CE 0682

KODEN

INSTALLATION MANUAL

MARINE RADAR

MDC-5200

SERIES

MDC-5500

SERIES

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.

MDC-5200_5500.IM.E 0092655002-01

MDC-5200/5500 Series Installation Manual

Doc No: 0092655002

Document Revision History

No.	Doc. No.-Rev. No.	Date Revised (Y/M/D)	Revised Content
0	0092655002-00	2016/04/08	First edition
1	0092655002-01	2016/09/07	Content, Chapter 2, Chapter 3, Chapter 4, Chapter 5, Chapter 7, Cover
2			
3			
4			
5			
6			
7			
8			
9			
10			

Document No. Revised Version Norm

When part of the document needs to be revised, the document has advanced revision number. The document No. is indicated at the lower right side on the cover and at the left or right side of the footer region of each page.

A table of content

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 radiation.

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 operation 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	50W/m^2	10 W/m^2
4 kW / 3 feet antenna	0.9 m	1.3 m	2.8 m
4 kW / 4 feet antenna	1.0 m	1.4 m	3.1 m
4 kW / 6 feet antenna	1.2 m	1.7 m	3.7 m
6 kW / 4 feet antenna	1.5 m	2.1 m	4.5 m
6 kW / 6 feet antenna	1.7 m	2.4 m	5.4 m
12 kW / 4 feet antenna	2.1 m	2.9 m	6.4 m
12 kW / 6 feet antenna	2.4 m	3.4 m	7.6 m
12 kW / 9 feet antenna	2.9 m	4.1 m	9.0 m
25 kW / 4 feet antenna	2.9 m	4.1 m	9.2 m
25 kW / 6 feet antenna	3.5 m	4.9 m	10.9 m
25 kW / 9 feet antenna	4.1 m	5.8 m	13.0 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:

Capacitors used in the Display unit and the modulator circuit of the transmission unit may keep high voltage for several minutes even after turning off power. 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 ensure 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 work on the printed circuit board only after taking measures against static electricity.

• Break in procedure of stored radar:

Following procedure is recommended for “Break In” of the stored radar.
Otherwise the radar sometimes exhibits unstable transmitting operation such as arcing at its initial operation after long period of storage and make the operation more difficult.

1. Extend preheat time as long as possible (preferably 20 to 30 minutes).
2. Set the pulse width to the shortest one and start the operation.
   When the operation in the shortest pulse is stable then go to operation in longer pulse and repeat the similar step until the operation reaches to the final pulse condition.

Chapter 1 Prior to installation

1.1 Installation precautions

In order to obtain the maximum performance of radar systems, this radar system 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 installation materials;
(3) Checking of supply voltage and current capacity;
(4) Selection of the location for installation;
(5) Installation of the Antenna-Scanner 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 they are 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 after power 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 Scanner unit

(1) Blind sectors shall be kept to a minimum, and shall not be placed in an arc of the horizon from the right ahead direction to 22.5° abaft the beam and especially shall avoid the right ahead direction (relative bearing 000°). The installation of the antenna shall be in such a manner that the performance of the radar system is not substantially degraded. The antenna shall be mounted clear of any structure that may cause signal reflections, including other antenna and deck structure or cargo. In addition, the height of the antenna shall take account of target detection performance relating to range of first detection and target visibility in sea clutter.

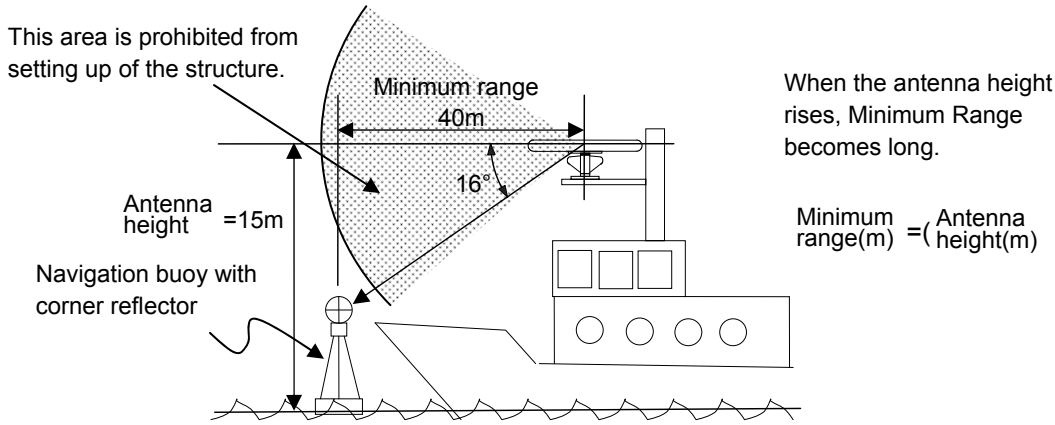


Figure 1.1 Vertical chart of recommended antenna installation position.

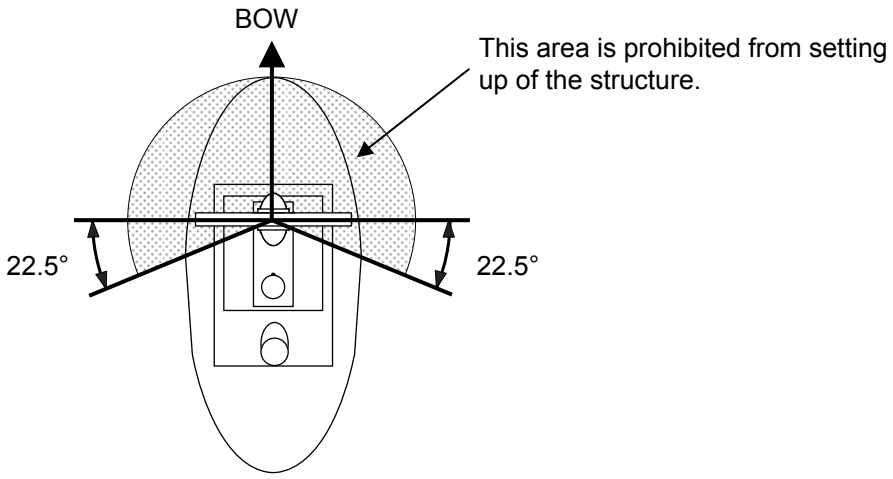


Figure 1.2 Horizontal chart of recommended antenna installation position.

(2) Keep the surface of the Antenna-Scanner unit platform horizontal as much as possible.

(3) The Antenna-Scanner 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.

(4) Keep sufficient maintenance area.

(5) Keep safety distance from magnetic compass.

Table 1.1 Safety distance of compass from the Scanner unit

Scanner unit type	Standard compass	Steering compass
RB806 (4kW)	2.00 m	1.40 m
RB807 (6kW)	1.20 m	0.80 m
RB808 (12kW)	1.40 m	0.90 m
RB809 (25kW)	1.40 m	0.90 m

1.4.2 Display unit and Operation unit

(1) The orientation of the Display unit shall be such that the user is looking ahead, the lookout view is not obscured and there is minimum ambient light on the display viewing surface.

(2) Choose the best location from humidity, spray, rain, and direct sunlight.

(3) Keep sufficient maintenance area. Especially sufficient space is required near the back panel where cables are connected.

(4) Keep as far as possible from other radio devices.

(5) Keep safety distance from magnetic compass.

Table 1.2 Safety distance of compass from Display unit and Operation unit

Display unit type	Standard compass	Steering compass
MRD-111 (MDC-5200 series)	0.70 m	0.50 m
MRD-109 (MDC-5500 series)	1.20 m	1.0 m
MRO-108 (MDC-5500 series)	1.20 m	0.70 m

1.5 Cable wiring and interconnection

1.5.1 Antenna Scanner unit

(1) The connecting cable between the antenna-Scanner 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 in parallel to the sea surface 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 suitable ways to shield.

(2) In order to maximize the performance of the radar, the antenna cable and the power cable should be as short as possible, and should be laid within the nominal length.

(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 by using the ground terminal of the back panel.

Chapter 2 System configurations

2.1 Standard configuration list

MDC-5204

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-03	3 ft	5 kg	1
		RW701A-04	4 ft	6 kg	
		RW701A-06	6 ft	8 kg	
2	Scanner unit	RB806	4 kW	16.1 kg	1
3	Display unit	MRD-111	12.1 inch	8.2 kg	1
4	Connecting cable	242J159098B-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-5200_5500.OM.E	Operation manual		1
9	Document	MDC-5200_5500.IM.E	Installation manual		1
10	Document	MDC-5200_5500.QR.E	Quick reference		1

MDC-5206

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04	4 ft	6 kg	1
		RW701A-06	6 ft	8 kg	
2	Scanner unit	RB807	6 kW	18.1 kg	1
3	Display unit	MRD-111	12.1 inch	8.2 kg	1
4	Connecting cable	CW-845-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-5200_5500.OM.E	Operation manual		1
9	Document	MDC-5200_5500.IM.E	Installation manual		1
10	Document	MDC-5200_5500.QR.E	Quick reference		1

MDC-5212

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04	4 ft	6 kg	1
		RW701A-06	6 ft	8 kg	
2	Scanner unit	RB808	12 kW	18.0 kg	1
3	Display unit	MRD-111	12.1 inch	8.2 kg	1
4	Connecting cable	CW-845-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-5200_5500.OM.E	Operation manual		1
9	Document	MDC-5200_5500.IM.E	Installation manual		1
10	Document	MDC-5200_5500.QR.E	Quick reference		1

MDC-5225

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04	4 ft	6 kg	1
		RW701A-06	6 ft	8 kg	
2	Scanner unit	RB809	25 kW	20.0 kg	1
3	Display unit	MRD-111	12.1 inch	8.2 kg	1
4	Connecting cable	CW-845-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
7	Installation material	M12-BOLT.KIT	See installation material list		1 set
8	Document	MDC-5200_5500.OM.E	Operation manual		1
9	Document	MDC-5200_5500.IM.E	Installation manual		1
10	Document	MDC-5200_5500.QR.E	Quick reference		1

MDC-5504

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-03	3 ft	5 kg	1
		RW701A-04	4 ft	6 kg	
		RW701A-06	6 ft	8 kg	
2	Scanner unit	RB806	4 kW	16.1 kg	1
3	Dispaly unit	MRD-109	15 inch	12.5 kg	1
4	Operation unit	MRO-108		1.8 kg	1
5	Connecting cable	242J159098B-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-5200_5500.OM.E	Operation manual		1
10	Document	MDC-5200_5500.IM.E	Installation manual		1
11	Document	MDC-5200_5500.QR.E	Quick reference		1

MDC-5506

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04	4 ft	6 kg	1
		RW701A-06	6 ft	8 kg	
2	Scanner unit	RB807	6 kW	18.1 kg	1
3	Dispaly unit	MRD-109	15 inch	12.5 kg	1
4	Operation unit	MRO-108		1.8 kg	1
5	Connecting cable	CW-845-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-5200_5500.OM.E	Operation manual		1
10	Document	MDC-5200_5500.IM.E	Installation manual		1
11	Document	MDC-5200_5500.QR.E	Quick reference		1

MDC-5512

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04	4 ft	6 kg	1
		RW701A-06	6 ft	8 kg	
		RW701B-09	9 ft	12 kg	
2	Scanner unit	RB808	12 kW	18.0 kg	1
3	Dispaly unit	MRD-109	15 inch	12.5 kg	1
4	Operation unit	MRO-108		1.8 kg	1
5	Connecting cable	CW-845-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-5200_5500.OM.E	Operation manual		1
10	Document	MDC-5200_5500.IM.E	Installation manual		1
11	Document	MDC-5200_5500.QR.E	Quick reference		1

MDC-5525

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna	RW701A-04	4 ft	6 kg	1
		RW701A-06	6 ft	8 kg	
		RW701B-09	9 ft	12 kg	
2	Scanner unit	RB809	25 kW	20.0 kg	1
3	Dispaly unit	MRD-109	15 inch	12.5 kg	1
4	Operation unit	MRO-108		1.8 kg	1
5	Connecting cable	CW-845-15M	With connectors 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-MRD-109_111	See spare parts list		1 set
8	Installation material	M12-BOLT.KIT	See installation material list		1 set
9	Document	MDC-5200_5500.OM.E	Operation manual		1
10	Document	MDC-5200_5500.IM.E	Installation manual		1
11	Document	MDC-5200_5500.QR.E	Quick reference		1

2.2 Spare parts list

SP-MRD-109/111

No.	Name	Specification	Comment	Type (Dimension)	Quantity	Usage
1	Fuse	F-1065-15A	Normal type	Tubular (ϕ6.4 x 30)	1	Main power
2	Fuse	MF51NN250V5A/ N20-250V	Normal type	Tubular (ϕ5.2 x 20)	1	Motor power
3	Fuse	FGMB 250V/0.8A	Normal type	Tubular (ϕ5.2 x 20)	1	High voltage power supply
4	Carbon brush	24Z125209B			1set	Antenna motor **(For RB806/RB807)**

2.3 Installation material list

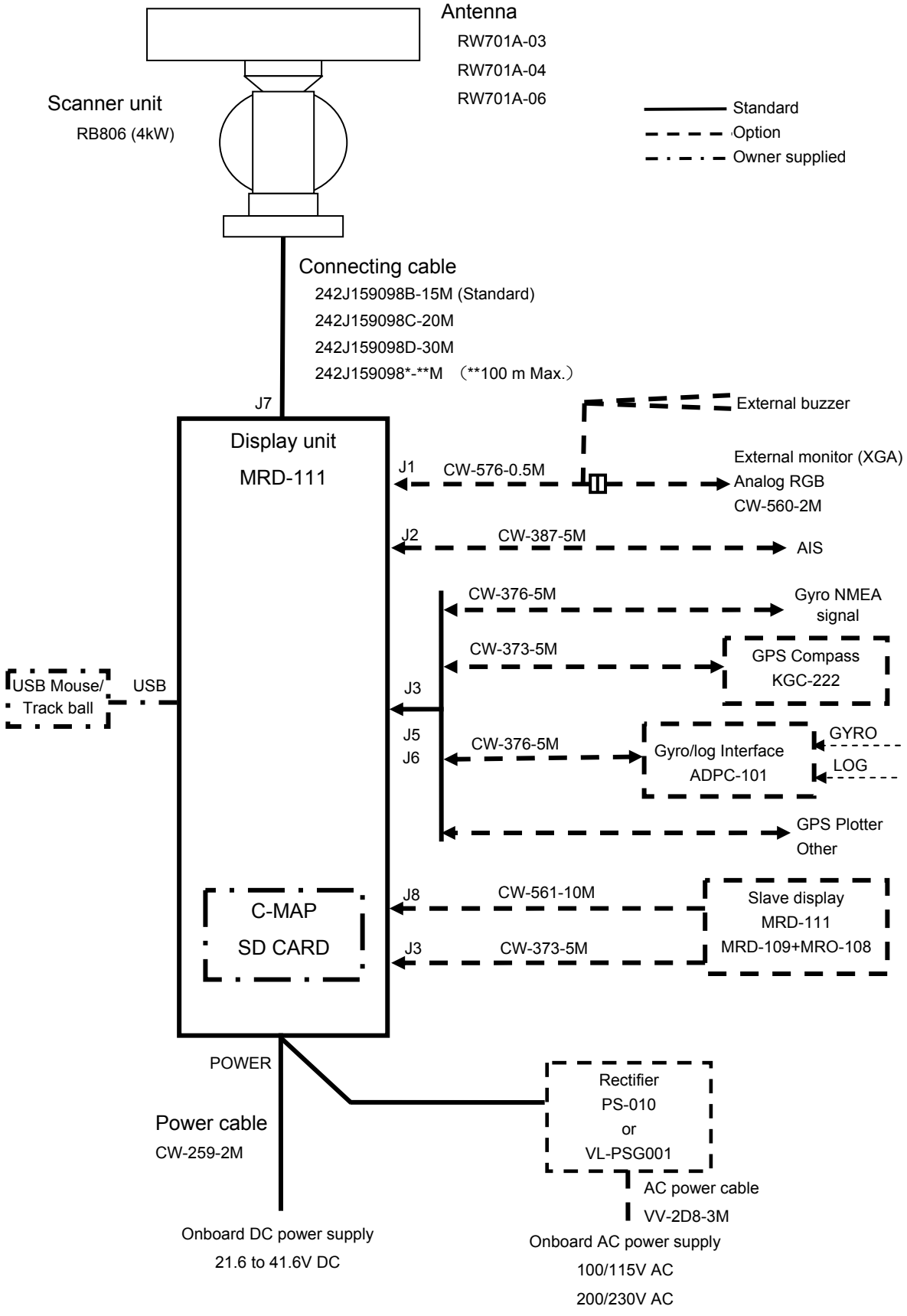
M12-BOLT.KIT

No.	Name	Specification	Quantity	Usage
1	Hexagon bolt	B12X55U	4	Antenna-Scanner unit
2	Nut	N12U	8	Antenna-Scanner unit
3	Plain washer	2W12U	8	Antenna-Scanner unit
4	Spring washer	SW12U	4	Antenna-Scanner unit
5	Anti electro corrosive washer	56R7201M2	4	Antenna-Scanner unit
6	Anti electro corrosive washer	56R7202M2	4	Antenna-Scanner unit
7	Ferrite core	GRFC-13	1	Antenna-Scanner unit
8	Cable band	AB150-W	2	Antenna-Scanner unit

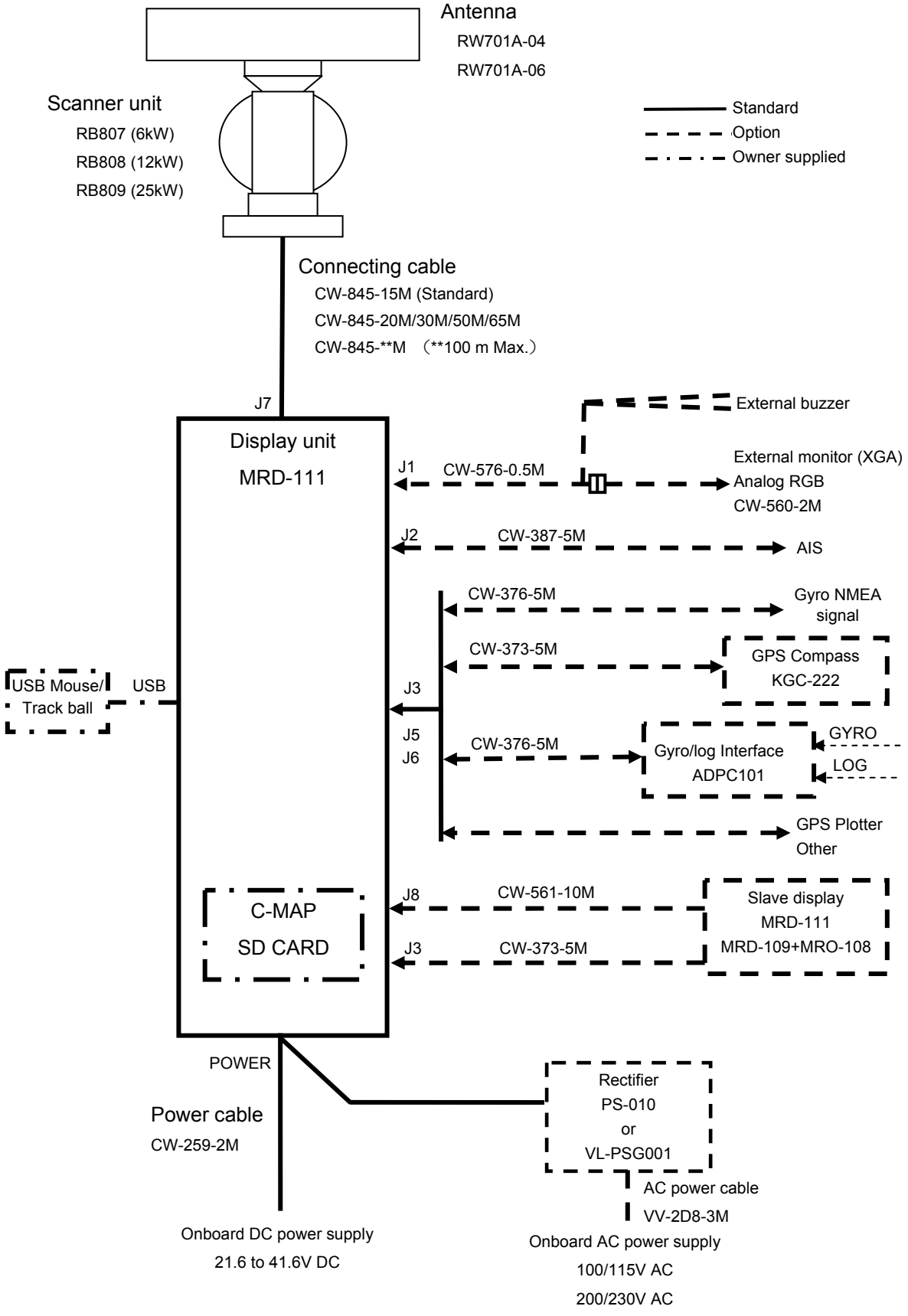
2.4 Option list

No.	Name	Specification	Comment	Weight /Dimension /Quantity
1	Gyro converter	S2N, U/N 9028C	qwerty-electronik	
2	Log pulse NMEA converter	L1N, U/N 9181A	qwerty-electronik 200pulse/NM only	
3	Gyro / Log interface	ADPC-101		1.5 kg
4	Rectifier unit	PS-010	5A fuse attached	3.5 kg
		VL-PSG001	20A fuse attached	
5	AC power cable	VV-2D8-3M	Without connectors on the both sides	3 m
6	Junction box	JB-35	With CW-376-5M	
7	Connecting cable	CW-373-* *: 5M, 10M or 30M	With 6-pin water resistant connectors at both ends (cable for data)	5 m, 10 m or 30 m
		CW-374-5M	With a 6-pin connector and a 6-pin water resistant connector (cable for data)	5 m
		CW-376-5M	With a 6-pin water resistant connector and one end plain (cable for data)	5 m
		CW-387-5M	With a 8-pin water resistant connector and one end plain (cable for AIS)	5 m
		CW-561- * *: 10M or 30M	With 12-pin water resistant connectors at both ends (cable for remote display)	10 m or 30 m
		CW-576-0.5M	With a 10-pin water resistant connector and D-Sub connector (analog RGB) +Alarm out	0.5 m
		CW-560-2M	With 15-pin water resistant D-Sub connectors at both ends (Cable for VDR or external Display unit to connect CW-576-0.5M)	2 m
		CW-401- * *: 5M or 10M	Operation unit cable (For MRO-108)	5 m or 10 m
8	Antenna-Scanner unit - Display unit connecting cable	242J159098C-20M	With connectors on both sides (242J159098:For RB806)	20 m
		242J159098D-30M		30 m
		242J159098*-**M		100 m Max.
		CW-845-* *: 20M, 30M, 50M, 65M	(CW-845: For RB807/808/809)	20 m, 30 m 50 m or 65 m
		CW-845-xxM		100 m Max. (Designated)

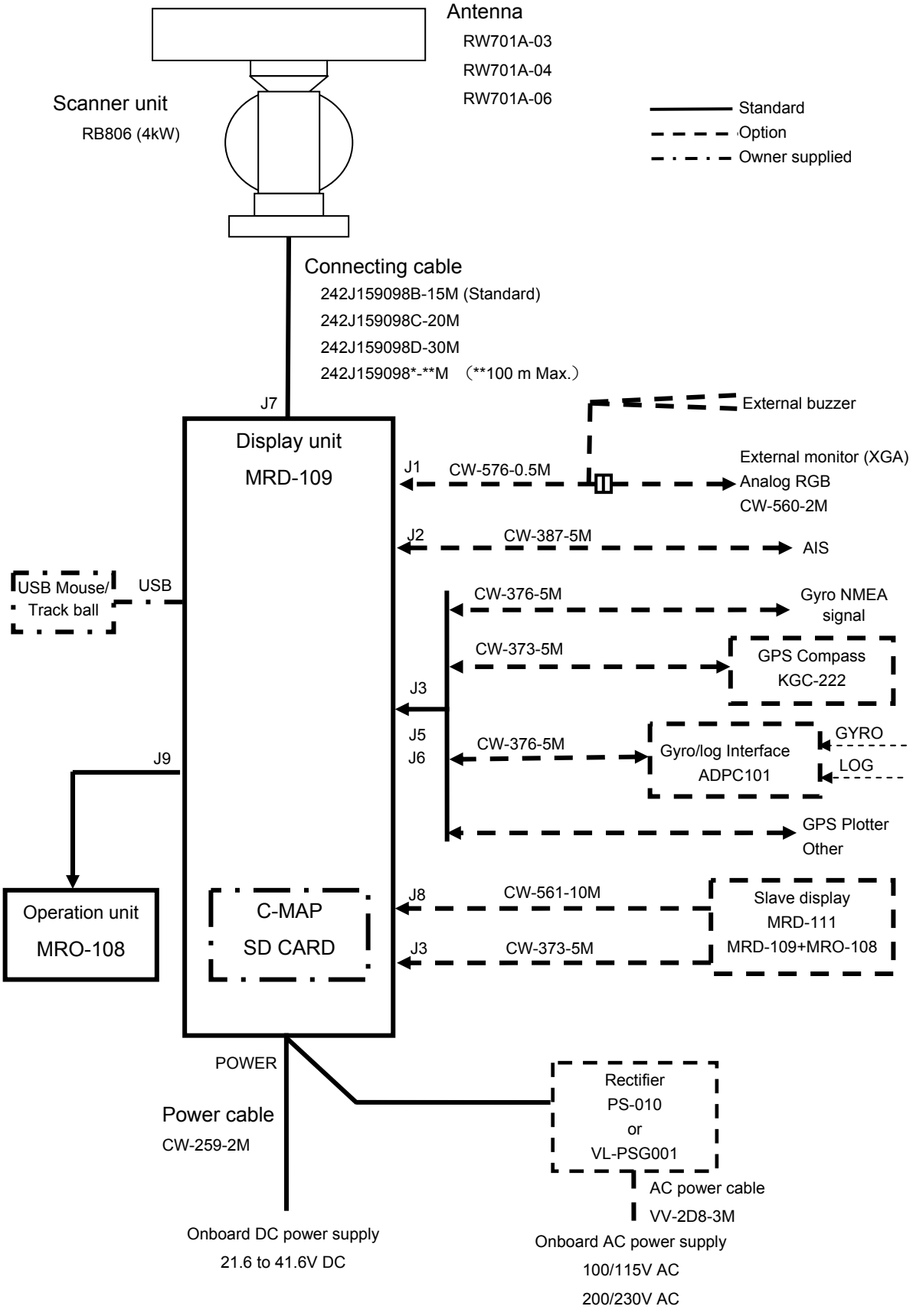
2.5 MDC-5204 series system configuration



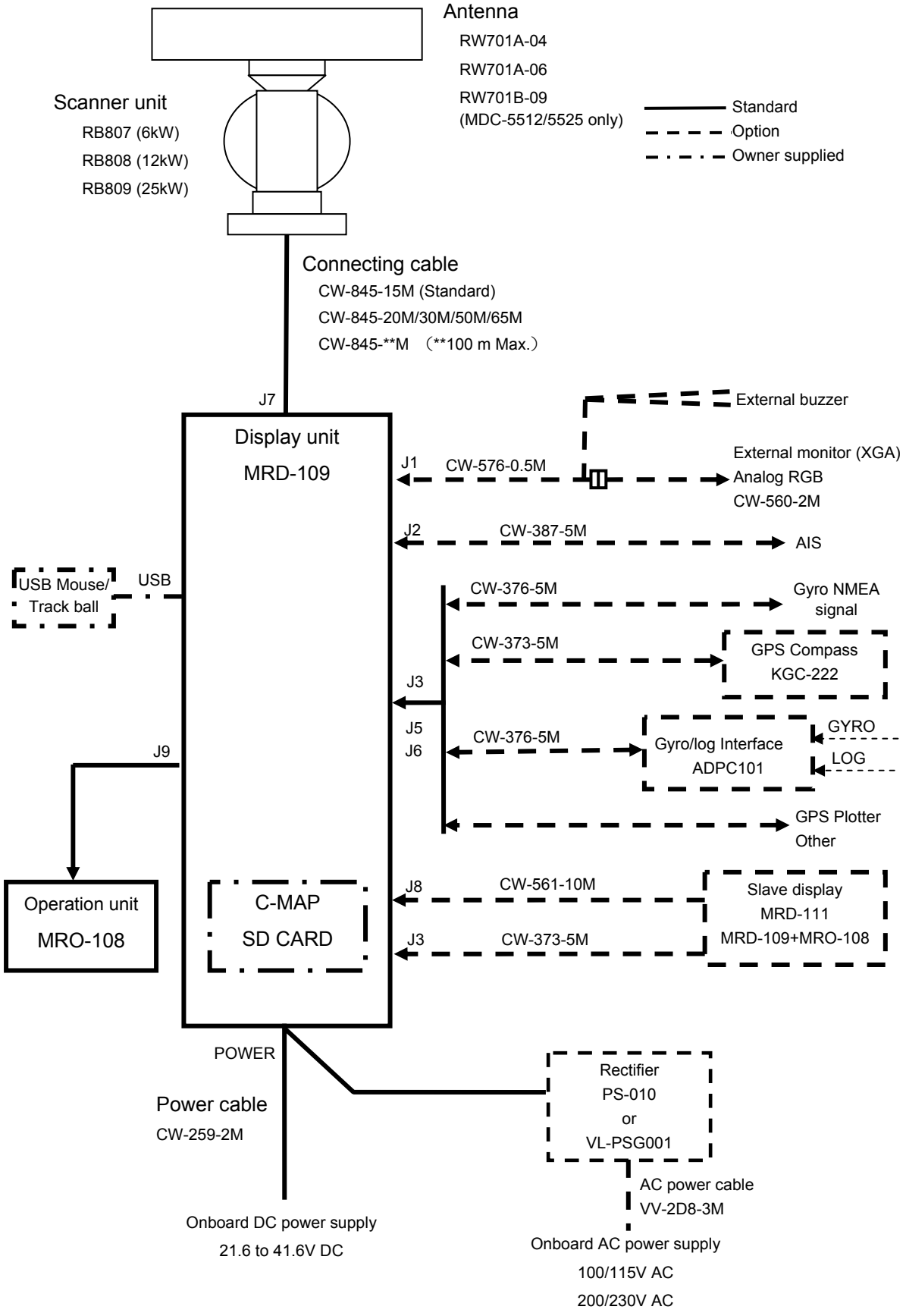
2.6 MDC-5206/5212/5225 series system configuration



2.7 MDC-5504 series system configuration



2.8 MDC-5506/5512/5525 series system configuration

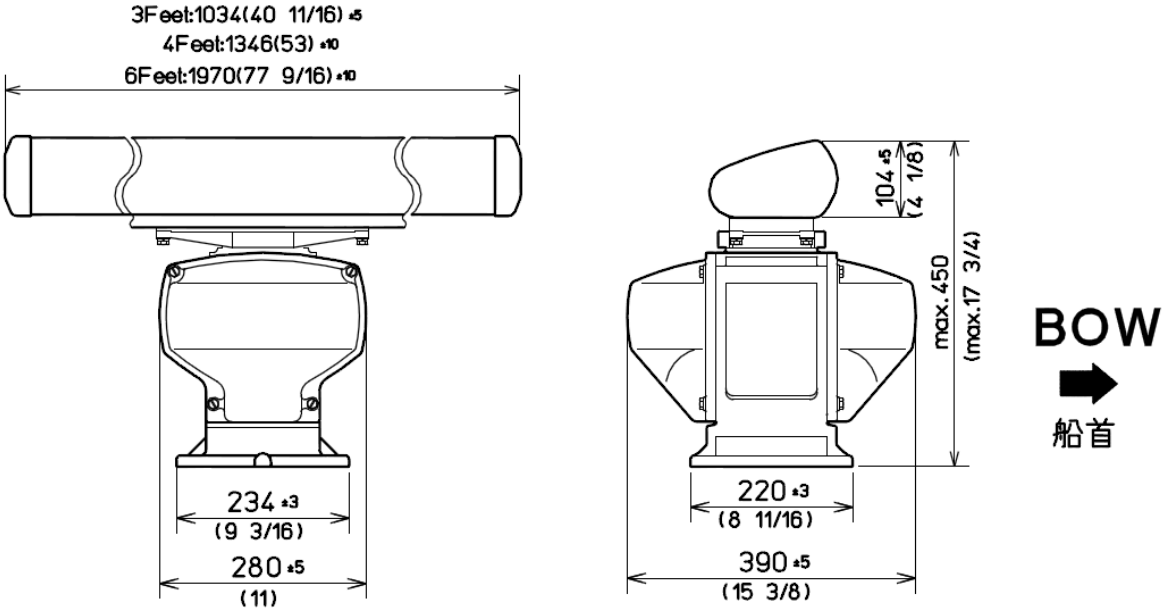


Chapter 3 Installation method

3.1 How to install the Antenna Scanner unit

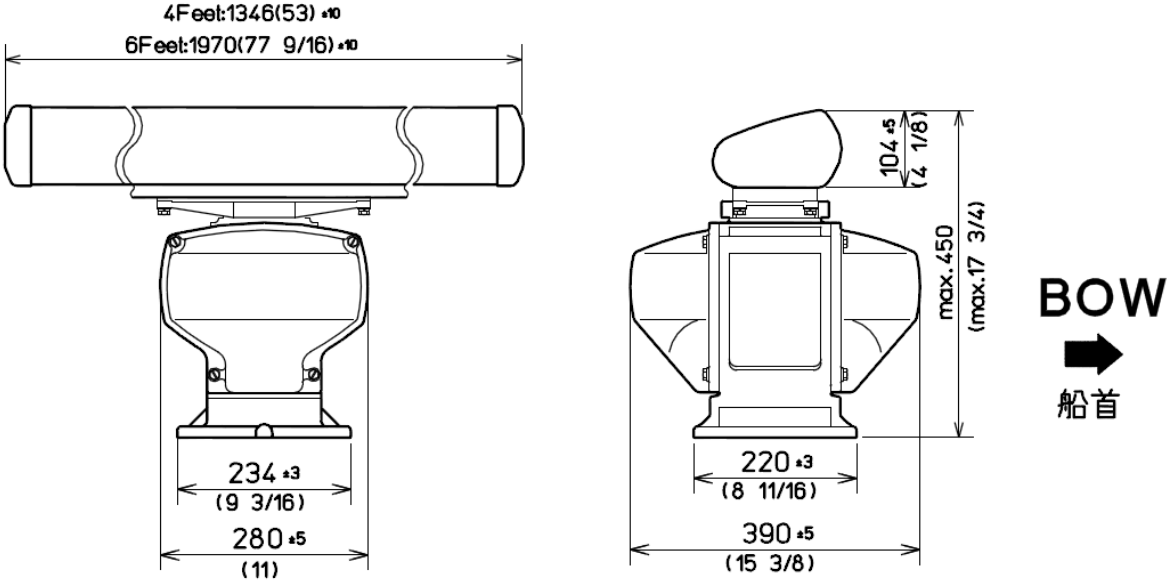
External view and dimensions

RB806



Weight : 21.5kg/(47lb) ・・・ 3Feet(RW701A-03)
22.5kg/(50lb) ・・・ 4Feet(RW701A-04)
24.5kg/(54lb) ・・・ 6Feet(RW701A-06)

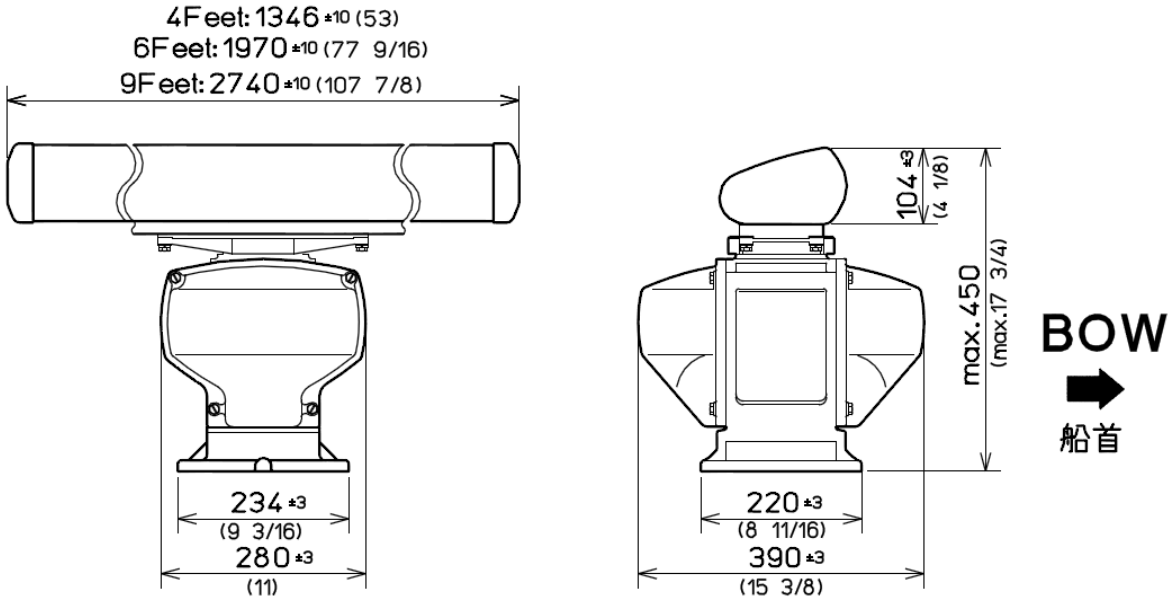
RB807



Weight : 24.1kg/(53lb) ・・・ 4Feet(RW701A-04)
26.1kg/(58lb) ・・・ 6Feet(RW701A-06)

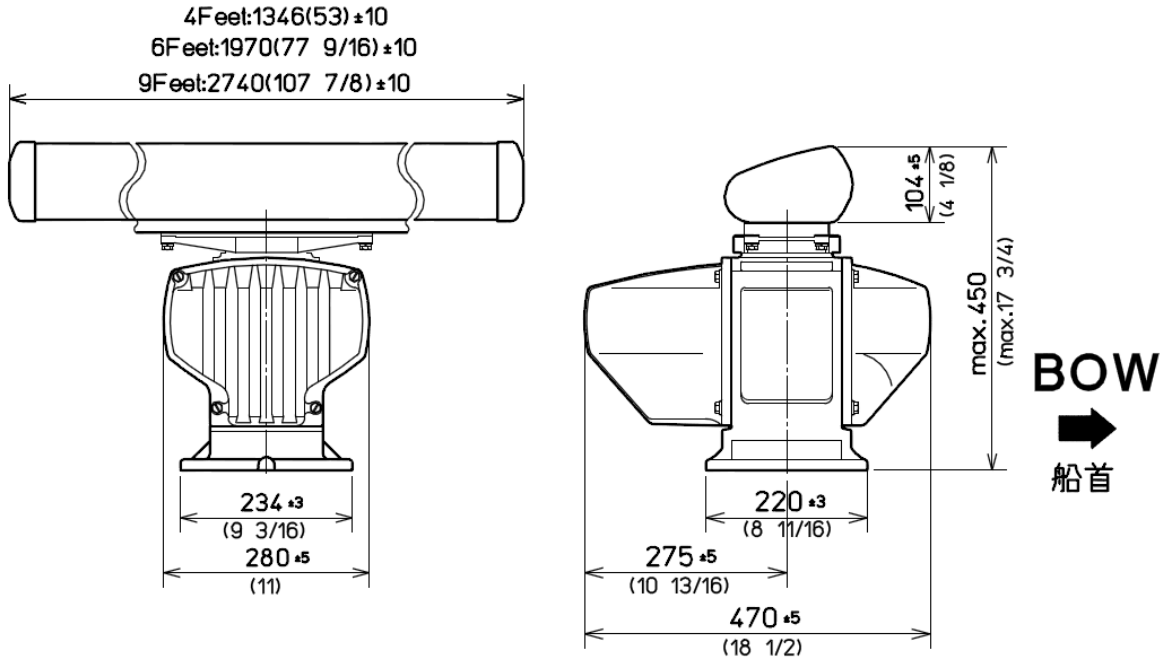
Unit: mm (inch)

RB808



Weight : 24kg(53lb) : (RW701A-04)
26kg(57.5lb) : (RW701A-06)
30kg(66.5lb) : (RW701B-09)

RB809



Weight : 26kg(57.5lb) : (RW701A-04)
28kg(62lb) : (RW701A-06)
32kg(71lb) : (RW701B-09)

Unit: mm (inch)

3.1.1 Installation of the Antenna Scanner unit

The Antenna Scanner 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 holes 14 mm in diameter are located on the mounting platform with reference to Figure 3.1.

