Lost target	ATA tracked target is lost.
	EPA target is not updated.	Second mark is not applied during EPA.
NAVE LINE	NAVE LINE is crossed.	Own ship crossed specified NAVE LINE.
Alarm 2	Detect	Target entered into (left from) Alarm 2 zone.
AIS	CPA/TCPA	Both CPA/TCPA values of AIS target dipped from specified CPA/TCPA alarm value.
	ALR 1 TX malfunction	Malfunction of AIS transmitter
	ALR 2 Antenna VSWR exceeds limit	Deviation of VSWR of AIS antenna is too much.

AIS	ALR 3 Rx channel 1 malfunction	Malfunction of receiver channel 1
	ALR 4 Rx channel 2 malfunction	Malfunction of receiver channel 2
	ALR 5 Rx channel 70 malfunction	Malfunction of receiver channel 70
	ALR 6 General failure	Generic malfunction of AIS
	Guard zone	AIS target entered into guard zone.
	Lost target	AIS target is lost.
	No AIS data Please confirm AIS board.	AIS connector is not connected.
	More than 100 targets	AIS targets exceed 100.
	No own ship information. Please confirm heading, latitude/longitude input.	Heading, speed and latitude/longitude signals could not be input during use of AIS.

6.2.1.3 Warning display list

Warning is displayed when the function is not available because of lack of information required for its operation.

Table 6.3 Warning

Error status	Cause
No heading input	Attempted to select display mode other than H-UP without heading input.
Neither heading nor latitude/longitude input	Attempted to set mark without heading and latitude/longitude input.
Neither heading nor speed input	Attempted to acquire ATA without heading and speed input.
No speed input	Attempted to acquire ATA without speed input.
No AIS interface connection	AIS PCB is not installed.
No more ATA targets can be acquired.	Attempted to acquire targets exceeding acquisition number specified in ATA/EPA>manual acquisition number.
No target	Attempted to select a tracking target from wrong position.
Out of range	Attempted to acquire ATA beyond 48 miles.
No cursor	Attempted to select a target without cursor.
Insufficient EPA elapsed time. Wait 30 sec.	Attempted to mark next one before the elapsed time has come up to 30 sec. after previous marking by EPA.
No more marks can be specified..	Attempted to input marks exceeded 50 on the chart.
Inter-switch mode was changed	Inter-switch mode is changed.
Out of specified zoom range. Or, Zoom is unavailable in the minimum range.	Attempted to zoom out of zoom range.
Pre-heating	Attempted to transmit during pre-heating.

6.2.2 Status indicator lamp

Three LED (Light Emitting Diodes) lamps are provided on the logic PCB in the display unit. The operational conditions are indicated by these LED's. Refer to the following table for details.

Table 6.4 Status indicator lamps

LED No.	Content	Operation status	LED status
DS1	Software status	Normal	ON
		Error	OFF
DS2	Hardware status	Normal	ON
		Error	OFF
DS3	FPGA status	Normal	Flashing
		Error	ON (OFF)

Location of status indicator lamp

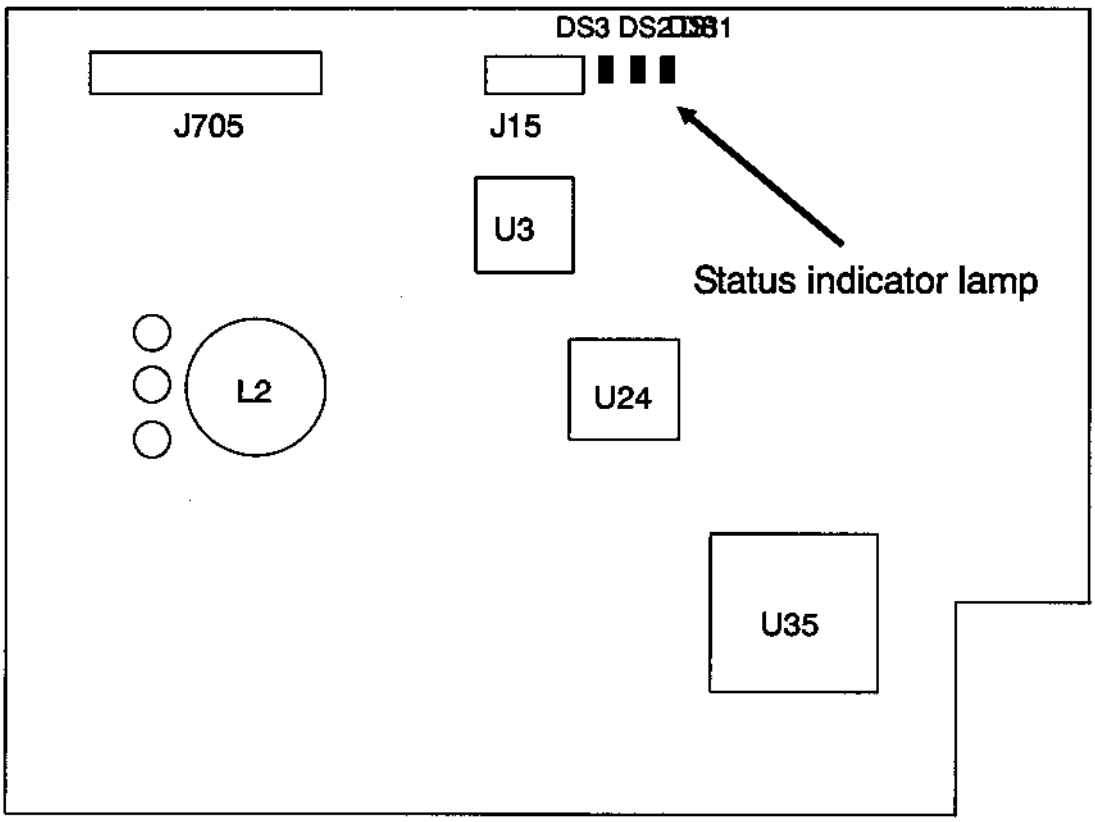


Figure 6.2 Status indicator lamp location

6.3 Malfunction diagnosis

This chapter specifies necessary information required troubleshooting and repair of the radar system.

6.3.1 Malfunction detection step

As a first step of on-board repair, refer to the following tables describing outlines of malfunction diagnosis procedure.

Table 6.5 basic malfunctions

Failure status	Possible cause	Measure
No power.	1. Power cable is disconnected. 2. Supply power is out of range. 3. Main power fuse is blown.	1. Connect power cable firmly and secure connector. 2. Use proper power source. 3. Change fuse to new one.
Power is applied but no display	1. Screen brilliance is adjusted to the minimum. 2. Failure of LCD unit 3. Failure of LCD driver unit	1. Rotate brilliance knob clockwise to adjust properly. 2. Request repair. 3. Request repair.

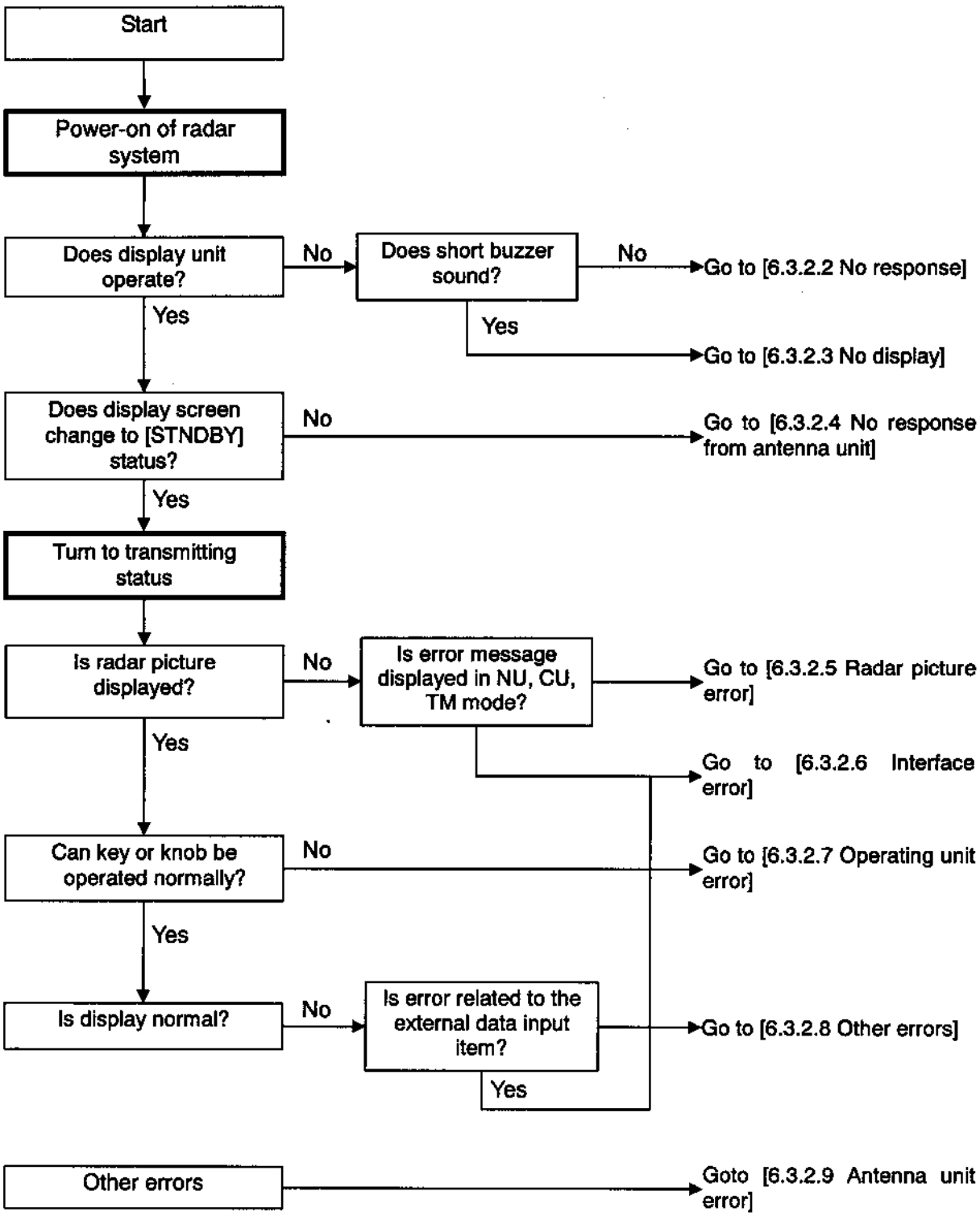
Table 6.6 possible malfunctions

Error status	Possible cause	Measure
Picture is dark.	1. Adjustment of display brilliance is incorrect. 2. Failure of LCD driver circuit	1. Press [Brilliance] key and adjust to proper brilliance. 2. Request repair
No radar picture is displayed.	1. Receiver is detuned. 2. Video contrast adjustment error 3. Failure of transceiver	1. Readjust by referring to chapter [4.1.3]. 2. Readjust by referring to chapter [4.4]. 3. Request repair
Picture is too weak.	1. Receiver is detuned. 2. Failure of Magnetron or MIC (front-end)	1. Readjust by referring to chapter [4.1.3]. 2. Request repair
Markers (Heading, EBL, VRM, Range Rings, Parallel index, Alarm range) are not displayed.	1. Improper marker brilliance adjustment. 2. Failure of Logic PCB	1. Readjust by referring to chapter [4.4]. 2. Request repair
Heading line is not displayed.	1. No heading line signal input.	1. Check [BP/HG] signal between an antenna unit and a display unit.
Antenna does not rotate.	1. Motor fuse is blown. 2. Motor power is not supplied. 3. Motor brush is worn out.	1. Replace fuse to a new one. 2. Check motor power connection. 3. Replace motor brush to a new one.

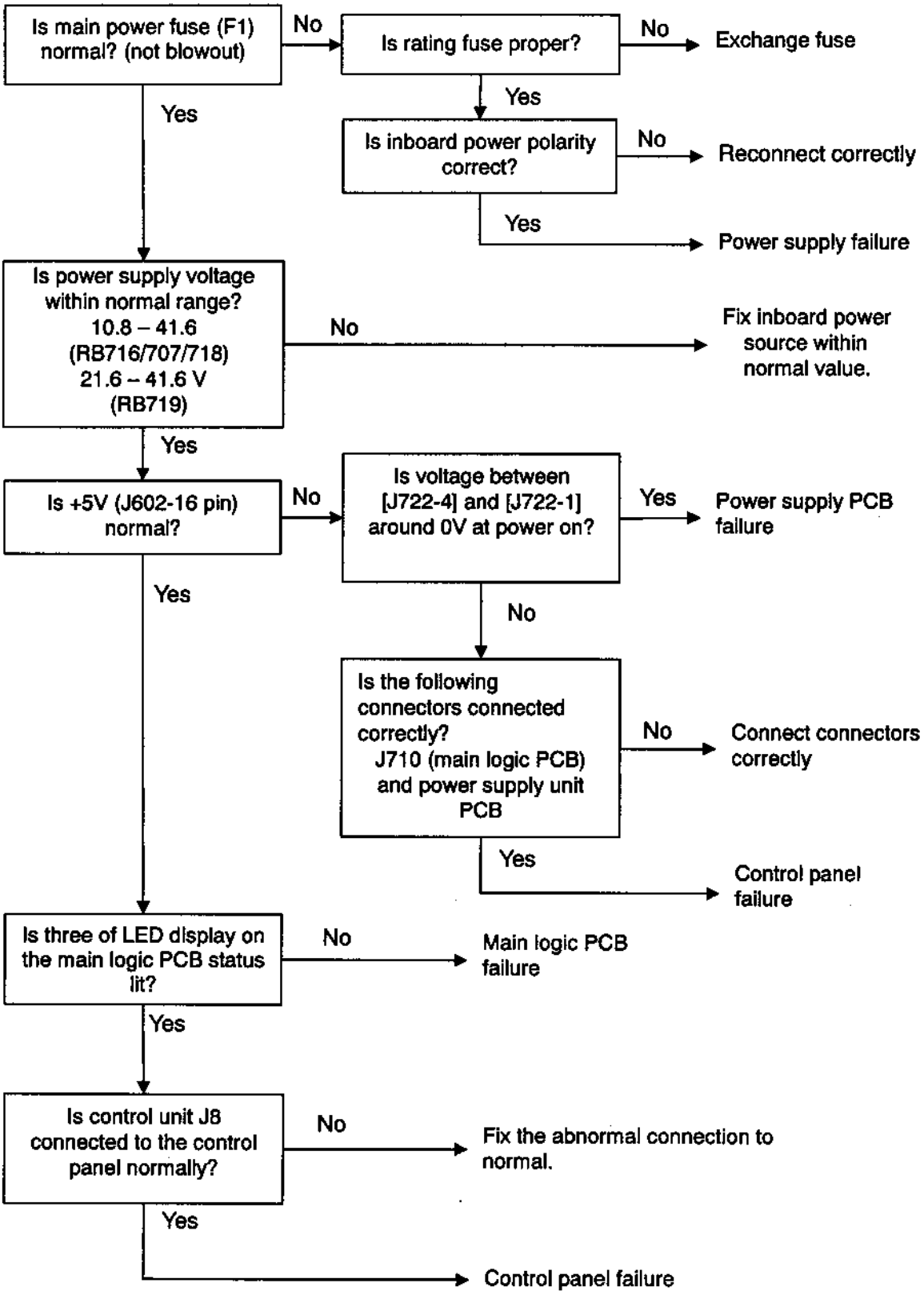
6.3.2 Malfunction diagnosis flow chart

The following malfunction analysis chart can be used by service personnel for malfunction diagnosis and location of defect module. This chart shows flow chart of analysis procedure of basic malfunction analysis to details.

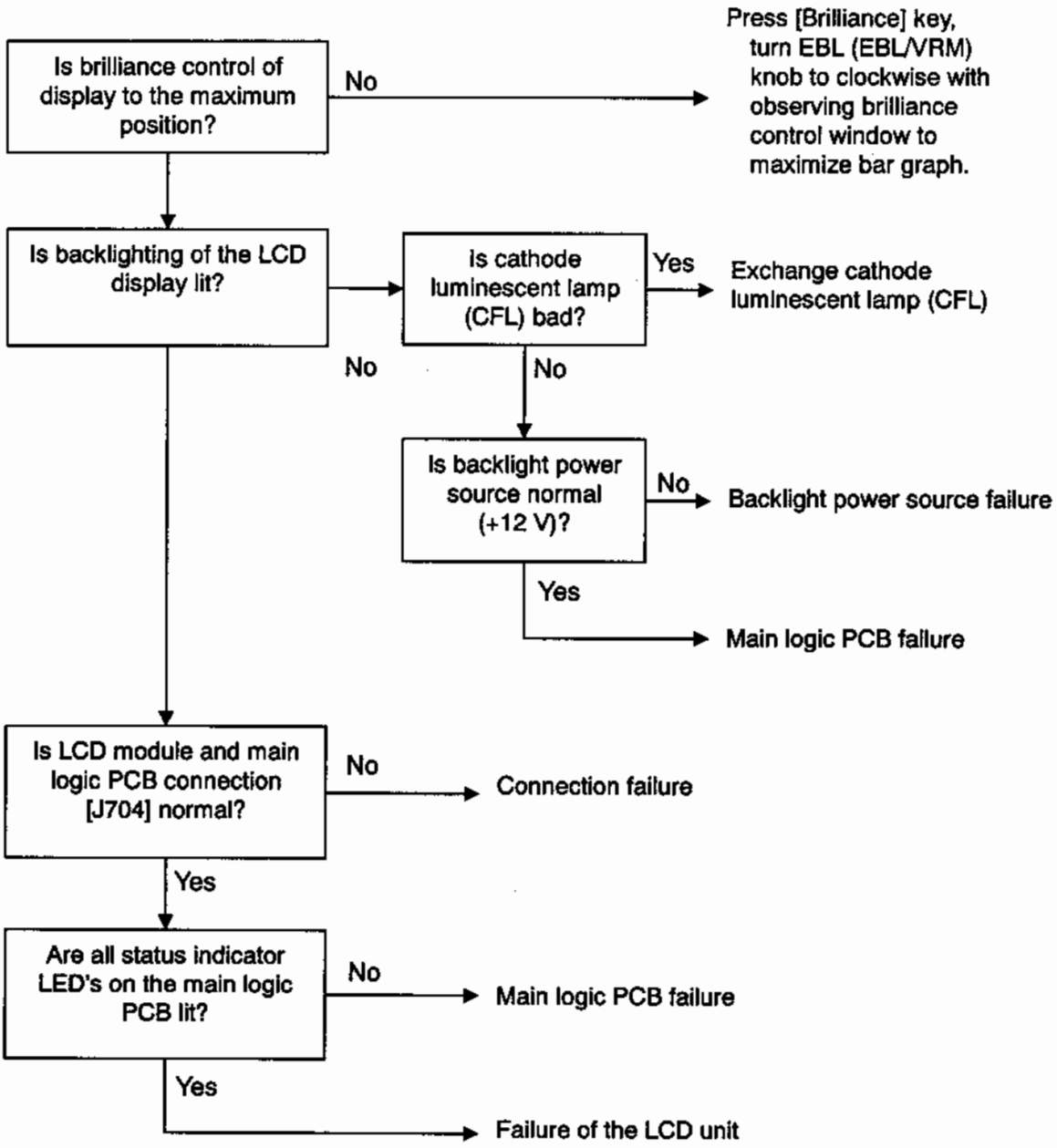
6.3.2.1. Initial malfunction diagnosis 1



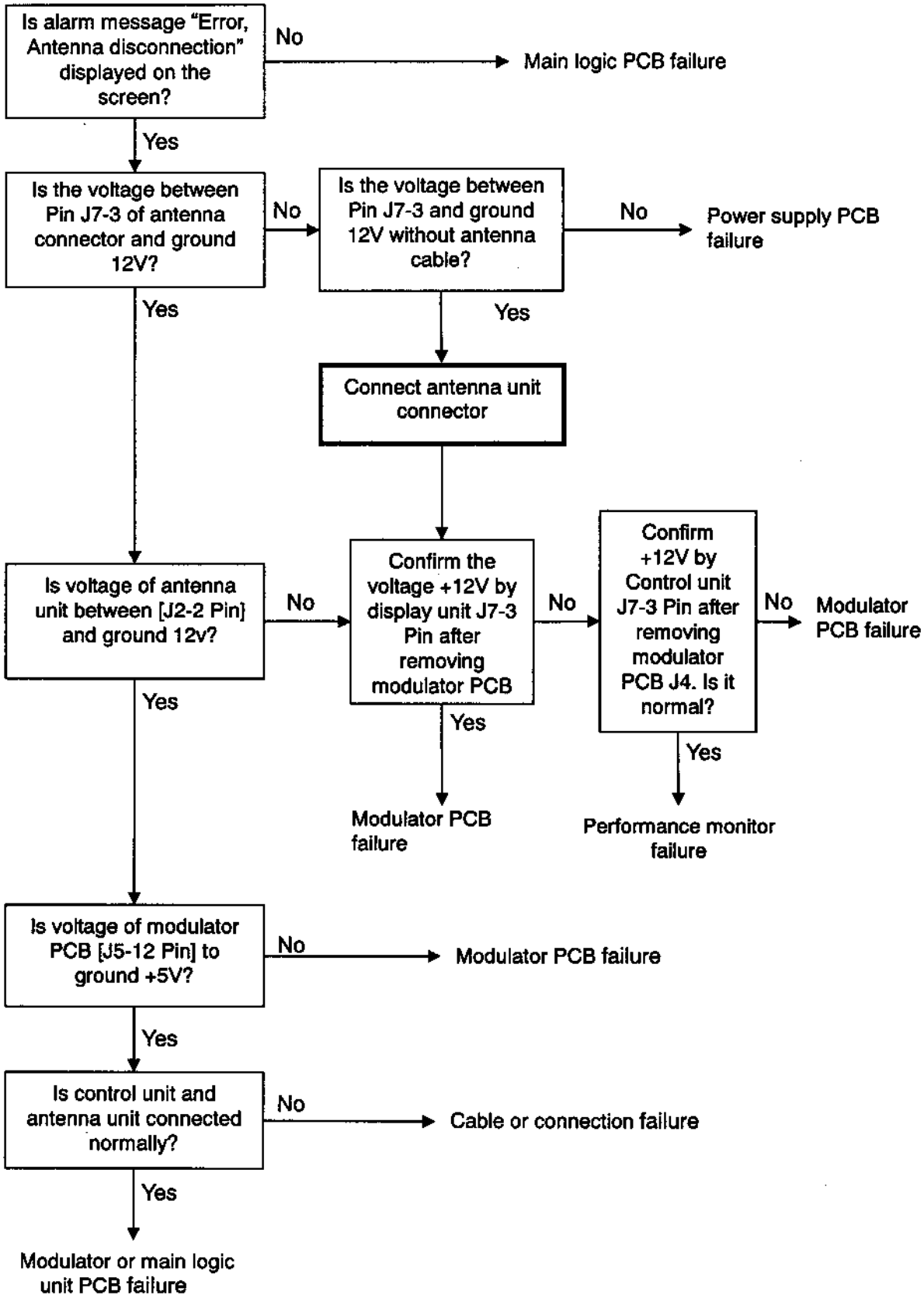
6.3.2.2. Initial malfunction diagnosis 2