(2) The Antenna Scanner unit is secured with four 12 mm stainless steel bolts contained in installation material.

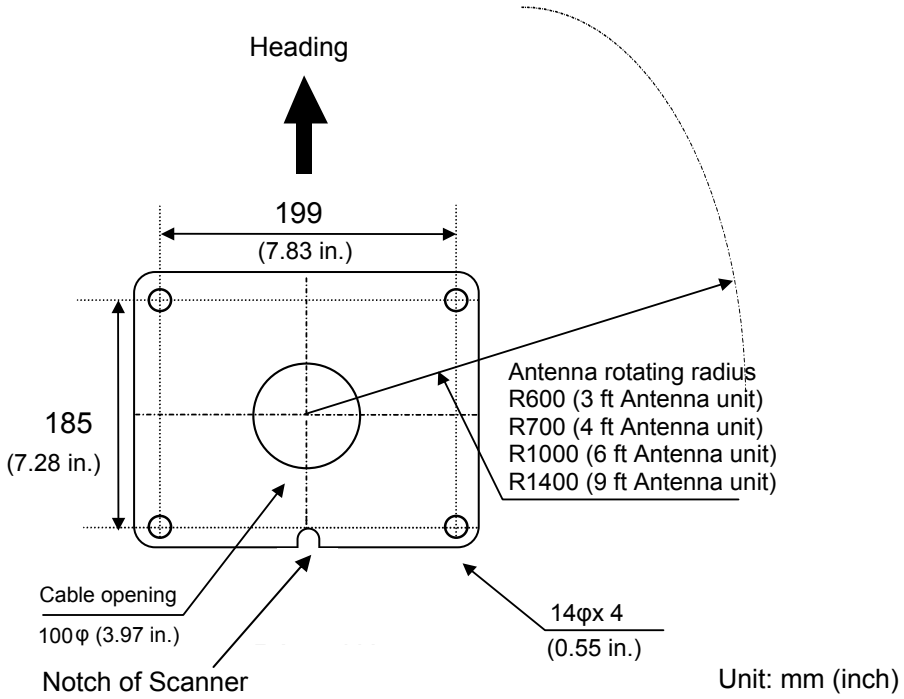


Figure 3.1 Plain view of mounting hole

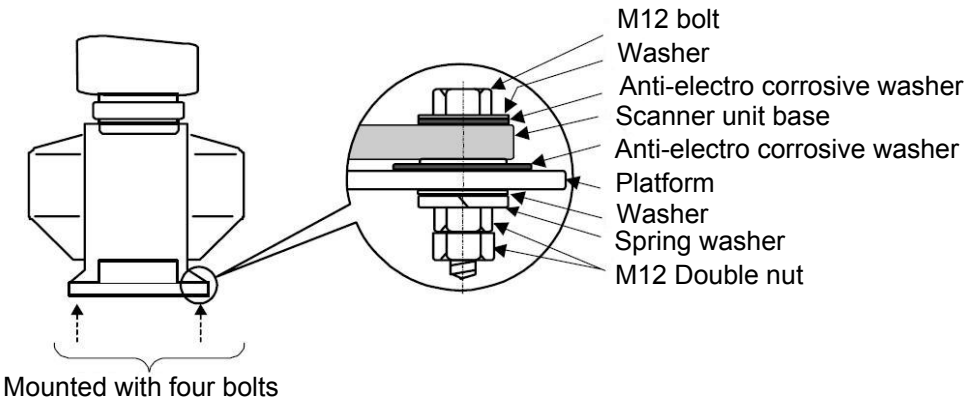


Figure 3.2 Assembly of Scanner unit base

3.1.2 Mounting the Antenna

(1) Remove the protective cap on top of the Scanner unit rotational shaft.

(2) Remove four bolts tentatively fixed to the base of the antenna and install the Scanner unit to the rotating base. Align the direction of antenna radiation side (KODEN –mark side) with the projection mark on the rotating base.

(3) Fix the aerial with four bolts removed in step 2.

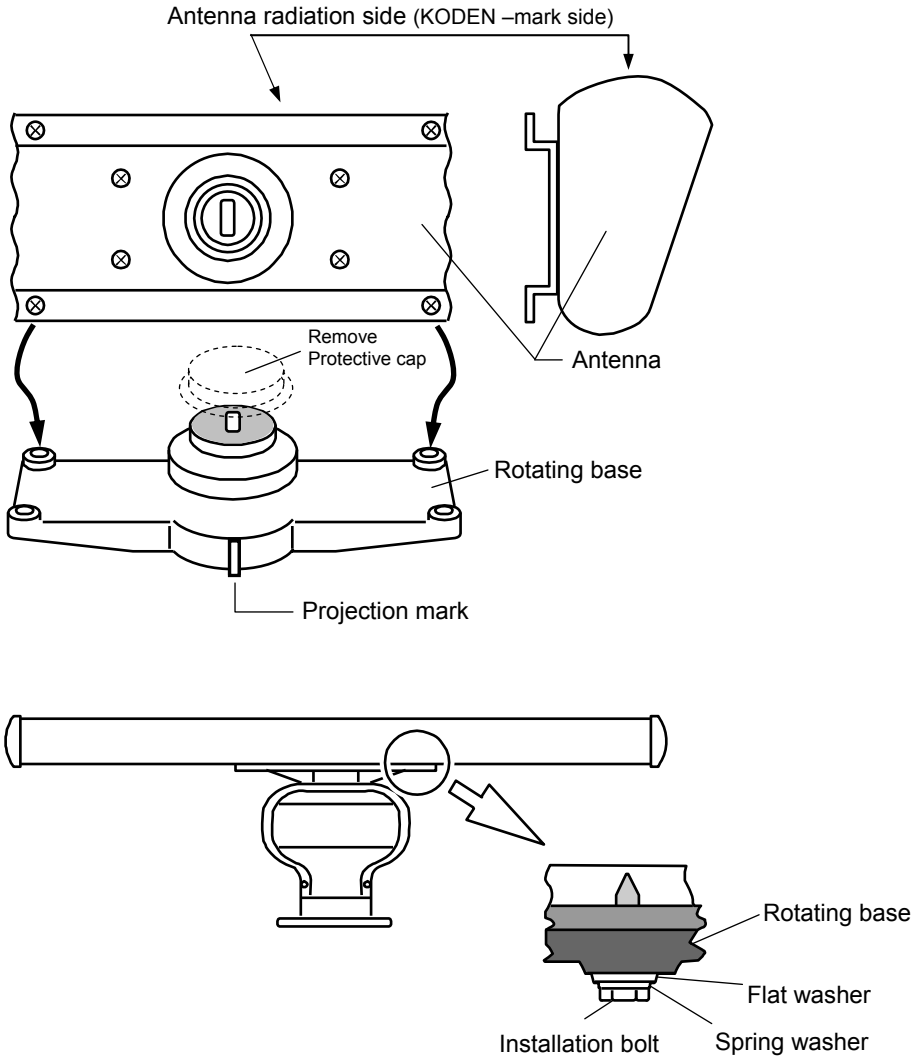


Figure 3.3 Antenna assembly to the rotating shaft

3.1.3 Installation of the connecting cable 242J159098x-xxM

3.1.3.1 Scanner unit 4kW (RB806: MDC-5204/5504)

(1) Please make sure power supply of the Scanner unit is OFF.

(2) Disassemble the front cover of the Scanner unit from the rear cover by loosening fixing bolts.

(3) Remove the TR unit by disconnecting the connector X1 and X2 after loosening fixing bolts of the TR unit. Please make sure magnetron does NOT touch metals.

(4) Remove the cable holder plate and the rubber packing by loosening bolts at the bottom of the Scanner unit box.

(5) Antenna cable shall be taken into the Scanner unit box through the cable inlet hole.

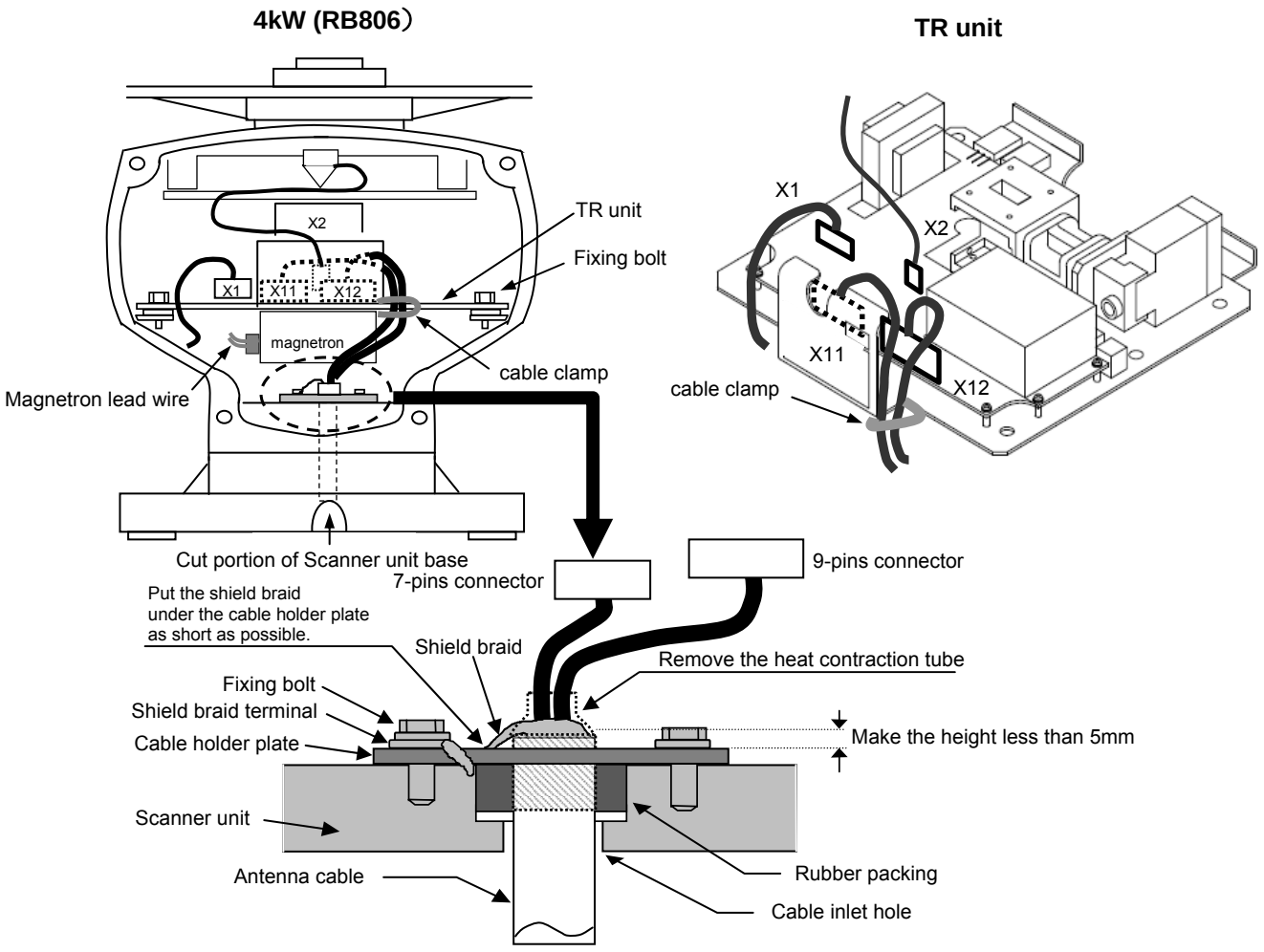
(6) Antenna cable shall be fixed as described in the illustration below, using the cable holder plate and the rubber packing removed in 4. Shield braid terminal shall be fixed under the cable holder plate together with lug terminal, after removing the edge portion of heat contraction tube of the antenna cable.

(7) Mount the TR unit after connecting the X1 and X2 connectors (removed in 3) by fixing bolts.

(8) 7 pin connector shall be connected to X11 of the TR unit, 9 pin connector to X12.

(9) Antenna cable shall be clamped onto the TR unit. Please make sure the antenna cable does NOT touch magnetron lead wires.

(10) The front and rear covers of the Scanner unit shall be fixed by fixing bolts.



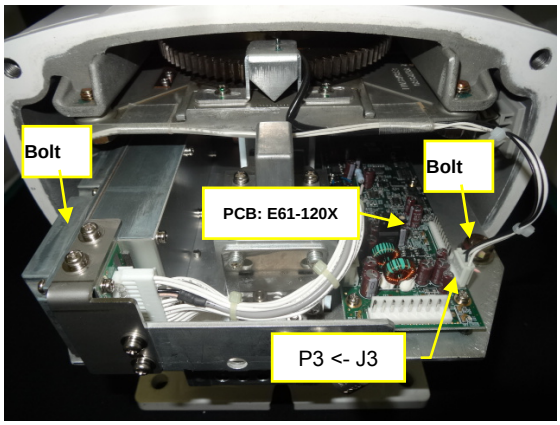
3.1.4 Installation of the connecting cable CW-845-xxM

3.1.4.1 Scanner unit 6kW (RB807)

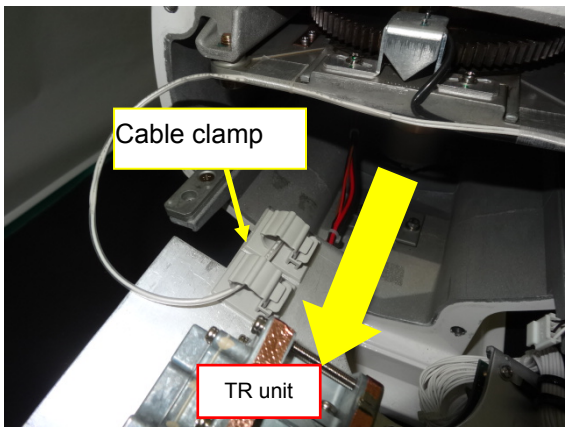
(RB807: MDC-5206/5506)

Make sure the radar system is turned off.

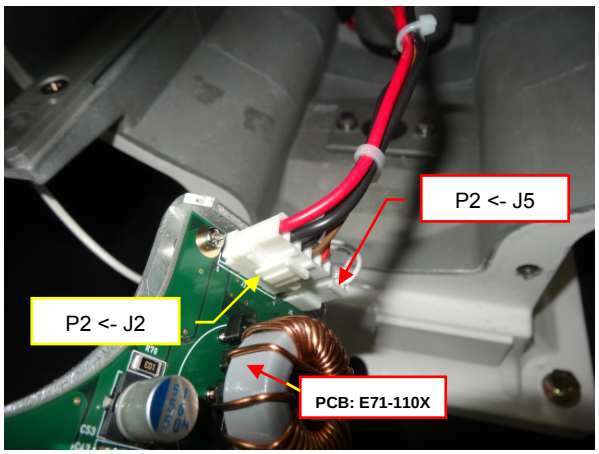
1) Remove back cover by loosening four fixing bolts.
(Tool: Wrench 13mm)



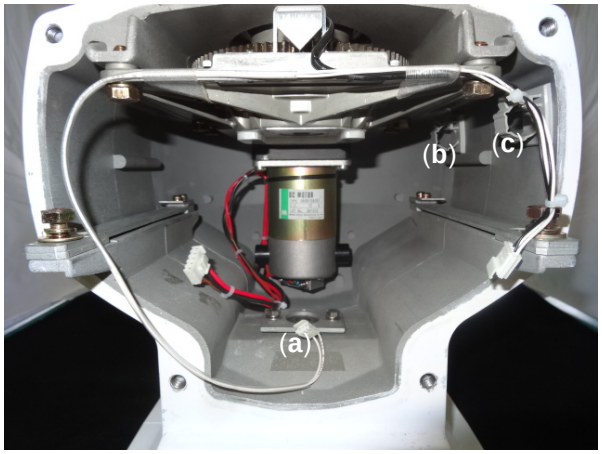
2) Disconnect connectors P3 from J3 [E61-120X].
Remove the two fixing bolts.
(Tool: Wrench 13mm)



3) Pull out the TR unit, remove the cable clamp.



4) Disconnect connector P2 from J2 and P2 from J5.

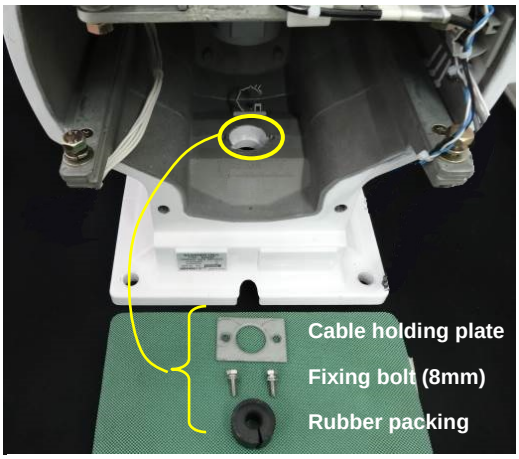


5) This picture is the view of scanner unit housing.

(**a**) Cable holder plate

(**b**) Cable clamp-b

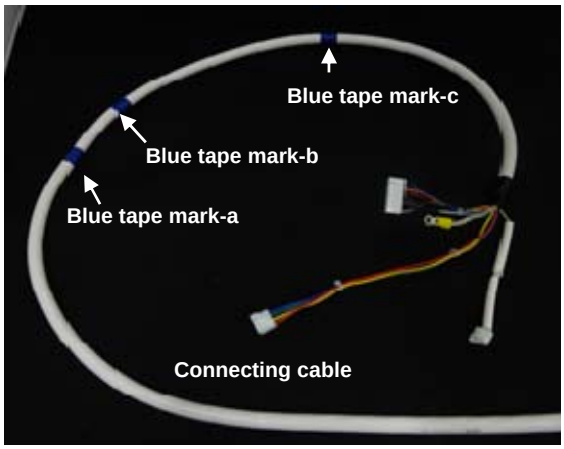
(**c**) Cable clamp-c



6) Remove two fixing bolts.

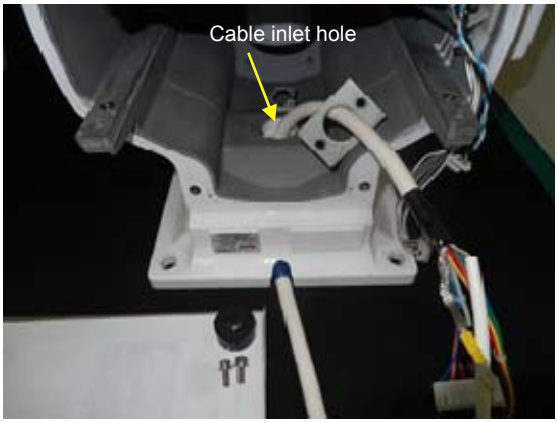
(Tool: Wrench 8mm)

Remove the cable holding plate and rubber packing.



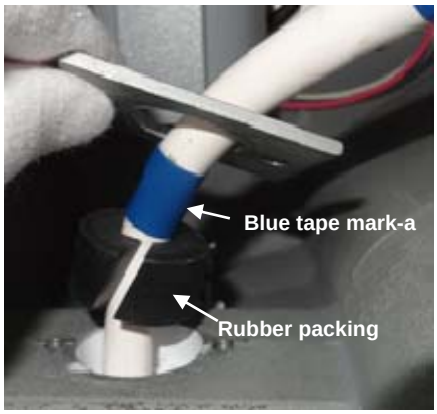
7) The connecting cable CW-845-xxM

Blue tapes are wound as a mark on the cable.



8) Pull in the connecting cable into the scanner unit through the cable inlet hole

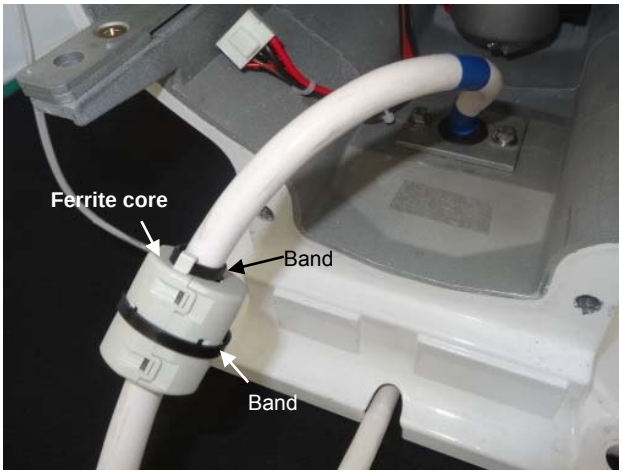
Guide the cable to the cable holding plate.



9) Attach rubber packing to the blue tape mark-a.

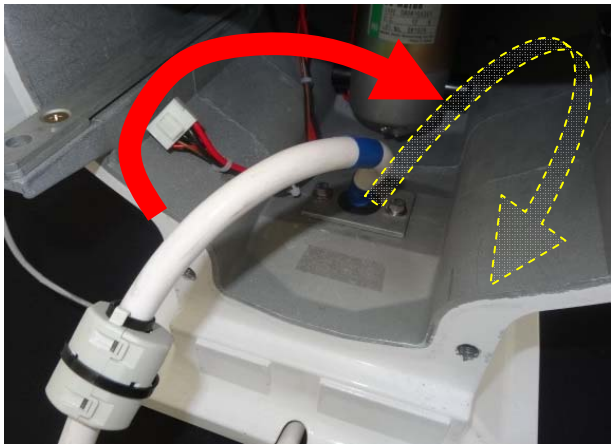
10) Attach cable holding plate and fix it with two bolts.
(Tool: Wrench 8mm)

11) Attach the ferrite core from blue tape-b to 10cm end.



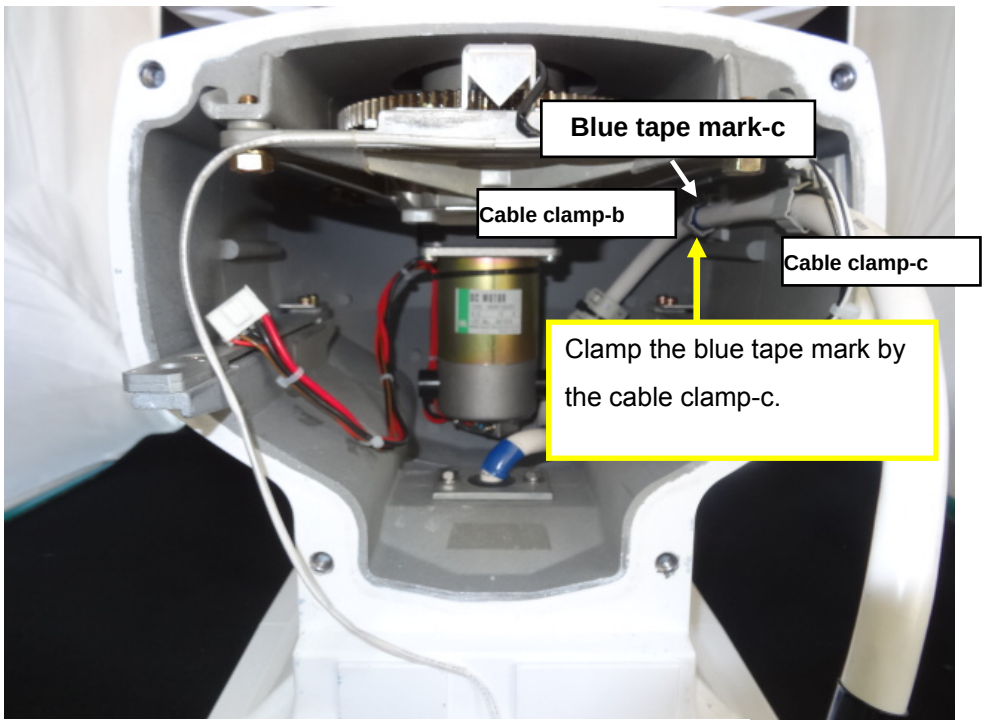
12) Secure the ferrite core in place by using provided bands.

Note: The ferrite core and the bands are included with the installation material.

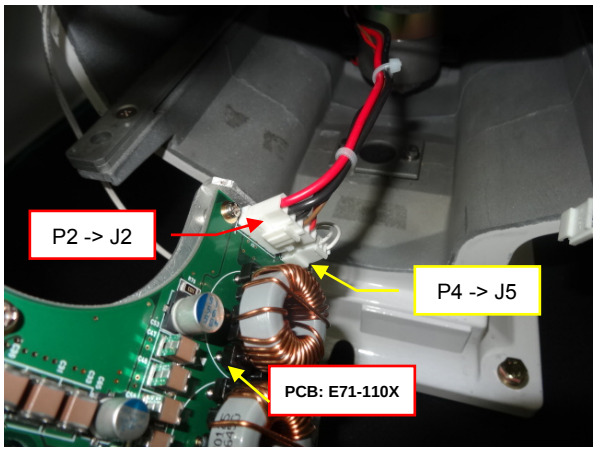


13) The cable placed in the far right under the motor.

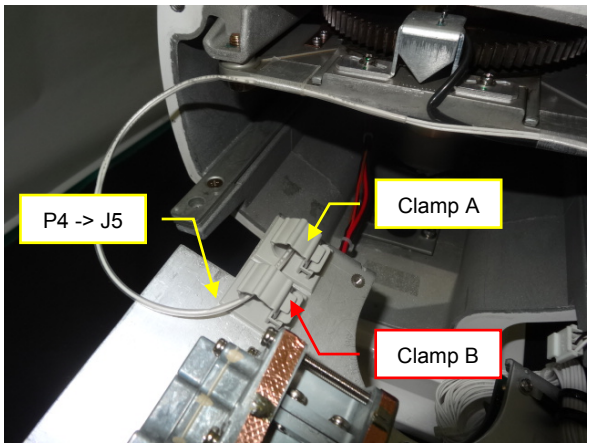
14) Clamp the cable by the cable clamp-b.



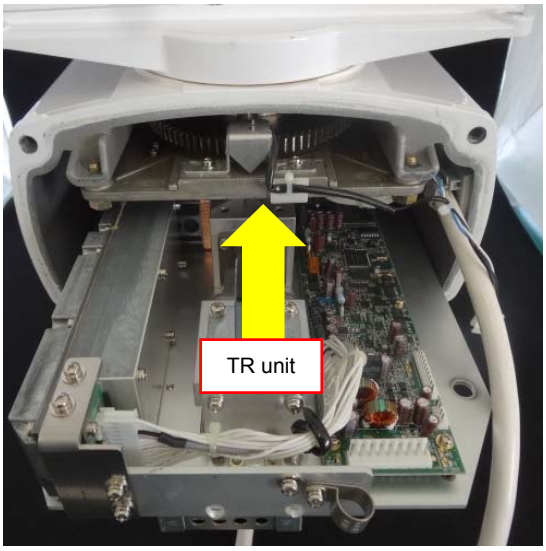
15) This picture is the view of the cable layout.
Clamp the blue tape mark-c by the cable clamp-c.



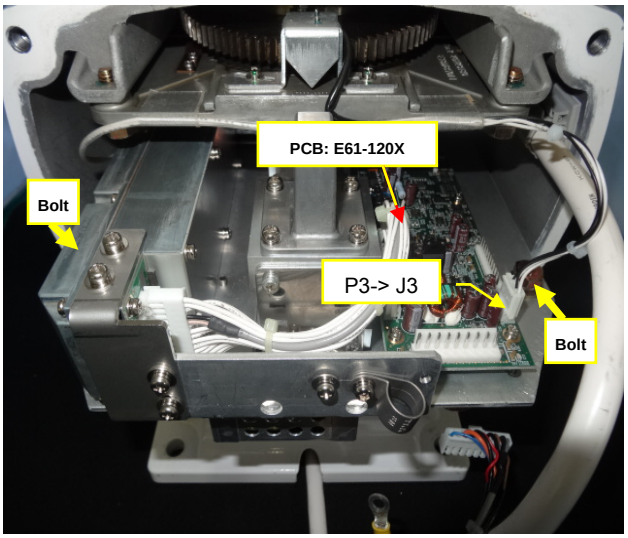
16) Connect connector P2 to J2 and P4 to J5. [PCB E71-110X].



17) Through the P4 to J5 to clamp A and B.

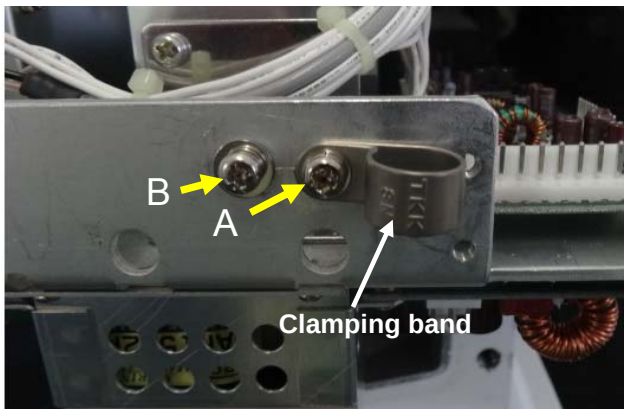


18) Insert TR unit in the scanner unit housing.

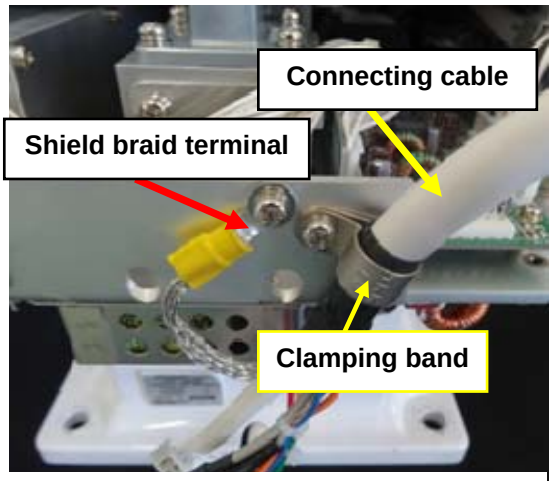


19) Connect connectors P3 to J3 [PCB E61-120X]

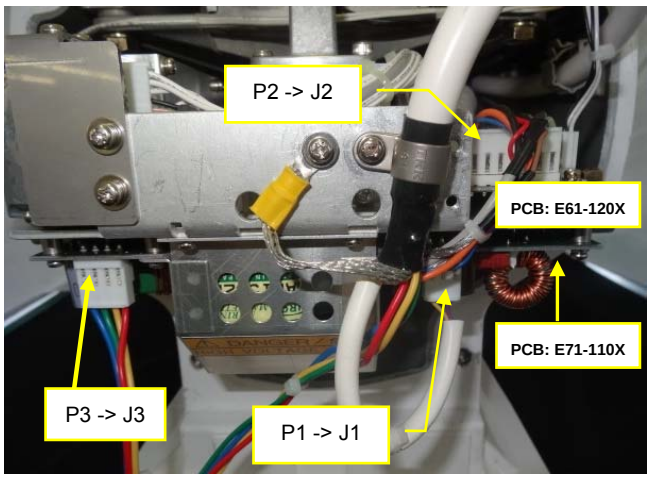
Fix the two fixing bolts.
(Tool: Wrench 13mm)



20) Remove the screw-A and the screw-B.



21) Clamp the connecting cable by the clamping band and fix with screw-A.
Fix the shield braid terminal with screw-B.



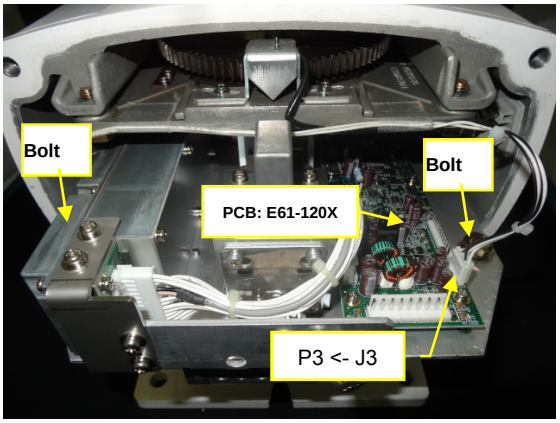
22) Connect connector P2 to J2 [PCB E61-120x].
Connect the connectors P1 and P3 to J1 and J3 [PCB E71-110X].

23) Attach the back cover by tightening four fixing bolts.
(Tool: Wrench 13mm)

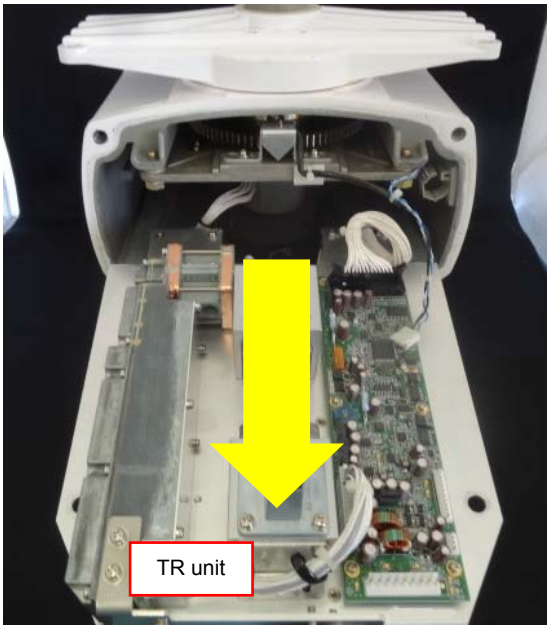
3.1.4.2 Scanner unit 12kW (RB808: MDC-5212/5512)

Make sure the radar system is turned off.

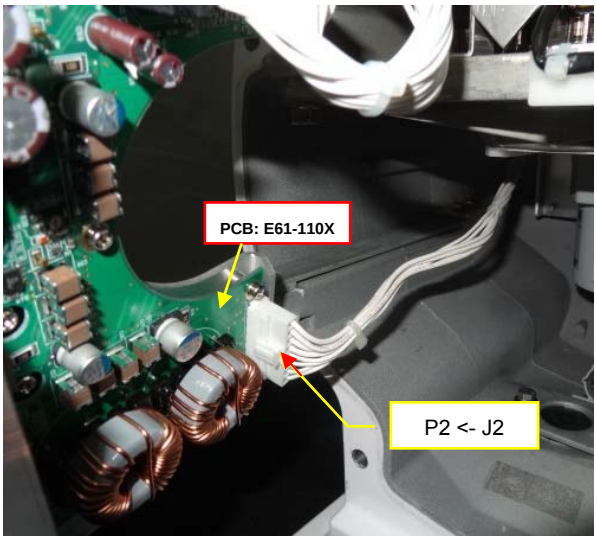
1) Remove back cover by loosening four fixing bolts.
(Tool: Wrench 13mm)



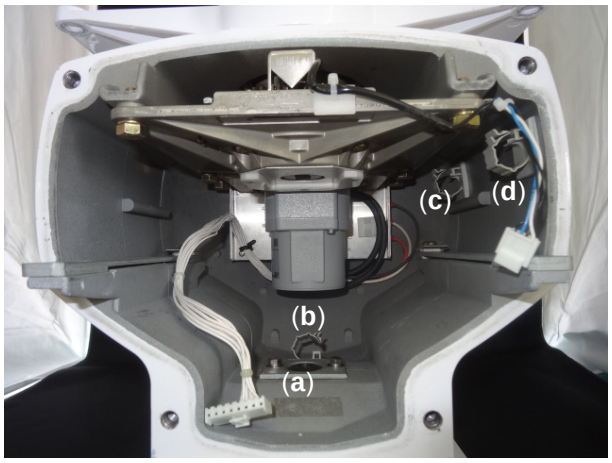
2) Disconnect connectors P3 from J3 [E61-120X].
Remove the two fixing bolts.
(Tool: Wrench 13mm)



3) Pull out the TR unit.



4) Disconnect connector P2 from J2 [E61-110X].



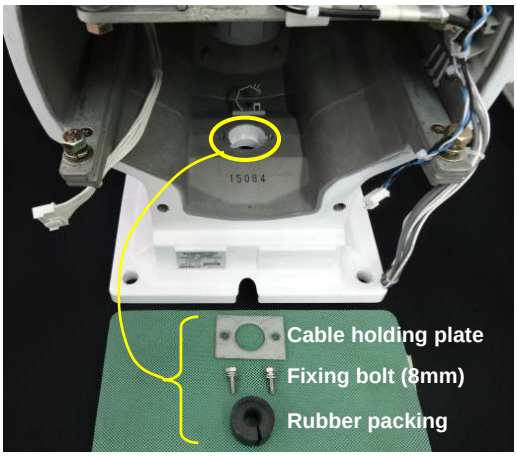
5) This picture is the view of the inside of the scanner unit housing.

(**a**) Cable holding plate

(**b**) Cable clamp-b

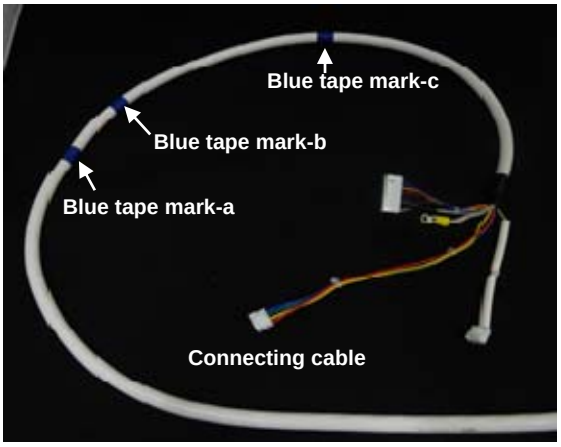
(**c**) Cable clamp-c

(**d**) Cable clamp-d

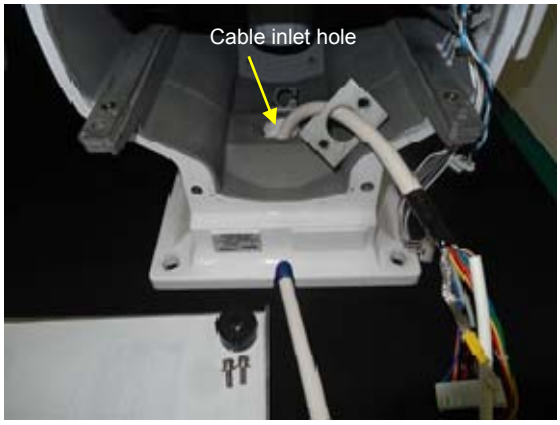


6) Remove two fixing bolts.
(Tool: Wrench 8mm)

Remove the cable holding plate and rubber packing.



7) The connecting cable CW-845-xxM
Blue tapes are wound as a mark on the cable.

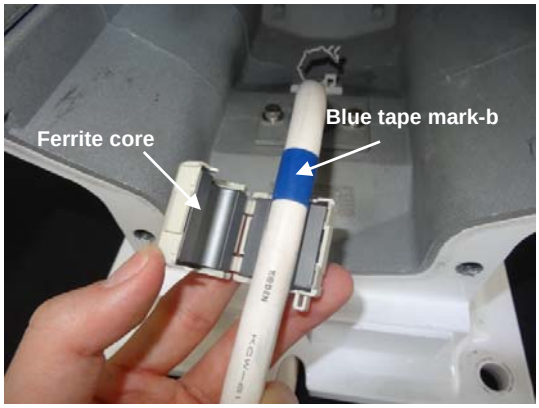


8) Pull in the connecting cable into the scanner unit through the cable inlet hole.

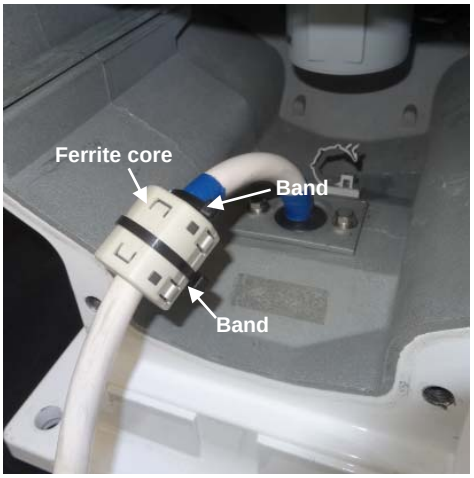
Guide the cable to the cable holding plate.

9) Attach rubber packing to the blue tape Mark-a.

10) Attach cable holding plate and fix it with two bolts.
(Tool: Wrench 8mm)

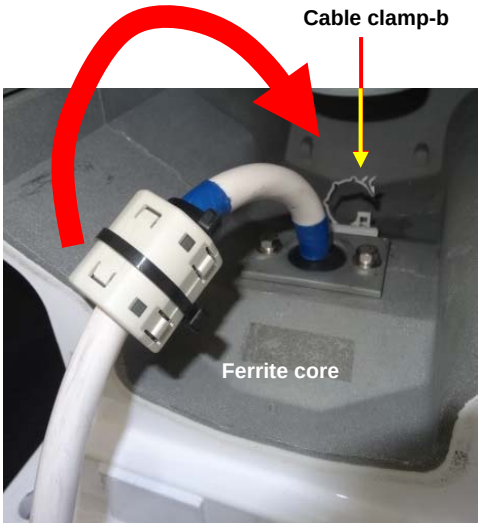


11) Attach the ferrite core to side of the blue tape mark-b.



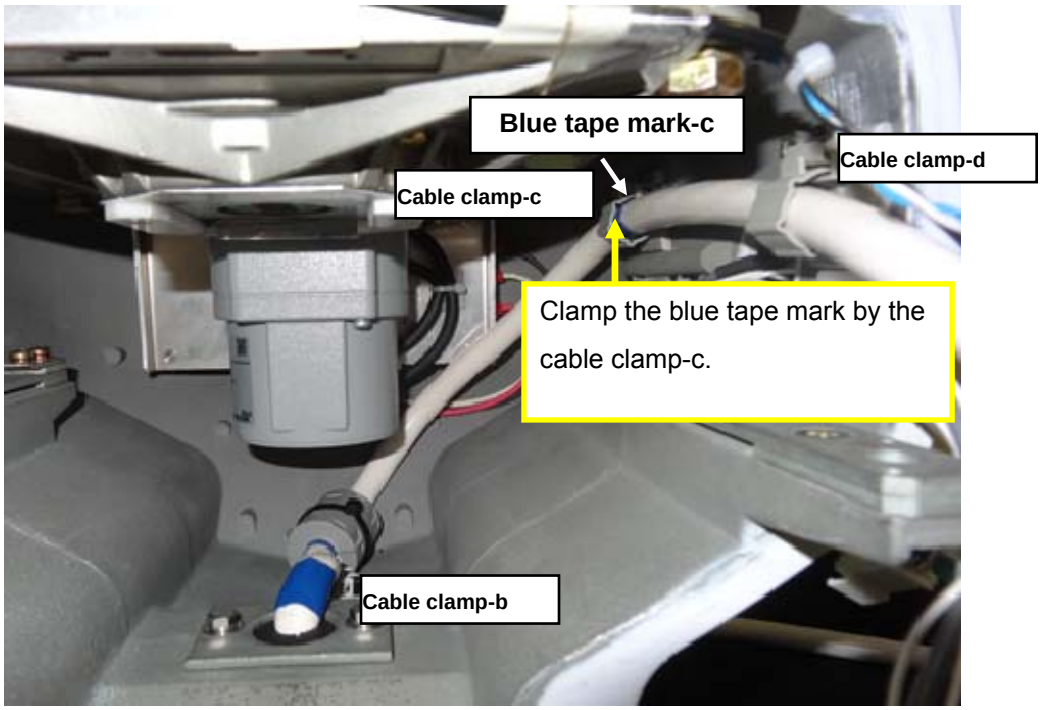
12) Secure the ferrite core in place by using provided bands.

Note: The ferrite core and the bands are included with the installation material.

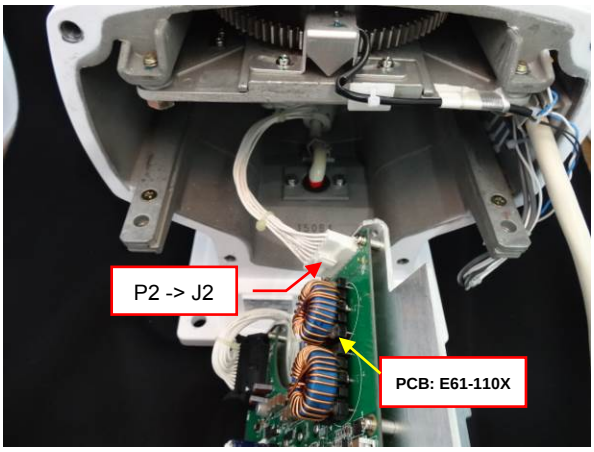


13) Tilt the cable with the ferrite core toward the cable clamp-b.

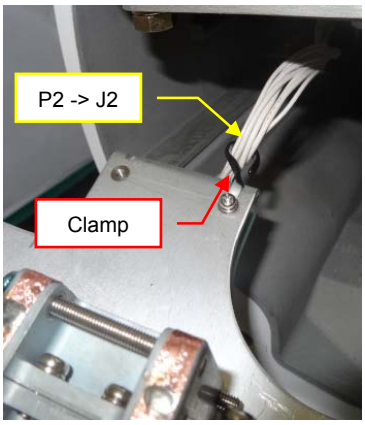
14) Clamp the cable by the cable clamp-b.



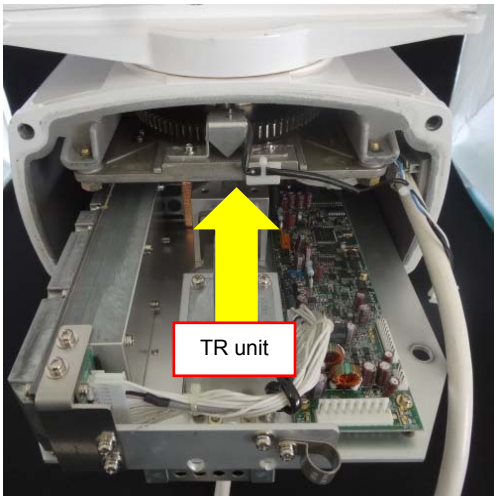
15) This picture is the view of the cable layout.
Clamp the blue tape mark-c by the cable clamp-c.



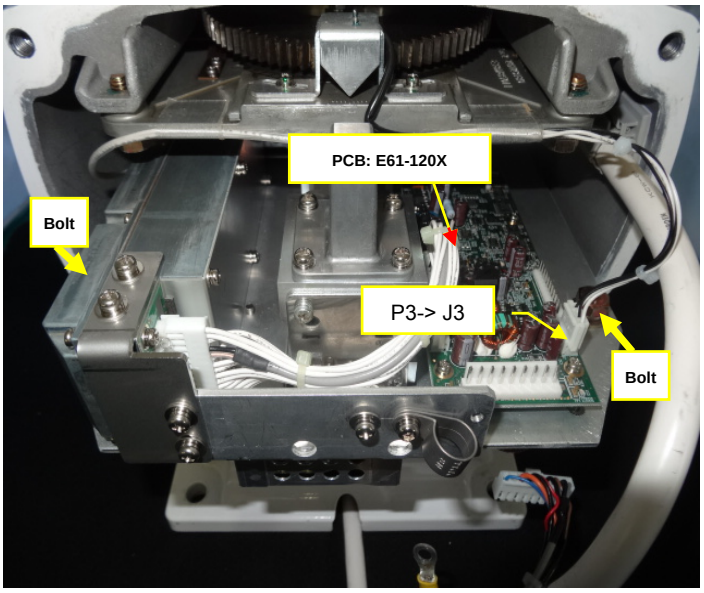
16) Connect connector P2 to J2 [PCB E61-110X].



17) Hook the P2 to J2 to the clamp.



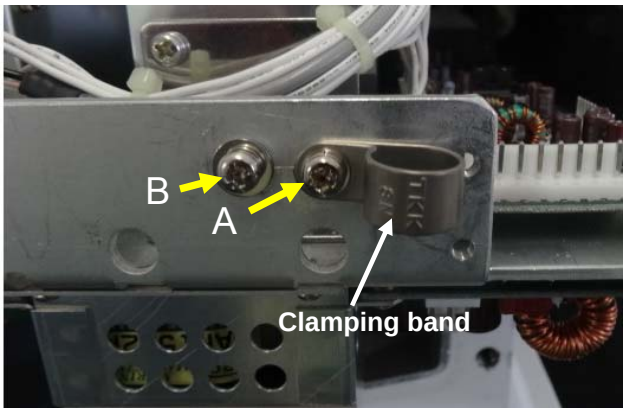
18) Insert TR unit in the scanner unit housing.



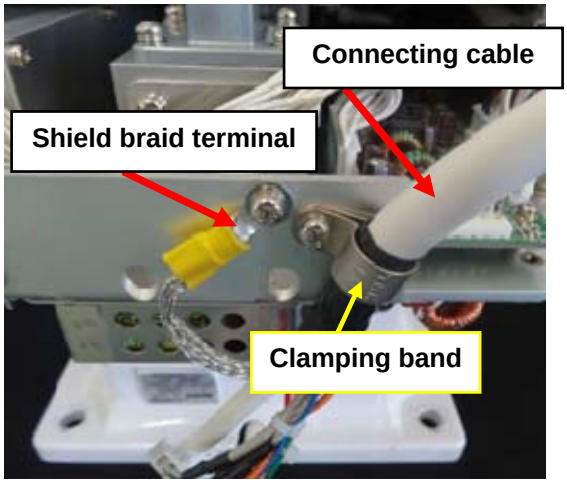
19) Connect connectors P3 to J3 [PCB E61-120X]

Fix the two fixing bolts.

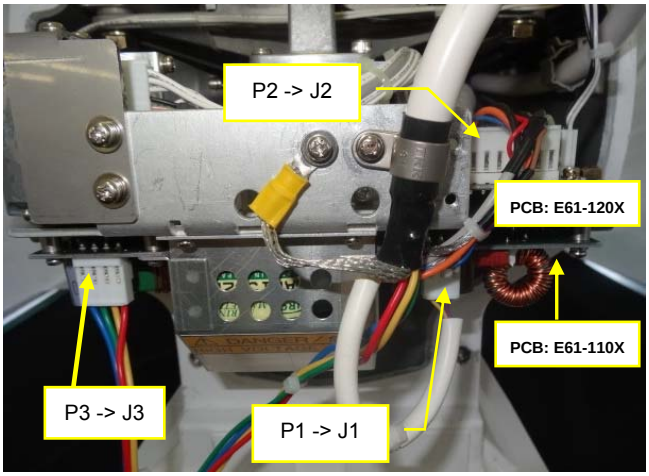
(Tool: Wrench 13mm)



20) Remove the screw-A and the screw-B.



21) Clamp the connecting cable by the clamping band and fix with screw-A.
Fix the shield braid terminal with screw-B.



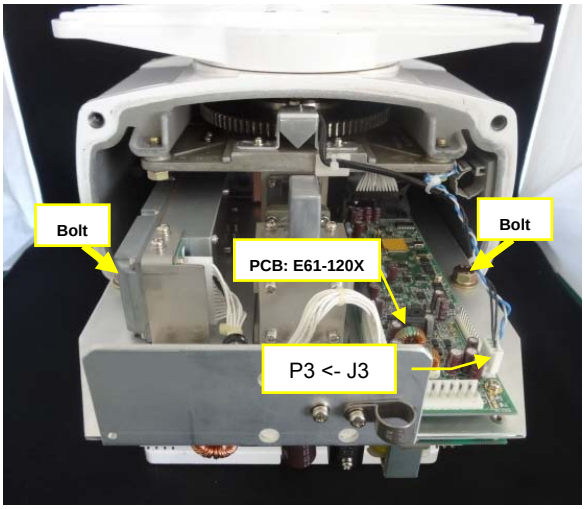
22) Connect connector P2 to J2 [PCB E61-120x].
Connect the connectors P1 and P3 to J1 and J3 [PCB E61-110X].

23) Attach the back cover by tightening four fixing bolts.
(Tool: Wrench 13mm)

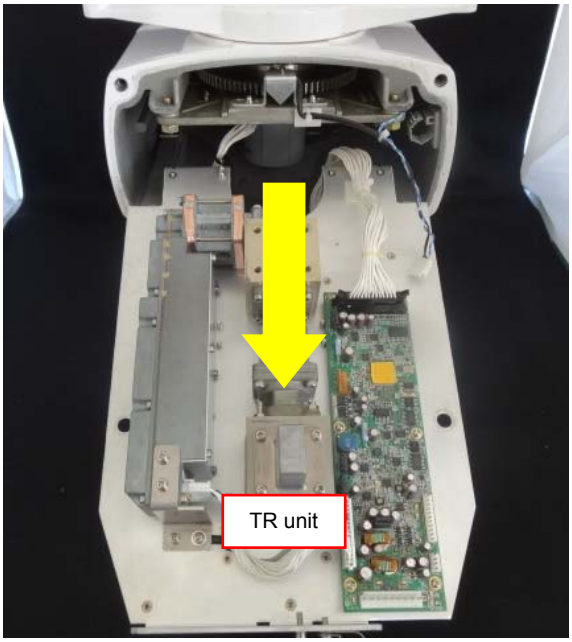
3.1.4.3 Scanner unit 25kW (RB809: MDC-5225/5525)

Make sure the radar system is turned off.

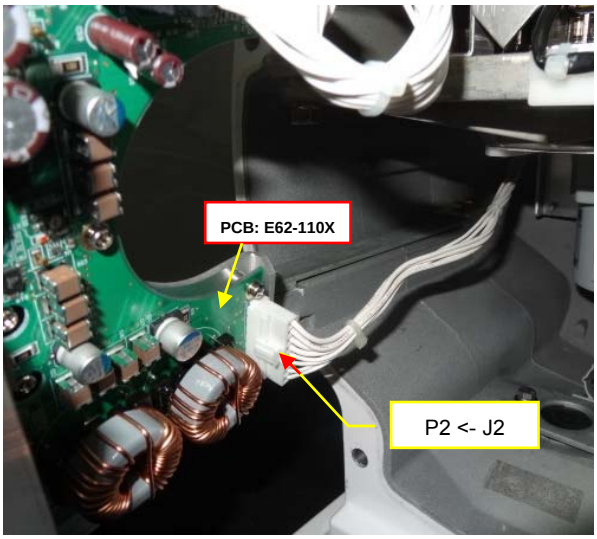
1) Remove the back cover by loosening four fixing bolts.
(Tool: Wrench 13mm)



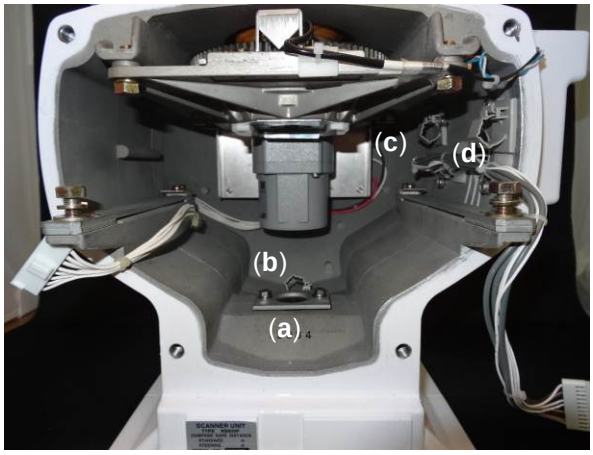
2) Disconnect connectors P3 and P4 from J3 and J4 [E61-120X].
Remove the two fixing bolts.
(Tool: Wrench 13mm)



3) Pull out the TR unit.



4) Disconnect connector P2 from J2 [E62-110X].



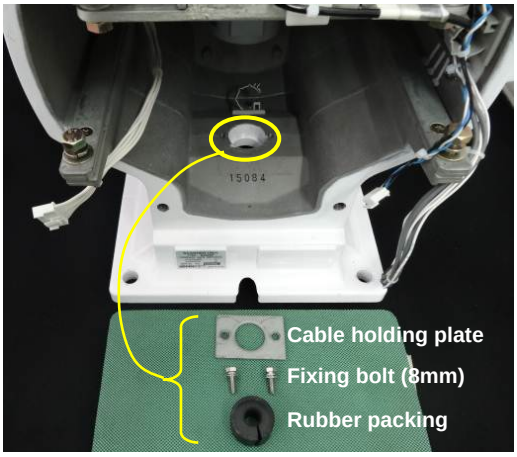
5) This picture is the view of the inside of the scanner unit housing.

(**a**) Cable holding plate

(**b**) Cable clamp-b

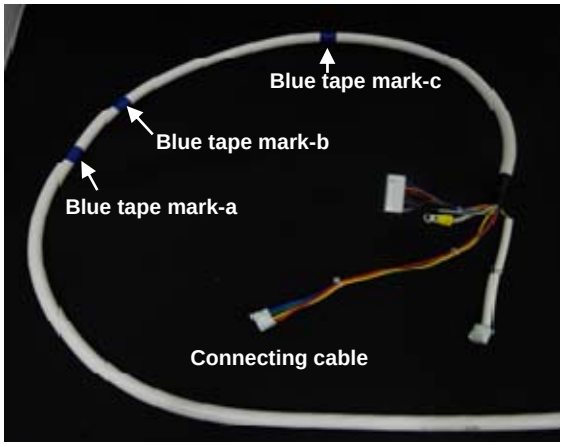
(**c**) Cable clamp-c

(**d**) Cable clamp-d

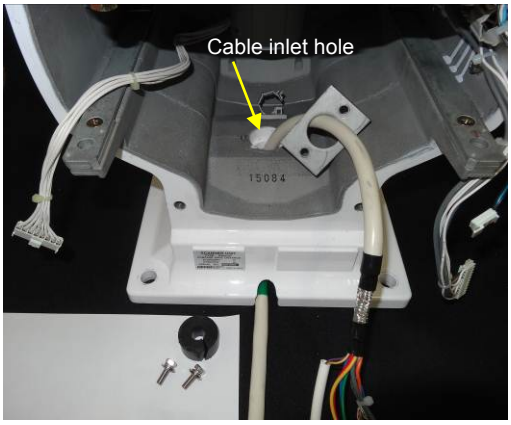


6) Remove the fixing two bolts.
(Tool: Wrench 8mm)

Remove cable holding plate and rubber packing.



7) The connecting cable CW-845-xxM
Blue tapes are wound as a mark on the cable.

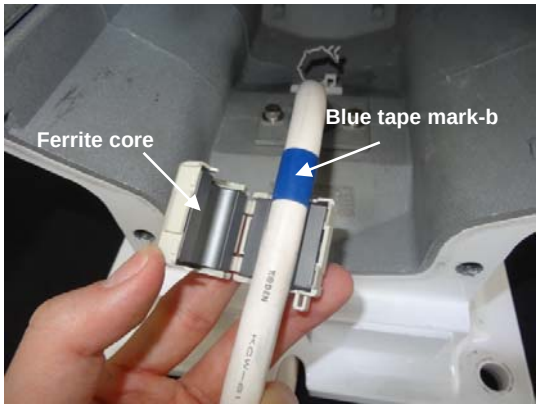


8) Pull into the inside of the scanner unit housing through the cable inlet hole.

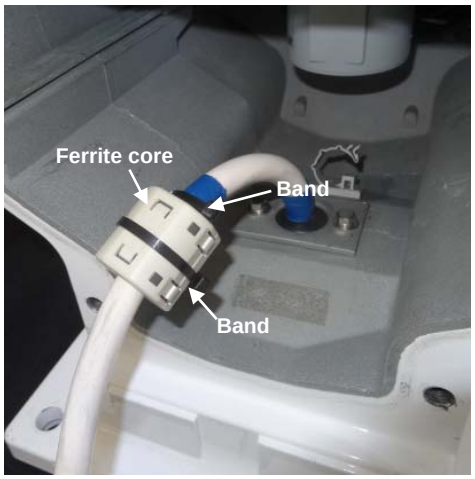
Guide the cable to the cable holding plate.

9) Attach rubber packing to the blue tape Mark-a.

10) Attach cable holding plate and fix it with two bolts.
(Tool: Wrench 8mm)

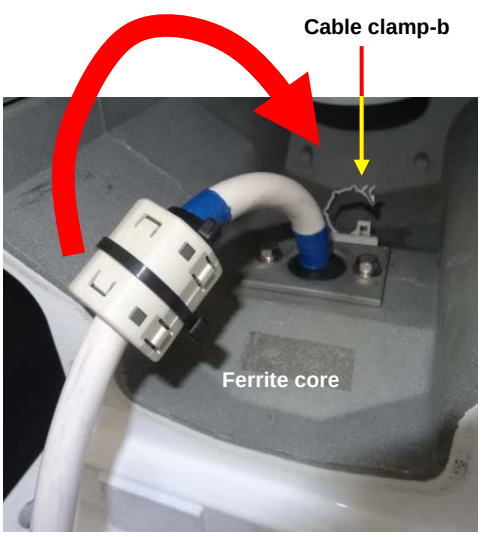


11) Attach the ferrite core to side of the blue tape mark-b.



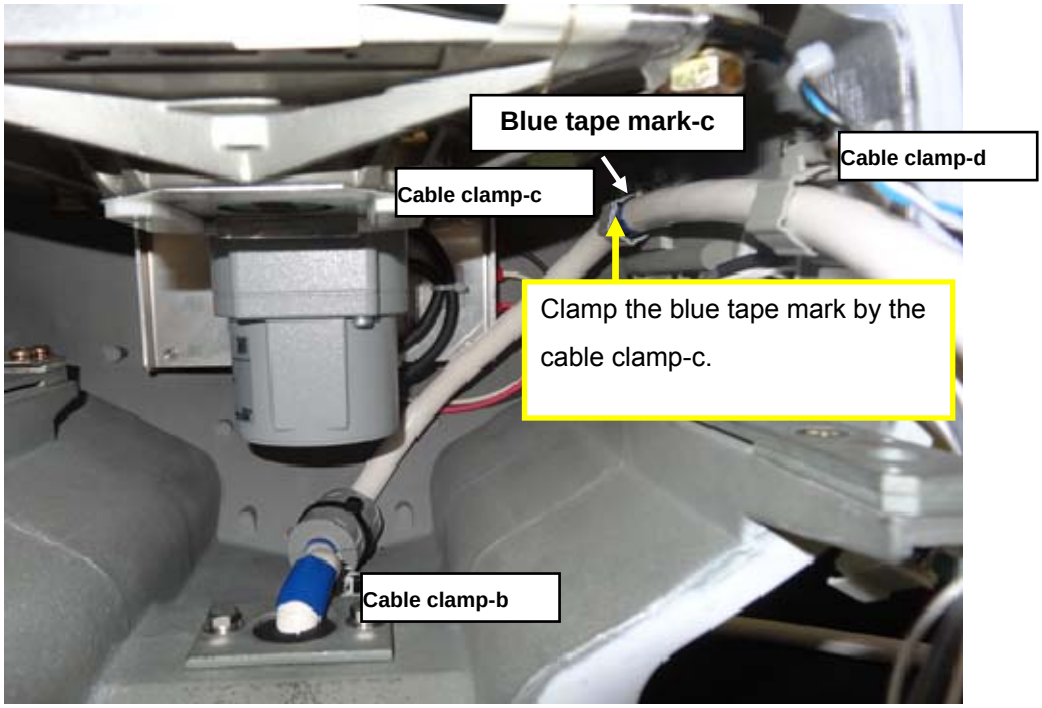
12) Secure the ferrite core in place by using provided bands.

Note: The ferrite core and the bands are included with the installation material.

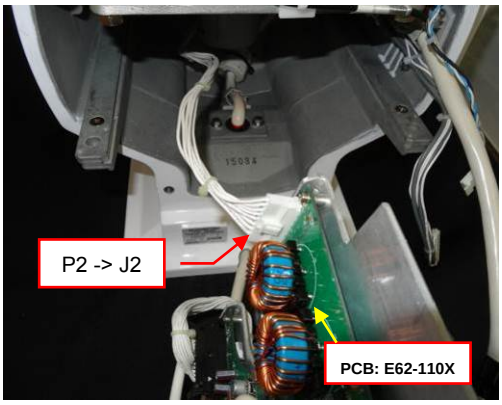


13) Tilt the cable with the ferrite core toward the cable clamp-b.

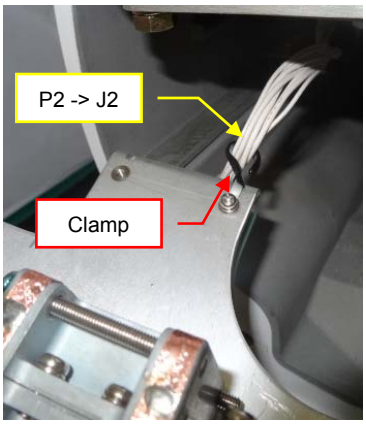
14) Clamp the cable by the cable clamp-b.



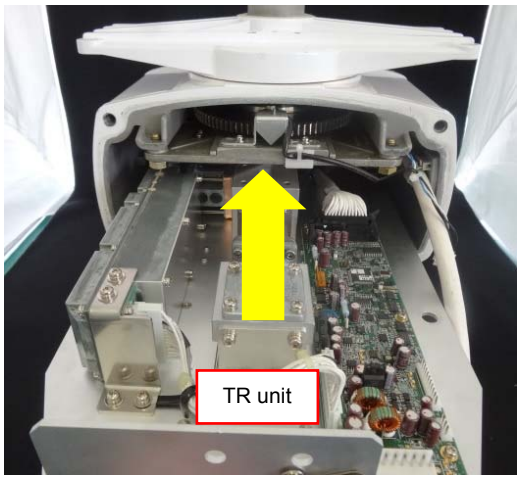
15) This picture is the view of the cable layout.
Clamp the blue tape mark-c by the cable clamp-c.



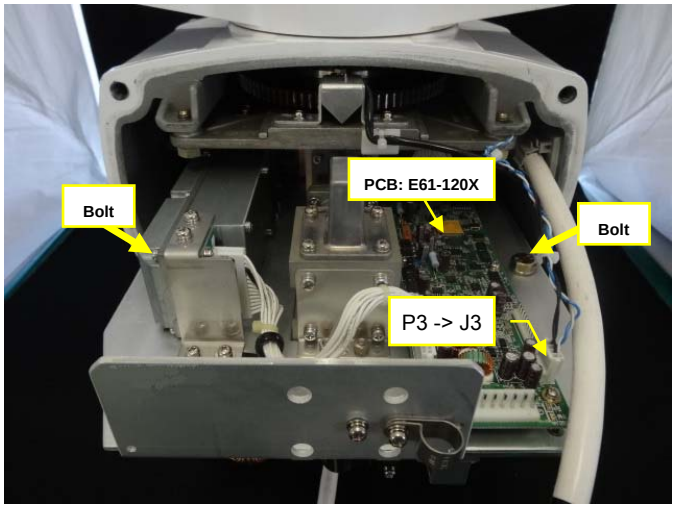
16) Connect connector P2 to J2 [PCB 62-110X].



17) Hook the P2 to J2 to the clamp.

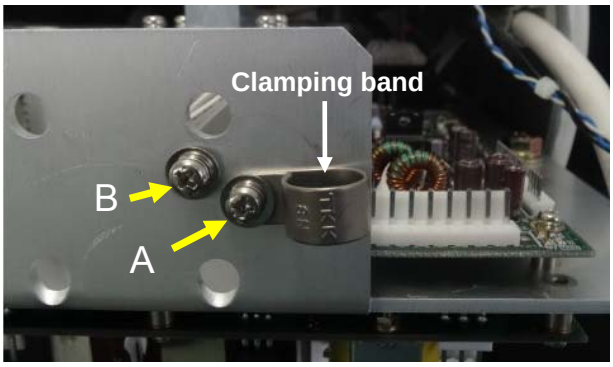


18) Insert the TR unit in the scanner unit housing.

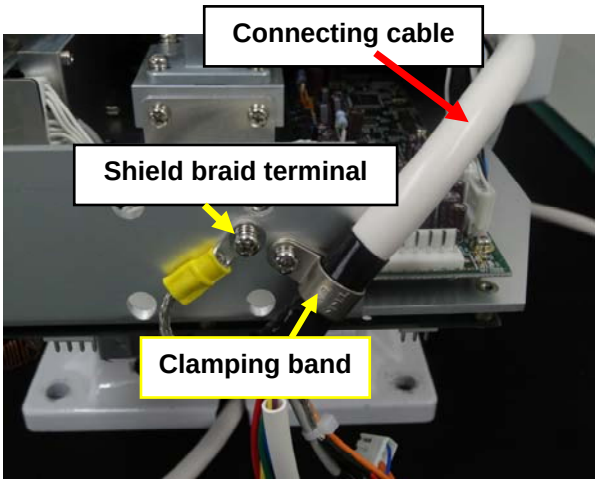


19) Connect connectors P3 and P4 to J3 and J4 [PCB E61-120X]

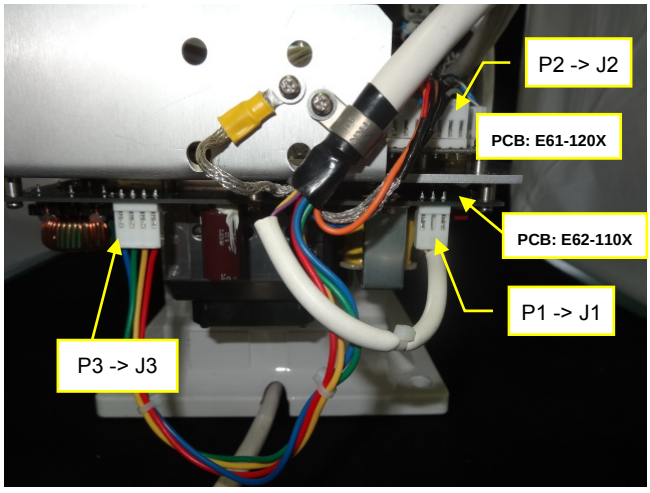
Fix the two fixing bolts.
(Tool: Wrench 13mm)



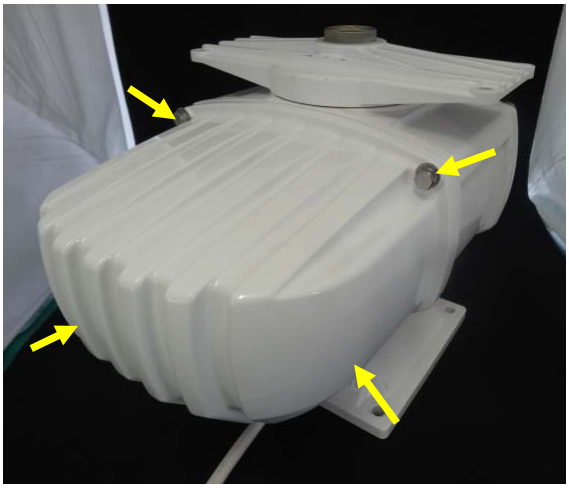
20) Remove screw-A and screw-B.



21) Clamp the connecting cable by the clamping band and fix with screw-A.
Fix the shield braid terminal with screw-B.



22) Connect connector P2 to J2 [PCB E61-120x].
Connect connectors P1 and P3 to J1 and J3 [PCB E62-110X].



23) Attach the back cover by tightening four fixing bolts.
(Tool: Wrench 13mm)

3.2 Interconnection diagram of cable

3.2.1 242J159098 (MDC-5204/5504)

Antenna-scanner unit

P2

Description	Cable color	No.
+250V	Purple	1
-	-	2
GND	Yellow	3
+53V	**Red (thick)**	4
+53V	**Yellow (thick)**	5
+53V-RTN	**Green (thick)**	6
+53V-RTN	**Blue (thick)**	7

P1

Description	Cable color	No.
+24V	Blue	1
-	-	2
+12V	**Orange (thick)**	3
DATA-RTN	Shield	4
DATA	Red (coax)	5
BP/SHF-RTN	Shield	6
BP/SHF	Brown (coax)	7
V/TRG-RTN	Shield	8
V/TRG	Grey (coax)	9

Ground

GND	Shield	

Display unit

PX

No.	Cable color	Description
1	Purple	+250V
2	Blue	+24V
3	**Orange (thick)**	**+12V**
4	Yellow	GND
5	Shield	DATA-RTN
6	Red (coax)	DATA
7	-	-
8	Brown (coax)	BP/SHF
9	Shield	BP/SHF-RTN
10	Grey (coax)	V/TRG
11	-	-
12	**Red (thick)**	**+53V**
13	**Yellow (thick)**	**+53V**
14	Shied	V/TRG-RTN
15	**Green (thick)**	**+53V-RTN**
16	**Blue (thick)**	**+53V-RTN**

Figure 3.4 Interconnection of cable (242J159098x) between Antenna-Scanner unit and Display unit

3.2.2 CW-845 (MDC-5206/5212/5225/5506/5512/5525)

Antenna-scanner unit

P1

Description	Cable color	No.
+24V	Blue	1
-	-	2
+12V	**Orange (thick)**	3
DATA-RTN	Shield	4
DATA	Red (coax)	5
BP/SHF-RTN	Shield	6
BP/SHF	Brown (coax)	7
V/TRG-RTN	Shied	8
V/TRG	Grey (coax)	9

P2

Description	Cable color	No.
+250V	Purple	1
-	-	2
GND	Yellow	3

P3

Description	Cable color	No.
+53V	**Red (thick)**	1
+53V	**Yellow (thick)**	2
+53V-RTN	**Green (thick)**	3
+53V-RTN	**Blue (thick)**	4

Ground

GND	Shield	

Display unit

PX

No.	Cable color	Description
1	Purple	+250V
2	Blue	+24V
3	**Orange (thick)**	**+12V**
4	Yellow	GND
5	Shield	DATA-RTN
6	Red (coax)	DATA
7	-	-
8	Brown (coax)	BP/SHF
9	Shield	BP/SHF-RTN
10	Grey (coax)	V/TRG
11	-	-
12	**Red (thick)**	**+53V**
13	**Yellow (thick)**	**+53V**
14	Shied	V/TRG-RTN
15	**Green (thick)**	**+53V-RTN**
16	**Blue (thick)**	**+53V-RTN**

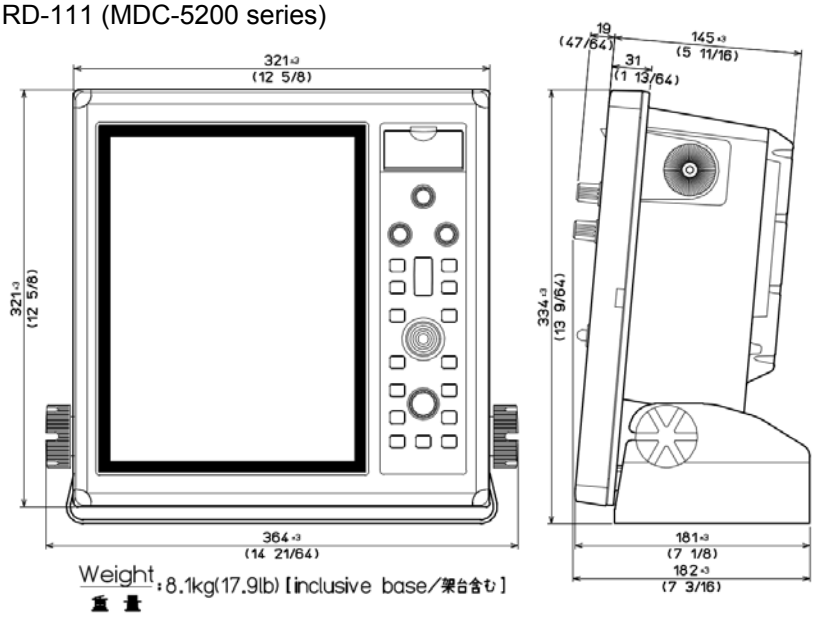
Figure 3.5 Interconnection of cable (CW-845) between Antenna-Scanner unit and Display unit

3.3 Installation of the display unit

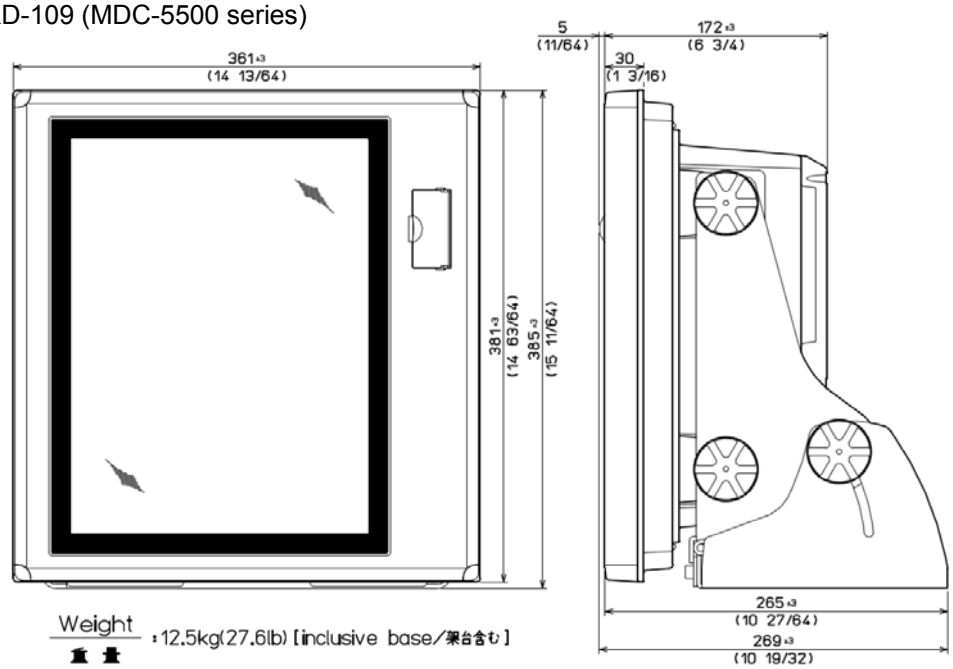
The Display unit can be mounted tabletop or panel flush mount using following procedures.
Install the display unit so that when user is looking ahead, the lookout view is not obscured. The orientation of the display unit should be such that the user is looking ahead. The lookout view should not be obscured and the ambient light should cause minimum degradation on the display.