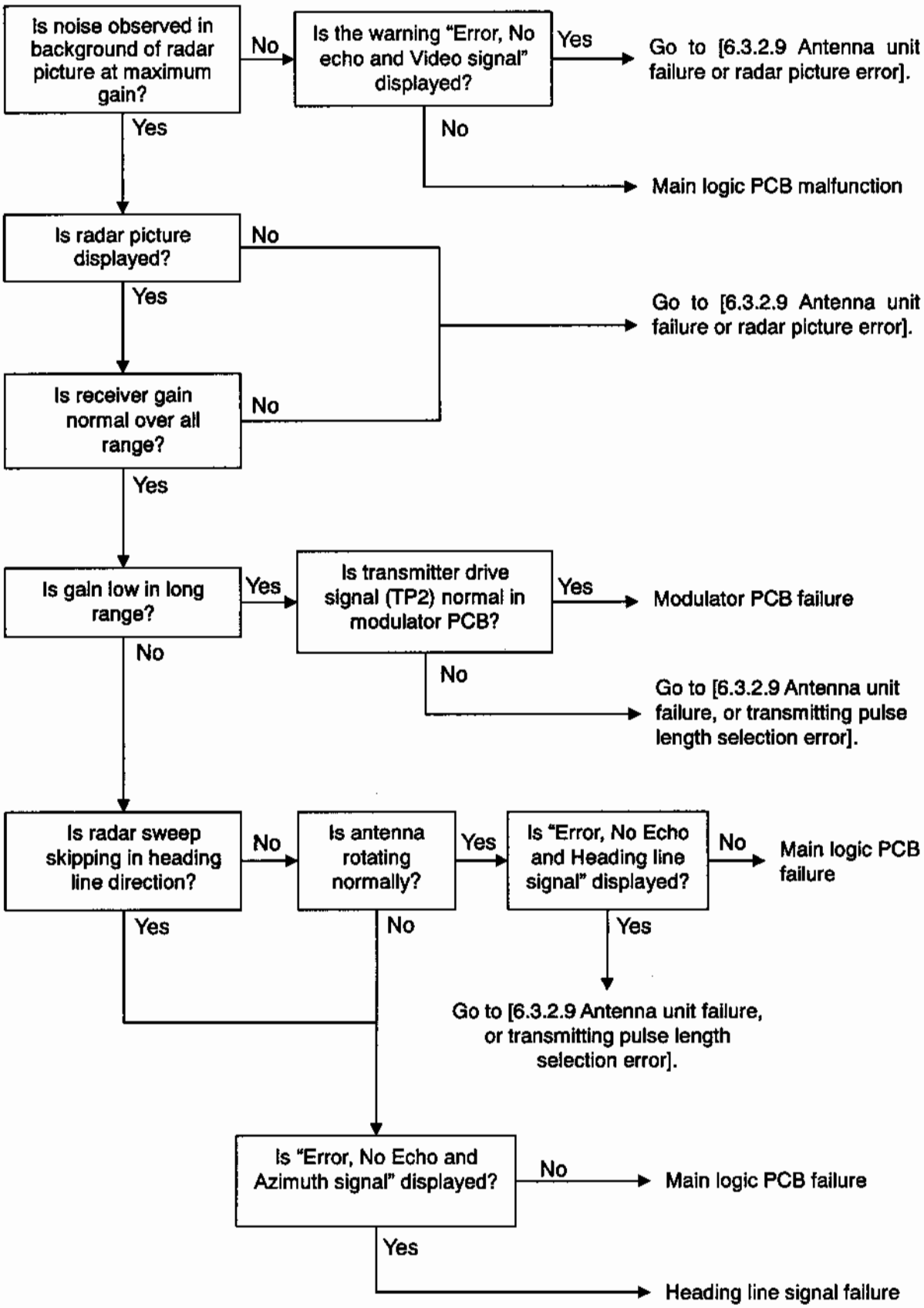
6.3.2.3. No display



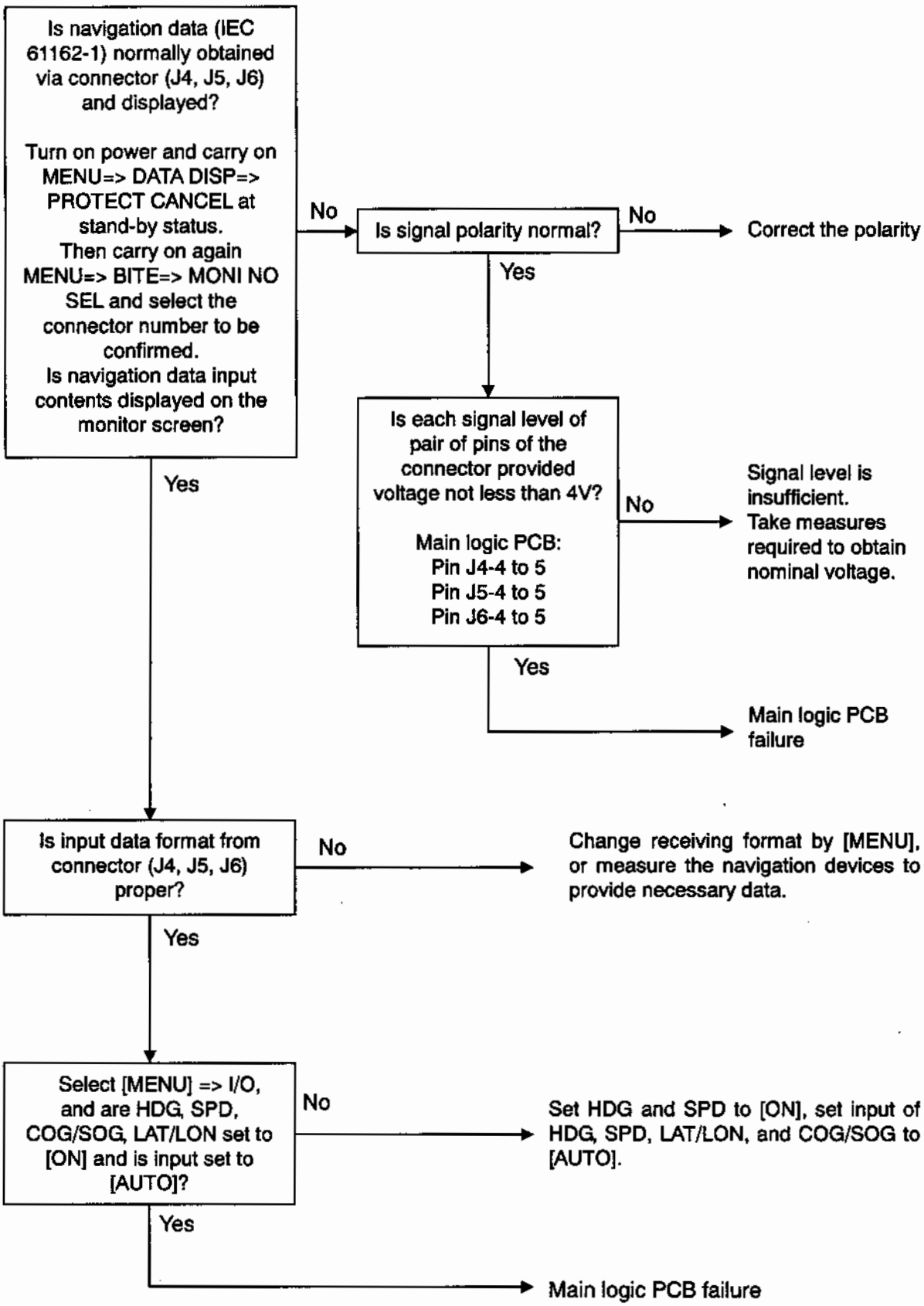
6.3.2.4 No response from the antenna unit



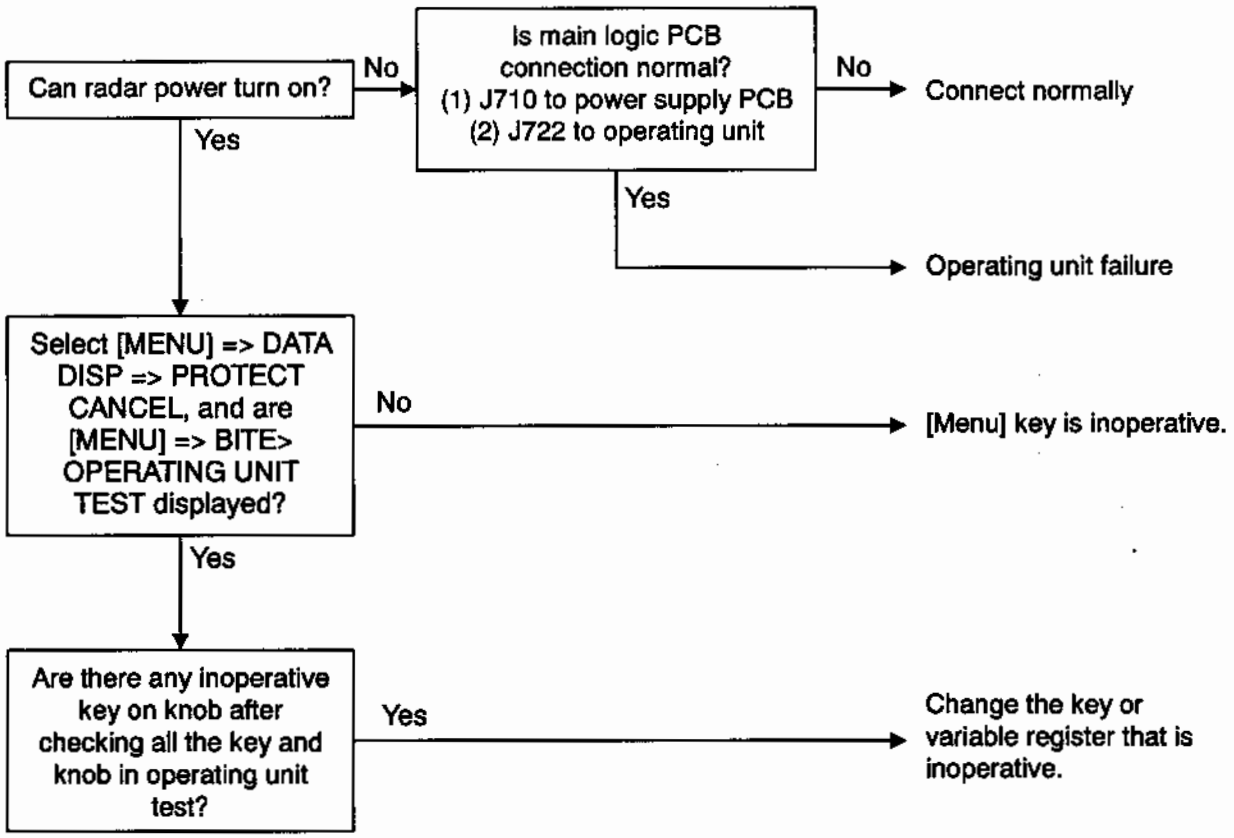
6.3.2.5. Radar picture error



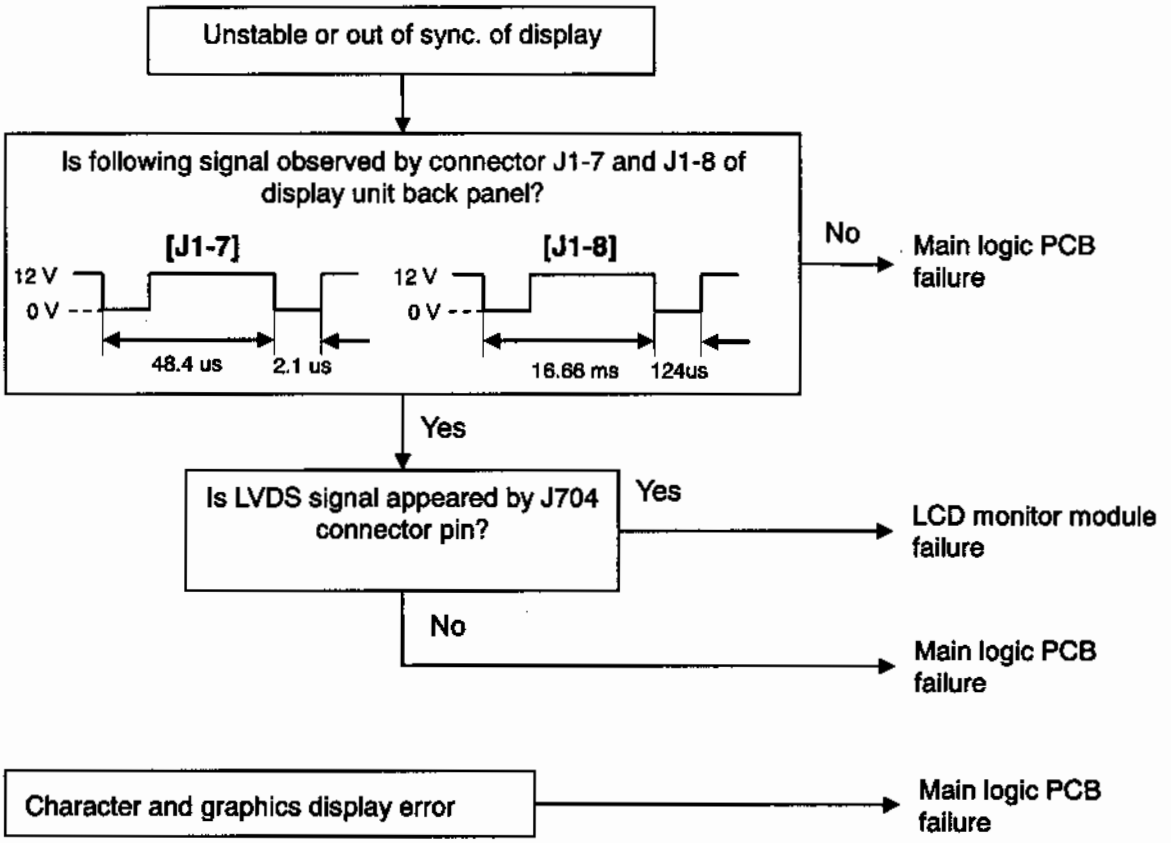
6.3.2.6. Data such as heading, speed, latitude/longitude cannot be received