External view and dimensions

MRD-111 (MDC-5200 series)

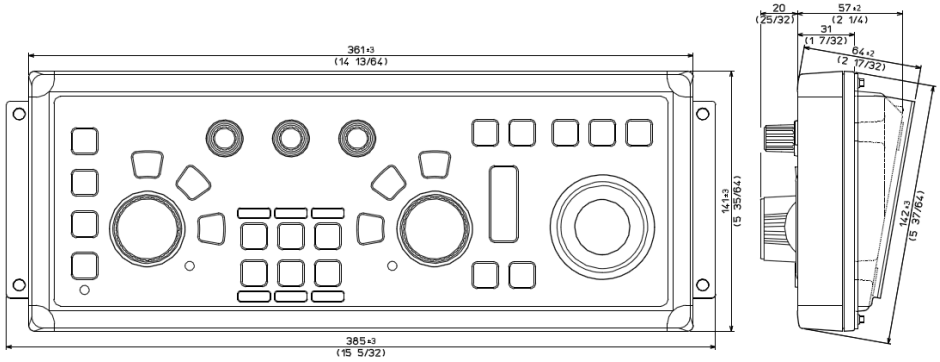


MRD-109 (MDC-5500 series)



Unit: mm (inch)

MRO-108 (MDC-5500 series)



Weight 重量 : 1.8kg(4lb) [inclusive base and connecting cable /架台及び接続ケーブル含む]

Unit: mm (inch)

3.3.1 Installation of MRD-111 (MDC-5200 series)

3.3.1.1 Table mounting of MRD-111

(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).

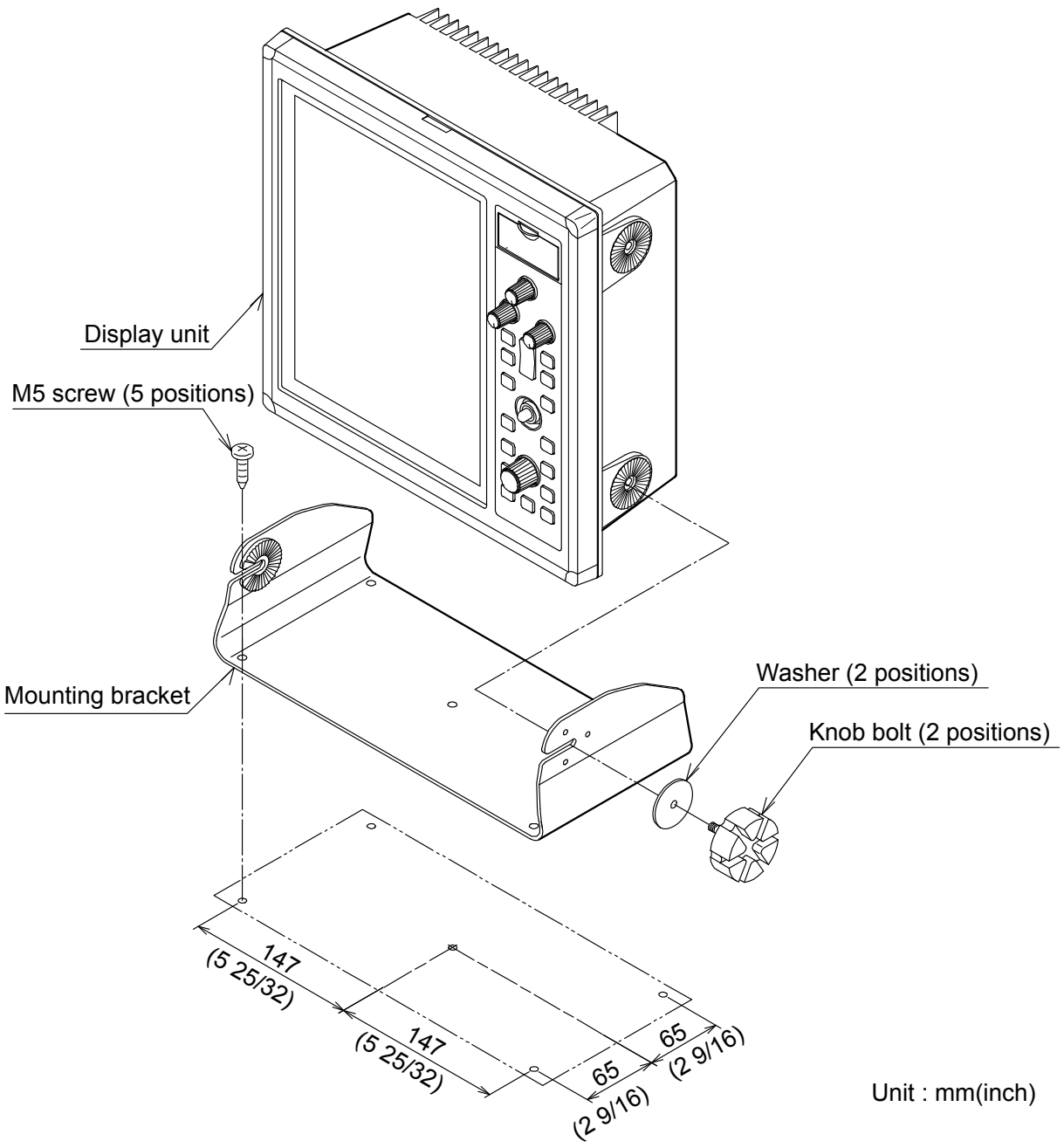
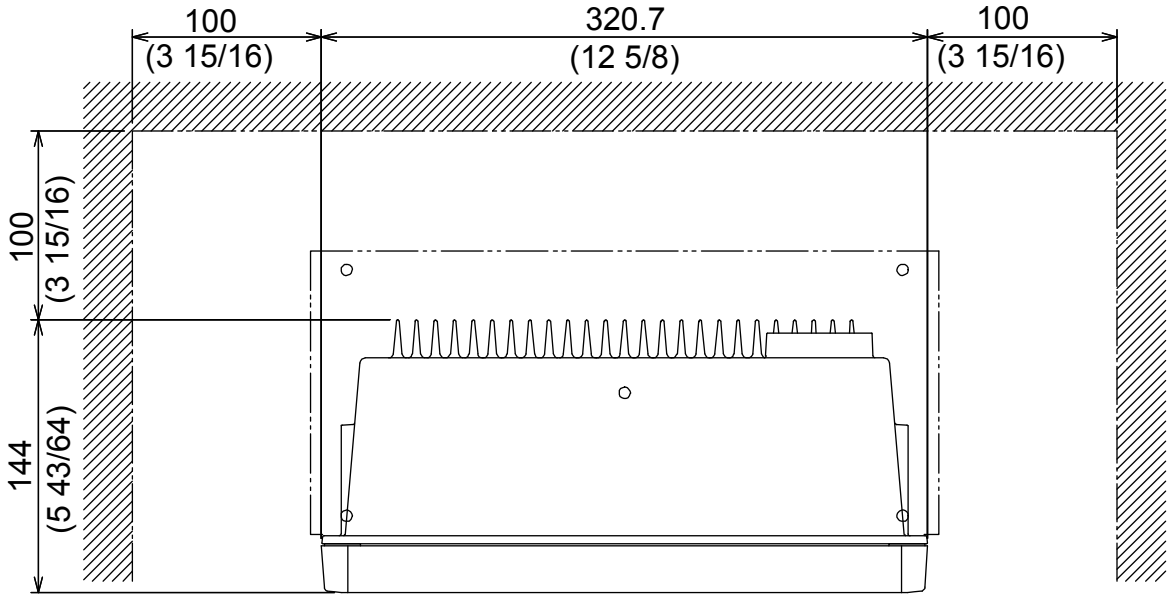


Figure 3.6 Diagram of installation procedure on the table

Note: In 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 unit

3.3.1.2 Flush Mounting for MRD-111

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.

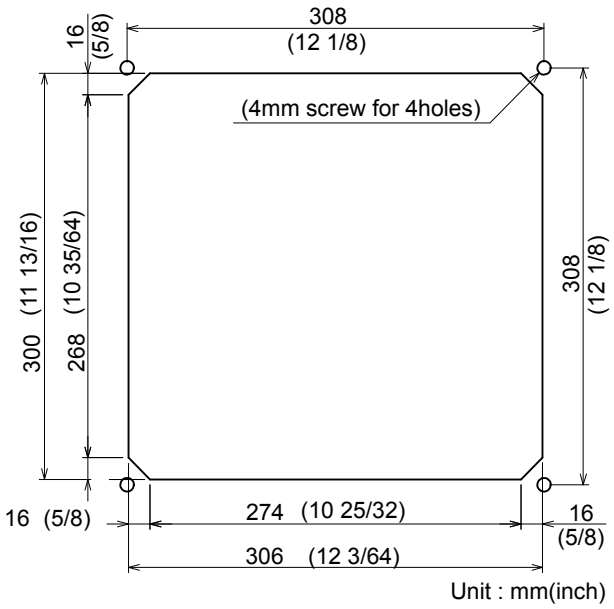


Figure 3.8 The opening and nut-holes for Display unit

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.

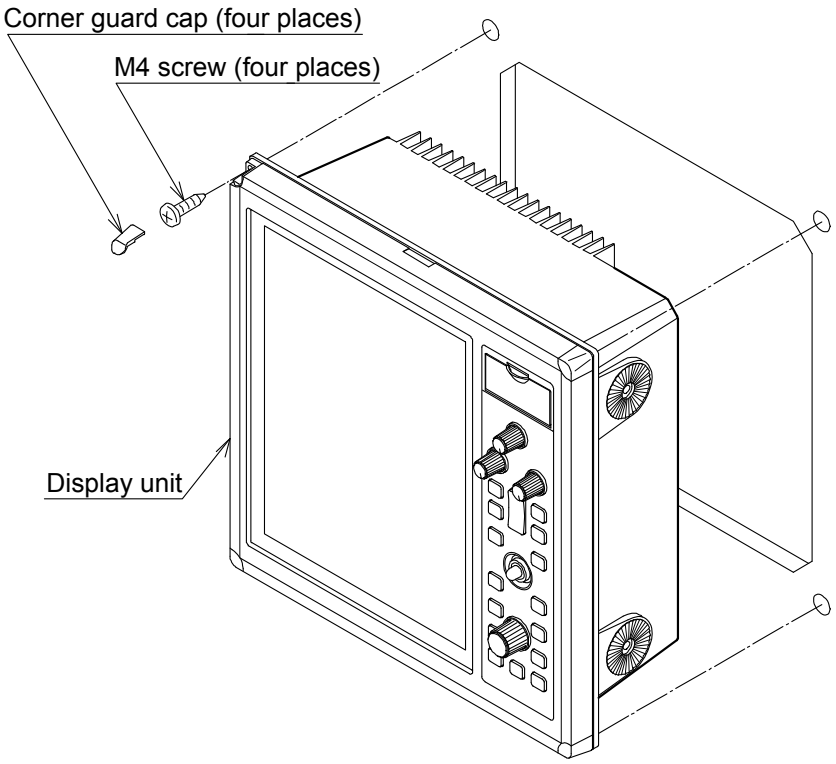


Figure 3.9 Mounting the Display unit into place

3.3.2 Installation of MRD-109/MRO-108 (MDC-5500 series)

3.3.2.1 Table mounting of MRD-109

(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).

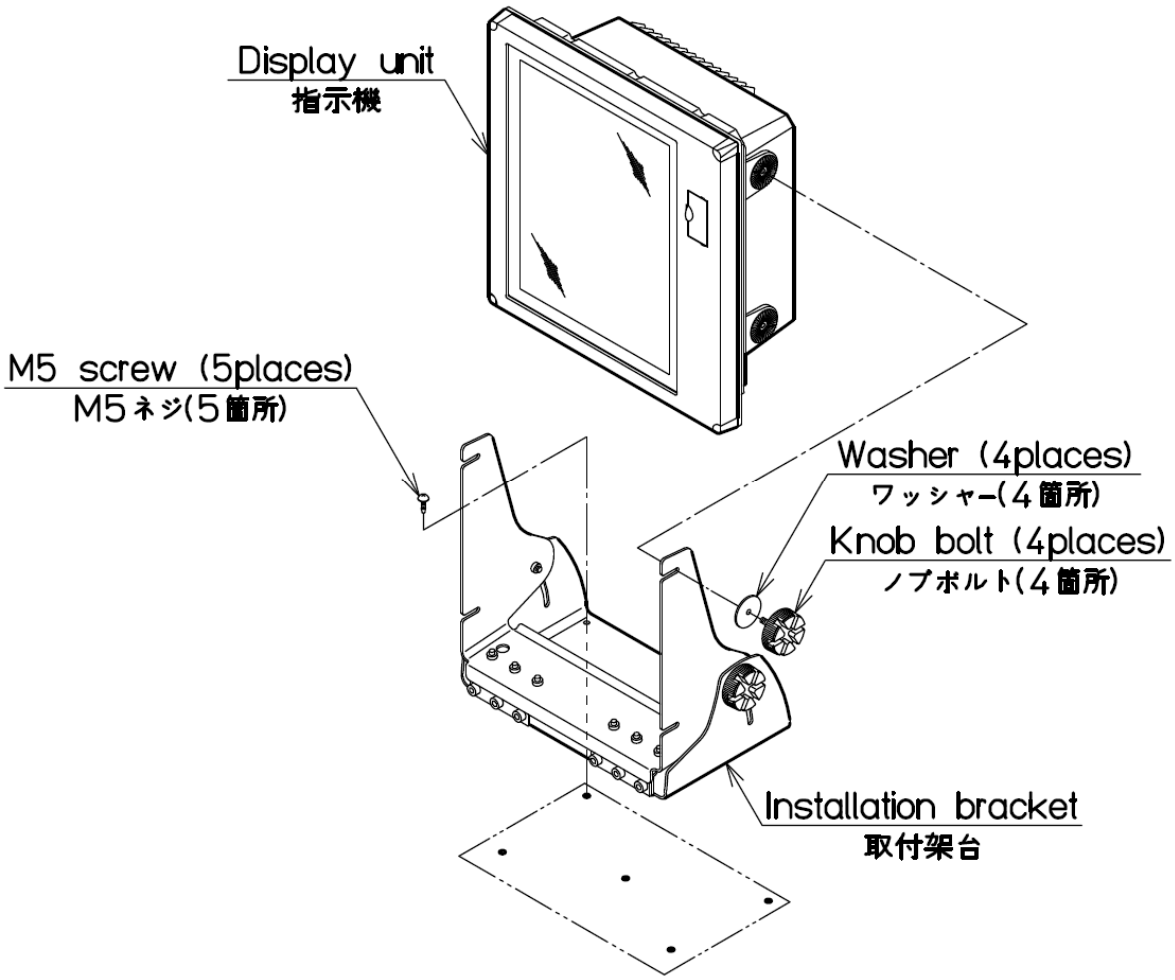
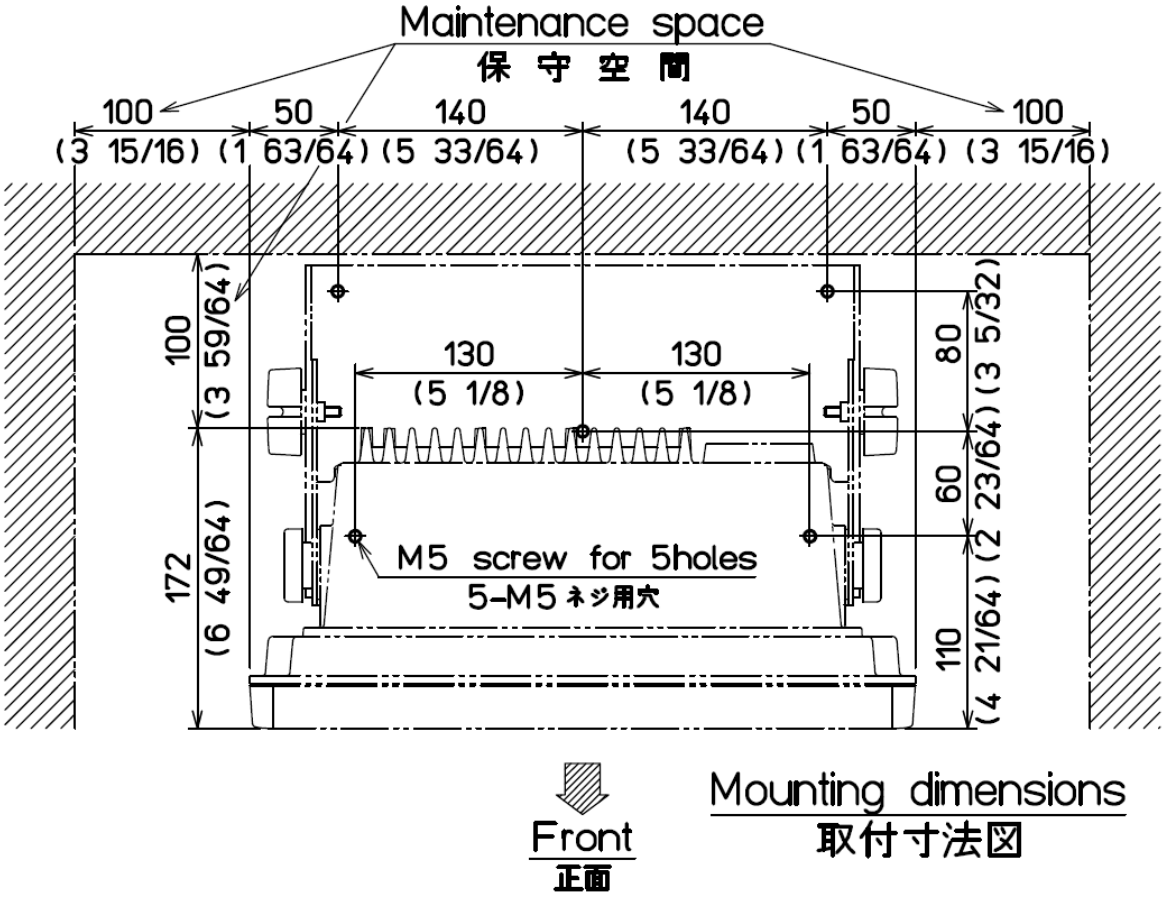


Figure 3.10 Diagram of installation procedure

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

3.3.2.2 Table mounting of MRO-108

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

(2) Remove M4 (4 mm) screws with which the Operation panel is secured to the mounting bracket and remove the Operation panel 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 Operation panel to clamps with M4 (4 mm) screws that were removed in (2) and fit the corner guard caps of the four corners.

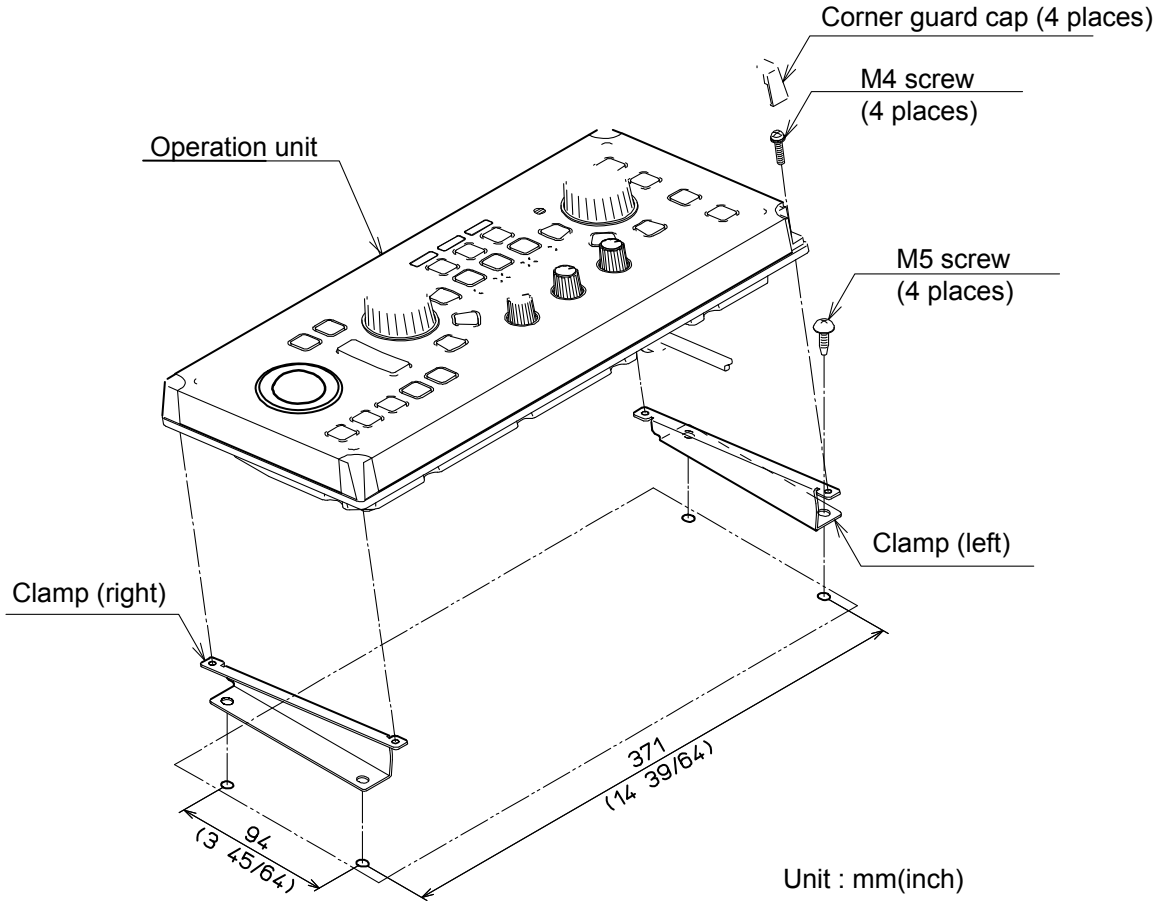


Figure 3.12 Installation of Operation unit

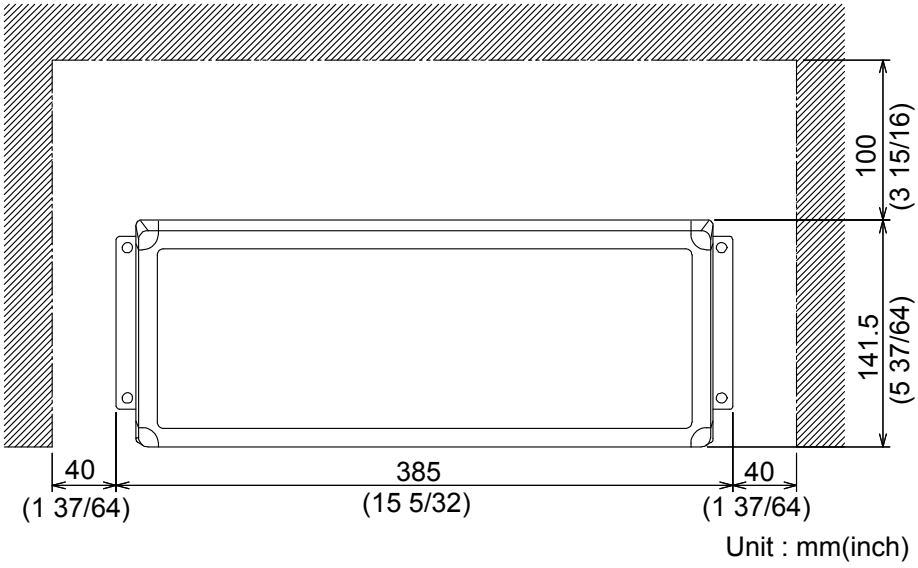


Figure 3.13 Maintenance space necessary for operation

3.3.2.3 Flush Mounting of MRD-109

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.

(4) Remove the Display unit from the mounting bracket and set it on the level place.

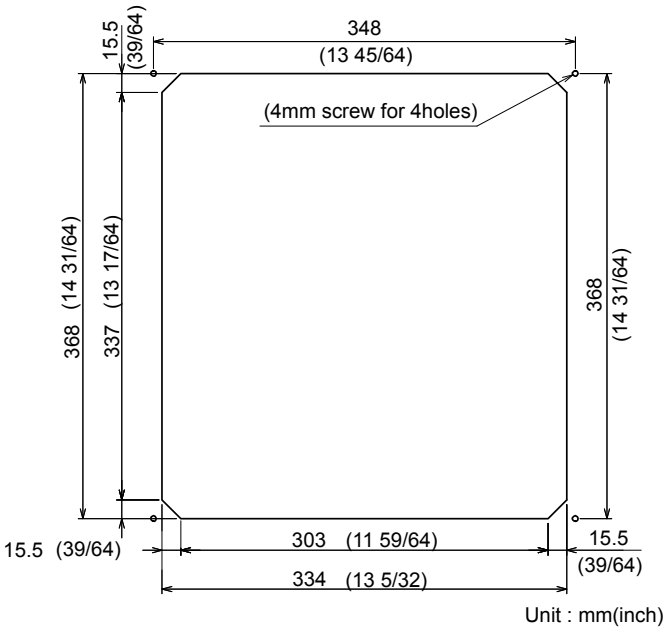


Figure 3.14 Opening and holes for mounting a Display unit

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.

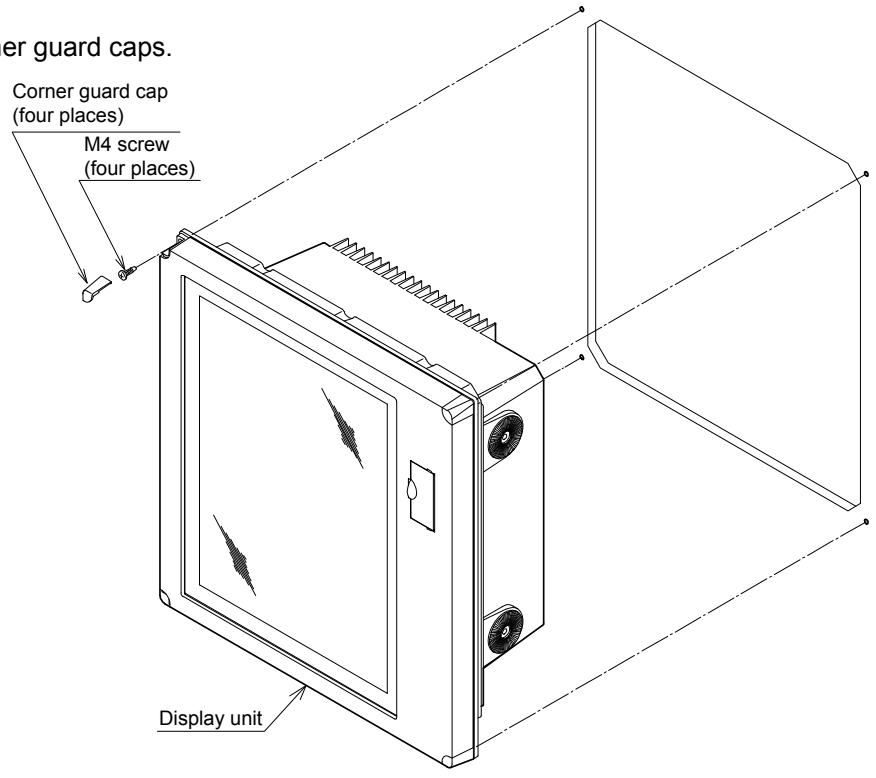


Figure 3.15 Flush Mounting the Display unit

3.3.2.4 Flush mounting of MRO-108

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.

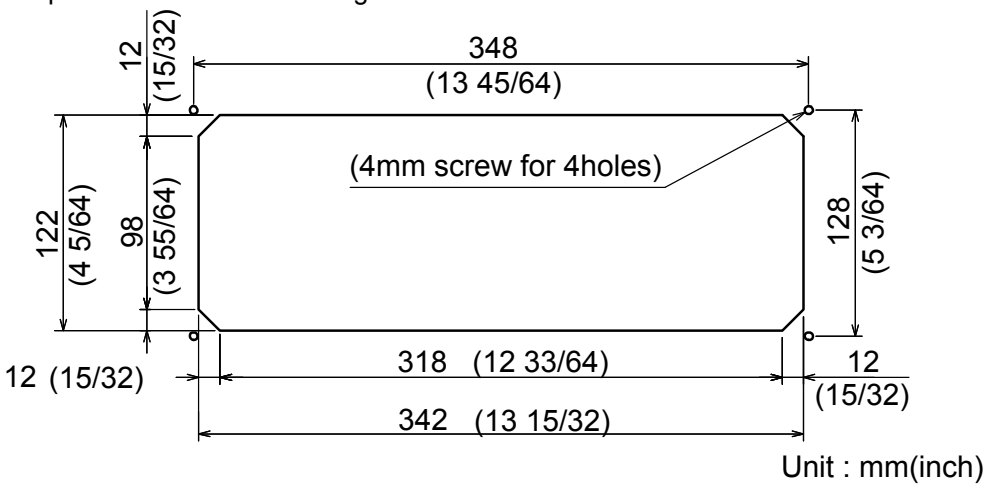


Figure 3.16 Diagram of processing holes for mounting an Operation panel

Installation:

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

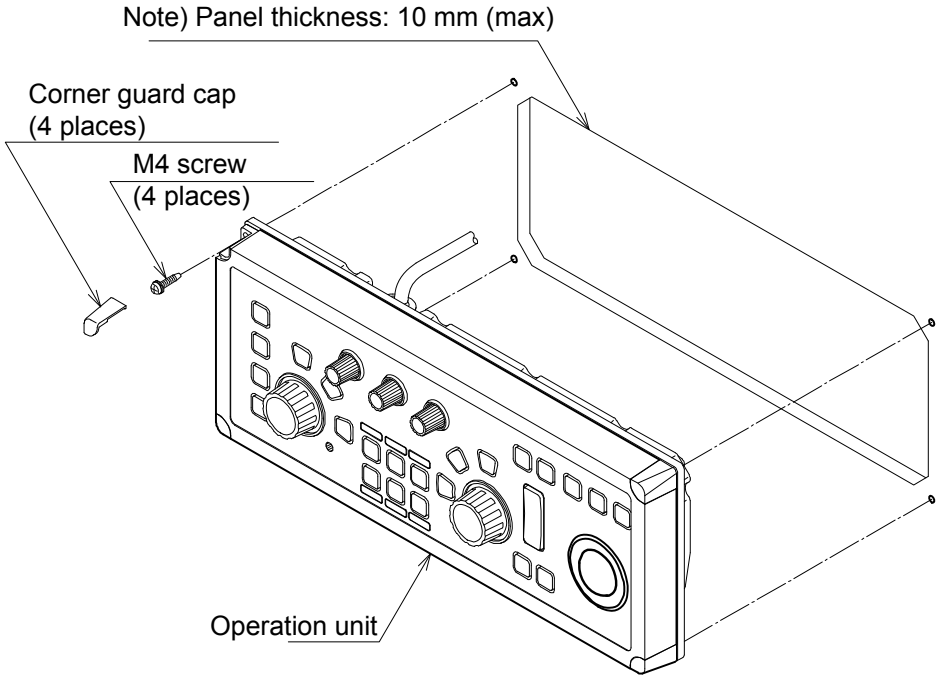
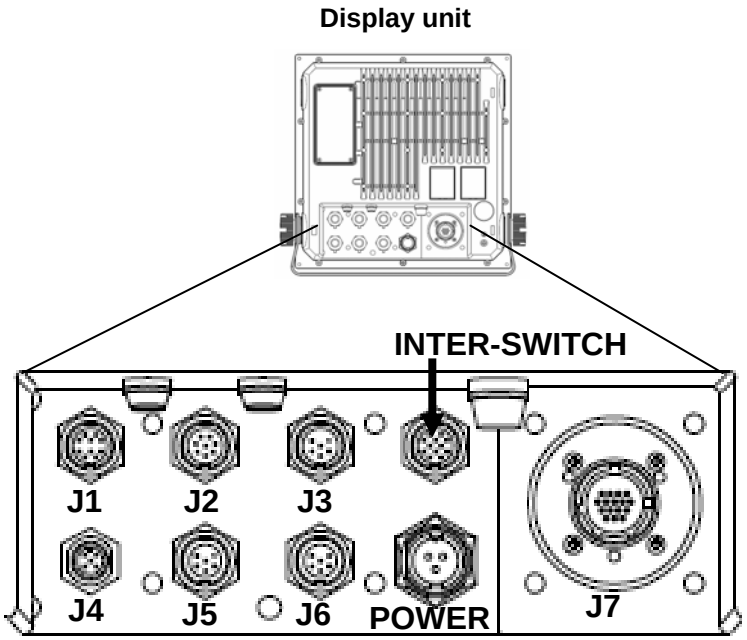


Figure 3.17 Flush Mounting the Operation unit

3.4 Cable connection to a Display unit



J1: External monitor and external buzzer output

J2: AIS signal input

J3: NMEA input/output

Inter-switch status control

J4: NC

J5: NMEA input/output

J6: NMEA input/output

Connection port of KODEN GPS compass

INTER-SWITCH: Radar video, Trig, AZI, SHM signal input/output for inter-switch

POWER: Input DC power source

J7: Connection Antenna-Scanner unit

3.4.1 Cable connection for MRD-111 (MDC-5200 series)

Attach cables from an Antenna-Scanner unit and power source, to corresponding receptacles as shown in Figure 3.18.

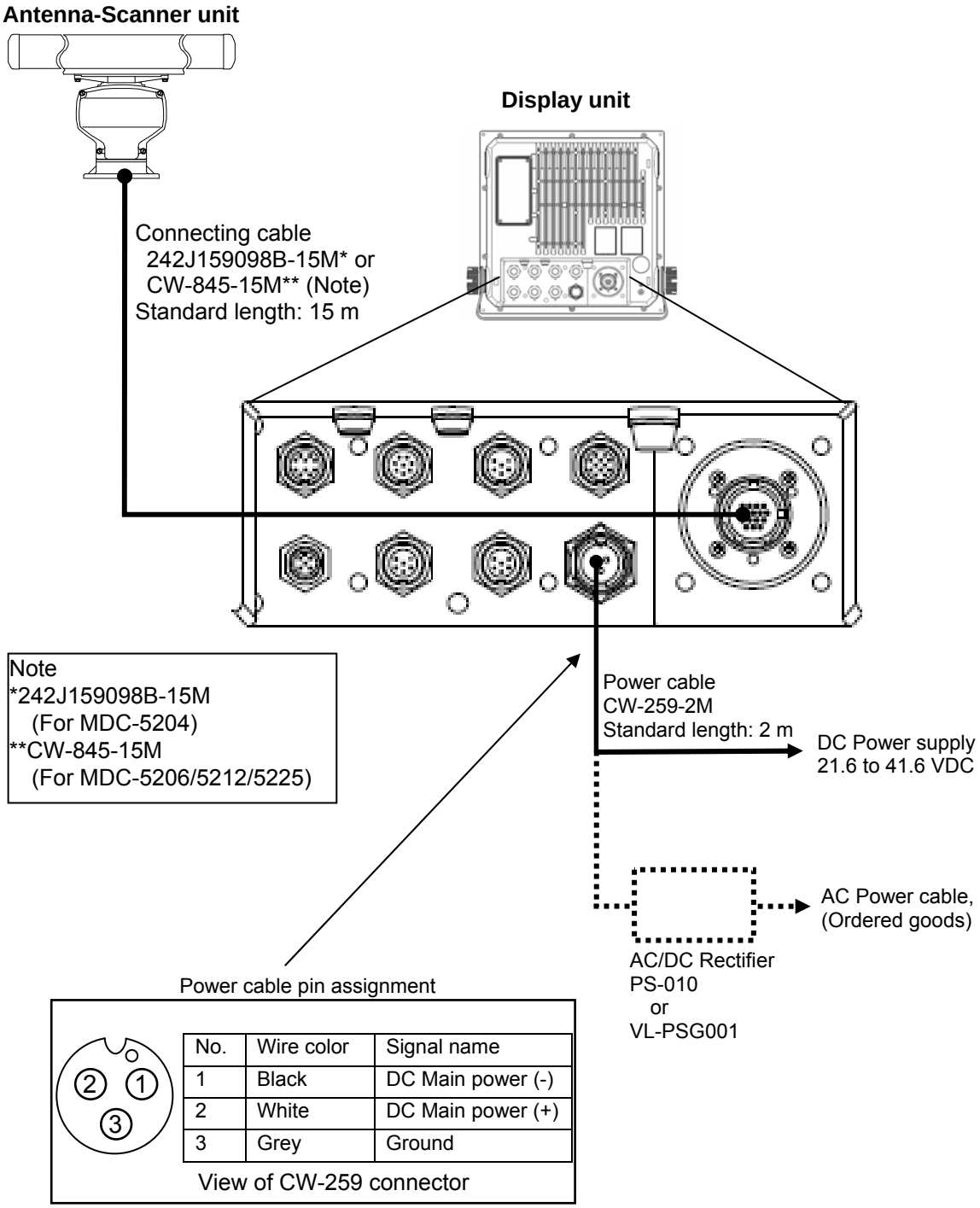


Figure 3.18 Cable connections for standard configuration of MRD-111 Display unit

3.4.2 Cable connection for MRD-109 (MDC-5500 series)

Attach cables from an Antenna-Scanner unit, power source and Operation unit, to corresponding receptacles as shown in Figure 3.19.

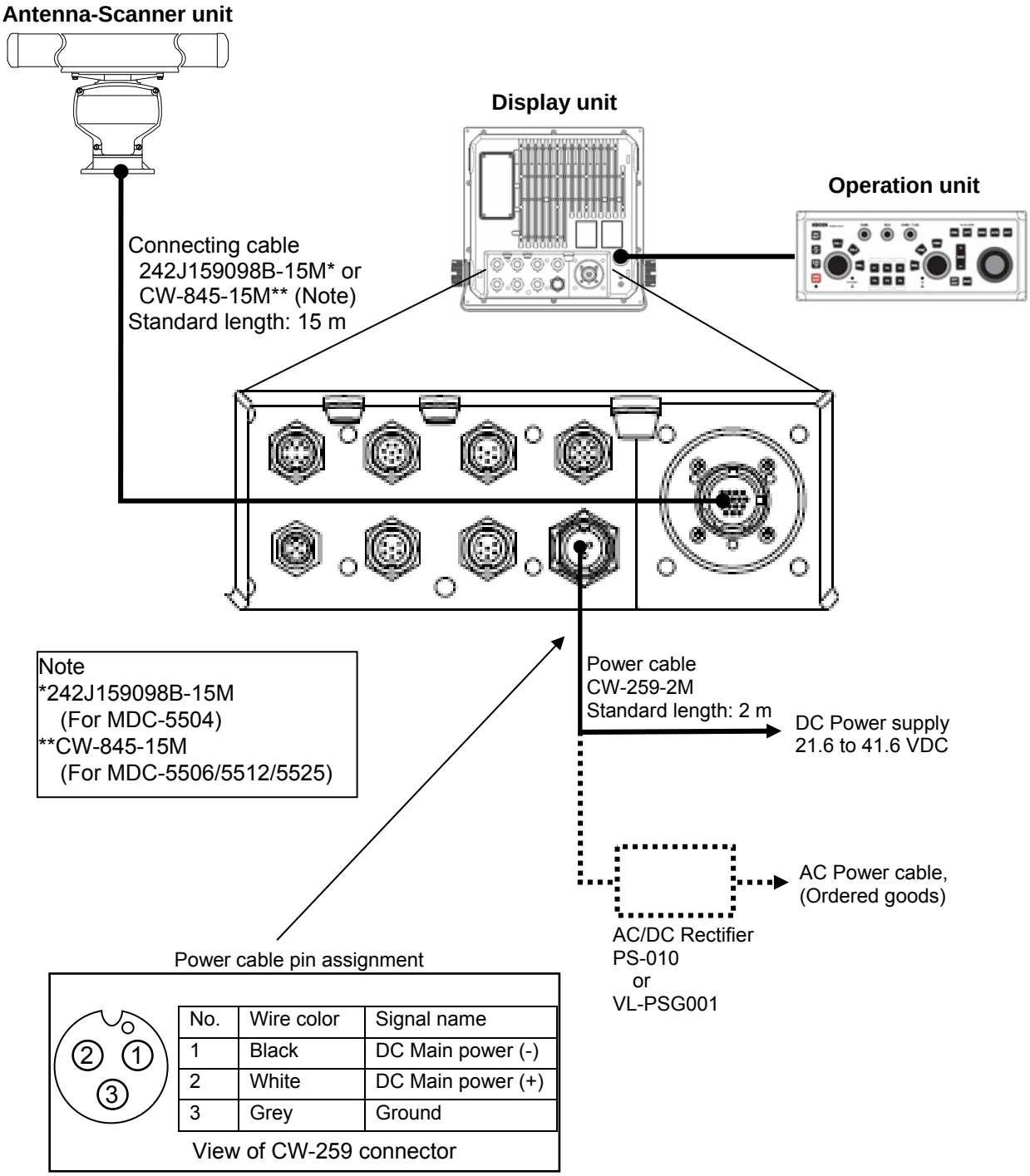


Figure 3.19 Cable connections for standard configuration of MRD-109 Display unit

3.4.3 KODEN GPS compass connection

When using the KODEN GPS compass (KGC-1, KGC-222), connect the **J6 port** of the Display unit to DATA2 connector of KGC-1/ DATA1 or DATA2 connector of KGC-222. This connection allows high data speed.

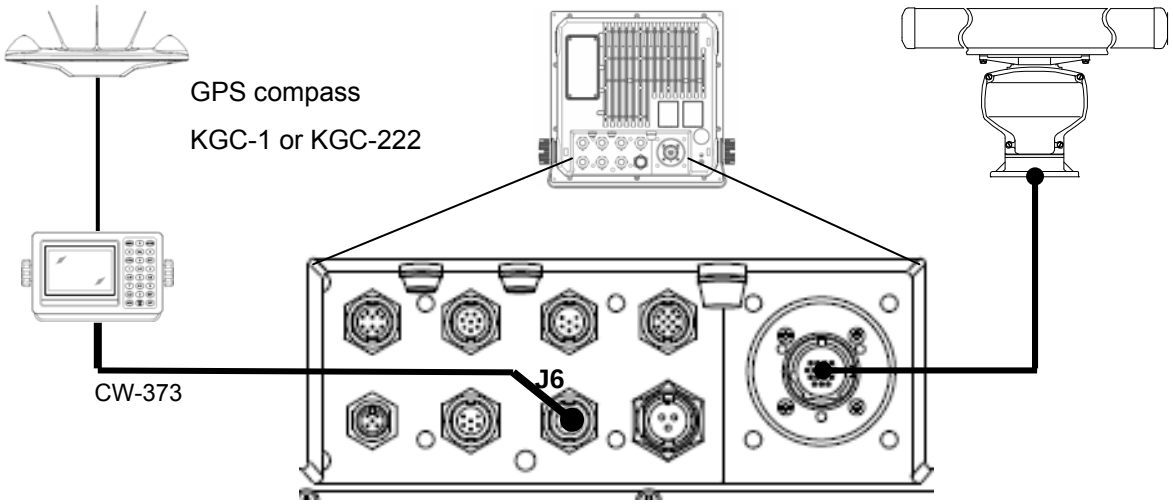


Figure 3.20 Cable connection between Display unit and KODEN GPS compass

The procedure to Switch to high-speed communication mode

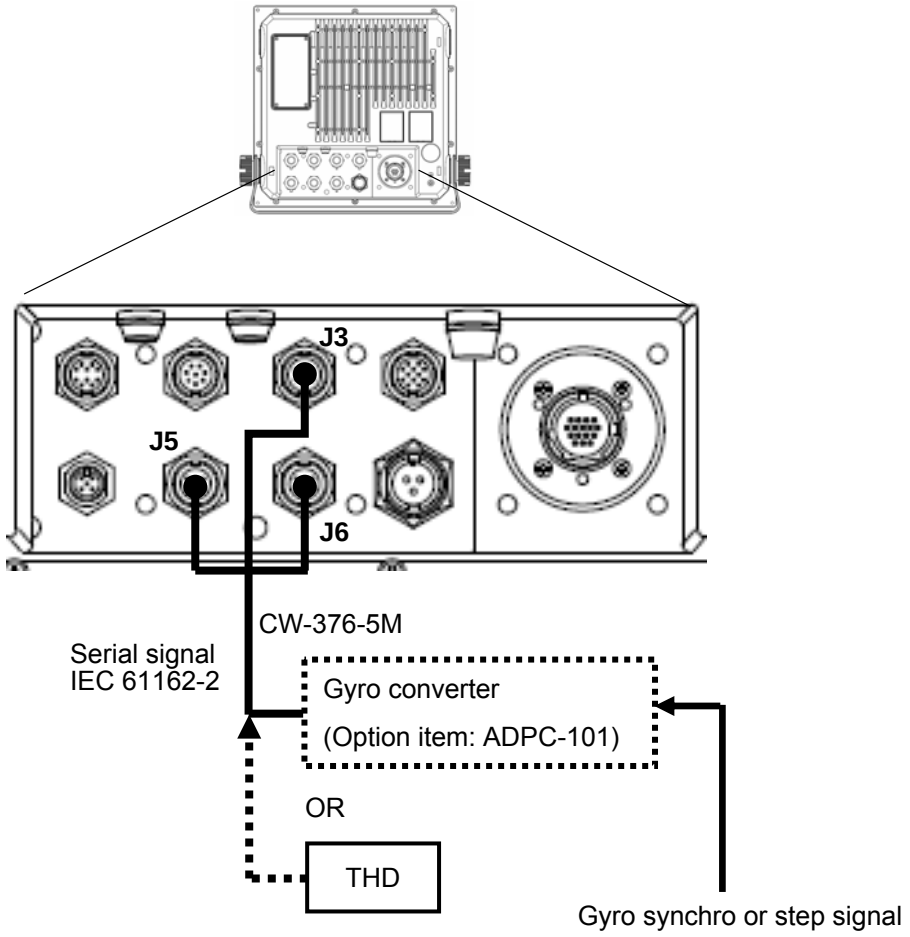
(1) Press MENU key to display “Menu”
Select [MAINTENANCE] => [I/O] = [KGC SET] => [INITIAL] => [GO]

(2) Press ENT key.
The communication baud rate is set to 38400 bps (IEC61162-2) or both Display unit and GPS compass. Start the GPS compass to output HDT, GGA, VTG and ZDA sentence signals.

Refer to 4.2.11 Setup KGC (GPS compass)

Note: The KGC-1 DATA2 port or KGC-222 DATA1/DATA2 port (connecting port to radar) is set as 38400 bps, signal type: HDT, GGA, VTG and ZDA by this initialization. When these ports of GPS compass is used for another device that cannot handle this baud rate setting, connect radar to another port and do not perform initialization.

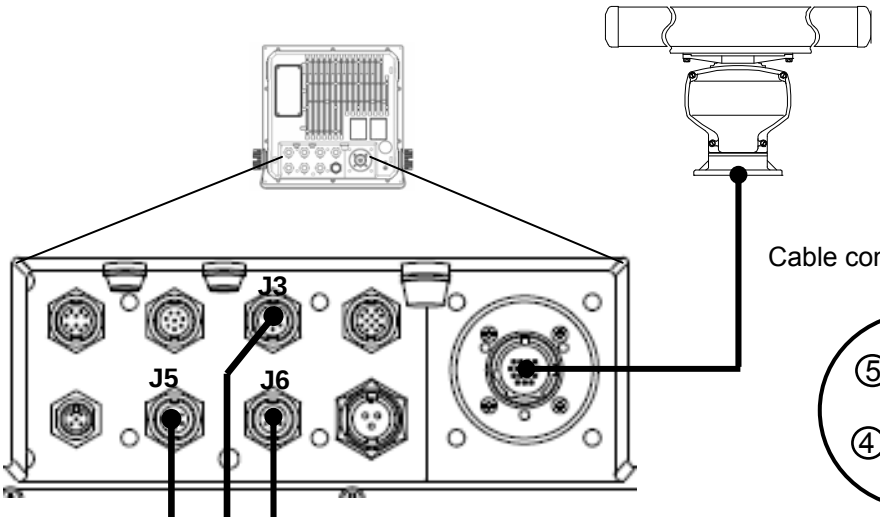
3.4.4 Connecting a Gyro converter unit or THD



Connect GPS converter or THD signal to one of the J3, J5 or J6 port.
Set the baud rate of connected port to 38400 bps (61162-2) in [MAINTENANCE] => [I/O] menu.
Set the output of Gyro converter and THD (gyro serial output) as follows.
Baud rate: 38400bps
TX cycle: 25ms - 50ms,
Sentence: THS or HDT,
Please refer to the operation manual of each unit for details.

Figure 3.21 Cable connection of Display unit to Gyro converter unit or THD

3.4.5 Connecting a Position, Speed or other device of NMEA in/out



J3, J5 & J6		
Pin number	CW-376 wire color	Signal name
1	Blue+shield	Shield
2	White	OUT-A
3	Red	OUT-B
4	Orange	IN-A
5	Black	IN-B
6	Green	J3, J5:12V J6:NC

Figure 3.22 Cable connection for J5 and J6 or Log

An initial value of the I/O baud rate of the port is as follows.

J3: 38400 bps (IEC61162-2)
J5: 4800 bps (IEC61162-1)
J6: 4800 bps (IEC61162-1)

The I/O baud rate can switch 4800, 9600, 19200 or 38400 in the radar menu.

[MAINTENANCE] => [I/O] => [BAUDRATE]

The sentence input to these ports is shown below.

Position information:	GLL, GGA, GNS, RMC, RMA
Heading information:	THS, HDT, HDG, HDM, VTG, RMC, RMA
Speed information:	VBW, VTG, VHW,
Set and drift:	VDR
Waypoint information:	RMB, BWC, RTE, WPL
Routes:	RTE, WPL
Cross-track	RMB, XTE
Datum:	DTM
Depth:	DBT, DPT
Temperature:	MTW
Date:	ZDA, RMC, GGA
LOP:	GLC
Wind:	MWD
ROT:	ROT

These sentences can select the port of each sentence input in the radar menu.
The output port is J3, J5 and J6 ports. As for the J5 and J6 ports, the transmission cycle is set at 0 seconds and not output by default.

3.4.6 Connecting an External monitor & external buzzer

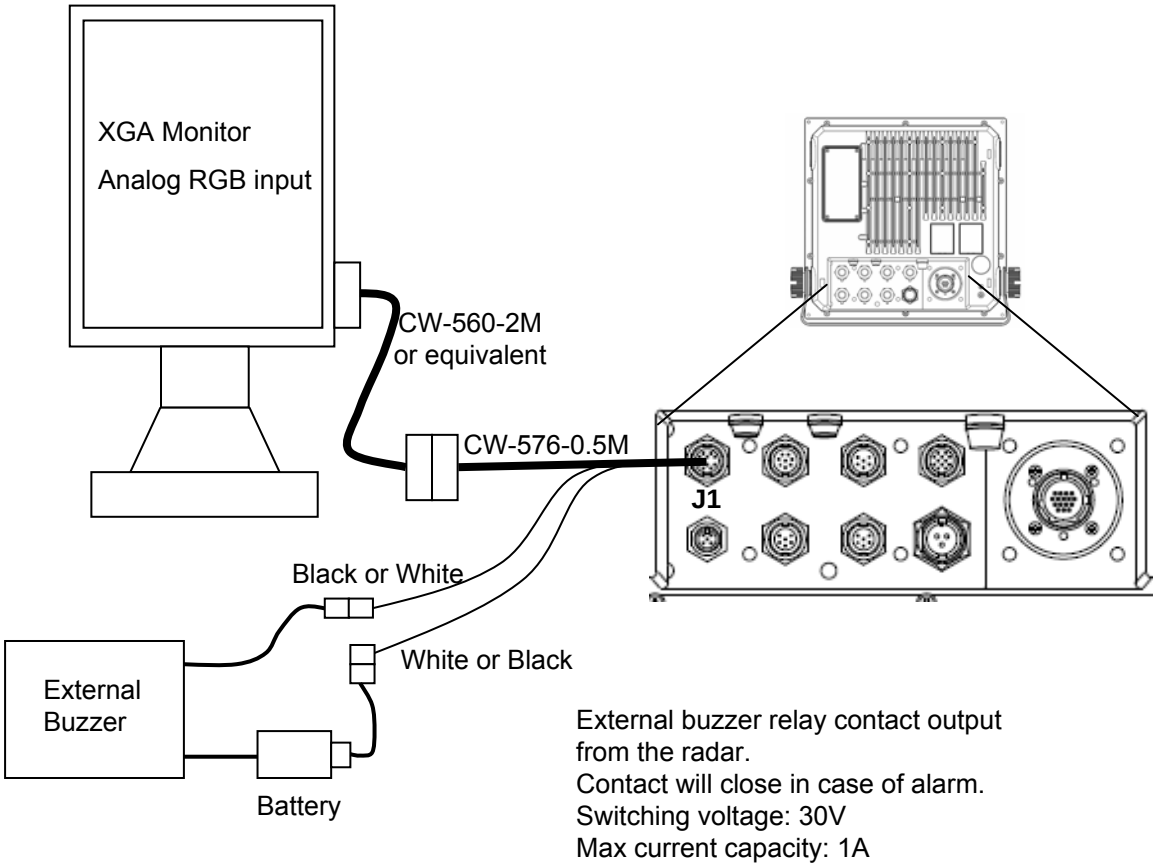
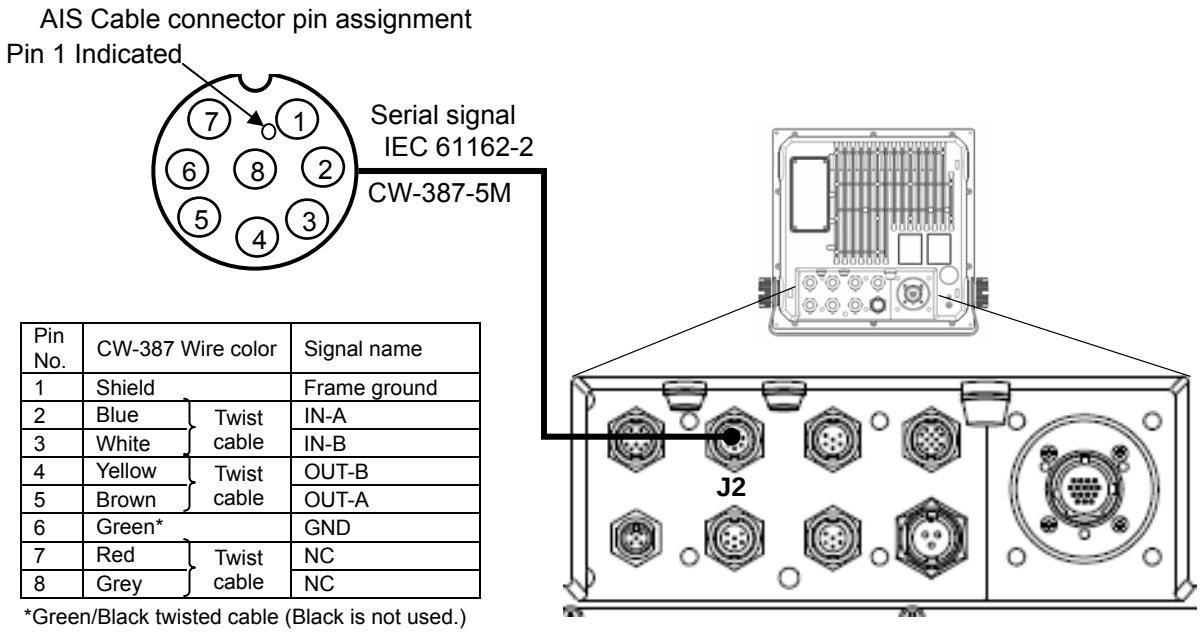


Figure 3.23 Cable connection of Display unit to external monitor and buzzer

3.4.7 AIS cable connection



Pin No.	CW-387 Wire color		Signal name
1	Shield		Frame ground
2	Blue	Twist cable	IN-A
3	White		IN-B
4	Yellow	Twist cable	OUT-B
5	Brown		OUT-A
6	Green*		GND
7	Red	Twist cable	NC
8	Grey		NC

*Green/Black twisted cable (Black is not used.)

Figure 3.24 Cable connections for AIS

3.4.8 Cable connection for inter-switch

3.4.8.1 Cable connection instructions for cross-over, dual and independent connection

In case of a dual, cross-over, 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 3.25.

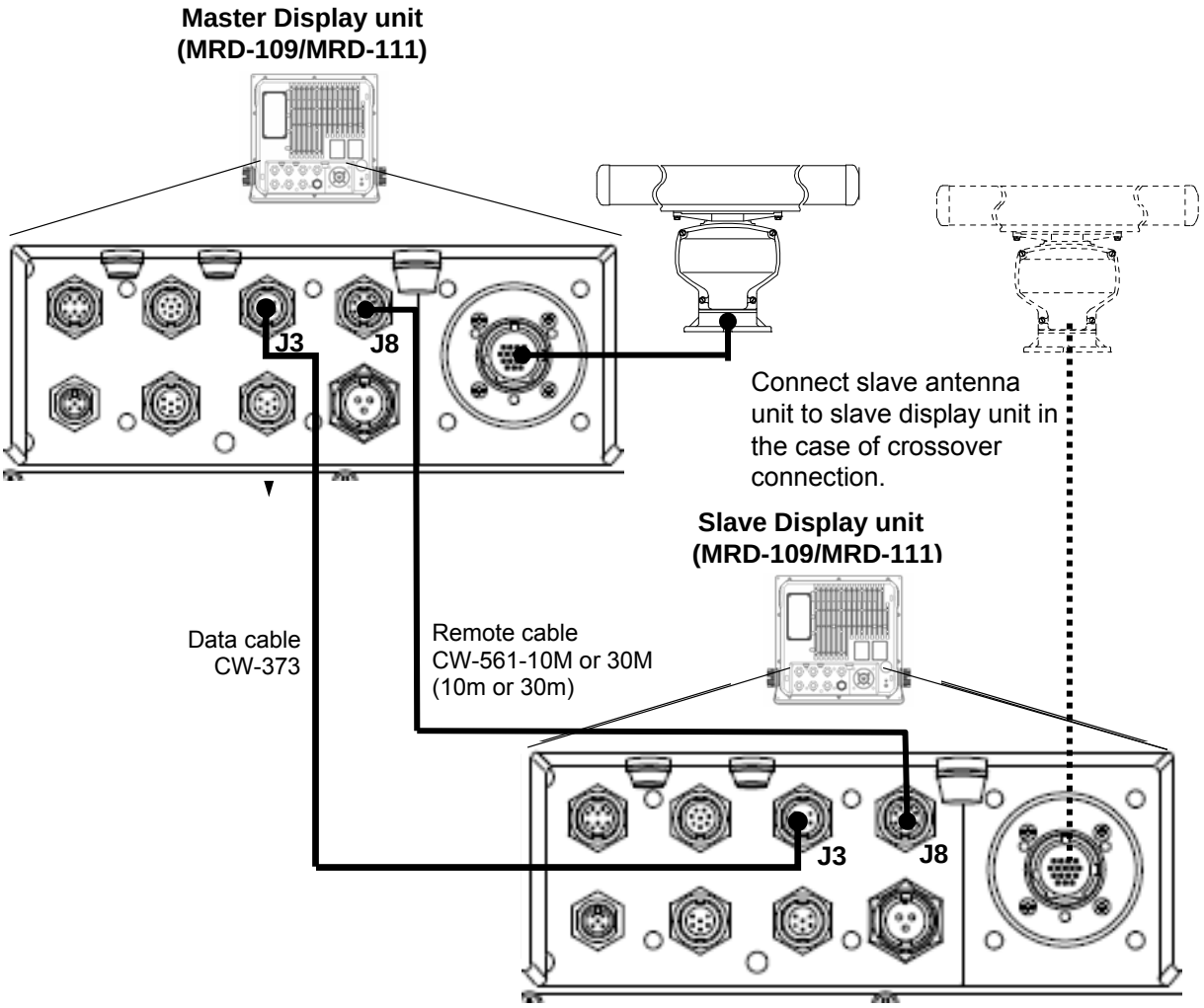


Figure 3.25 Connecting a slave Display unit on Crossover, dual and independent connection

(1) The heading, speed and latitude/longitude signals input to the data connector of master Display unit and are supplied to the slave Display unit via data cable. The slave Display unit can also use ATA and chart option functions in the same way as the master one.

(2) Connect the slave Scanner unit to the slave Display unit in a crossover connection.

(3) Operation unit (MRO-108) is required for MRD-109.

3.4.8.2 Cable connection for slave display used as a monitor

When the slave Display unit for radar is used as monitor, the remote cable is connected as follows.

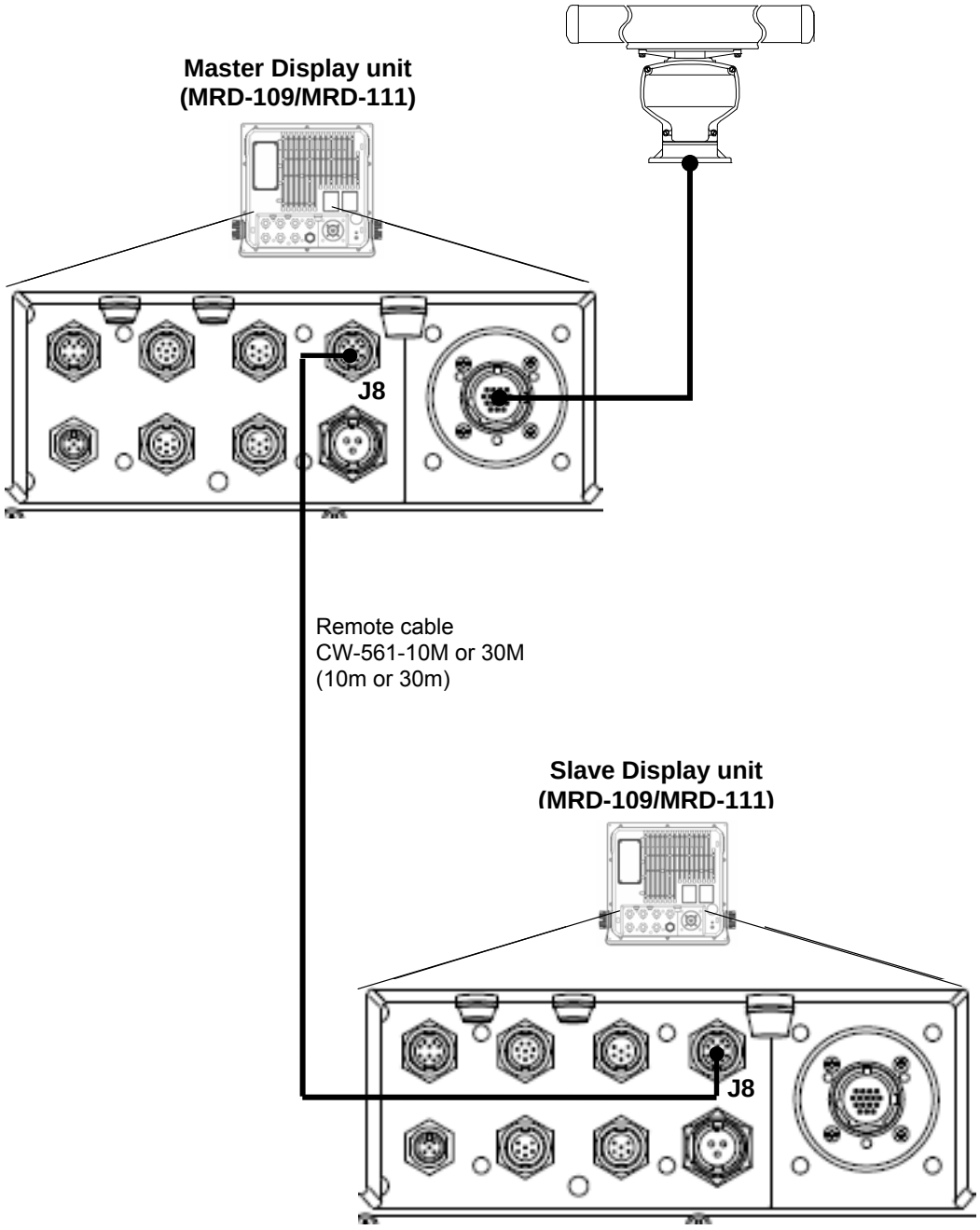


Figure 3.26 Connecting a slave Display unit as a monitor

(1) When used as a monitor, the slave Display unit cannot control the Scanner unit. The monitor (slave Display unit) will display its range in accordance with the master one.

(2) Operation unit (MRO-108) is required for MRD-109.

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 has the specified voltage.

(2) No one is in the area around the Antenna unit on the mast. The indication “Under the radar coordination, do not touch the Operation unit.” is marked on the Display unit.

Please execute the items in the [MAINTENANCE] menu to the equipment adjustment in the following order.

STARTUP	TUNE, HL OFFSET, TX DELAY, ANT HEIGHT, ANT CABLE, MBS, SEA CURVE, FUNCTION KEY, RANGE ENABLE, TIMES ENABLE, LOGO, MOTOR HIGH SPEED, MOUSE SPEED
I/O	Serial interface setting with other equipments.
SECTOR MUTE	Setup sector mute mode ON or OFF, START and END position.
PRESET	Setup RAIN min and max, SEA min and max, GAIN min and max, and GAIN offset.
BACKUP	How to save and load BACKUP data.
BITE	System hardware check.
TOTAL HOUR	Confirmation of the power on time of this system and, reset the time.
TX HOUR	Confirmation of the transmission time, and reset the time.
MENU SETUP	Setup menu item display on or off.
VERSION	Confirmation of installed software version.

4.1 STARTUP menu

4.1.1 Tune adjustment (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.

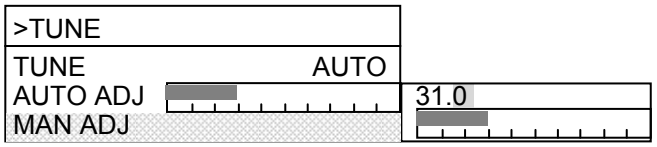
(1) Change the range scale to 12 NM or more by pressing "+" (or "-") key on the Operation unit. Find stable object such as the mountain or island of 6 NM or more as far as possible. Adjust GAIN knob to decrease the gain to a level where the chosen target is barely visible.

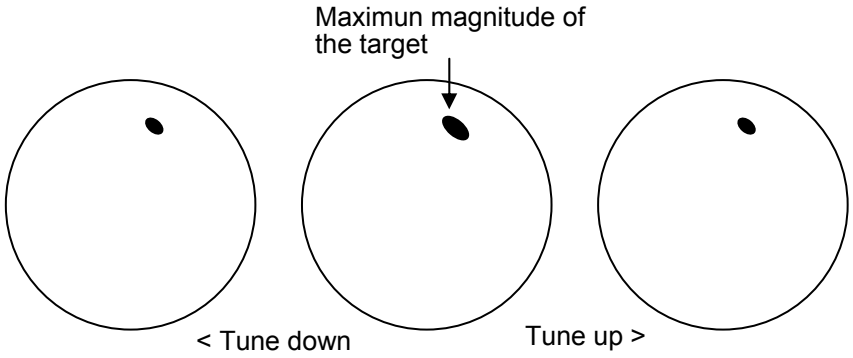
(2) Press MENU key, select [MAINTENANCE] => [STARTUP] => [TUNE] and set it to [AUTO] by moving the trackball/joystick, and then press ENT key.

(3) Select [MAINTENANCE] => [STARTUP] => [AUTO ADJ] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(4) Move the trackball/joystick up or down to change the value, and obtain the maximum magnitude of the target on the display. When a target becomes too strong to find the peak, lower gain with GAIN knob once again and adjust the tune to obtain the maximum magnitude of target.

(5) Press ENT key to save the result of the maximum magnitude of target.





4.1.2 Heading adjustment (HL OFFSET)

Bearing compensation due to installation can be adjusted.

(1) Change the range scale to 1 NM or more by pressing “+” (or “-”) key on the Operation unit.

(2) Select a visible fixed object as far as possible and measure its bearing using magnetic compass or equivalent. Measure the bearing of the same target on the radar display. Adjust it according to the following procedures when both values differ 1 degree or more.

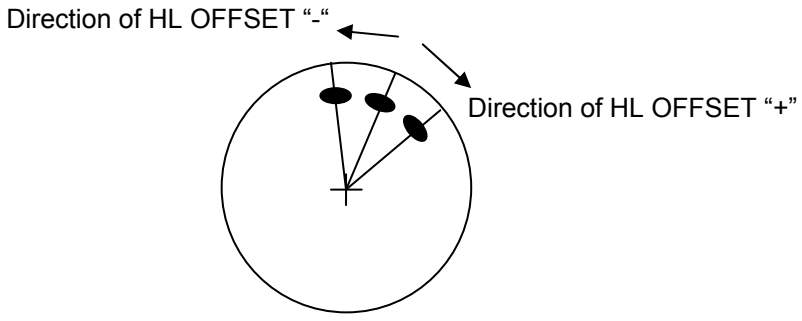
(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [HL OFFSET] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(4) Move the trackball/joystick up or down to adjust the value to match the bearing value of the target picture to the compass value.

(5) Press ENT key to save the adjustment result.

Adjustable value: -180.0 to +180.0

Note: When you use inter-switch mode at first time, please set Heading (HL OFFSET) adjustnebt of each antenna. These setting data are memorized in non-volatile memory, and applied automatically when each antenna is setected.



4.1.3 Transmitting delay time adjustment (TX 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. Select or chose within 100 m an object for the best result. Transmitting delay time is adjusted in accordance with the following procedures.

(1) Change the range scale to 0.25 NM by pressing "+" (or "-") key on the Operation unit.

(2) Press MENU key to display "Menu".
Select [MAINTENANCE] => [STARTUP] => [TX DELAY] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

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

(4) Press ENT key to save the adjustment result.

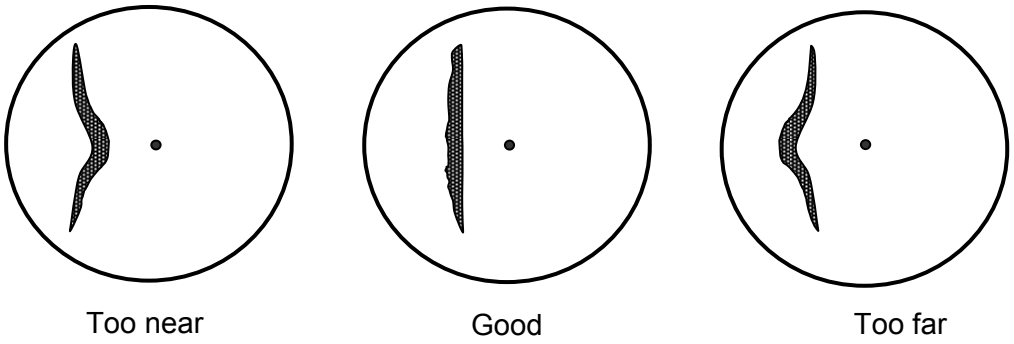


Figure 4.1 Picture display of Trigger Adjustment

Note: When you use inter-switch mode at first time, please set TX DELAY adjustment of each antenna. These setting data are memorized in non-volatile memory, and applied automatically when each antenna is selected.

4.1.4 Antenna height (ANT HEIGHT)

Set up antenna height from sea level. This setup value influences the maximum range of STC control. When the setting value is lower, effective STC range is narrower, and higher setting value works wider.

(1) Press MENU key to display "Menu".
Select [MAINTENANCE] => [STARTUP] => [ANT HEIGHT] => and set antenna height from the sea level by the trackball/joystick, then press ENT key to save the setting.

Setting value: 0 to 100 m
Refer to 4.1.7 Setup SEA curve (STC CURVE)

4.1.5 Antenna cable length (ANT CABLE)

This adjustment corrects the echo signal level by the difference of the antenna cabel length. Inproper setting of antenna cable length may result in degraded target detection.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [ANT CABLE] => and set cable length by the trackball/joystick, then press ENT key to save the setting.

Setting value: 0 to 100 m

Note: When you use inter-switch mode at first time, please set ANT CABLE adjustment cable of each antenna. These setting data are memorized in non-volatile memory, and automatically when each antenna is selected.

4.1.6 Main Bang Suppression (MBS)

This setting is utilized to suppress the center spot (transmit leak) signal at the short and middle of the picture as shown in Figure 4.2.

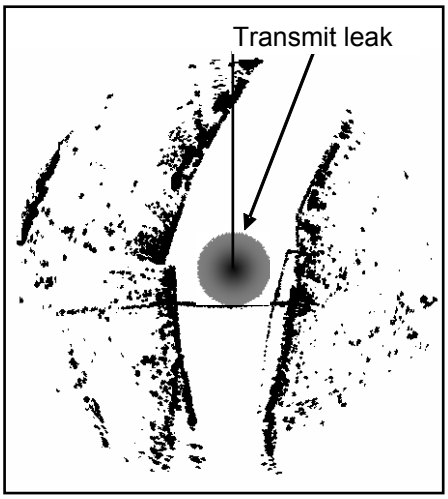


Figure 4.2 Center spot

(1) If GAIN mode is AUTO, change to MAN mode.
(2) Set the range scale to 0.25 NM, set RAIN at 0 turning RAIN knob, set SEA at 0 by turning SEA knob, set GAIN at 80 by turning GAIN knob, and set BRILL at a maximum level by turning BRILL knob respectively.
(3) Press MENU key, select [MAINTENANCE] => [STARTUP] => [MBS] => to highlight the last digit value, using the trackball/joystick.
(4) Turn GAIN knob to counterclockwise to display center spot in the middle of the picture.
(5) Move the trackball/joystick up or down to increase [MBS] value from 0 with observing the center circle until the circle is faded out. Press ENT key to save the setting.

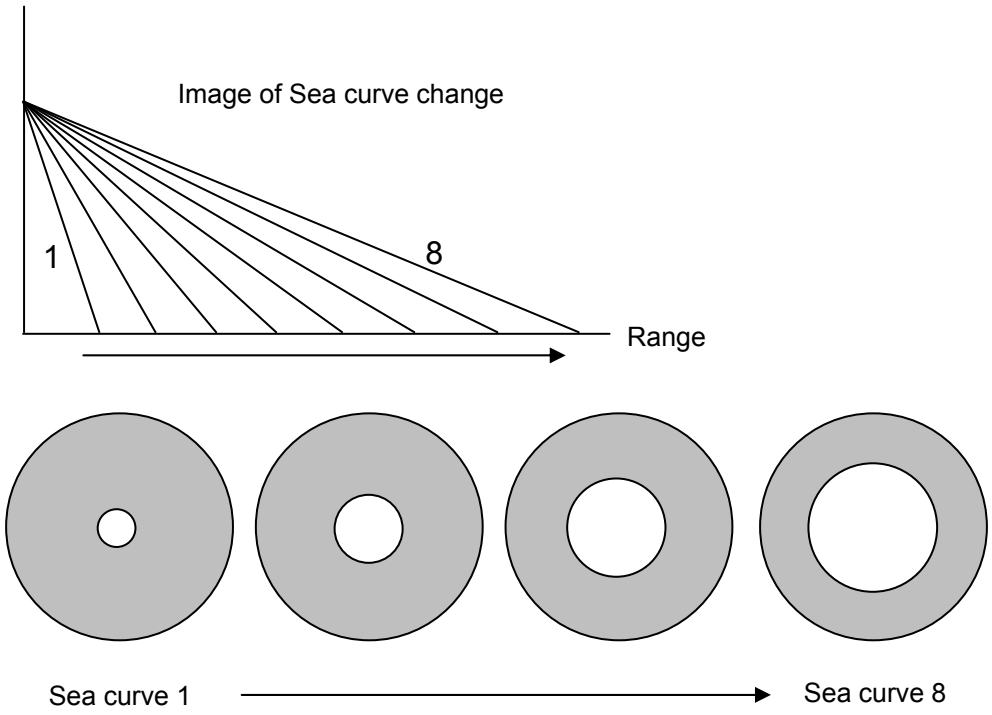
Adjustable value: 0.000 to 2.000

4.1.7 Setup SEA curve (STC CURVE)

Depending on the height at which the antenna is installed, it may be necessary to make the following SEA CURVE correction.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [SEA CURVE] => and select setting level by the trackball/joystick, then press ENT key.

Adjustable value: 1 to 8



Echoes in short range are varied in accordance with antenna height. Use 1 for the lowest antenna and 8 for highest antenna. Actual adjustment of the STC CURVE is done by obtaining a continuous echo return of sea clutter out to maximum selected range.
Be carefull when removing sea clutter in short range as it may also remove small tagets.