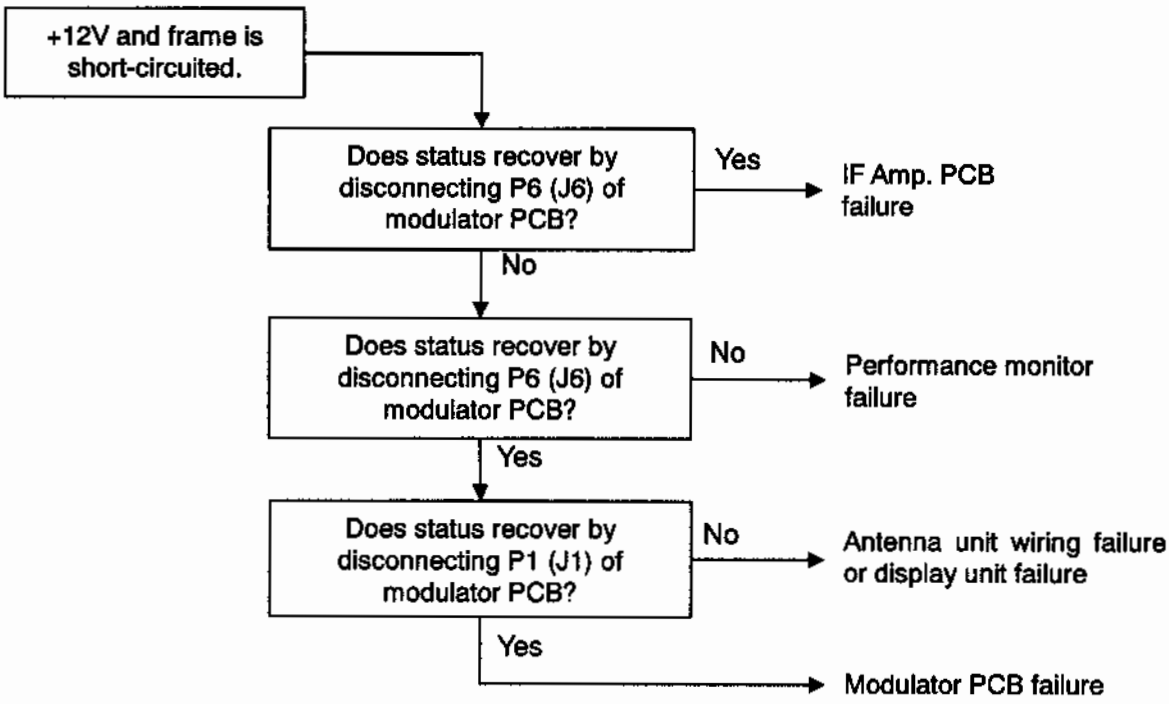
6.3.2.7. Operating unit error



6.3.2.8. Other errors



6.3.2.9. Antenna unit error



+250 V and frame is shorted

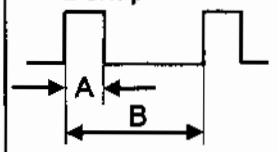
Does status recover by disconnecting J2 connector from modulator PCB?

No → Antenna unit wiring failure or display unit failure

Yes → Modulator PCB failure

Pulse length control failure

TP2 shape



Pulse length	A(ns)	B(ms)
SP	100	0.5
M1	200	0.67 or 0.77
M2	550	1 or 1.25
LP	1050	2 or 2.5

Is transmitter unit drive signal (modulator PCB TP2) normal?

Yes → Modulator PCB failure

No

Is +24V (modulator PCB PinJ1-1) normal?

No → Antenna unit wiring failure or display unit failure

Yes → Modulator PCB failure

Antenna does not rotate.

Is display unit fuse (F2) blowout?

Blowout → Change fuse to a new one.

Not blowout

Is antenna rotating normally?

Yes → End

No

Can antenna rotate by hand?

No → Please check the following points and measure.
1) Rope is winding around antenna.
2) Failure of rotating mechanism such as "Gear unit".

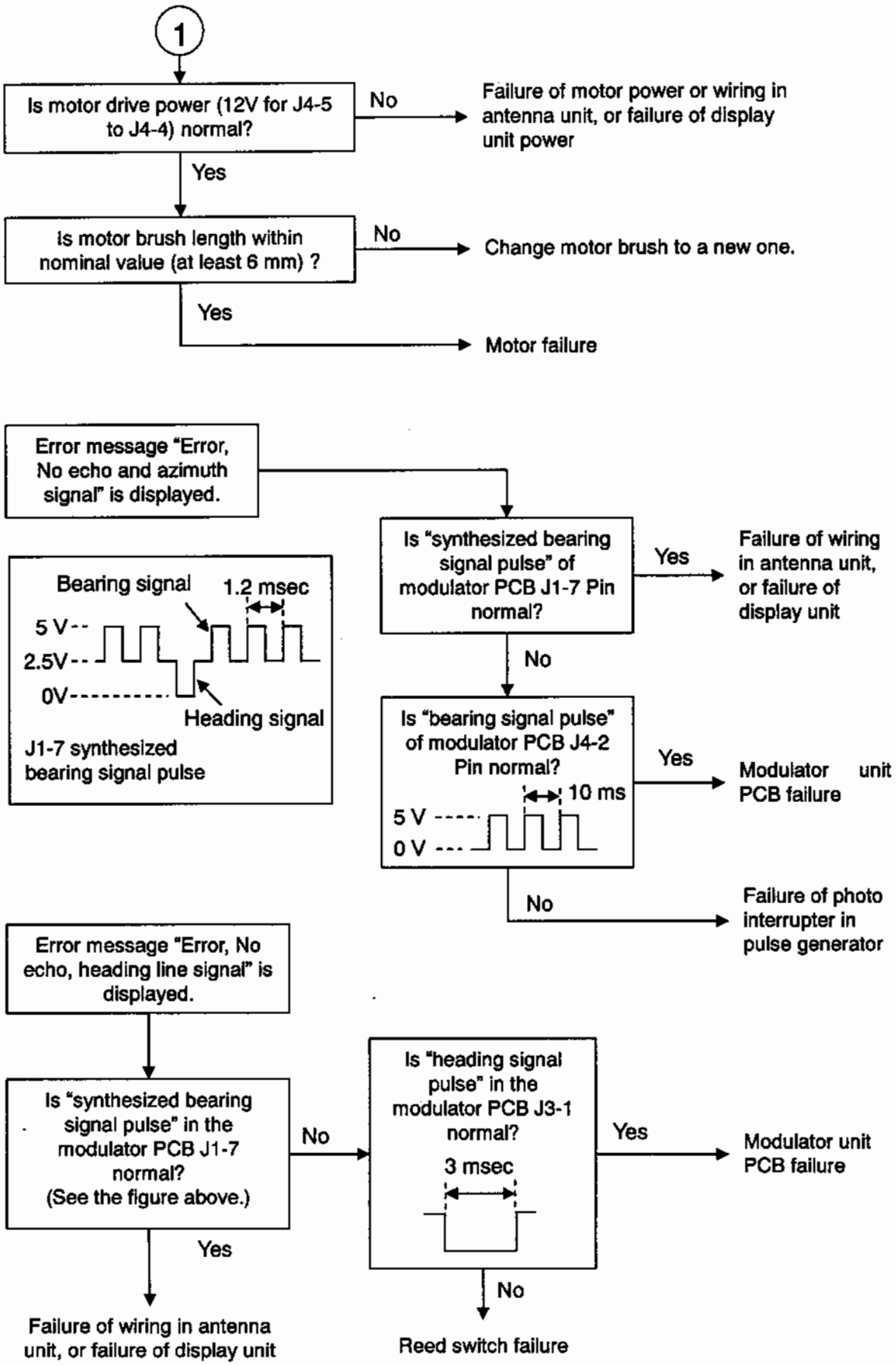
Yes

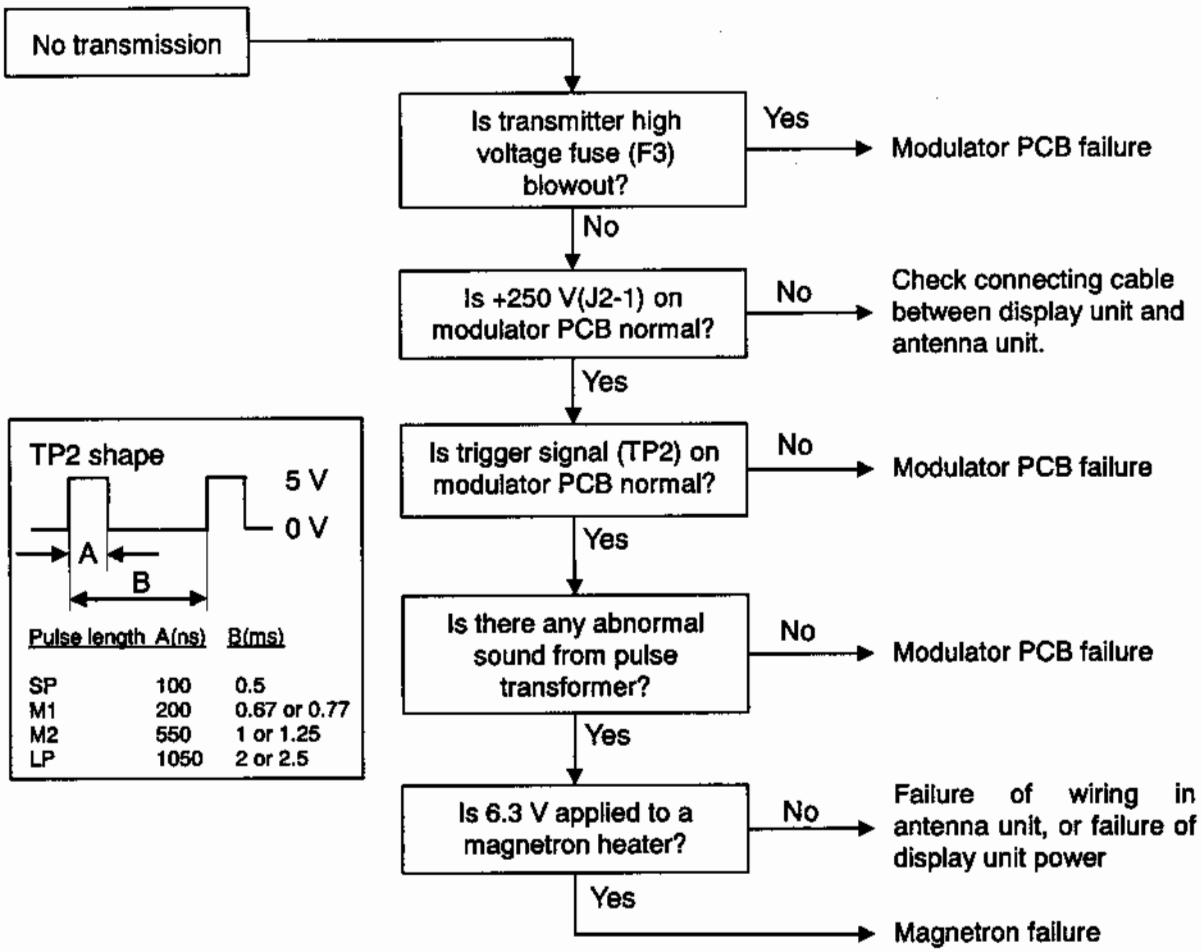
Does the status recover after removing connector from modulator PCB P4 (J4)?