4.1.8 Function key usage

For quick function access, there are four (MDC-5200 series) or six (MDC-5500 series) dedicated function keys provided on this radar (“F1”, “F2”, “F3”, ”F4” , “F5” , “F6”).
You can switch to a pre-specified function by pressing each key.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [FUNCTION KEY] => [F1] key => press ENT key and after selecting the setup value.

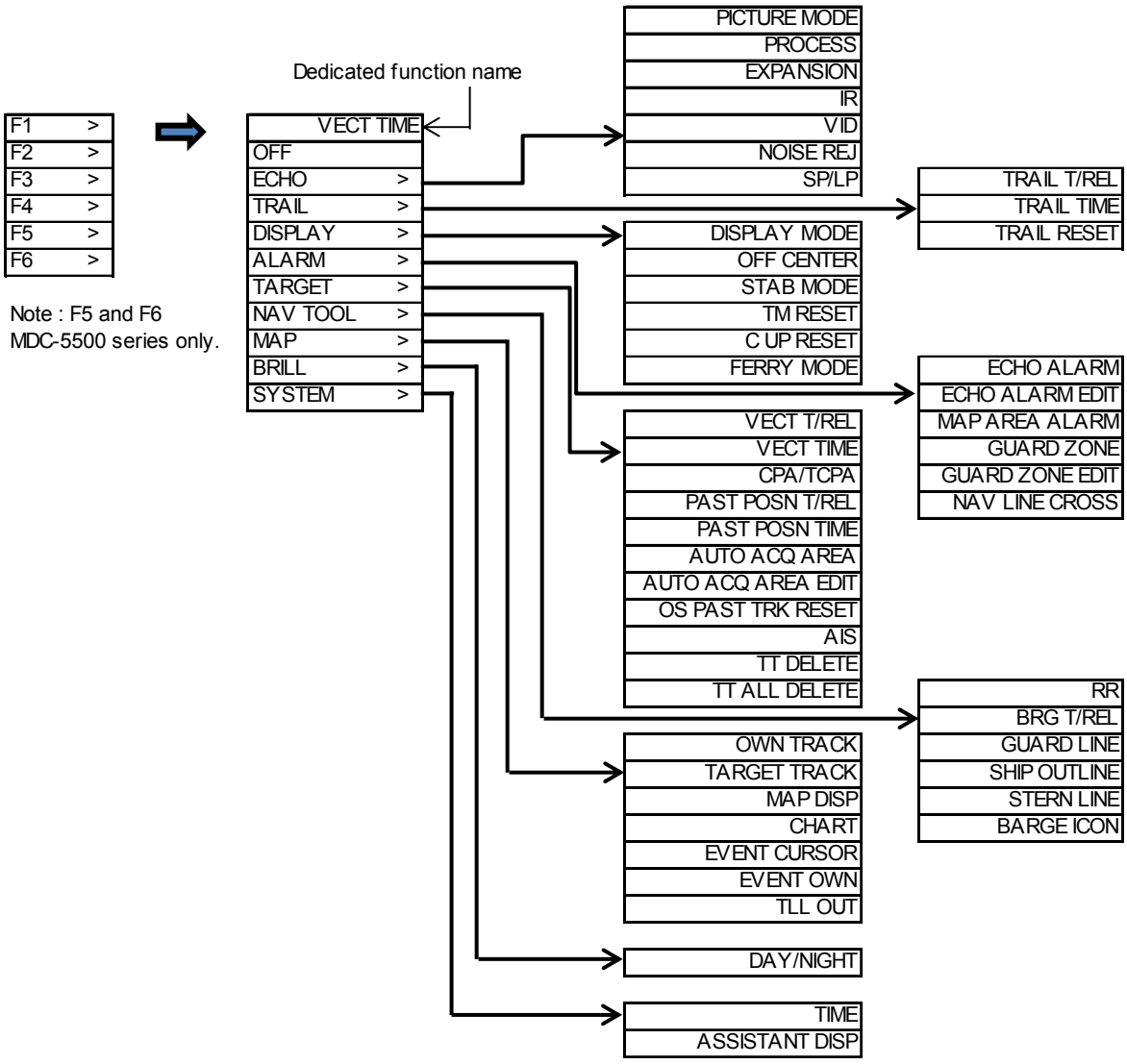


Figure 4.3

(2) Follow procedure (1) to setup keys [F2], [F3], [F4], [F5] and [F6] by selecting each item and press ENT key.

(3) Another way to setup each function key is to press and hold desired key until menu selection shows up on the lower left of display. Using trackball/joystick and ENT key make a selection and save to designated function key.

4.1.9 RANGE ENABLE

Following operation can enable suitable ranges.

(1) Press MENU key to display “Menu”.

Select [MAINTENANCE] => [STARTUP] => [RANGE ENABLE]

(2) Select range value and set [ON] or [OFF].

(3) Press ENT key to save the range enable or disable to use.

MDC-5204/5504

>RANGE ENANBLE	
0.0625	OFF
0.125	ON
0.25	ON
0.5	ON
0.75	ON
1	OFF
1.5	ON
2	OFF
3	ON
4	OFF
5	OFF
6	ON
8	OFF
10	OFF
12	ON
16	OFF
20	OFF
24	ON
32	OFF
36	OFF
40	OFF
48	ON
50	OFF
64	OFF
80	OFF
96	OFF
100	OFF
120	OFF
144	OFF

MDC-5206/5212/5506/5512

>RANGE ENANBLE	
0.0625	OFF
0.125	ON
0.25	ON
0.5	ON
0.75	ON
1	OFF
1.5	ON
2	OFF
3	ON
4	OFF
5	OFF
6	ON
8	OFF
10	OFF
12	ON
16	OFF
20	OFF
24	ON
32	ON
36	OFF
40	OFF
48	ON
50	OFF
64	ON
80	OFF
96	OFF
100	OFF
120	OFF
144	OFF

MDC-5225/5525

>RANGE ENANBLE	
0.0625	OFF
0.125	ON
0.25	ON
0.5	ON
0.75	ON
1	OFF
1.5	ON
2	OFF
3	ON
4	OFF
5	OFF
6	ON
8	OFF
10	OFF
12	ON
16	OFF
20	OFF
24	ON
32	OFF
36	OFF
40	OFF
48	ON
50	OFF
64	OFF
80	OFF
96	ON
100	OFF
120	OFF
144	OFF

Fig.4.4. Initial range scale setting.

4.1.10 TIMES ENABLE

In following operation user can enable trail times, past position, vector time, etc that are not available by default.

By this setting, you can choose useful these functions time easily.

Initial value: 5sec, 30sec, 1min, 3min, 6min, 12min, 30min, 60min

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [TIMES ENABLE]

(2) Select trail times value and set [ON] or [OFF].

(3) Press ENT key to save the times enable or disable to use.

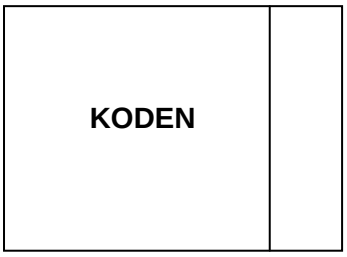
>TIMES ENABLE	
5sec	ON
10sec	OFF
15sec	OFF
30sec	ON
1min	ON
2min	OFF
3min	ON
5min	OFF
6min	ON
10min	OFF
12min	ON
15min	OFF
24min	OFF
30min	ON
45min	OFF
48min	OFF
60min	ON
2hr	OFF
4hr	OFF
8hr	OFF
16hr	OFF
24hr	OFF

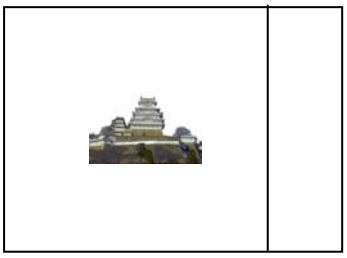
Fig.4.5. Times enable setting.

4.1.11 LOGO

This radar can display your favorite picture or characters at wait or standby mode.

It is necessary to load data as “logo.bmp” file beforehand to let you display this.





How to make and load the data file

(1) Edit a letter or picture in 256 colors of bitmap using PC. Size is up to 512x384 pixels.
The black color is not displayed as a transparent color on the screen.

(2) Save it as “logo.bmp” file to an SD memory card.

(3) Insert SD memory card in the card reader on front panel.

(4) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [LOGO] => [LOAD] => [GO], and press ENT key.

(5) 5 sec. later, remove SD memory card from the card reader.

(6) Select [MAINTENANCE] => [STARTUP] => [LOGO] => [LOGO] => select [WAIT] or [STANDBY]
And press ENT key.
WAIT: Logo is displayed during countdown time.
STANDBY: Logo is displayed during standby mode.

CAUTION: Put the cover firmly after the SD card Insert /Remove. Water protection of the Display unit is not guaranteed when the card reader cover is removed.

4.1.12 MOTOR HIGH SPEED

Set up when antenna high speed rotation is used.

High speed rotation is not available in OFF.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [MOTOR HIGH SPEED].

Select high speed rotation range, then press ENT key.
For example, when 6NM is selected and press ENT key.
High speed rotation in 0.0625 to 6NM range
Low speed (normal) rotation in 8 NM or up.

Note: This menu cannot perform while transmitting.

4.1.13 MOUSE SPEED

This menu sets the operation speed of the USB mouse.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [STARTUP] => [MOUSE SPEED] => select [FAST], [MEDIUM] or [SLOW], and press ENT key.

Setting value: FAST, MEDIUM, SLOW

4.2 Setup I/O Interface

For display mode, TT(ARPA), true ship's trail and own ship's trail, it is necessary to input ship's bearing data and ship's speed data from other devices. In addition, for AIS, mapping function, display of own ship's information and display of latitude and longitude, it is necessary to input latitude and longitude data of own ship's data. In order to use these data, set the following menu items after connection in accordance with "3.4 Cable connection to a Display unit".

Note: Refer to "4.2.2 How to use without NMEA input connection" for the method to use without inputting NMEA data.

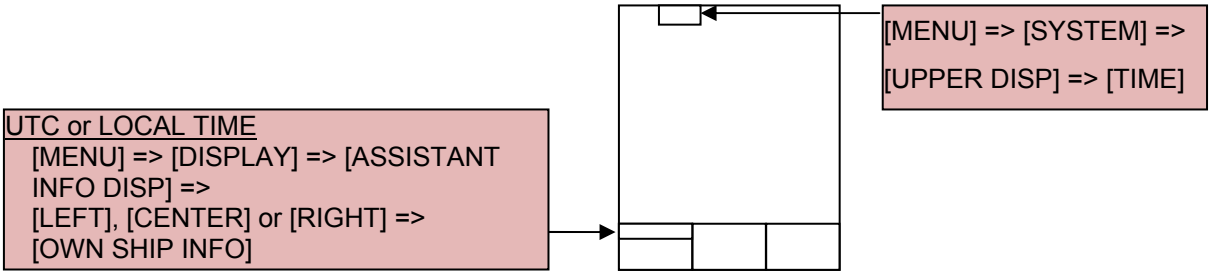
Example display: Press MENU key to display "Menu" and select [MAINTENANCE] => [I/O]

>I/O		
HDG	>	Select heading input source
GYRO	295.5°	Talker device name and heading value
OFFSET	0.0°	Offset value of heading input
STW	>	Select STW input source
DLOG	6.6kn	Talker device name and speed value
COG/SOG	>	Select COG/SOG input source
DLOG	295.5°	Talker device name and course value
DLOG	6.6kn	Talker device name and speed value
POSITION	>	Select position input source
DGPS	35°14.722N	Talker device name and LAT/LON value
	139°48.122E	
OFFSET	DTM	Select position offset input source
MAN	0.000N	Offset input source name and offset value
	0.000E	
DATUM REF	W84	Reference datum name
LOCAL	W84	Local datum name
SET/DRIFT	>	Select SET/DRIFT input source
MAN	0.0°	Talker device name and SET data
	0.0kn	DRIFT data
TIME	>	Select time input source
GPS	01/01/16	Talker device name and date
	07:57	Clock
TIME ZONE	00:00	Time zone value
OUTPUT	>	Setup output NMEA sentences
INPUT	>	Setup input NMEA sentences
BAUDRATE	>	Setup NMEA data baud rate
KGC SET	>	Setup KODEN GPS compass
JB-35 SET	>	Setup junction box JB-35
SERIAL MONITOR	>	Monitor of input NMEA serial data

Figure 4.6 I/O menu

4.2.1 Setup TIME

Set up time related items to be displayed in the upper left part of the display (Upper disp area) or own ship data in the lower of the display ("ASSISTANT INFO DISP" area).



Select information source of time to be indicated.

(1) Press MENU key to display "Menu".
Select [MAINTENANCE] => [I/O] => [TIME] => [TIME] => [ZDA] or [CLOCK], and press ENT key.
CLOCK: Internal clock of the radar

Note:

- When [TIME] sets to [ZDA], and RMC or GGA sentence is received without ZDA, only time data will be displayed.
- When the battery runs low, the internal clock of the radar will not always work properly. Please exchange the internal battery. (Refer to "5.4.2 Replacement of Internal Battery")

In order to use the internal clock of the radar, time set is required.

(1) Press MENU key to display "Menu".
Select [MAINTENANCE] => [I/O] => [TIME] => [TIME] => [CLOCK], and press ENT key.

Set the internal clock for year, month and day by UTC.

(1) Press MENU key to display "Menu".
Select [MAINTENANCE] => [I/O] => [TIME] => [CLOCK SET] => [DATE] => to highlight the value of [Day/Month/Year]. Move the trackball/joystick up or down to match it to the coordinated universal time, and then press ENT key.

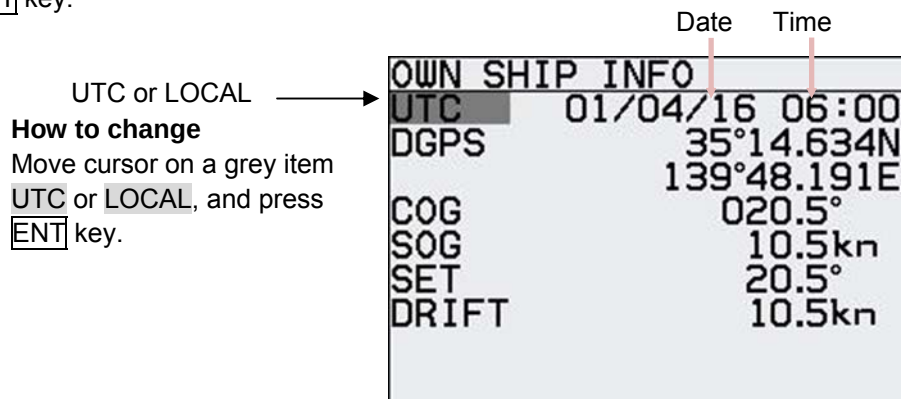
Set the internal clock for time by UTC.

(1) Press MENU key to display "Menu".
Select [MAINTENANCE] => [I/O] => [TIME] => [CLOCK SET] => [TIME] => to highlight the value of [hour: minute]. Move the trackball/joystick up or down to match it to the coordinated universal time, and then press ENT key.

Input time difference between local time and UTC.

(1) Press MENU key to display “Menu”.

Select [MAINTENANCE] => [I/O] => [TIME] => [TIME ZONE] => to highlight the value of [hour: minute]. Move the trackball/joystick up or down to match it to the time difference, and then press ENT key.



Note:

Display “OWN SHIP INFO” method

(1) Press MENU key to display “Menu”.

(2) Select [DISPLAY] => [ASSISTANT INFO DISP] => [LEFT], [CENTER] or [RIGHT] => [OWN SHIP INFO].

4.2.2 How to use without NMEA input connection

To use the function of this radar effectivily, the default is set provided that all external input shall be connected at the initial status. Therefore, when only basic function of radar (excluding navigation function, mapping function, display of data, TT (ARPA) and AIS, etc.) will be used without connection to other devices, an alarm with sound is displayed to remind an operator of input of ship’s bearing, ship’s speed and latitude and longitude. Please use this radar with keeping the ship’s bearing, ship’s speed and latitude and longitude OFF as follows.

Method of setting

Press MENU key to display “Menu” and set as follows with the trackball/joystick.

When HDG is not input (GPS compass and GYRO are not connected):

(1) [ALARM] => [ALARM ON/OFF] => [I/O] => [HDG INPUT] => [OFF], and press ENT key.

When SPD is not input (LOG and GPS are not connected):

(1) [ALARM] => [ALARM ON/OFF] => [I/O] => [SPD INPUT] => [OFF], and press ENT key.

When LAT/LON is not input (GPS and PLOTTER are not connected):

(1) [ALARM] => [ALARM ON/OFF] => [I/O] => [LAT/LON INPUT] => [OFF], and press ENT key.

4.2.3 Set up Heading interfaces

4.2.3.1 Connection of KODEN GPS compass

Connect GPS compass to the J6 port. Refer to “3.4.3 KODEN GPS compass connection”.

Press MENU key to display “Menu” and set as follows with the trackball/joystick.

(1) [MAINTENANCE] => [I/O] => [HDG] => [HDG] => [AUTO], and press ENT key.

Initialize GPS compass (DATA 1 or DATA 2 in KGC-222, DATA 2 in KGC-1 and J6 port of the radar are optimally reset.)

(1) [MAINTENANCE] => [I/O] => [KGC SET] => [INITIAL] => [GO], and press ENT key.

Note: With this initialization, port connected to the radar of GPS compass is set at 38400 bps, 50 ms for signal cycle, and HDT, GGA, VTG, DTM and ZDA for signal type.

Conpensate angles of GPS compass

When mounting direction of GPS compass has been out of alignment, compecsation of the misalignment slows GPS compass to output HDT signals as follows.

(1) [MAINTENANCE] => [I/O] => [KGC SET] => [BRG CORR] => [0.0°], and then select the last digit of entry frame for a numerical value and set with ENT key after pointing at the angle to be compensated by moving the trackball/joystick up and down.

4.2.3.2 Connection of other device

In case of a gyro with analogue signal output such as step signal or synchronous signal (Refer to “3.4.4 Connecting a Gyro converter unit or THD”), insert a gyro converter unit (optimal item: S2N) between them, convert the analogue signal into that of IEC 61162-2, and then input the signal into the J3, J5 or J6 port of this radar.

When a THD (a gyro with output based on IEC 61162-2) or a GPS compass from another manufacturer is connected, connect the output based on IEC 61162 directly to the J3, J5 or J6 port of this radar.

Setting can be performed with pressing MENU key as follows:

(1) [MAINTENANCE] => [I/O] => [HDG] => [HDG] => [AUTO], and press ENT key.

Set values: AUTO, THS, HDT, HDG, HDM, VTG, RMC, RMA, MAN

Caution: In case of either HDG, HDM, VTG, RMC, RMA or Manual is selected, TT (ARPA) function and true trail will not always work properly.

4.2.3.3 How to input the heading value by manual

The heading data can be set by manual for the purpose of an examination or repair.

Setting can be performed with pressing MENU key as follows:

(1) [MAINTENANCE] => [I/O] => [HDG] => [HDG] => [MAN], and press ENT key.

(2) [MAINTENANCE] => [I/O] => [HDG] => [MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(3) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 0.0 to 359.9°

Note: The manual input data is displayed with yellow color.

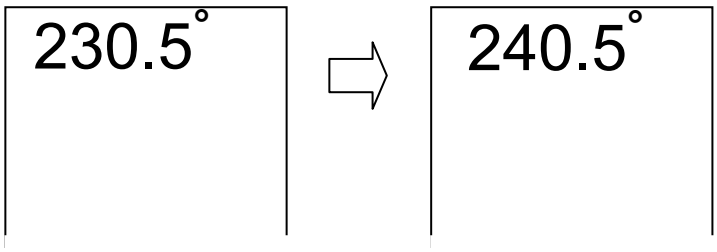
4.2.3.4 Compensation of angle of ship's bearing

When there is any constant error in input ship's bearing, it can be used after compensated as follows:

(1) [MAINTENANCE] => [I/O] => [HDG] => [OFFSET] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(2) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 0.0 to 359.9°

Example: OFFSET value: 10.0°



4.2.4 Setting of STW to be used for SEA STAB

Select an input device for STW to be used for TT (ARPA), AIS, TM, True Trail and PAST POSN at stabilized speed against water.

In case of speed meter against water with pulse output such as LOG, the output shall be put in any NMEA port of this unit after conversion of the signal into that of IEC 61162-1 through LOG converter unit (optional item: L12) inserted between them. Speed signal from GPS compass or GPS can be also input. For setting of this, use of [AUTO] is recommended as shown below.

(1) [MAINTENANCE] => [I/O] => [STW] => [STW] => [AUTO], and press ENT key.
Set values: AUTO, VHW, VBW, VTG, RMC, RMA, MAN, CURRENT

MAN: This function is intended to input speed values manually. [MAN] is provided as an emergency measure, because many functions of radar become unavailable when the speed meter is faulty. However, when [MAN] is selected, AIS is not available.

CURRENT: This means that STW is calculated from ground speed data and SET/DRIFT data inputted from VDR sentence or by manual.

4.2.4.1 How to input the STW value by manual

(1) [MAINTENANCE] => [I/O] => [STW] => [MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(2) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 0.0 to 100.0 kn

Note: The manual input data is displayed with yellow color.

4.2.5 Setting of COG/SOG to be used for GROUND STAB

Select an input device of COG/SOG to be used for TT (ARPA), AIS, True Trail and PAST POSN at stabilized speed against ground. It is necessary to connect to GPS, Navigation device (VTG, RMC and RMA), 2-axis SDME (VBW) or current meter (CURRENT)

(1) [MAINTENANCE] => [I/O] => [COG/SOG] => [COG/SOG] => [AUTO], and press ENT key.
Set values: AUTO, VBW, VTG, RMC, RMA, MAN, CURRENT

CURRENT: COG/SOG is calculated from STW and SET/DRIFT data.

Caution: When a ship has been brought to or is sailing, VTG, RMC and RMA of GPS may wamble in the course. Therefore, the speed vector of TT (ARPA) may also wamble. In this case, use it at the stabilized speed against water.

4.2.5.1 How to input the COG value by manual

(1) [MAINTENANCE] => [I/O] => [COG/SOG] => [COG MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(2) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 0.0 to 359.9°

Note: The manual input data is displayed with yellow color.

4.2.5.2 How to input the SOG value by manual

(1) [MAINTENANCE] => [I/O] => [COG/SOG] => [SOG MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(2) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 0.0 to 100.0 kn

Note: The manual input data is displayed with yellow color.

4.2.6 Setting of SET/DRIFT to be used for CURRENT mode

When [CURRENT] is selected in 4.2.4 (STW) and 4.2.5 (COG/SOG), the device to input SET/DRIFT is selected.

Select the sensor of SET/DRIFT when [CURRENT] is selected at STW and COG/SOG.

(1) [MAINTENANCE] => [I/O] => [SET/DRIFT] => [SET/DRIFT] => [VDR] or [MAN], and press ENT key.
Set values: VDR, MAN

MAN: Use SET/DRIFT value manually input.

Note: AIS display does not work when [MAN] is selected.

4.2.6.1 How to input the SET/DRIFT value by manual

(1) [MAINTENANCE] => [I/O] => [SET/DRIFT] => [SET MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(2) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 0.0 to 359.9°

(3) [MAINTENANCE] => [I/O] => [SET/DRIFT] => [DRIFT MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.

(4) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 0.0 to 100.0 kn

Note: The manual input data is displayed with yellow color.

4.2.7 Setting of latitude and longitude (POSITION)

When AIS and MAP functions are used, it is necessary to input position data from GPS or navigation davices.

(1) [MAINTENANCE] => [I/O] => [POSITION] => [POSITION] => Select [AUTO], [GNS], [GGA], [GLL], [RMC], [RMA], or [MAN], and press ENT key.
Set value: AUTO, GNS, GGA, GLL, RMC, RMA, MAN,

MAN: Manual input function as an emergency measure when positioning device such as GPS is faulty.

4.2.7.1 How to input the POSITION value by manual

(1) [MAINTENANCE] => [I/O] => [POSITION] => [POSITION] => [MAN], and press ENT key.
(2) [MAINTENANCE] => [I/O] => [POSITION] => [LAT MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.
(3) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
(4) [MAINTENANCE] => [I/O] => [POSITION] => [LON MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.
(5) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.

Note: The manual input data is displayed with yellow color.

4.2.7.2 Compensation of POSITION data

When the geodetic system in navigator and that in the map used are different, the position may become different even with the same values of latitude and longitude. In this case, input of [OFFSET] allows these positions to be matched.

[MAINTENANCE] => [I/O] => [POSITION] => [OFFSET] => [OFFSET] => [DTM] or [MAN], and press ENT key.

Set values: DTM and MAN

MAN: Setting is done by manual input of values.

AIS cannot be displayed because radar DATUM differs from DATUM of AIS when you used position offset.

4.2.7.3 How to input the compensation of position data by manual

(1) [MAINTENANCE] => [I/O] => [POSITION] => [OFFSET] => [OFFSET] => [MAN], and press ENT key.
(2) [MAINTENANCE] => [I/O] => [POSITION] => [OFFSET] => [LAT MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.
(3) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 1.000S to 1.000N

(4) [MAINTENANCE] => [I/O] => [POSITION] => [OFFSET] => [LON MAN] => [VALUE] will show the current setting of the input value by highlighting the last digit value by the trackball/joystick.
(5) Move the trackball/joystick up or down to set the value. Press ENT key to save the set result.
Setting value: 1.000W to 1.000E

For setting in [MAN] mode, set the radar in N-UP mode to display map. Transmit radar and display the echo. Then, comparing the landscape of the radar image with the map, input offset values of latitude and longitude with the trackball/joystick. When a value is input, it moves right and left. Compensation can be easily applied.

4.2.8 Setting of serial output

Following serial data sentences can be output from NMEA ports (J3, J5 or J6).

Note: OP1 and OP2 will be active when the junction box JB-35 is connected.

Make selection by following steps.

Select [MAINTENANCE] => [I/O] => [OUTPUT] => [OUTPUT J3], [OUTPUT J5], [OUTPUT J6], [OUTPUT OP1] or [OUTPUT OP2].

Then indicate following submenu by move the trackball/joystick to the right.

>OUTPUT J3	
DTM	0.0sec
EVE	1.0sec
GLL	0.0sec
HBT	5.0sec
HDT	0.0sec
OSD	1.0sec
POS	0.0sec
ROT	0.0sec
RSD	1.0sec
THS	0.0sec
TLB	5.0sec
TLL	0.0sec
TTD	0.0sec
TTM	0.0sec
VBW	0.0sec
VDR	0.0sec
VHW	0.0sec
VTG	0.0sec
ZDA	0.0sec

>OUTPUT xxxxx	
DTM	0.0sec
EVE	0.0sec
GLL	0.0sec
HBT	0.0sec
HDT	0.0sec
OSD	0.0sec
POS	0.0sec
ROT	0.0sec
RSD	0.0sec
THS	0.0sec
TLB	0.0sec
TLL	0.0sec
TTD	0.0sec
TTM	0.0sec
VBW	0.0sec
VDR	0.0sec
VHW	0.0sec
VTG	0.0sec
ZDA	0.0sec

xxxxx: J5, J6, OP1 or OP2

Highlight numeral value and enter desired period for desired sentence.

No output is available by 0.0 sec setting.

ENT key press validates the value.

4.2.8.1 Setting of TLL output

The position of marks and a cursor can be output to external devices.

Select the kinds of TLL sentences to be output.

(1) [MAINTENANCE] => [I/O] => [OUTPUT] => [TLL OUT] => Select [TT], [MARK] or [TARGET], and press ENT key.

Set values: TT, MARK, TARGET

TT: The position of automatic tracking target captured is output with the cycle set in “4.2.8 Setting of serial output”.

MARK: The positions marked in drawing will be output at every marking.

TARGET: TLL output is set on the function key. Every press of the function key allows the position of cursor to be output as TLL on the screen.

4.2.9 Limiting of type of signal to input port

When the device is connected with multiple nautical instruments, the same signals from HDT and GLL, etc. are input from several input ports. If the values of these input signals are different, interference that may cause jumping of ship's bearing and LAT/LON may occur. In these cases, an input port can be assigned for each signal type.

Select as [MAINTENANCE] => [I/O] => [INPUT] and display the setting sub-menu as follows:

Setting sub-menu

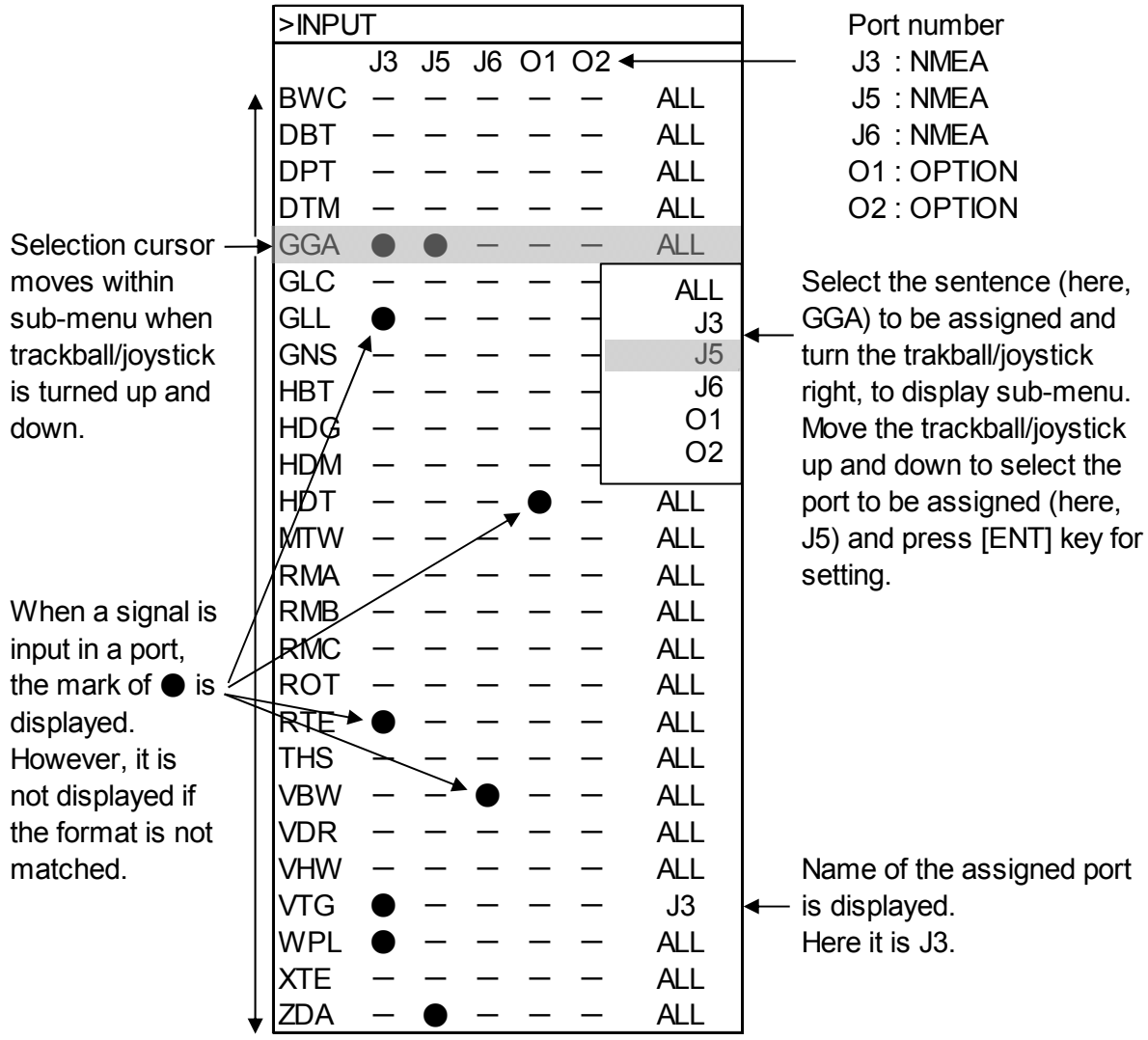


Fig 4.7 Input signals and ports

4.2.10 Changing the baud rate of I/O port J3, J5 and J6

Each I/O port serial baud rate can be modified to speed of connected device. Selectable rate is 4800, 9600, 19200 or 38400.

Default value per port is set as follows:

J3: 38400
J5: 4800
J6: 4800
OP1: 38400
OP2: 4800
OP1 and OP2 port will be displayed when JB-35 is connected to J3.

Example of change of setting: J3 port 38400 bps => 4800 bps
Select [MAINTENANCE] => [I/O] => [BAUDRATE] => [J3] => [4800] and set with ENT key.

4.2.10.1 Setting all I/O ports automatically

This radar can set the format of all I/O ports automatically by following procedure.

(1) Press MENU key to display “Menu”.
[MAINTENANCE] => [I/O] => [BAUDRATE] => [AUTO SETUP] => [GO], and press ENT key.
About 30 sec. later all I/O ports can be set by input signals connected to external devices.

4.2.11 Setup KGC (GPS compass)

When connect KGC (KODEN GPS compass) to the J6 port, please set KGC to set format and output sentences.

(1) Press MENU key to display “Menu”.
(2) Select [MAINTENANCE] => [I/O] => [KGC SET] => [INITIAL] => [GO], and press ENT key.
Data 1 or Data 2 in KGC-222 and J6 port of the radar are optimally set.

Caution: With this initialization, Data 1 or Data 2 (port connected to the radar) of KGC-222 is set at 38400 bps for baud rate, 50ms for signal scycle, and HDT, GGA, VTG, DTM and ZDA for signal type.

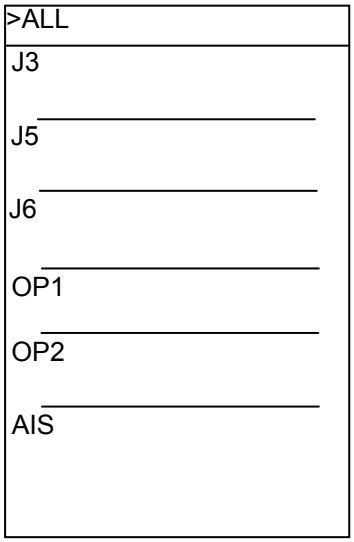
Bearing correction of KGC-222
When the mounting direction of KGC-222 has been out of alignment, compensation of the misalignment allows KGC-222 to output HDT signal as follows.

(1) Select [MAINTENANCE] => [I/O] => [KGC SET] => [BRG CORR] =>
(2) Select the last digit of entry frame for a numerical value and press ENT key after pointing at the angle to be compensated by turnig the trackball/joystick up and down.

4.2.12 Serial monitor

Serial input signals can be checked by the window of serial data monitor.

Press MENU key to display “Menu”.
Select [MAINTENANCE] => [I/O] => [SERIAL MONITOR] => select [J3], [J5], [J6], [OP1], [OP2], [AIS J2] or [ALL] => Input data of selected port will be displayed.
[AIS] port means AIS data from AIS device.
[ALL] means that the data of all ports will be displayed at the same time.



4.3 Setup SECTOR MUTE mode (Cannot use while transmitting)

SECTOR MUTE is the function enabling user to stop transmission to designated direction when there are hazardous objects near antenna location or near a human body.

When using SECTOR MUTE, it takes longer time to detect optimum value in auto tuning at the start of transmission and change of range. Therefore manual tuning is recommended to use when using SECTOR MUTE.Press MENU key to display “Menu” and set as follows with the trackball/joystick.

SECTOR MUTE mode ON or OFF

Select [MAINTENANCE] => [SECTOR MUTE] => [MUTE] => [ON or OFF] => and set ENT key.

Setup starting angel setup of SECTOR MUTE

Select [MAINTENANCE] => [SECTOR MUTE] => [START] => select 0 to 359°, and press ENT key.

Setup ending angle of SECTOR MUTE

Select [MAINTENANCE] => [SECTOR MUTE] => [END] => select 0 to 359°, and press ENT key.

4.4 Setup PRESET

4.4.1 Setup RAIN MIN and MAX mode

There are two modes of MAN and CFAR in anti-rain clutter mode.

Change method of MAN and CFAR.

Press the RAIN knob, or put a cursor on the indicator of MAN or CFAR upper right of the display and press ENT key.

4.4.1.1 RAIN MIN (MAN and CFAR mode)

RAIN MIN is intended to adjust the preset minimum value of anti-rain clutter. This is a function even when anti-rain clutter suppression knob is set at minimum.

This function has also effect to moderate the effect against turned angle of the knob and to make adjustment easy. This setting can be applied to the entire range.

MAN mode

(1) Check MAN indication of RAIN mode from upper right of the display. If RAIN mode is CFAR, change to MAN mode. If GAIN mode is AUTO, change to MAN mode.

(2) Set RAIN at 0 by turning RAIN knob, set SEA at a moderate level by turning SEA knob, set GAIN at 80 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.

(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [RAIN MIN] and highlight the last digit of the numerical entry frame.

(4) Move the trackball/joystick up and down to change the value, and press ENT key when bondens and seaway buoys have reduced small enough in size on the display.
Setting value is 0 to 4095

CFAR mode

(1) Check CFAR indication of RAIN mode from upper right of the display. If RAIN mode is MAN, change to CFAR mode. If GAIN mode is AUTO, change to MAN mode.
(2) Set RAIN at 0 by turning RAIN knob, set SEA at a moderate level by turning SEA knob, set GAIN at 80 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.
(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [RAIN MIN] and highlight the last digit of the numerical entry frame.
(4) Move the trackball/joystick up and down to change the value, and press ENT key when bondens and seaway buoys have reduced small enough in size on the display.
Setting value is 0 to 4095

4.4.1.2 RAIN MAX (MAN and CFAR mode)

This is intended to adjust the maximum value of anti-rain clutter. When the effect of anti-rain clutter suppression is weak or strong, this can be used.

MAN mode

(1) Check MAN indication of RAIN mode from upper right of the display. If RAIN mode is CFAR, change to MAN mode.
(2) Set RAIN at 80 by turning RAIN knob in rainfall.
(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [RAIN MAX] and highlight the last digit of the numerical entry frame.
(4) Move the trackball/joystick up and down to change watching the display, and press ENT key when large blocks of rain clutter become smaller points and just before small boats and seaway buoys will disappear.
Setting value is 0 to 4095

CFAR mode

(1) Check CFAR indication of RAIN mode from upper right of the display. If RAIN mode is MAN, change to CFAR mode.
(2) Set RAIN at 80 by turning RAIN knob in rainfall.
(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [RAIN MAX] and highlight the last digit of the numerical entry frame.
(4) Move the trackball/joystick up and down to change watching the display, and press ENT key when large blocks of rain clutter become smaller points and just before small boats and seaway buoys will disappear.
Setting value is 0 to 4095

4.4.2 Setup SEA MIN and MAX mode

There are two modes of MAN and AUTO in sea clutter suppression.

Change method of MAN and AUTO.

Press the SEA knob, or put a cursor on the indicator of MAN or AUTO upper right of the display and press ENT key.

4.4.2.1 SEA MIN (MAN and AUTO mode)

This setting is a function to make the value set under Sea suppression effective even when SEA is set at a minimum level by turning SEA knob. Due to the raise of the minimum value, this function allows the effect against the angle of the turning of the knob to be moderated and the adjustment with the knob to be made easier. This adjustment can be used in common for the entire range. Please carry out the adjustment at mild state of sea.

MAN mode

(1) Check MAN indication of SEA mode from upper right of the display. If SEA mode is AUTO, change to MAN mode. If GAIN mode is AUTO, change to MAN mode.

(2) Set the range scale at 0.75 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set GAIN at 80 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.

(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [SEA MIN] and highlight of the last digit of entry frame of numerical value by moving the trackball/joystick.

(4) Move the trackball/joystick up and down to change the value, erase sea clutter on the display that may be generated by dust and birds, and set not to erase bondens and seaway buoys. Press ENT key for setting.
Setting value is 0 to 4095

AUTO mode

(1) Check AUTO indication of SEA mode from upper right of the display. If SEA mode is MAN, change to AUTO mode. If GAIN mode is AUTO, change to MAN mode.

(2) Set the range scale at 0.75 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set GAIN at 80 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.

(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [SEA MIN] and highlight of the last digit of entry frame of numerical value by moving the trackball/joystick.

(4) Move the trackball/joystick up and down to change the value, erase sea clutter on the display that may be generated by dust and birds, and set not to erase bondens and seaway buoys. Press ENT key for setting.
Setting value is 0 to 4095

4.4.2.2 SEA MAX (MAN and AUTO mode)

The use of manual and auto SEA suppression allows the suppression effect at the maximum level.

MAN mode

(1) Check MAN indication of SEA mode from upper right of the display. If SEA mode is AUTO, change to MAN mode. If GAIN mode is AUTO, change to MAN mode.
(2) Set the range scale at 12 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set GAIN at 80 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.
(3) Turn VRM 1 ON and set VRM at 8.0 NM.
(4) Put the cursor on IR1, IR2 or IR3 on the display, then press ENT key to select OFF. When IR is turned OFF, white noise on the display increases. Keep GAIN at 80.
(5) Set SEA at 100 (a maximum level) by turning SEA knob.
(6) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [SEA MAX] and highlight of the last digit of entry frame of numerical value by moving the trackball/joystick.
(7) Move the trackball/joystick up and down watching white noise on the display to increase the set value of [SEA MAX] from 0. When the white noise on the display disappears from the area between the center and 8 NM, stop the movement of the trackball/joystick and press ENT key for setting.
(8) After completion of all setting, return IR1, IR 2 or IR3.

The set value of [SEA MAX] is applied to the entire ranges.

AUTO mode

(1) Check AUTO indication of SEA mode from upper right of the display. If SEA mode is MAN, change to AUTO mode. If GAIN mode is AUTO, change to MAN mode.
(2) Set the range scale at 12 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set GAIN at 80 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.
(3) Turn VRM 1 ON and set VRM at 8.0 NM.
(4) Put the cursor on IR1, IR2 or IR3 on the display, then press ENT key to select OFF. When IR is turned OFF, white noise on the display increases. Keep GAIN at 80.
(5) Set SEA at 100 (a maximum level) by turning SEA knob.

(6) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [SEA MAX] and highlight of the last digit of entry frame of numerical value by moving the trackball/joystick.

(7) Move the trackball/joystick up and down watching white noise on the display to increase the set value of [SEA MAX] from 0. When the white noise on the display disappears from the area between the center and 8 NM, stop the movement of the trackball/joystick and press ENT key for setting.

(8) After completion of all setting, return IR1, IR 2 or IR3.

4.4.3 Setup GAIN MIN and MAX mode

Display sensitivity of the screen against the GAIN knob is set. When the sensitivity against turning of the knob is too high or too low, it can be adjusted with knob.
There are two modes of MAN and AUTO in gain sensitivity control.

Change method of MAN and AUTO.
Press the GAIN knob, or put a cursor on the indicator of MAN or AUTO upper right of the display and press ENT key.

4.4.3.1 GAIN MIN (MAN and AUTO mode)

This setting is a function to make the value set under GAIN sensitivity control effective even when GAIN is set at a minimum level by turning GAIN knob. Due to the raise of the minimum value, this function allows the effect against the angle of the turning of the knob to be moderated and the adjustment with the knob to be made easier. This adjustment can be used in common for the entire range.

MAN mode

(1) Check MAN indication of GAIN mode from upper right of the display. If GAIN mode is AUTO, change to MAN mode. If GAIN mode is AUTO, change to MAN mode.

(2) Set the range scale at 24 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set PICTURE 1 mode, set GAIN at 0 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.

(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [GAIN MIN] and highlight of the last digit of entry frame of numerical value by moving the trackball/joystick.

(4) Move the trackball/joystick up and down to change the value, only the highest signal levels are presented. Press ENT key for setting.
Setting value is 0 to 4095

AUTO mode

(1) Check AUTO indication of GAIN mode from upper right of the display. If GAIN mode is MAN, change to AUTO mode.
(2) Set the range scale at 24 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set PICTURE 1 mode, set GAIN at 0 by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.
(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [GAIN MIN] and highlight of the last digit of entry frame of numerical value by moving the trackball/joystick.
(4) Move the trackball/joystick up and down to change the value, only the highest signal levels are presented. Press ENT key for setting.
Setting value is 0 to 4095

4.4.3.2 GAIN MAX (MAN and AUTO mode)

This setting is a function to make the value set under GAIN sensitivity control effective even when GAIN is set at a maximum level by turning GAIN knob.

MAN mode

(1) Check MAN indication of GAIN mode from upper right of the display. If GAIN mode is AUTO, change to MAN mode.
(2) Set the range scale at 24 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set PICTURE 1 mode, set GAIN at a maximum level by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.
(3) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [GAIN MAX] and highlight the last digit of entry frame of numerical value by moving the trackball/joystick.
(4) Watching the white noise on the display, change the setting value for gain with moving the trackball/joystick up and down, and press ENT key at an appropriate point for setting.
Setting value is 0 to 4095

AUTO mode

(1) Check AUTO indication of GAIN mode from upper right of the display. If GAIN mode is MAN, change to AUTO mode.
(2) Set the range scale at 24 NM, set SEA at 0 by turning SEA knob, set RAIN at 0 by turning RAIN knob, set PICTURE 1 mode, set GAIN at a maximum level by turning GAIN knob and set BRILL at a maximum level by turning BRILL knob.
(3) Press MENU key to display “Menu”.

Select [MAINTENANCE] => [PRESET] => [GAIN MAX] and highlight of the last digit of entry frame of numerical value by moving the trackball/joystick.

(4) Watching the white noise on the display, change the setting value for gain with moving the trackball/joystick up and down, and press ENT key at an appropriate point for setting.
Setting value is 0 to 4095

4.4.4 Setup GAIN OFFSET mode

This is a function to adjust the gain sensitivity difference of every range when range scale is changed. This setting is performed by every each range scale.

For example: When gain sensitivity of 3NM looks low.

(1) Set range scale 3NM.

(2) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [PRESET] => [GAIN OFFSET] => increase setting value.

(3) Change range scale up and down to check the gain sensitivity difference.
Setting value is 0 to 4095

4.5 SAVE and LOAD of Setup data / MAP (Cannot be used while transmitting)

By saving setup data to the internal memory or external memory, the initial setup and all settings are saved, in the event that the radar needs to be reinitialized or some changes been made, user can go back to the original settings by restoring from memory.

Backup of setup data should be saved after initial setup.
In case of malfunction of display where re-initialization must be done, restore of backup data saved at the time of original setup will bring all proper settings and turning setup back to normal operation.

4.5.1 Internal save of setup data

To save data internally at the time of setup,

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [BACKUP] => [SETUP SAVE] => [GO] and press ENT key.

To restore from internal ffbackup after re-intialization,

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [BACKUP] => [SETUP LOAD] => [GO] and press ENT key.

4.5.2 External save of setup and map data ~~(Cannot be performed while transmitting)~~

To save setup and map data externally, this information can be later used to restore after a possible malfunction.

The external memory uses an SD memory card.

CAUTION: Please do not use the SD momory card which is loaded with software program files.

To perform external backup to SD card,

(1) Insert SD memory card in the card reader on front panel.

(2) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [BACKUP] => [SD CARD] => select [SETUP SAVE], [MARK SAVE], [TGT TRACK SAVE] or [OWN TRACK SAVE] => [GO], and press ENT key.
When SD memory card not inserted, [SD CARD] menu is shaded menu and cannot be operated.

To restore from SD card backup after reinitialization,

(1) Insert SD card that was used to store settings in above procedure in the card reader on front panel.

(2) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [BACKUP] => [SD CARD] => select [SETUP LOAD], [MARK LOAD], [TGT TRACK LOAD] or [OWN TRACK LOAD] => [GO], and press ENT key.
When SD memory card not inserted or no data found on the card, [SD CARD] menu is shaded menu and cannot be operated.

CAUTION: Put the cover firmly after the SD card Insert /Remove. Water protection of the Display unit is not guaranteed when the card reader cover is removed.

4.5.3 Parameter reset

Use this function as means to return the radar to its default settings as it was at first power on.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [BACKUP] => [PARAMETER RESET] => [GO], and press ENT key.

4.5.4 MAP, Target Track and Past Position reset

Use this function as means to delete all the map, target track and past position data from radar internal memory.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [BACKUP] => [MAP/PAST RESET] => [GO], and press ENT key.

4.6 TOTAL Hour and TX Hour (Cannot use while transmitting)

TOTAL HOUR menu indicates the total operating time of the radar.
Following operation can be used to reset total hours to 0.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [TOTAL HOUR] => [RESET] => and press ENT key.

TX HOUR menu indicates the total transmitting time of the radar.
This is useful information to use when exchanging radar parts. Use this hour information to judge magnetron life expectancy.
Reset after components have been exchanged

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [TX HOUR] => [RESET] => and press ENT key.

4.7 MENU Setup

MENU SETUP menu can be used to simplify full menu and turn off the items in full menu that are not used. This is often used to remove not needed menu items for simple operation of the radar.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [MENU SETUP] => [GO] => and press ENT key.
Setup menu display will display.
(2) Select menu item to set ON or OFF => select [X] or [○] => and press ENT key.
(3) When setup finish, press MENU key. Menu display will disappear.
Press MENU key again. [X] mark menu items are not displayed.

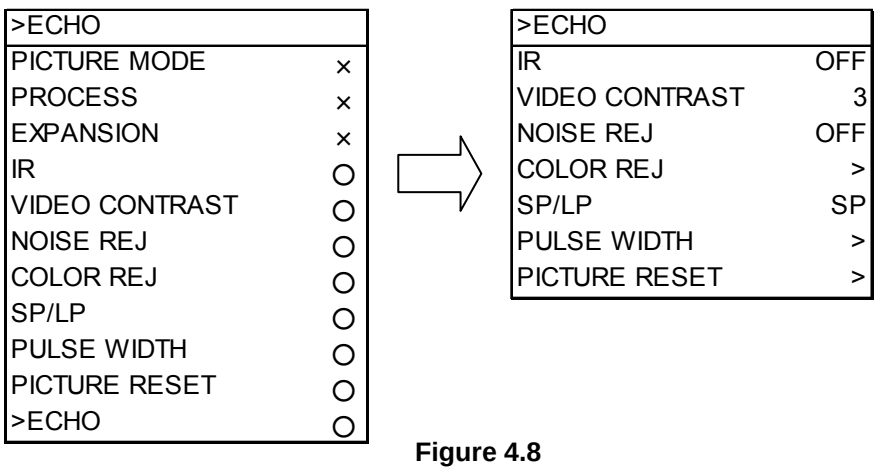


Figure 4.8

4.8 Version confirmation

Currently installed firmware version can be found by using following menu operation.

(1) Press MENU key to display “Menu”.
Select [MAINTENANCE] => [VERSION] =>

4.9 How to update the system program

(1) Prepare SD memory card with latest program.
File name: radar
File type: MOT

(2) Turn off the power.

(3) Insert SD memory card in the card reader on front panel.

(4) Press POWER ON/OFF key to turn on, radar will start update procedure automatically.
Message of “LOADING IN PROGRESS” “PLEASE DO NOT POWER OFF” and time bar will be displayed.
EBL1, EBL2 and BRILL, VRM1, VRM2 and PANEL key’s lamps flash red. (MDC-5500 series only)
Few minutes later, when program update is complete, “LOADING COMPLETE” “PLEASE EJECT SD CARD” message appears on the display.

(5) Eject SD memory card from the card reader, and reboot automatically.

CAUTION: Put the cover firmly after the SD card Insert /Remove. Water protection of the Display unit is not guaranteed when the card reader cover is removed.

Chapter 5 Troubleshooting and on board repair

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

5.1 Necessary information at the time of repair request

Please note the following items:

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

(2) Product type name

(3) Product serial number

(4) Software version name described in the [MAINTENANCE] Menu.

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

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

5.2 Provided self diagnostic facilities

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

5.2.1 Alarm display and how to cancel

Alarm display may appear at the lower right of the radar display as shown in Figure 5.1 when a malfunction or operation error has been detected in the device.

Abnormalities are categorized as [Alarm], [Warning] and [Caution]. When alarm display actually appears and there is something wrong with radar, record the alarm details by type, location and status and press OFF key. The alarm sound and display will disappear. Multiple errors may be displayed one by one. Record all alarms and press OFF key for every alarm.

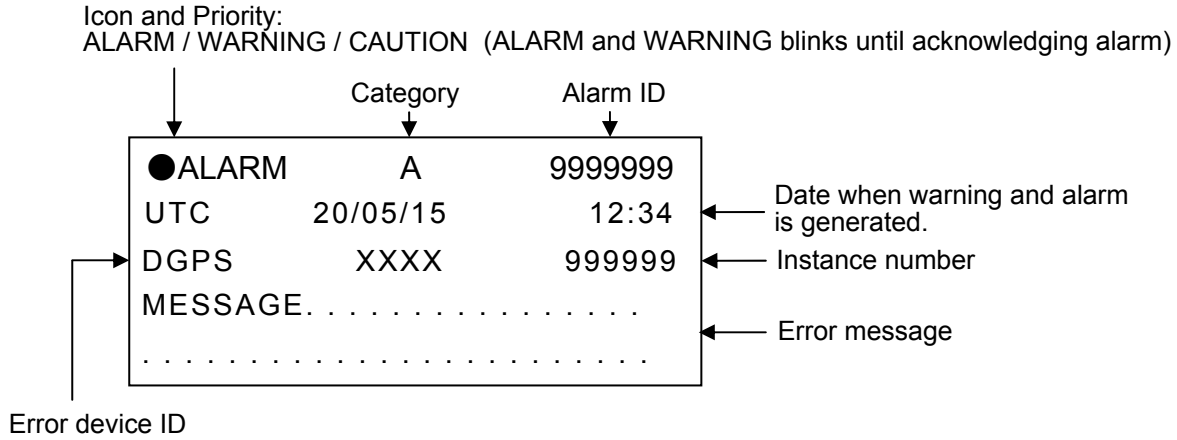


Figure 5.1 Alarm, Warning and Caution display

5.3 Malfunction diagnostics

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

5.3.1 Malfunction detection step

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

Table 5.1 basic malfunctions

Failure status	Possible cause	Measure
No power.	1. Power cable is disconnected. 2. Operation unit cable is disconnected. 3. Supply voltage is out of range. 4. Main power fuse is blown.	1. Connect power cable firmly and secure connector. 2. Connect operation cable firmly and secure connector. 3. Use proper power source. 4. Change fuse with new one.
Power is applied but no display	1. Display brilliance is adjusted to the minimum. 2. Connector of internal cable is disconnected. 3. Failure of LCD unit or Backlight power PCB	1. Press BRILL key and turn BRILL knob clockwise to adjust properly. 2. Confirm by a serviceman. 3. Request repair.

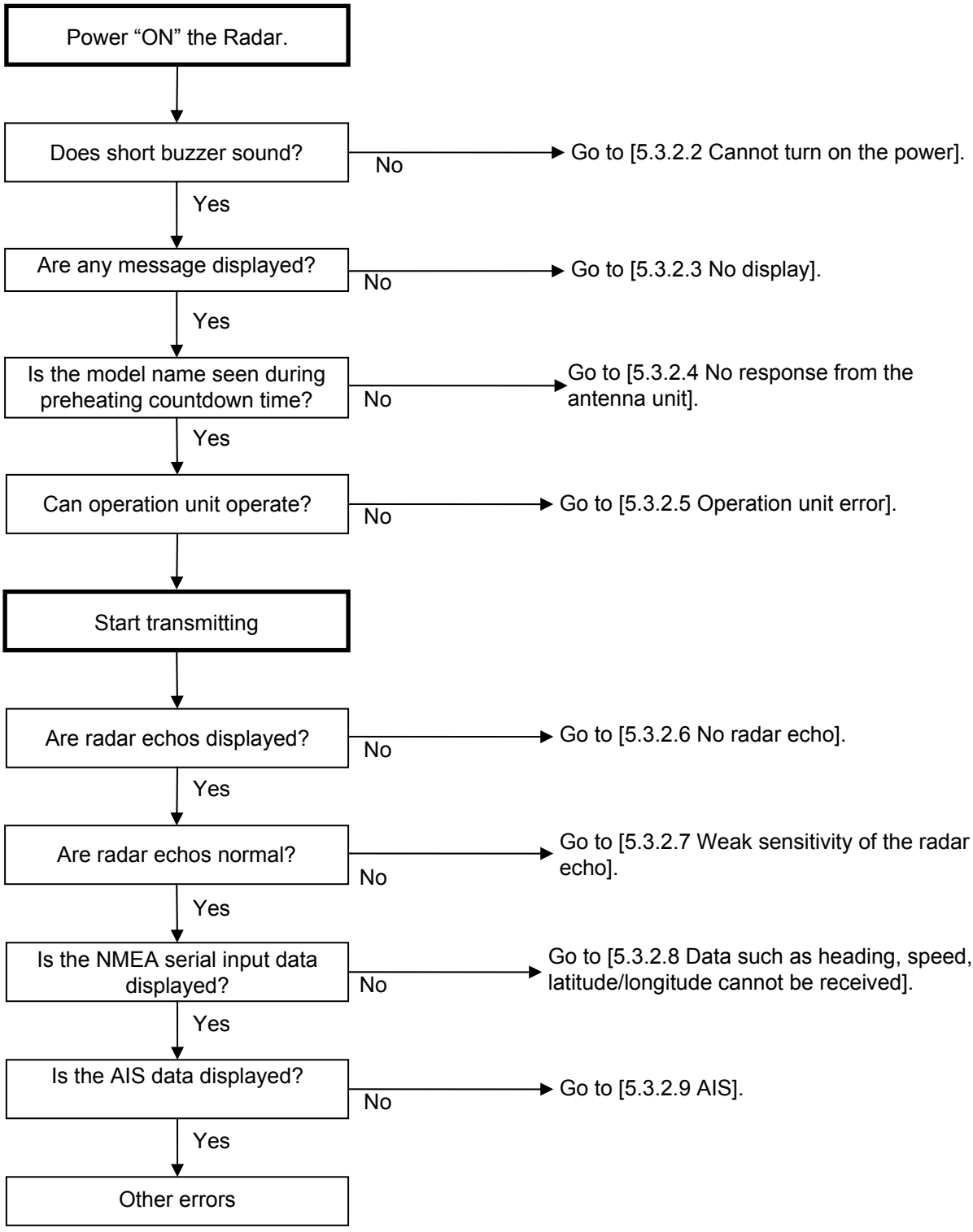
Table 5.2 possible malfunctions

Error status	Possible cause	Measure
Display brilliance is dark.	1. Adjustment of display brilliance is incorrect. 2. Failure of LCD driver circuit 3. Failure of Backlight power PCB	1. Readjust by referring to Operation manual “2.2 Change Brilliance” 2. Request repair 3. Request repair
No radar echo is displayed.	1. Receiver is detuned. 2. Video contrast adjustment error 3. Failure of transceiver	1. Readjust by referring to “4.1.1 Tune adjustment”. 2. Readjust by referring to “4.1.1 Tune adjustment”. 3. Request repair
Radar echo is too weak.	1. Receiver is detuned. 2. Failure of Magnetron or MIC (front-end)	1. Readjust by referring to “4.1.1 Tune adjustment”. 2. Request repair
Error message “Head line signal abnormal.” is displayed.	1. No heading line signal input.	1. Check [BP/HG] signal between an Antenna Scanner unit and a Display unit.
Antenna does not rotate.	1. Motor fuse is blown. 2. Motor power is not supplied. 3. Inter-switch mode is difference.	1. Replace fuse with a new one. 2. Check motor power connection. 3. Set inter-switch mode to master mode.

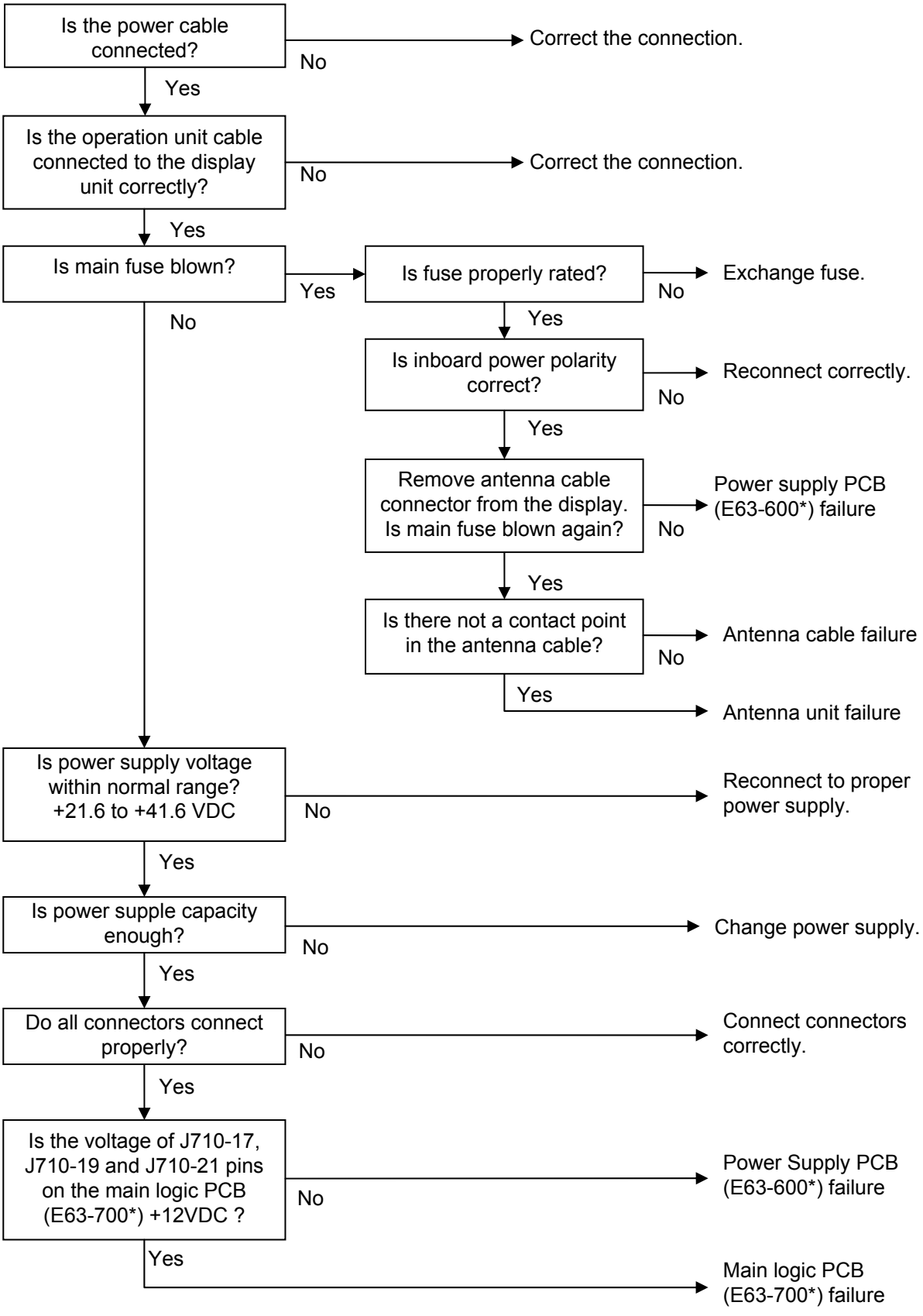
5.3.2 Malfunction diagnostics flow chart

The following malfunction analysis chart can be used by service personnel for malfunction diagnostics and location of defective module. This chart shows flow chart of dignostics for basic malfunction troubleshooting.