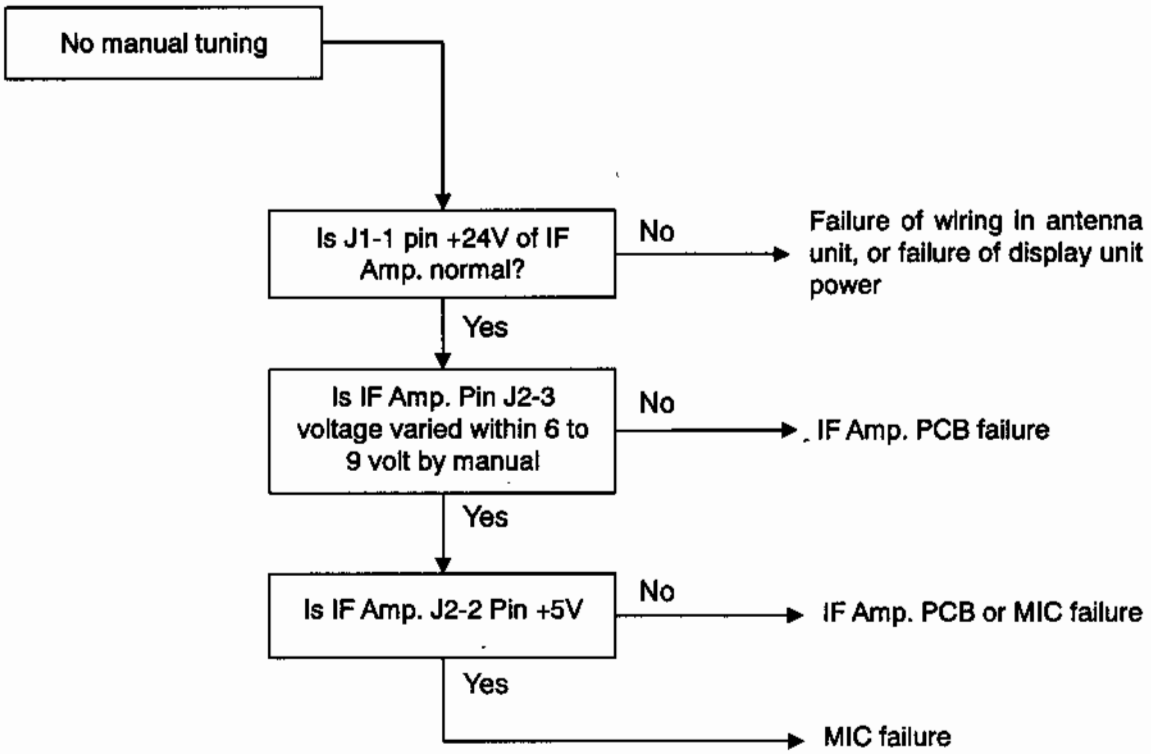
No → Failure of motor power or wiring in antenna unit, or failure of display unit power

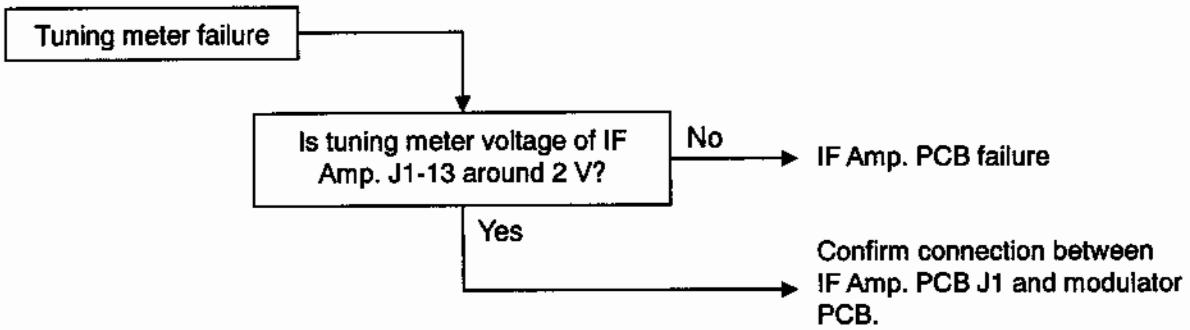
Yes → Motor failure

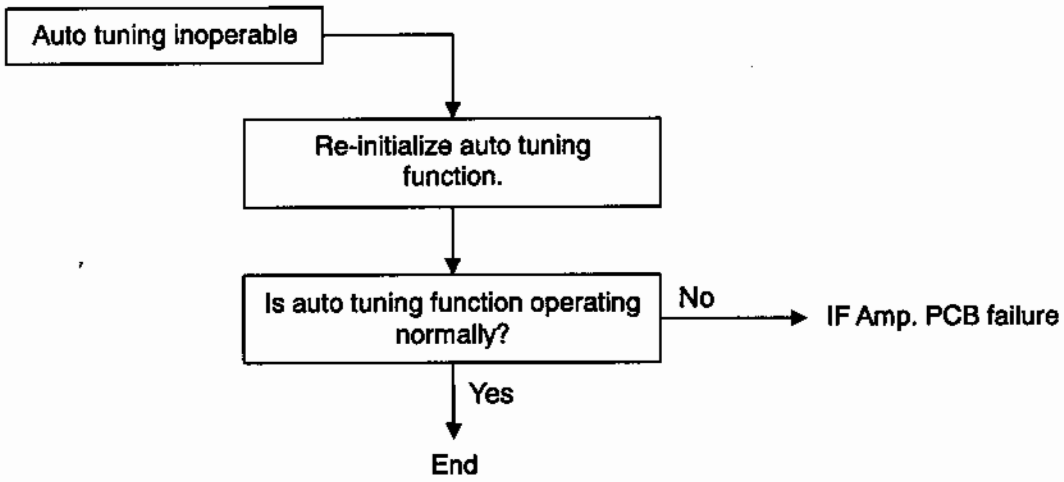
(1)

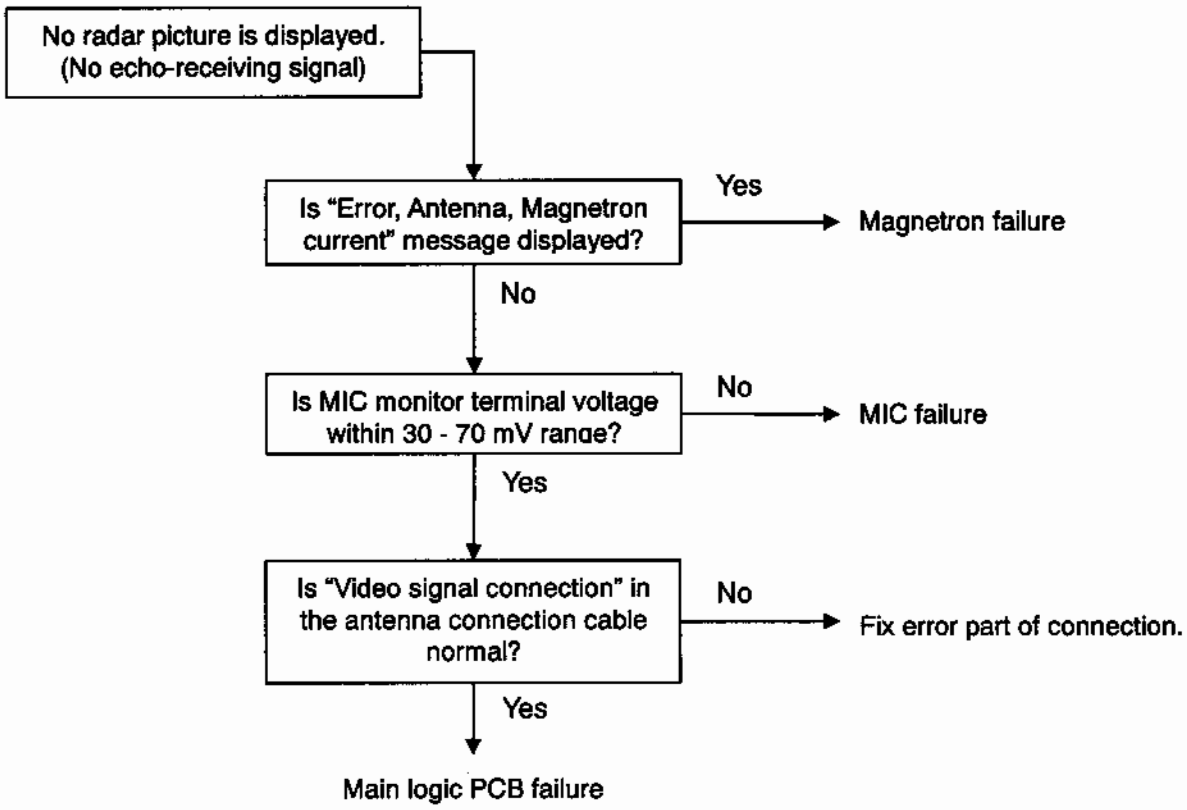

1
Is motor drive power (12V for J4-5 to J4-4) normal?
No
Failure of motor power or wiring in antenna unit, or failure of display unit power
Yes
Is motor brush length within nominal value (at least 6 mm) ?
No
Change motor brush to a new one.
Yes
Motor failure
Error message "Error, No echo and azimuth signal" is displayed.
Is "synthesized bearing signal pulse" of modulator PCB J1-7 Pin normal?
Yes
Failure of wiring in antenna unit, or failure of display unit
Bearing signal
1.2 msec
5 V
2.5V
0V
Heading signal
J1-7 synthesized bearing signal pulse
No
Is "bearing signal pulse" of modulator PCB J4-2 Pin normal?
Yes
Modulator unit PCB failure
10 ms
5 V
0 V
No
Failure of photo interrupter in pulse generator
Error message "Error, No echo, heading line signal" is displayed.
Is "synthesized bearing signal pulse" in the modulator PCB J1-7 normal? (See the figure above.)
No
Is "heading signal pulse" in the modulator PCB J3-1 normal?
3 msec
Yes
Modulator unit PCB failure
Yes
No
Failure of wiring in antenna unit, or failure of display unit
Reed switch failure

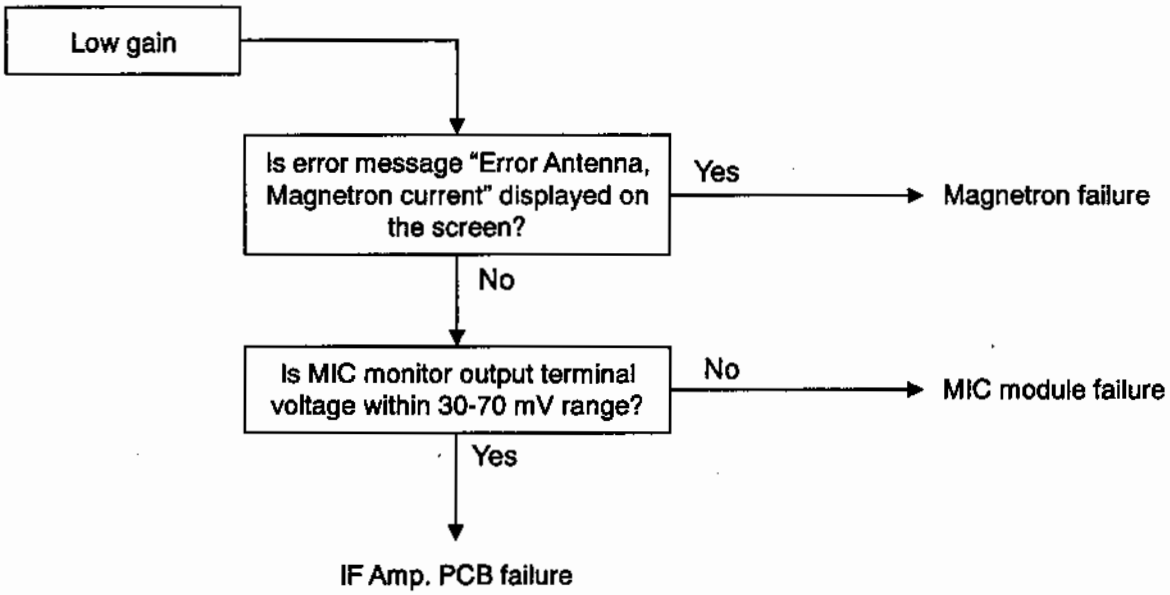

No transmission
Is transmitter high voltage fuse (F3) blowout?
Yes
Modulator PCB failure
No
Is +250 V(J2-1) on modulator PCB normal?
No
Check connecting cable between display unit and antenna unit.
Yes
Is trigger signal (TP2) on modulator PCB normal?
No
Modulator PCB failure
Yes
Is there any abnormal sound from pulse transformer?
No
Modulator PCB failure
Yes
Is 6.3 V applied to a magnetron heater?
No
Failure of wiring in antenna unit, or failure of display unit power
Yes
Magnetron failure
TP2 shape
5 V
0 V
A
B
Pulse length A(ns) B(ms)
SP 100 0.5
M1 200 0.67 or 0.77
M2 550 1 or 1.25
LP 1050 2 or 2.5


No manual tuning
Is J1-1 pin +24V of IF Amp. normal?
No
Failure of wiring in antenna unit, or failure of display unit power
Yes
Is IF Amp. Pin J2-3 voltage varied within 6 to 9 volt by manual
No
IF Amp. PCB failure
Yes
Is IF Amp. J2-2 Pin +5V
No
IF Amp. PCB or MIC failure
Yes
MIC failure


Tuning meter failure
Is tuning meter voltage of IF Amp. J1-13 around 2 V?
No
IF Amp. PCB failure
Yes
Confirm connection between IF Amp. PCB J1 and modulator PCB.


Auto tuning inoperable
Re-initialize auto tuning function.
Is auto tuning function operating normally?
No
IF Amp. PCB failure
Yes
End


No radar picture is displayed. (No echo-receiving signal)
Is "Error, Antenna, Magnetron current" message displayed?
Yes
Magnetron failure
No
Is MIC monitor terminal voltage within 30 - 70 mV range?
No
MIC failure
Yes
Is "Video signal connection" in the antenna connection cable normal?
No
Fix error part of connection.
Yes
Main logic PCB failure


Low gain
Is error message "Error Antenna, Magnetron current" displayed on the screen?
Yes
Magnetron failure
No
Is MIC monitor output terminal voltage within 30-70 mV range?
No
MIC module failure
Yes
IF Amp. PCB failure

6.4 On-board repair

6.4.1 Replacement of fuse

The location of the fuses is on the back panel of display unit.

Fuse type and rating

Application	Type, dimension (mm)	Fuse characteristic	Rating
Main power	Tubular (ϕ6.3 x 32)	Normal blow	15 A
Modulator high voltage	Tubular (ϕ5 x 20)	Normal blow	0.3 A
Antenna drive motor	Tubular (ϕ5 x 20)	Normal blow	5 A

Fuse location

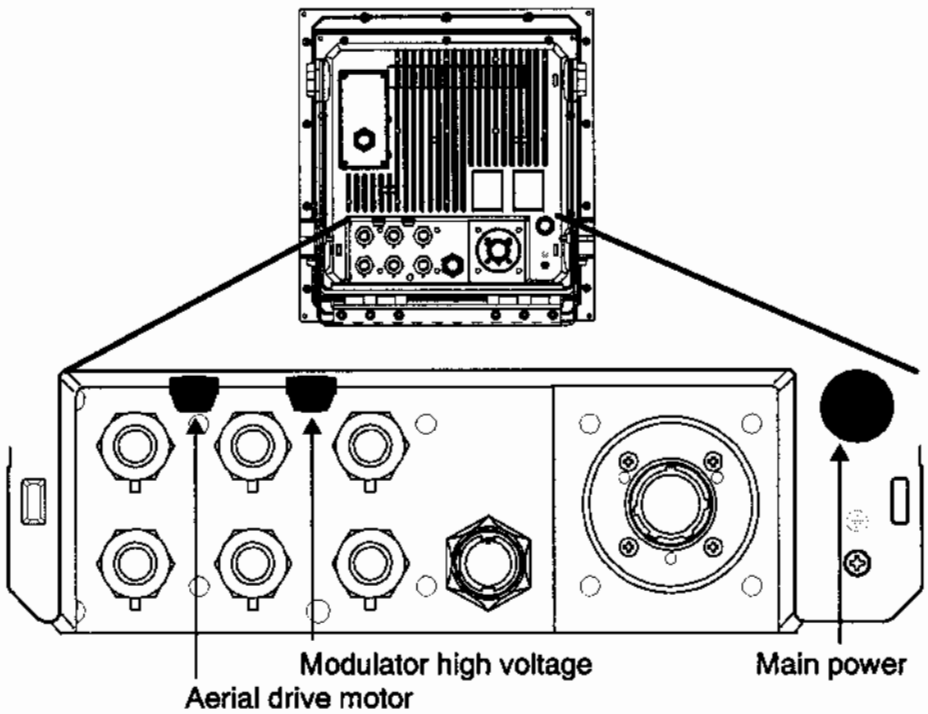


Figure 6.3 Fuse location on display unit back panel

Chapter 7 Maintenance

7.1 Regular service and cleaning up

Periodic inspection and cleaning is essential to keep the radar system in the good working order for the life of the radar.

7.1.1 Monthly Inspection

(1) Check whether there is any dirt or soot on the radiating part of the antenna unit. If any, wipe it with soft cloth soaked in water or soap detergent. Also make sure no cracks or coating material is on the front radiation part of antenna unit.

> Never turn on the power of radar system under inspection.

(2) Wipe the radar screen with cloth soaked in static electricity inhibitor if dirty. Avoid using a dry cloth since it will generate static electricity resulting in the accumulation of dust.

7.1.2 Annual Inspection

Inspect the antenna motor brushes in the transceiver unit every 2,000 operating hours. Replace with a new brush if the brush length is less than 6 mm.

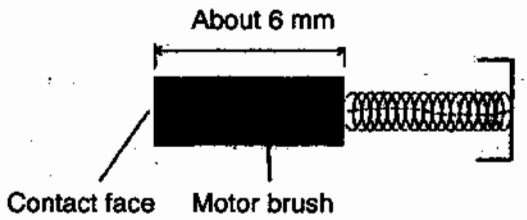
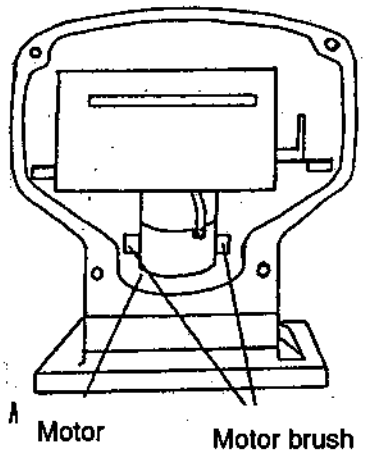


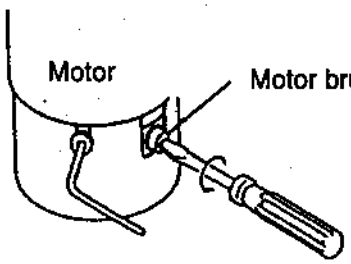
Figure 7.1 instructions for changing the motor brushes

(1) Remove the cover at the forward side of the antenna unit by unscrewing the mounting screw. The antenna drive motor is located inside the lower side of the housing.
(2) Remove the old motor brush using the slotted screwdriver. (Refer to Figure 7.2).
(3) Fit the screw to the slot and rotate slowly to counter clockwise. Both of the brushes should be changed simultaneously.
(4) Insert new brushes and rig them with a reverse sequence.

> **Warning:** To prevent electric shock, be sure to turn off the radar system power before opening the cover of the antenna unit.

Internal structure of the antenna housing





Turn the screw slowly to counter clockwise using a screwdriver to remove old motor brush.

Figure 7.2 Changing the motor brushes

Chapter 8 Input/output data

8.1 Input data

8.1.1 Details of the data input format.

Check sum: All the data from $ to the check sum position * is calculated by exclusive operation and used as checksum.

BWC — Bearing and distance to waypoint

$ - - BWC, , xxxx.xxx, N/S, xxxxx.xxx, E/W, x.x, T, x.x, M, x.x, N, xxx, a*hh <CR><LF>

- $: Start of sentence
- - : Talker device
- BWC : Formatter
- , : This field is not used
- xxxx.xxx, N/S : Way point latitude, N/S
- xxxxx.xxx, E/W : Way point longitude, N/S
- x.x, T : Bearing, degrees true
- x.x, M : Bearing, degrees magnetic
- x.x, N : Distance (nm) xx.xx : 00.00 ~ 09.99nm xxx.x : 010.0 ~ 999.9nm
- xxx : Way point ID
- a : Mode indicator
- *hh : Check sum
- <CR><LF>

DBT — Depth below transducer

$ - - DBT, xxxx.x, f, xxxx.x, M, xxxx.x F*hh <CR><LF>

- $: Start of sentence
- - : Talker device
- DBT : Formatter
- xxxx.x, f : Water depth, feet
- xxxx.x, M : Water depth, m
- xxxx.x F : Water depth, fathoms
- *hh : Check sum
- <CR><LF>

DPT — Depth

$ - - DPT, xxxx.x, xx.x, x.x*hh <CR><LF>

- $: Start of sentence
- - : Talker device
- DPT : Formatter
- xxxx.x : Water depth relative to the transducer, in meters
- xx.x : Offset trom tansducer, im meters
- x.x : Maximum range scale in use
- *hh : Check sum
- <CR><LF>

DTM — Datum reference

$ - - DTM, ccc, a, x.x, a, x.x, a, x.x, ccc*hh <CR><LF>

- $: Start of sentence
- - : Talker device
- DTM : Formatter
- ccc : Local datum
- a : Local datum subdivision code
- x.x, a : Lat offset, min, N/S
- x.x, a : Lon offset, min, E/W
- x.x : Altitude offset, m
- ccc : Reference datum
  - W84 : WGS84
  - W72 : WGS72
  - S85 : SGS85
  - P90 : PE90
  - 999 : user
- *hh : Check sum
- <CR><LF>

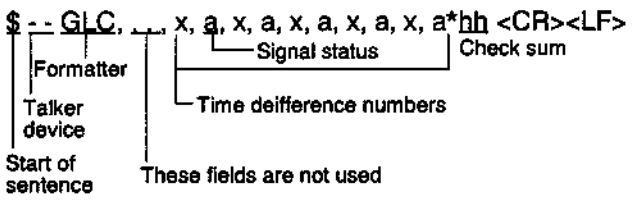
GGA — Global positioning system (GPS) fix data

$ - - GGA, hhmmss.ss, xxxx.xxx, N/S, xxxx.xxx, E/W, x, ,,,,,,,*hh <CR><LF>

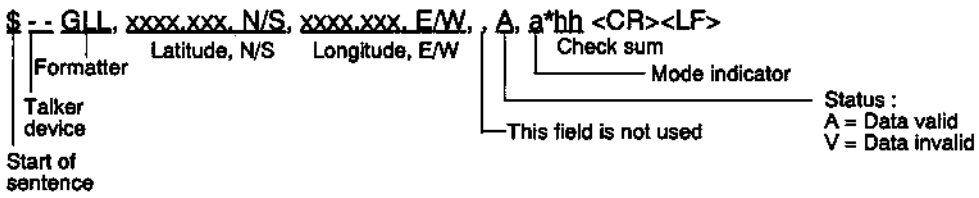
- $: Start of sentence
- - : Talker device
- GGA : Formatter
- hhmmss.ss : UTC
- xxxx.xxx, N/S : Latitude, N/S
- xxxx.xxx, E/W : Longitude, N/S
- x : GPS quality indicator
  - 0 : fix not available or invalid
  - 1 : GPS SPS mode, fix valid
  - 2 : DGPS,SPS mode, fix valid
  - 3 - 8 : Not accepted in
- ,,,,,,, : These fields are not used
- *hh : Check sum
- <CR><LF>

Note for Talker device identifer : Only GP(GPS) is accepted

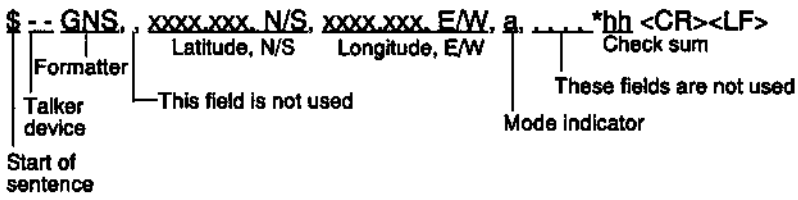
GLC — Geographic position, LORAN C



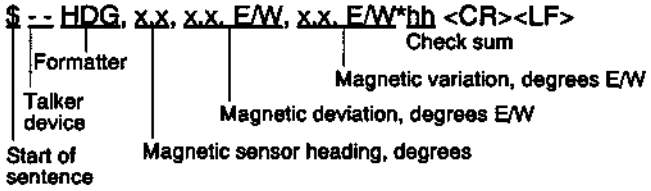
GLL — Geographic position Latitude/Longitude



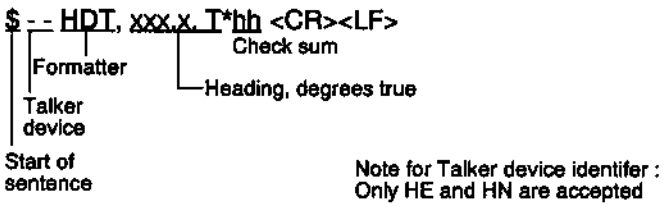
GNS — GNSS fix data



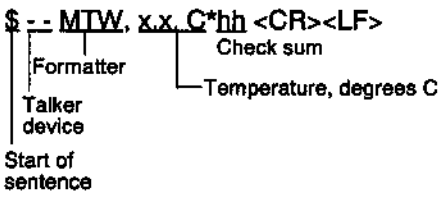
HDG — Heading, deviation and variation



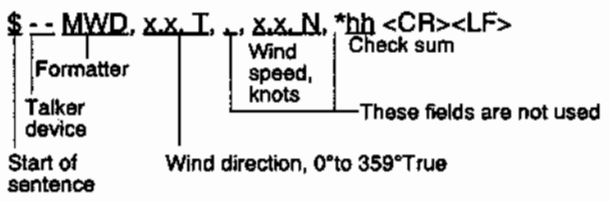
HDT — Heading true



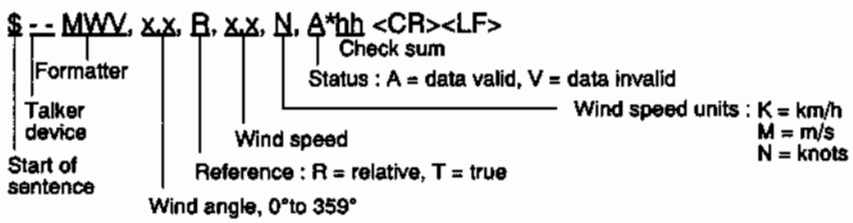
MTW — Water temperature



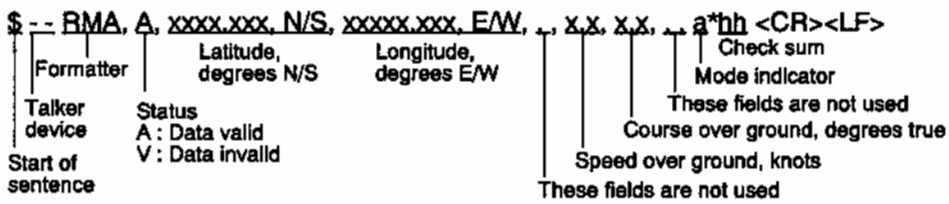
MWD Wind direction and speed



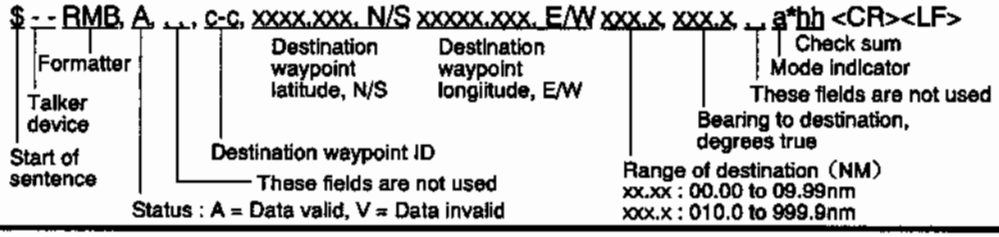
MWV Wind speed and angle



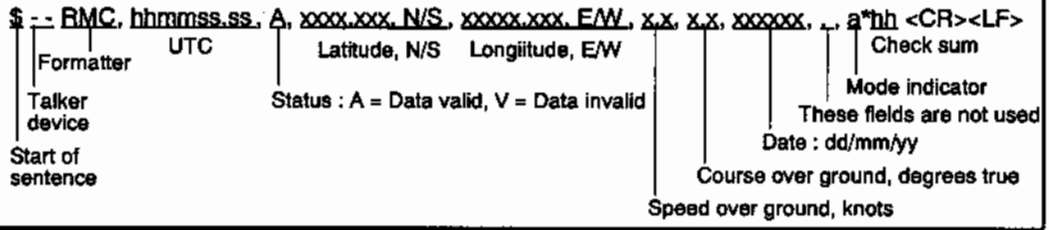
RMA Recommended minimum specific LORAN-C data



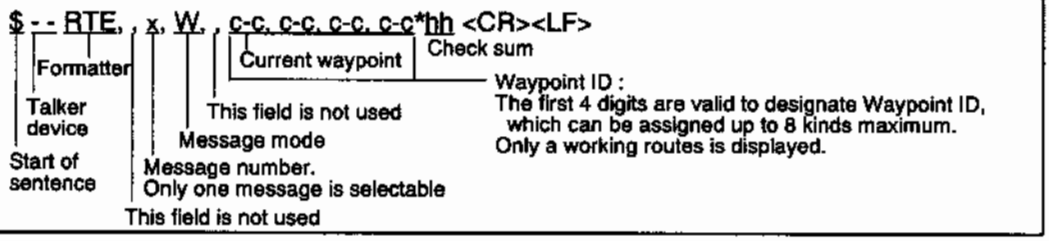
RMB Recommended minimum navigation information



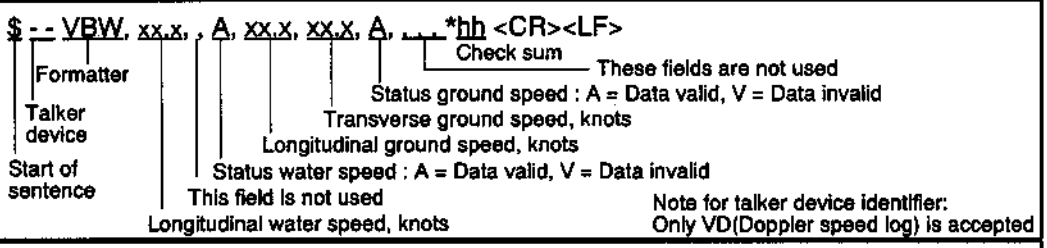
RMC Recommended minimum specific GNSS data



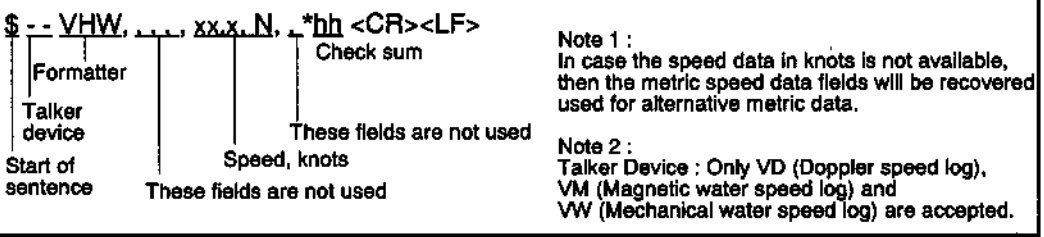
RTE Routes



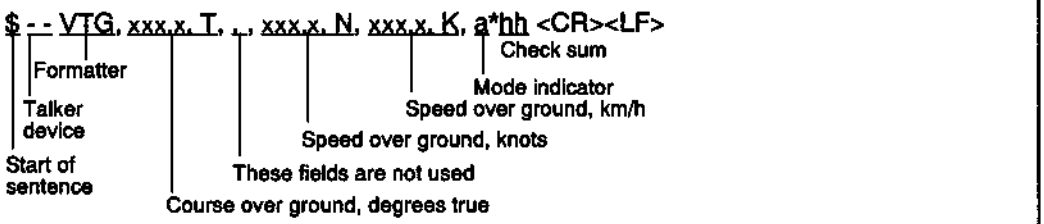
VBW — Dual ground/water speed



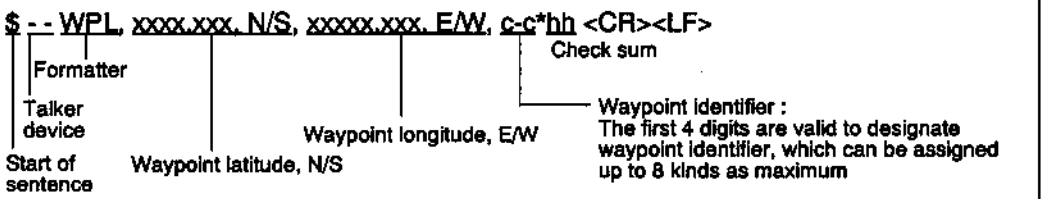
VHW — Water speed and heading



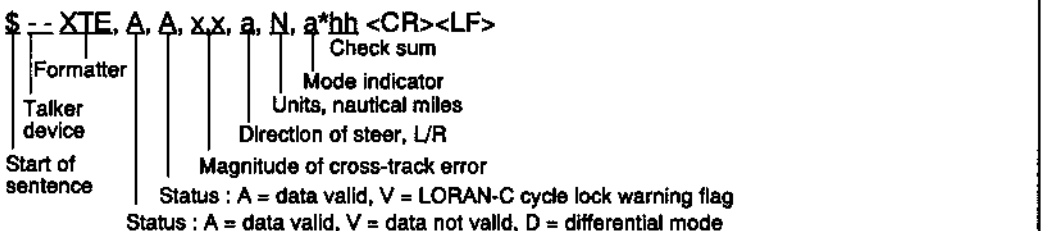
VTG — Course and ground speed



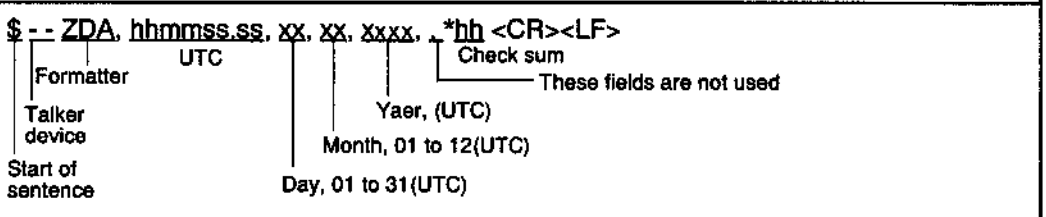
WPL — Waypoint location

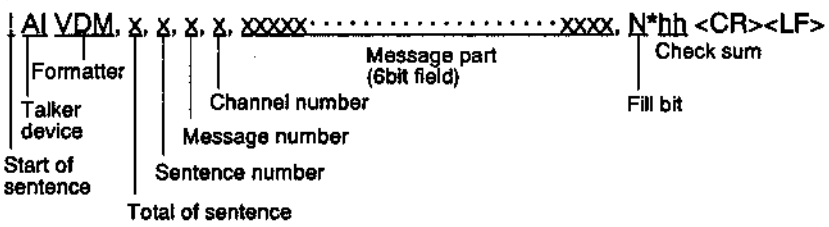


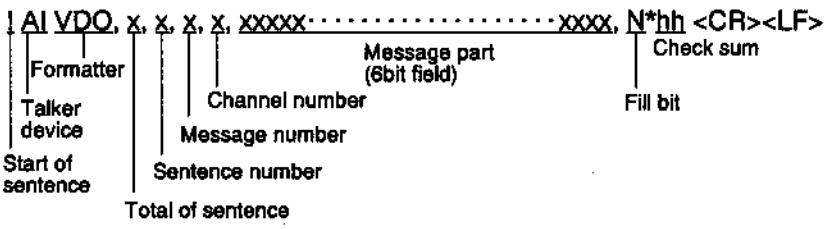
XTE — Cross-track error, measured

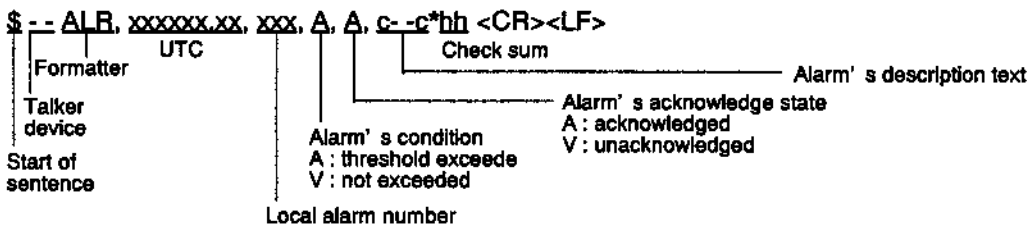


ZDA — Time and date



VDM	AIS other ship data
	

VDO	AIS own ship data
	

ALR	Set alarm state
	

8.1.2 Priority of received data

Received item	
Heading information(HDG)	HDT>HDG>HDM>VTG(True)>VTG（Magnetic）>RMC>RMA
Speed through water (SPD)	VHW>VBW(axis direction STW)
Speed over ground (SOG)	VBW(2 axis SOG)>VTG>RMC>RMA
Course over ground (COG)	VTG(True)>VTG（Magnetic）>RMC>RMA
Own ship location LOP	GLC
Own ship location L/L	GNS>GGA>GLL>RMC>RMA
Waypoint bearing, distance	RMB>BWC(Waypoint magnetic bearing invalid)
Waypoint location L/L	RMB>BWC>RTE/WPL
Waypoint course error	RMB> XTE
Route	RTE
Waypoint Latitude/Longitude	WPL
Depth	DPT>DBT
Water temperature	MTW
Geographic data	DTM
Time and date	ZDA>RMC>GGA

8.2 Details of ATA tracking data output

Data standard name: IEC61162-1

Target data of the automatic tracking unit is provided via data connectors (J4/J5) on the back panel.

TTM	Tracked target message
	$RATTM, x, x.x, xxx.T, xx.x, xxx.x, T, x.x, x.x, N, xxx, a, , , M*hh <CR><LF>

$RATTM, x, x.x, xxx.T, xx.x, xxx.x, T, x.x, x.x, N, xxx, a, , , M*hh <CR><LF>

- $ — Start of sentence
- RA — Talker device
- TTM — Formatter
- x — Target number, 00 to 49
- x.x — Target distance from own ship
- xxx.T — Bearing from own ship, degrees true
- xx.x — Target speed
- xxx.x, T — Target course, degrees true
- x.x — Distance of closest point of approach
- x.x — Time to CPA (min)
- N — Speed/distance units, NM
- xxx — Target name
- a — Target status*
- , — These fields are not used
- , — Type of aquisition
- M*hh <CR><LF> — Check sum

*Target status :
L = Lost, tracked target has been lost
Q = Query, target in the process of aquisition
T = Tracking

8.3 Details of the radar data output

Data standard name: IEC61162-1

Own ship data and radar system data are provided via data connectors (J4/J5) on the back panel.

8.3.1 Own ship data

OSD	Own ship data

$ RA OSD, xxx.x, A, xxx.x, a, xx.x, a, x.x, x.x, x.x*hh <CR><LF>

- $: Start of sentence
- RA : Talker device
- OSD : Formatter
- xxx.x : Heading, degrees true
- A : Heading status : A = data valid, V = data Invalid
- xxx.x : Vessel course, degrees true
- a : Course reference, B/M/W/R/P
- xx.x : Vessel speed
- a : Speed reference, B/M/W/R/P
- x.x : Vessel set, degrees true
- x.x : Vessel druft(speed)
- x.x : Speed units : K = km/h, N = knots, S = SM/h
- hh : Check sum
- <CR><LF>

Reference :
B = Bottom tracking log
M = Manually entered
W = Water referenced
R = Radar tracking
P = Positioning system ground reference

8.3.2 Radar system data

RSD	Radar system data

$ RA RSD, x.x, x.x, x.x, x.x, x.x, x.x, x.x, x.x, x.x, x.x, x.x, a, a*hh <CR><LF>

- $: Start of sentence
- RA : Talker device
- RSD : Formatter
- x.x : Origin 1 Range
- x.x : Origin 1 Bearing
- x.x : VRM 1 Range
- x.x : EBL 1 Bearing
- x.x : Origin 2 Range
- x.x : Origin 2 Bearing
- x.x : VRM 2 Range
- x.x : EBL 2 Bearing
- x.x : Cursor Range
- x.x : Cursor Bearing
- x.x : Display Range
- a : Range unit : K = km/h, N = NM, S = SM/h
- a : Display mode : C = Course Up, H = Head Up, N = North Up
- hh : Check sum
- <CR><LF>

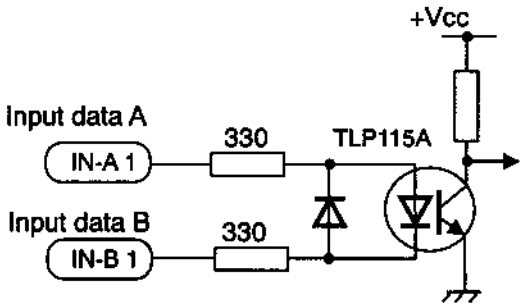
8.4 Interface specification

8.4.1 Serial data input/output specification

Input connector: J4, J5 and J6

Connector used: LTWD-06PMMP-LC

Connector acceptable: LTWD-06BFFA-L180



Serial data input circuit

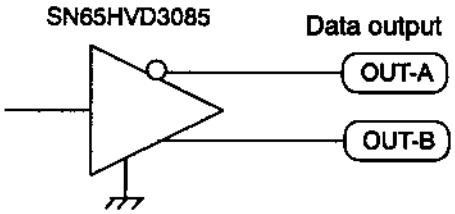
Serial data input (Listener):

Standard-type signal conforming to IEC61162-1 is acceptable.

Input load: 330 + 330 Ohm

Circuit configuration: Photo coupler

Type TLP115A (Toshiba)



Serial data output circuit

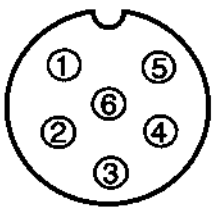
Serial data output (Talker):

Standard-type signal conforming to IEC61162-1 is transmittable.

Circuit configuration: RS422 driver IC

Type SN65HVD3085 (TI)

J4 – J6 Data connector pin location
(Display unit upper view)



Data connector pin assignment

J4, J5 & J6	
Pin number	Signal name
1	Shield
2	OUT-A
3	OUT-B
4	IN-A
5	IN-B
6	Ground

8.4.2 External buzzer and external monitor signal specification

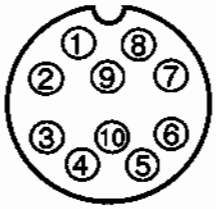
Output connector name: RGB & Buzzer

Connector used: LTWBU-10PMMP-LC

Connector acceptable: LTWBU-10BFFA-L180

Pin location is shown below.

J1 External monitor and external buzzer connector
(Display unit upper view)

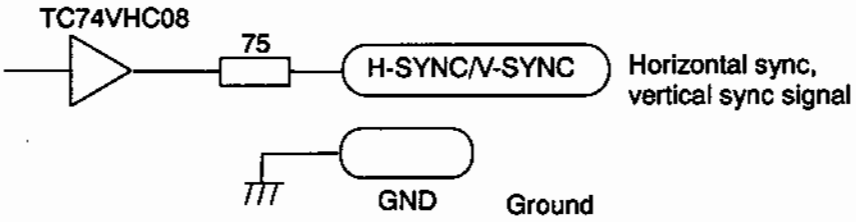


Pin number	Signal name
1	RVD
2	R-GND
3	GVD
4	G-GND
5	BVD
6	B-GND
7	H-SYNC
8	V-SYNC
9	BZ+
10	BZ-

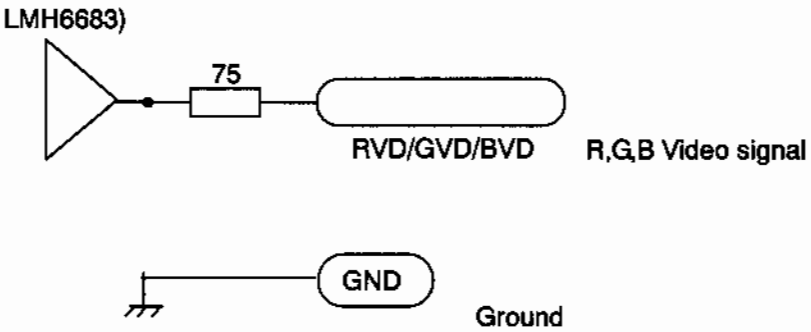
Signal specification

Signal name	Frequency	Polarity	Signal width	Level	Impedance
Horizontal sync signal (H-SYNC)	48.363kHz	Negative	2.092 us	TTL	200 Ω
Vertical sync signal (V-SYNC)	60.0Hz	Negative	124 us	TTL	200 Ω
R, G, B Video signal	-	Positive	—	0.7 V p-p	75 Ω
External buzzer + (BZ+)	DC	Positive	—	Inboard power supply	Capacity 1A

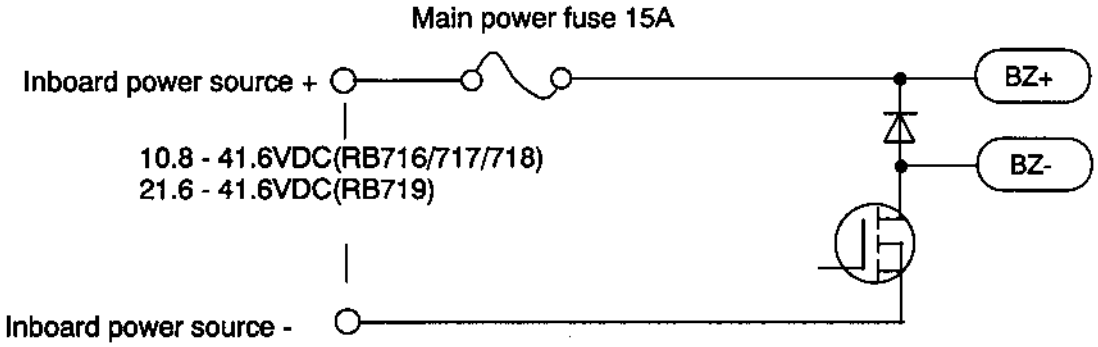
Circuit for horizontal sync, vertical sync signal output



Circuit for R, G, B video signal output



Buzzer output specification



8.4.3 Serial data input/output specification (AIS)

I/O connector J2 (AIS)

Connector used: LTWD-08PMMP-LC

Connector acceptable: LTWBD-08BFFA-L180

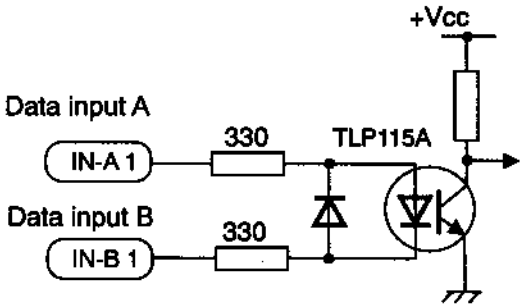
Serial data input (Listener):

Standard signals conforming to IEC61162-1 is acceptable.

Input load 330+330 Ohm

Circuit configuration: Photo coupler

Type TLP115A (Toshiba)



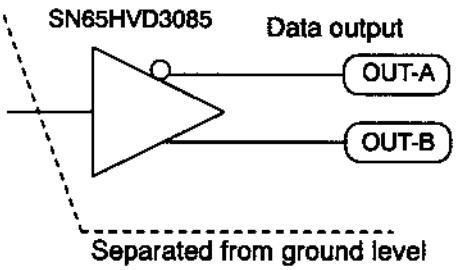
Serial data input circuit

Serial data output circuit (Talker):

Standard signals conforming to IEC61162-1 can be output.

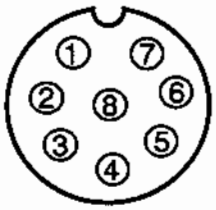
Circuit configuration: RS422 Driver/Receiver IC

Type SN65HVD3085 (TI)



Serial data output circuit

J2 Data connector pin diagram
(Display unit upper view)



Data connector pin assignment

Pin number	Signal name
1	Shield
2	IN-B
3	IN-A
4	OUT-B
5	OUT-A
6	GND
7	ALARM+
8	ALARM-

Note: Pin 7 and pin 8 are used for error detection input signal for AIS system.
It denotes [Short: Normal, Open: Error]. Please short #7 and #8 pin at ATS normal state.

8.4.5 Radar input/output signal specification

I/O connector: J3 Remote

Connector used: LTWU-12PMMP-LC

Connector acceptable: LTWBU-12BFFA-L180

J3 Remote connector pin location
(Upper view)

Data connector pin assignment

Pin number	Signal name
1	VIDEO OUT
2	TRIG OUT
3	GND
4	AZIP OUT
5	SHF OUT
6	GND
7	VIDEO IN
8	TRIG IN
9	GND
10	AZIP IN
11	SHF IN
12	+12Vdc

8.4.6 Talker device code of the data output devices

The device code displayed as talker is shown in the table below.

Data output device	Talker device code	Displayed code
Decca navigator device	DE	DEC
Global positioning system (GPS)	GP	GPS (See below)
Differential GPS (DGPS)	GP	DGPS (See below)
GLONASS receiver	GL	GLO
Global Navigation Satellite System	GN	GNSS
Integrated navigation system	IN	INS
Loran-C	LC	LOR
Electronic Position Finding System	SN	EPFS
True north tracking Gyro	HE	GYRO
Non-true north tracking Gyro	HN	GYRO
Magnetic compass	HC	MAG
Doppler Log and Generic Log	VD	DOLOG
Electromagnetic Log	VM	LOG
Mechanical Log	VW	LOG
Other devices		Display of talker device

Notice

The change between GPS and DGPS of the device name displayed on the screen is based on the operational status display in the GGA sentence. Refer to "Further description of the sentence" of Chapter 8.