5.3.2.1 Initial malfunction diagnostics

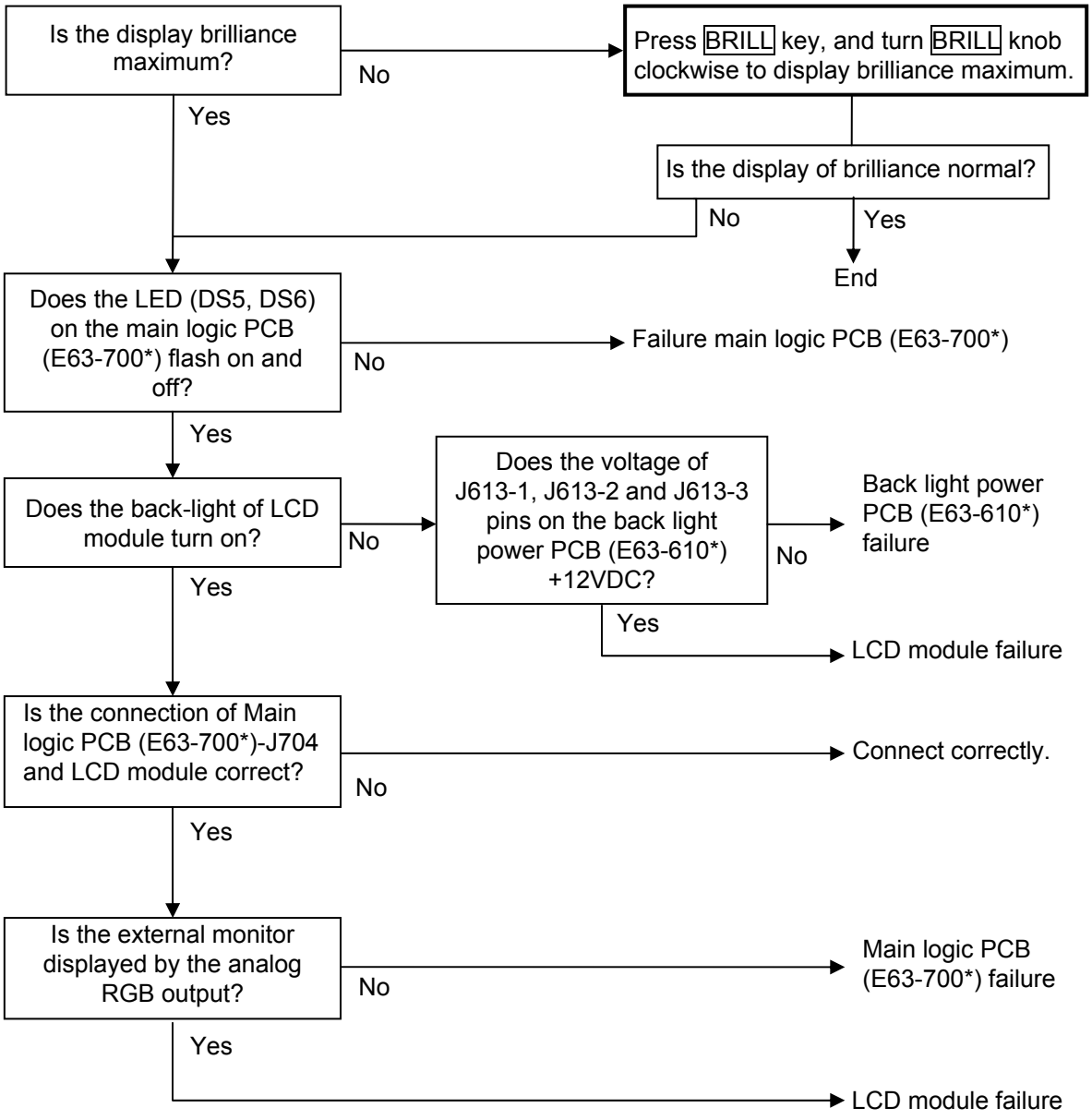


5.3.2.2 Cannot turn on the power



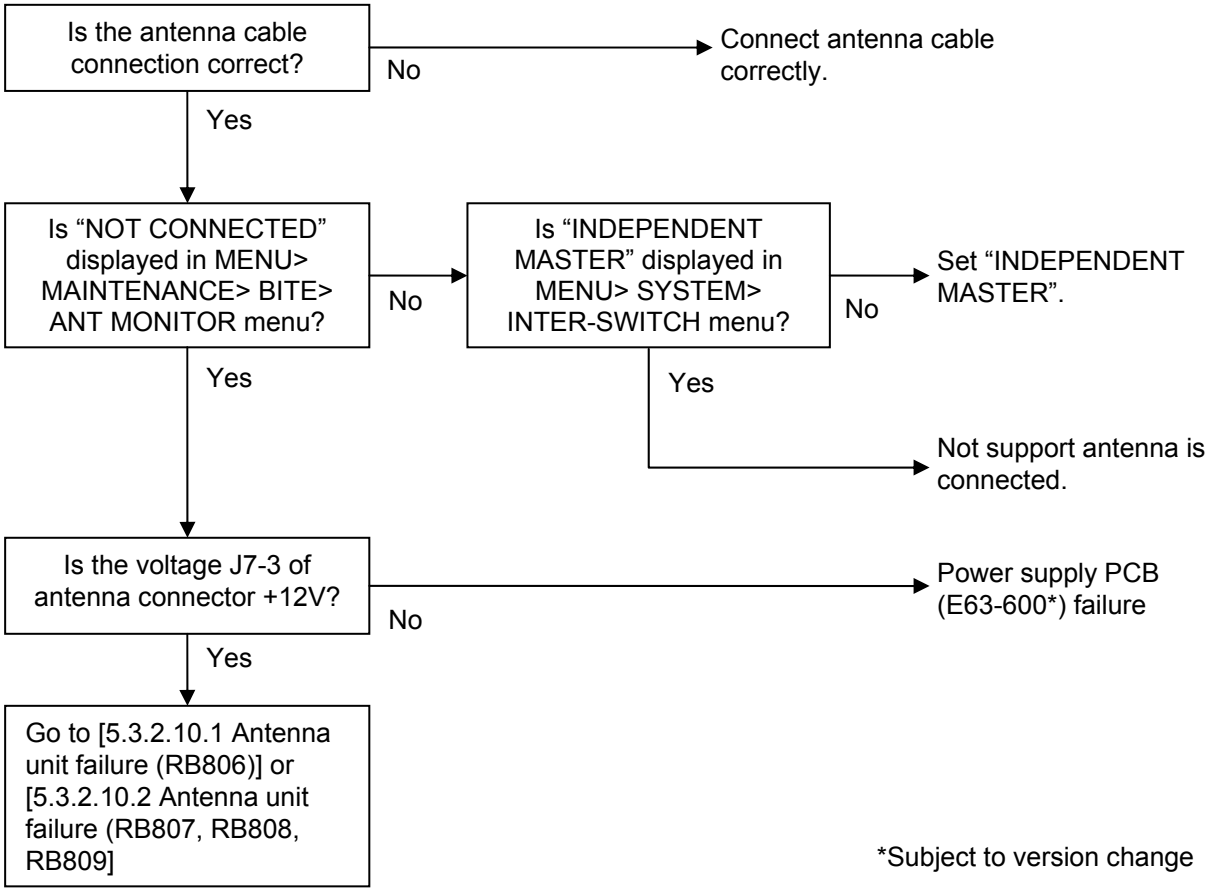
*Subject to version change

5.3.2.3 No display

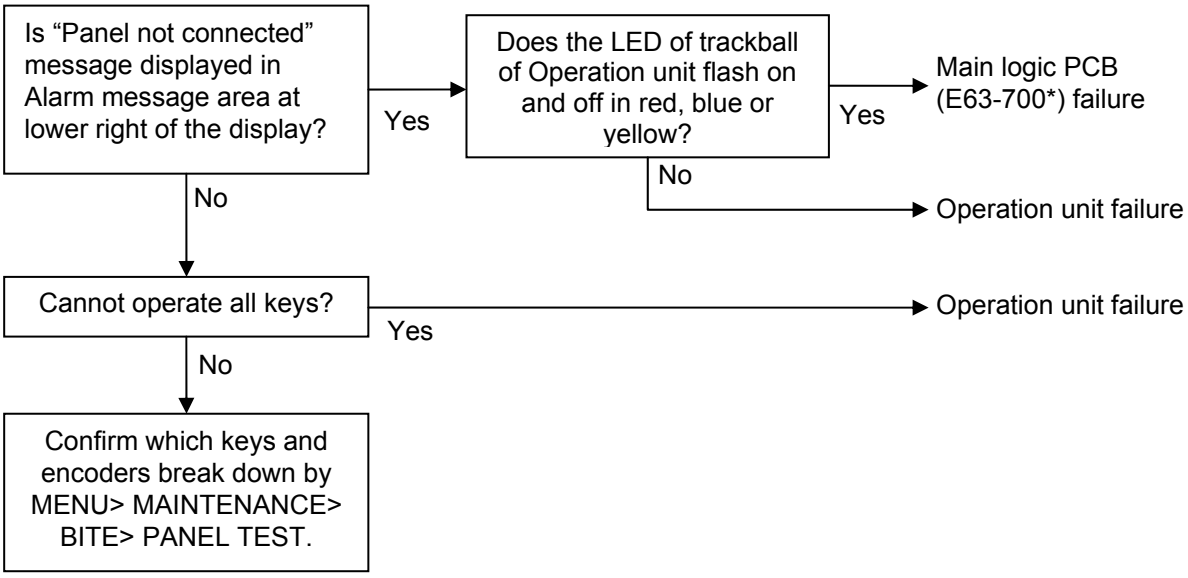


*Subject to version change

5.3.2.4 No response from the antenna unit

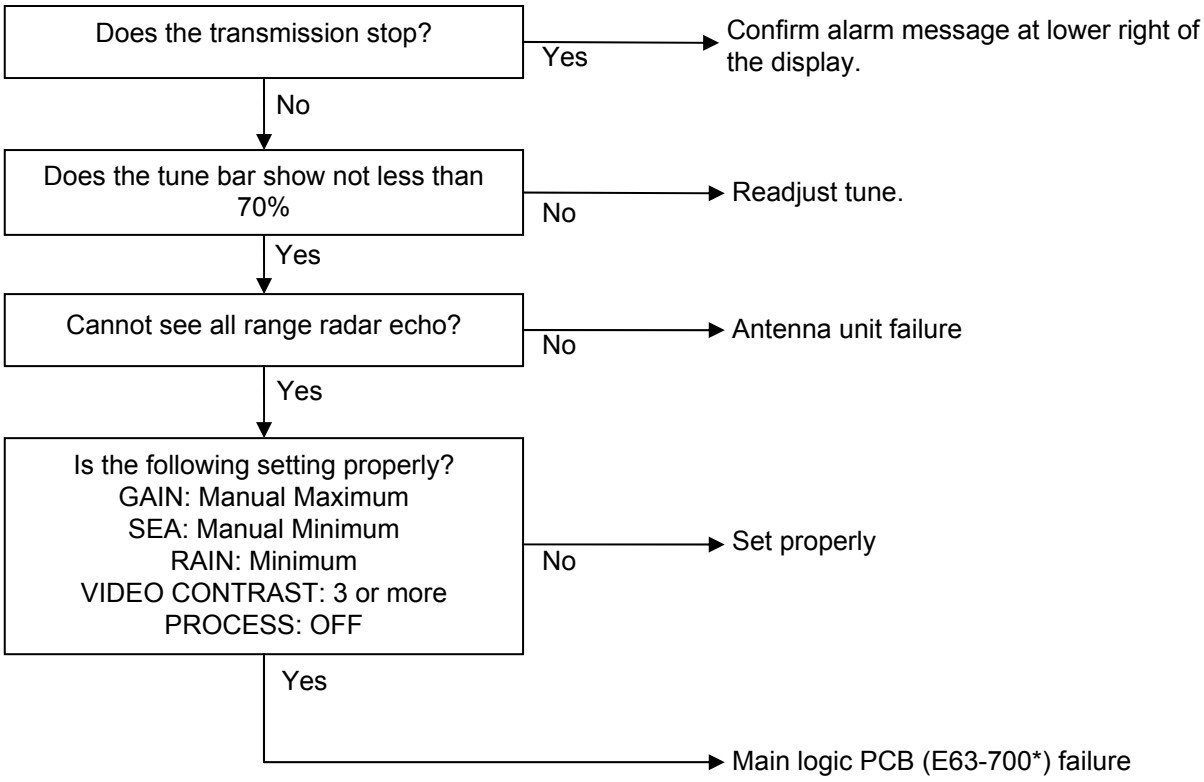


5.3.2.5 Operation unit error (MDC-5500 series only)



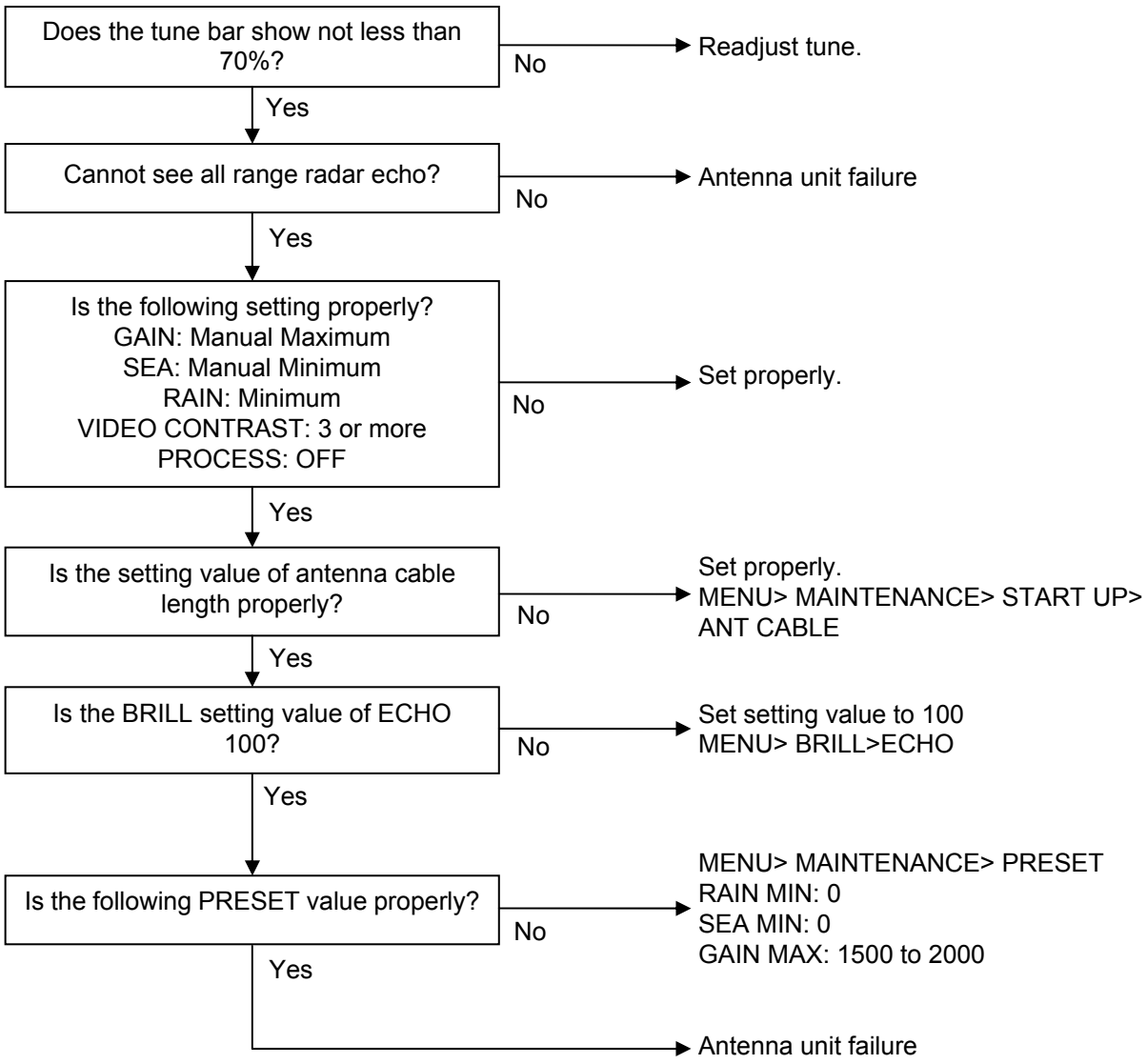
*Subject to version change

5.3.2.6 No radar echo

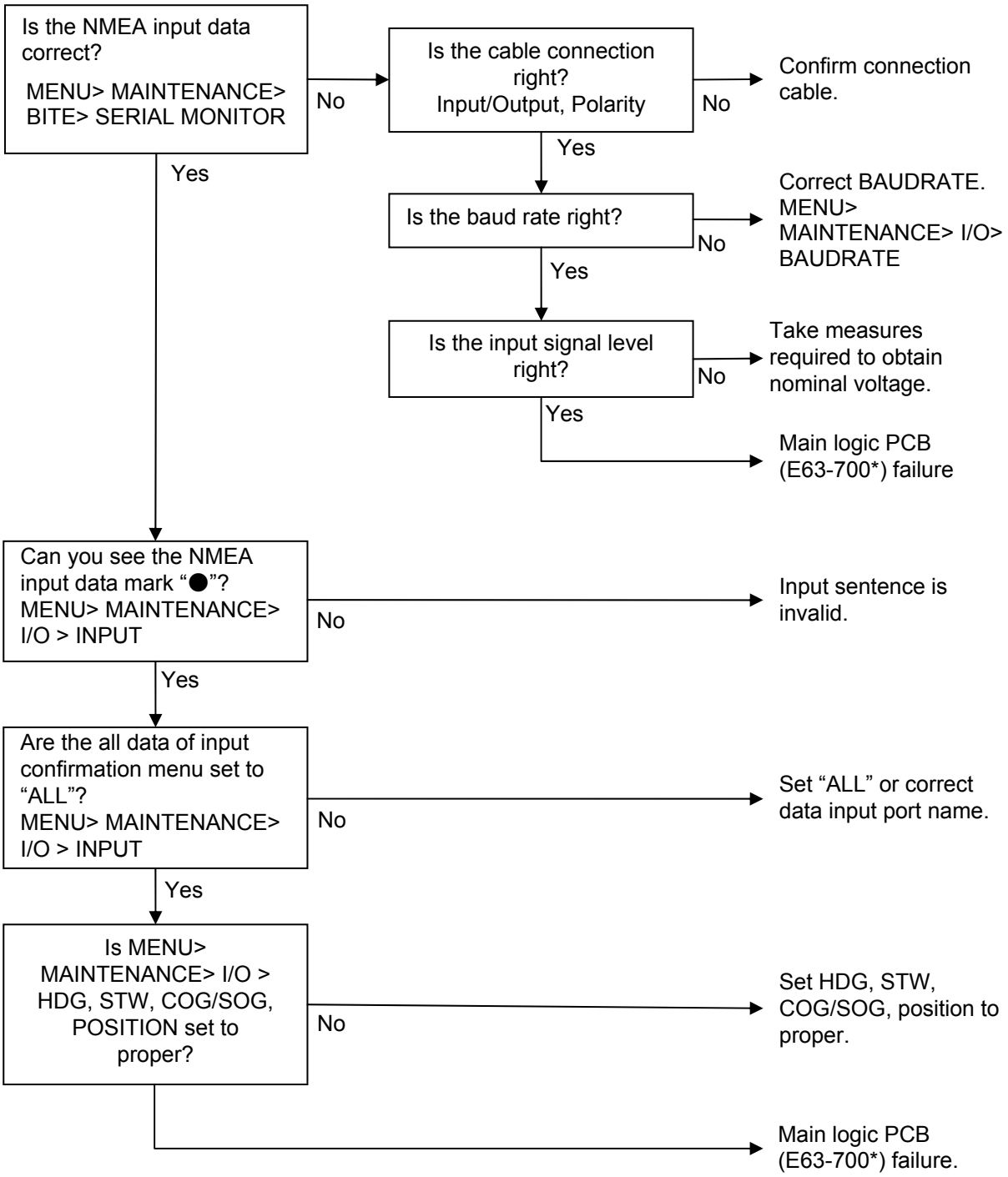


*Subject to version change

5.3.2.7 Weak sensitivity of the radar echo

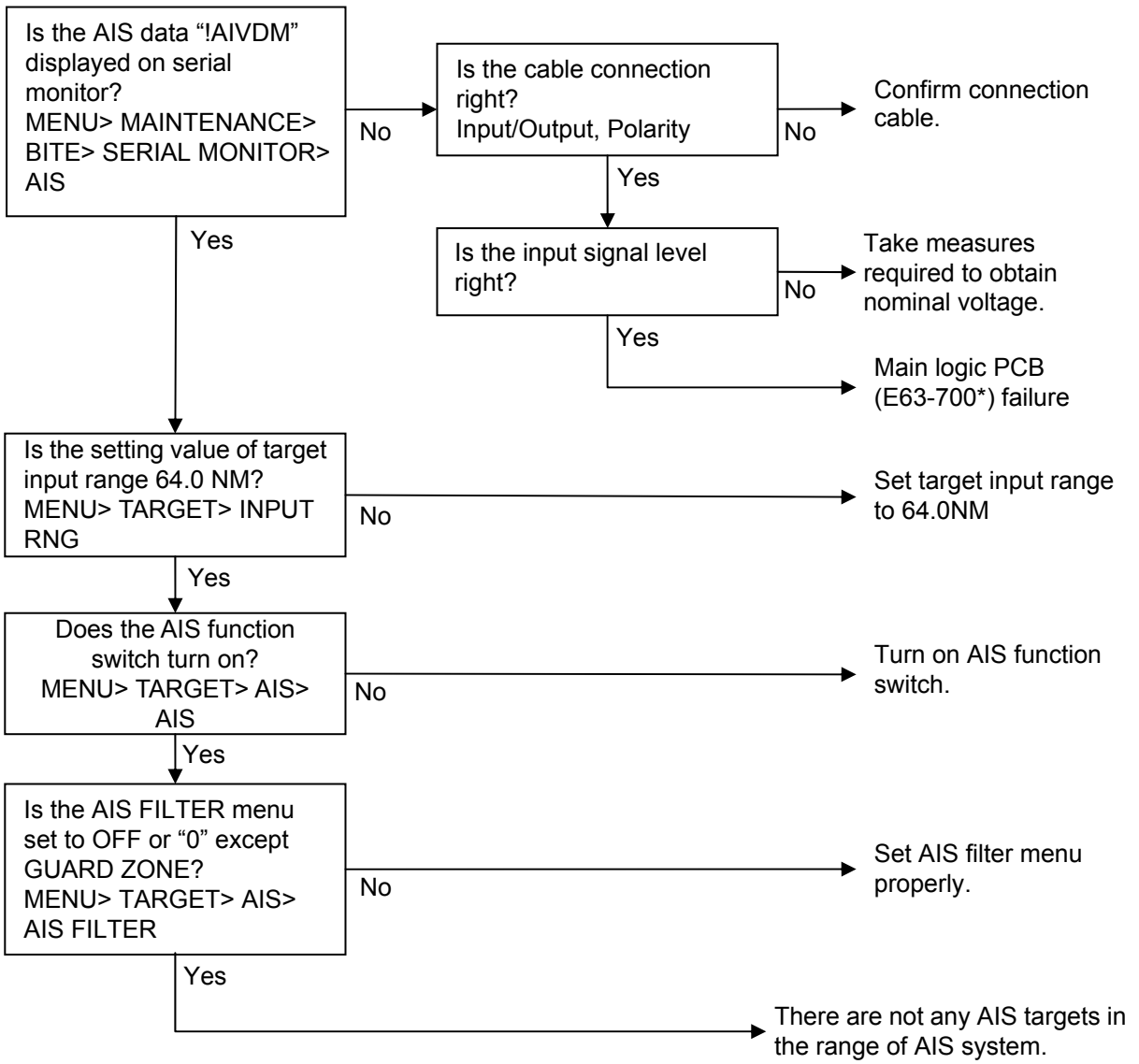


5.3.2.8 Data such as heading, speed, latitude/longitude cannot be received



*Subject to version change

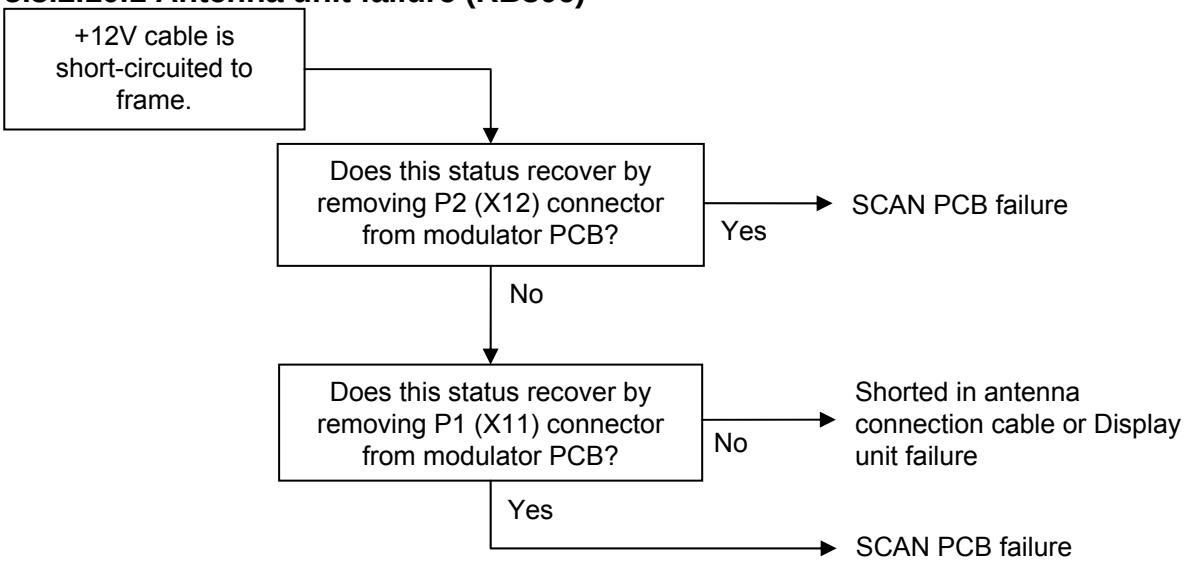
5.3.2.9 AIS

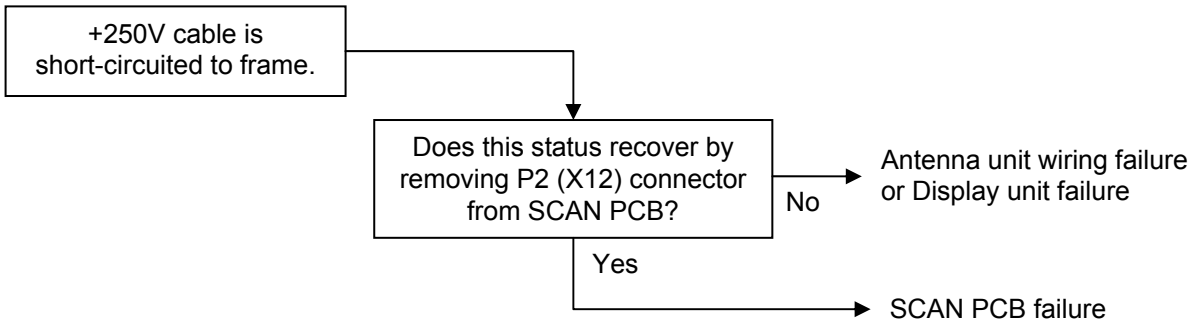


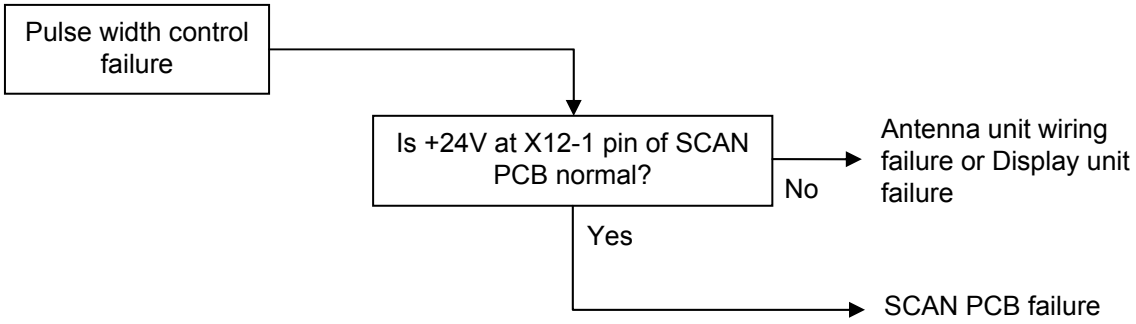
*Subject to version change

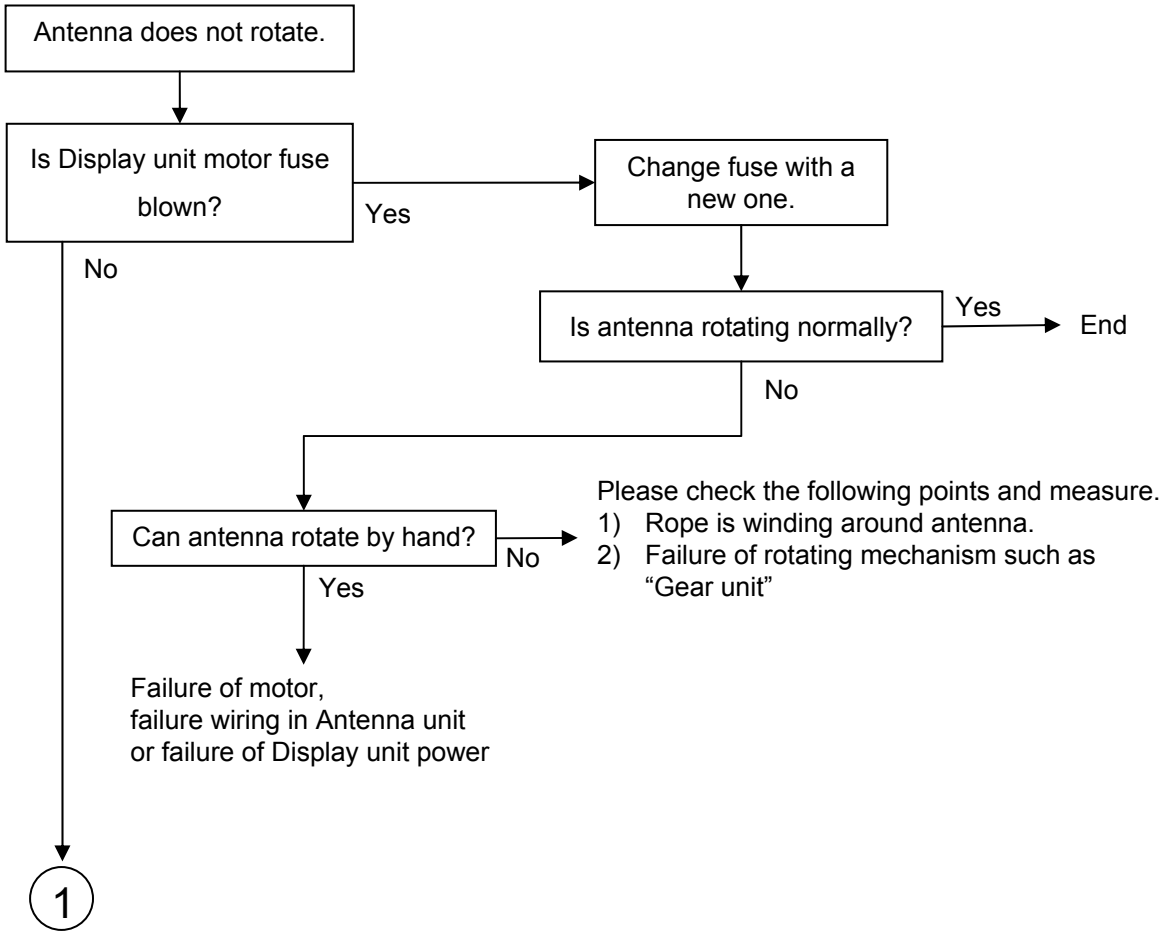
5.3.2.10 Antenna unit failure

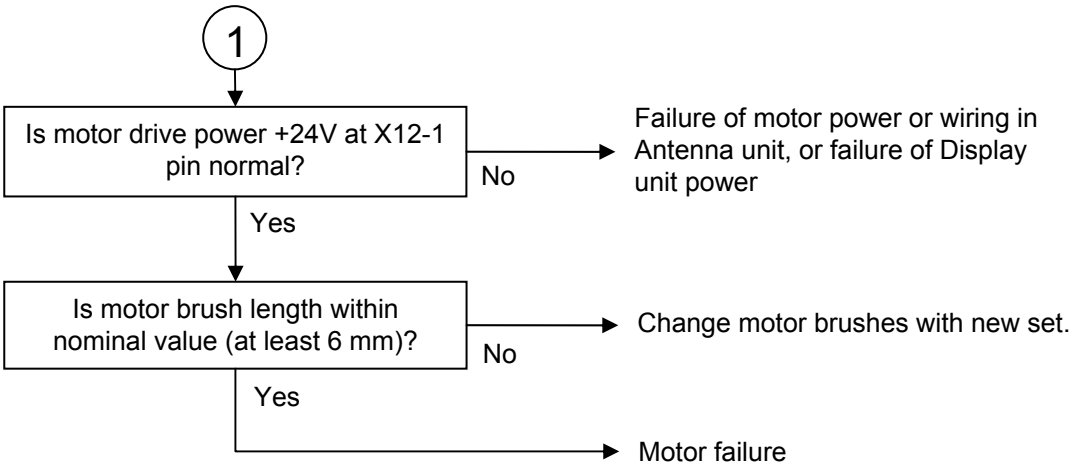
5.3.2.10.1 Antenna unit failure (RB806)

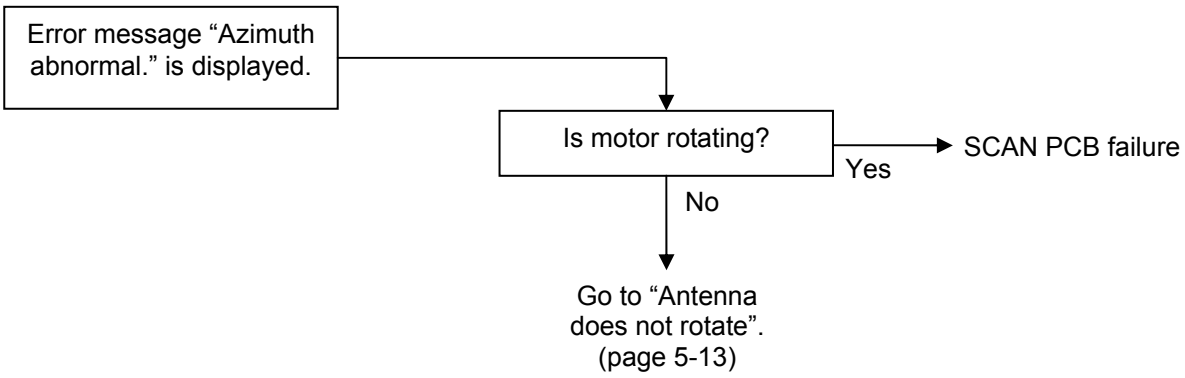


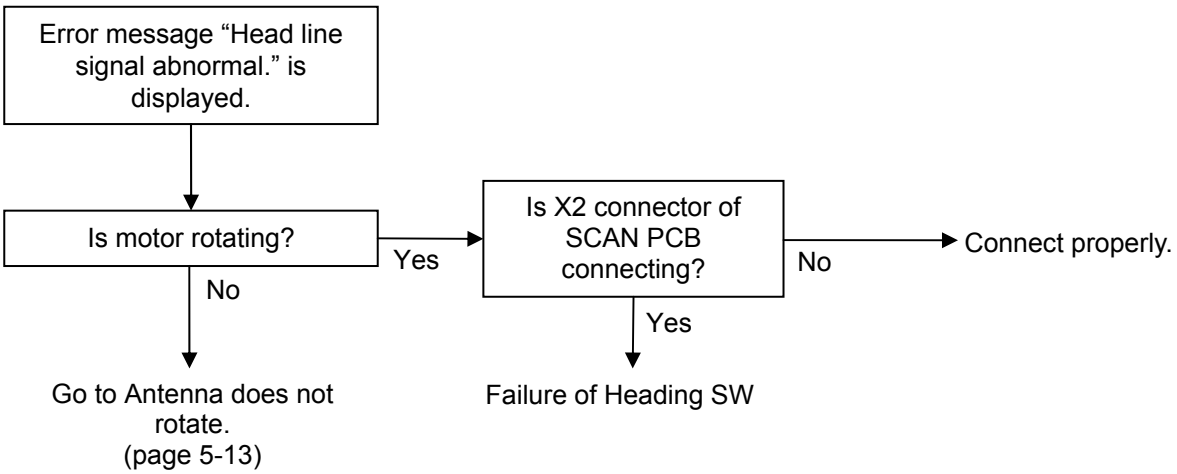

+250V cable is short-circuited to frame.
Does this status recover by removing P2 (X12) connector from SCAN PCB?
No
Antenna unit wiring failure or Display unit failure
Yes
SCAN PCB failure

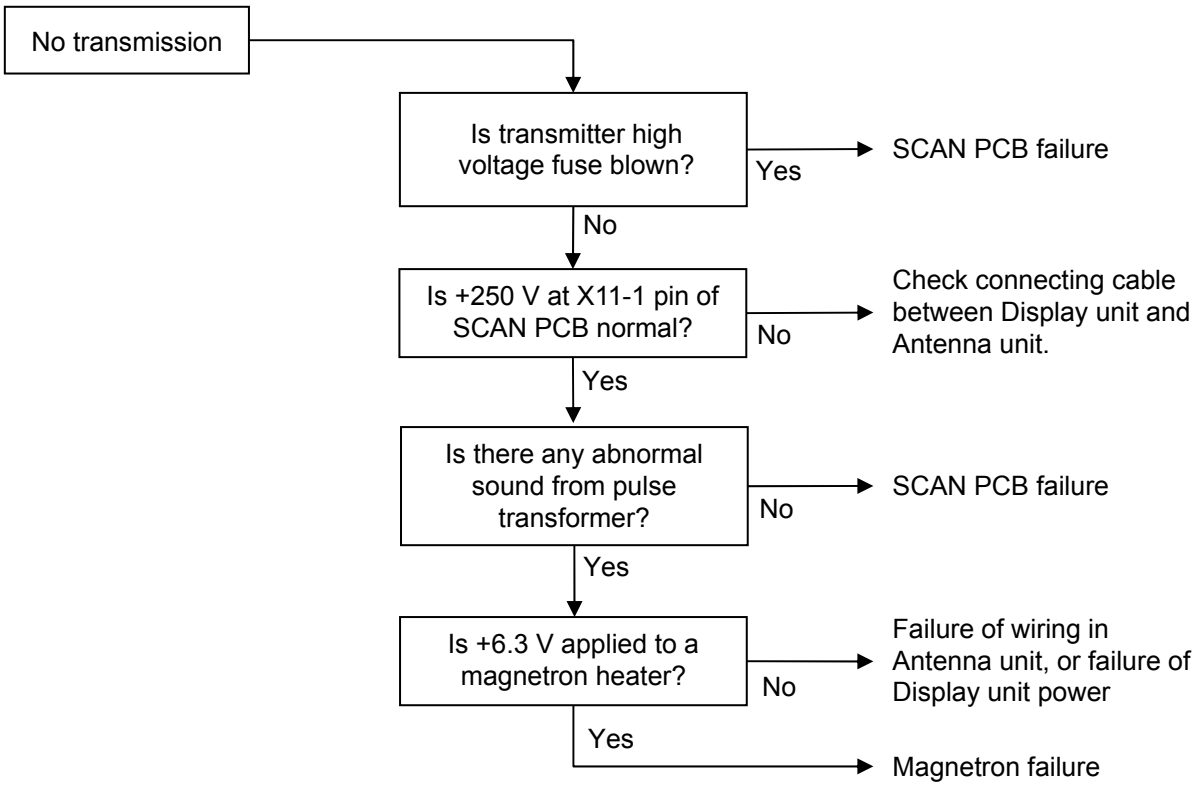

Pulse width control failure
Is +24V at X12-1 pin of SCAN PCB normal?
No
Antenna unit wiring failure or Display unit failure
Yes
SCAN PCB failure

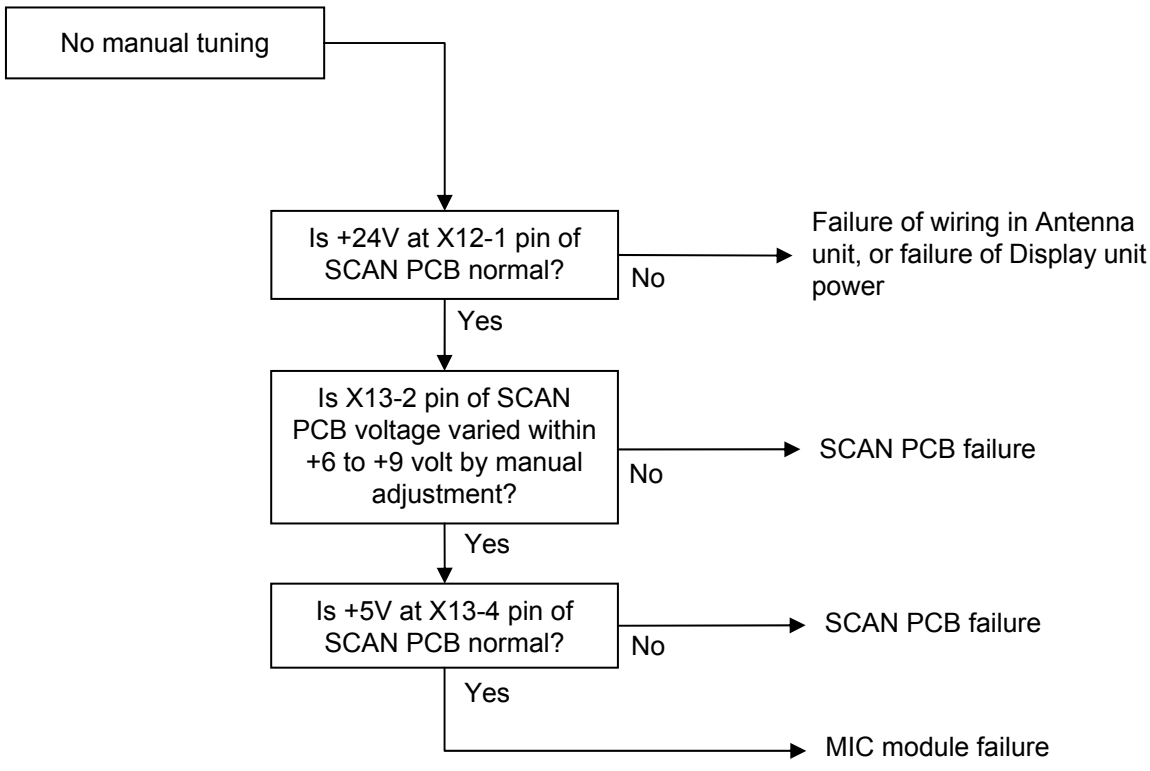

Antenna does not rotate.
Is Display unit motor fuse blown?
Yes
Change fuse with a new one.
No
Is antenna rotating normally?
Yes
End
No
Can antenna rotate by hand?
No
Please check the following points and measure.
1) Rope is winding around antenna.
2) Failure of rotating mechanism such as "Gear unit"
Yes
Failure of motor, failure wiring in Antenna unit or failure of Display unit power
1

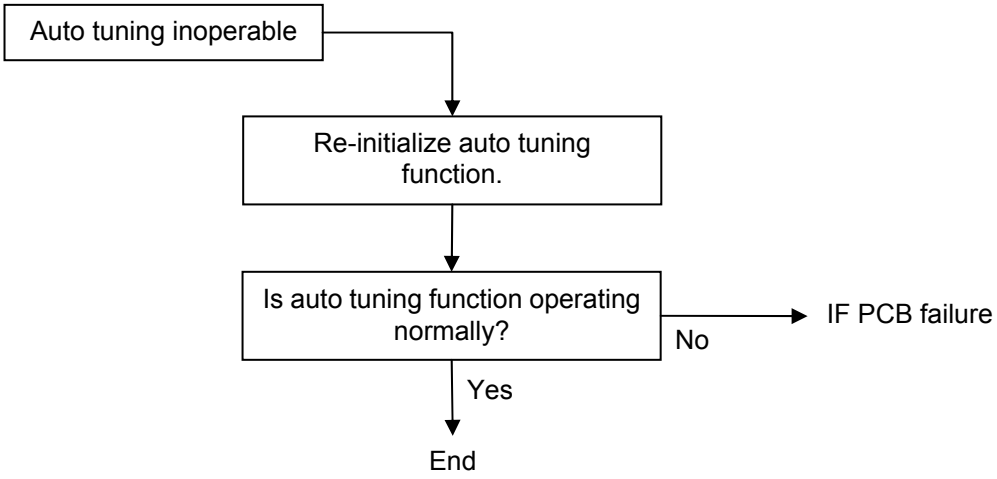

1
Is motor drive power +24V at X12-1 pin normal?
No
Failure of motor power or wiring in Antenna unit, or failure of Display unit power
Yes
Is motor brush length within nominal value (at least 6 mm)?
No
Change motor brushes with new set.
Yes
Motor failure

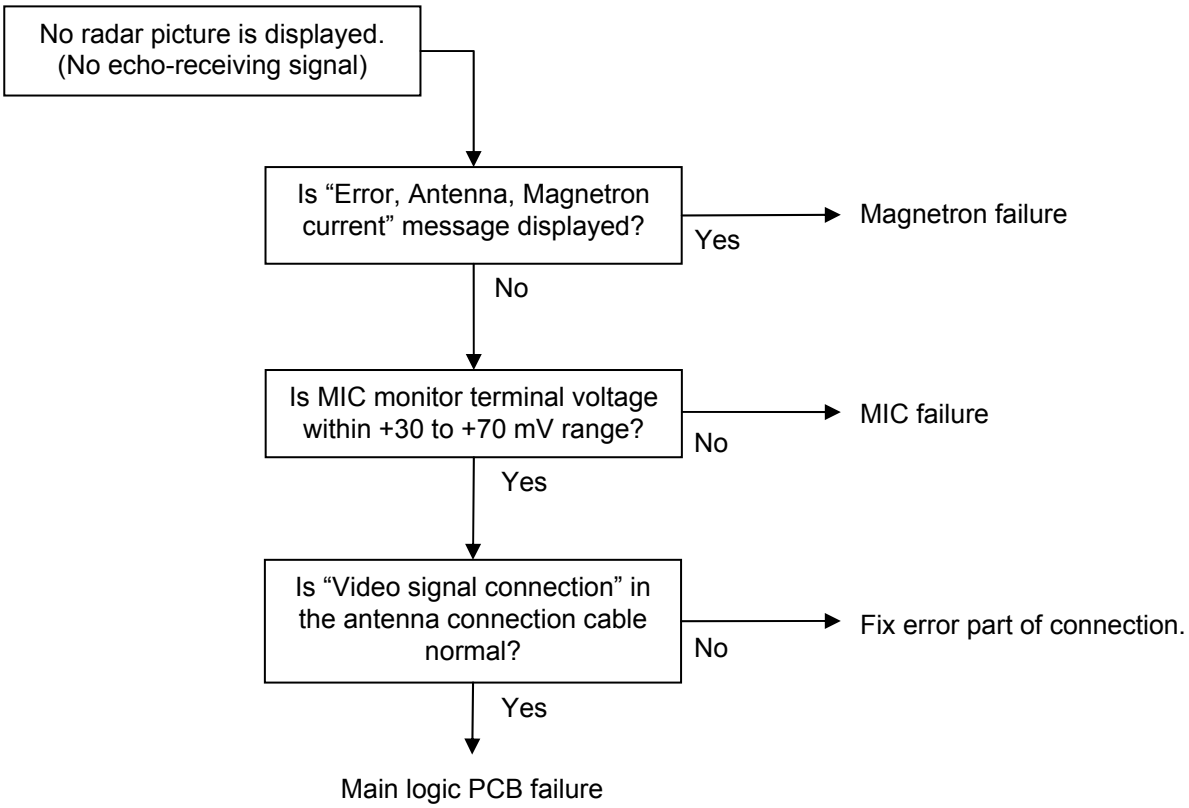

Error message “Azimuth abnormal.” is displayed.
Is motor rotating?
Yes
SCAN PCB failure
No
Go to “Antenna does not rotate”. (page 5-13)

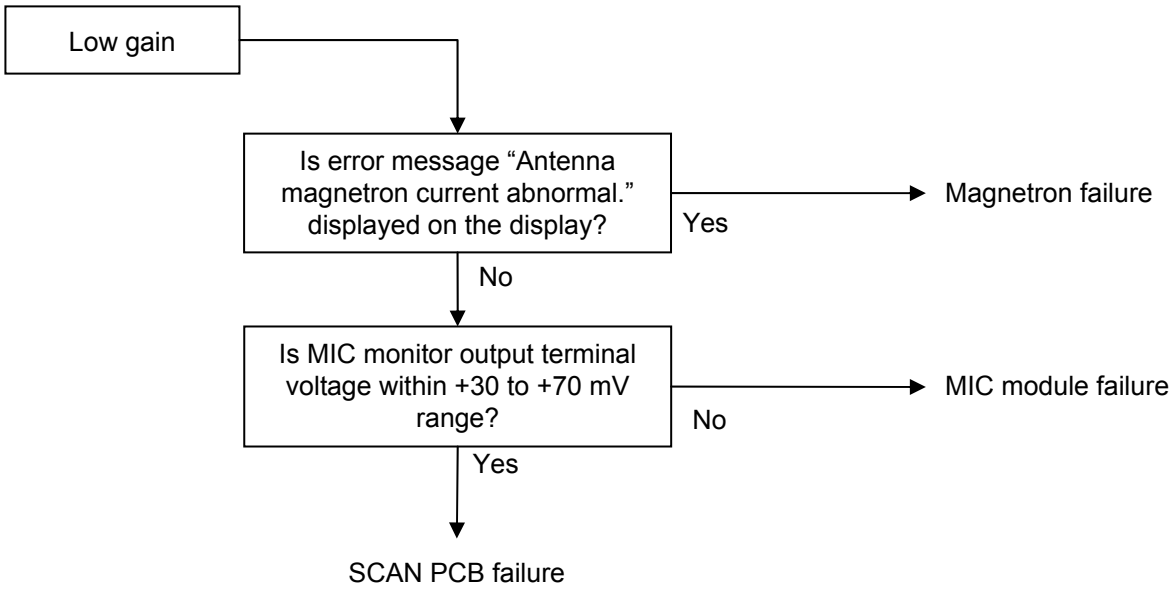

Error message “Head line signal abnormal.” is displayed.
Is motor rotating?
Yes
Is X2 connector of SCAN PCB connecting?
No
Connect properly.
No
Yes
Go to Antenna does not rotate. (page 5-13)
Failure of Heading SW


No transmission
Is transmitter high voltage fuse blown?
Yes
SCAN PCB failure
No
Is +250 V at X11-1 pin of SCAN PCB normal?
No
Check connecting cable between Display unit and Antenna unit.
Yes
Is there any abnormal sound from pulse transformer?
No
SCAN 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

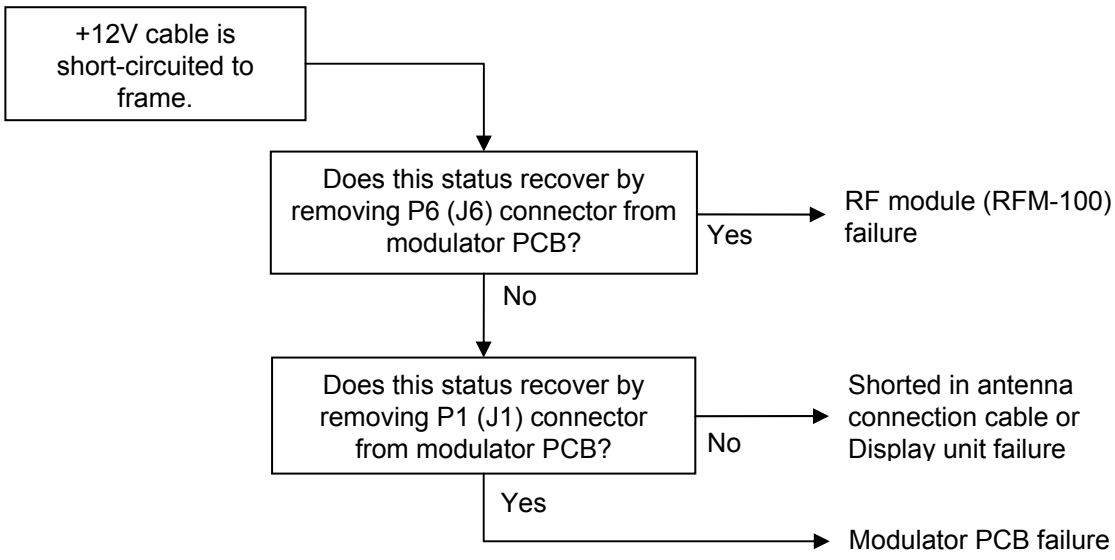

No manual tuning
Is +24V at X12-1 pin of SCAN PCB normal?
No
Failure of wiring in Antenna unit, or failure of Display unit power
Yes
Is X13-2 pin of SCAN PCB voltage varied within +6 to +9 volt by manual adjustment?
No
SCAN PCB failure
Yes
Is +5V at X13-4 pin of SCAN PCB normal?
No
SCAN PCB failure
Yes
MIC module failure

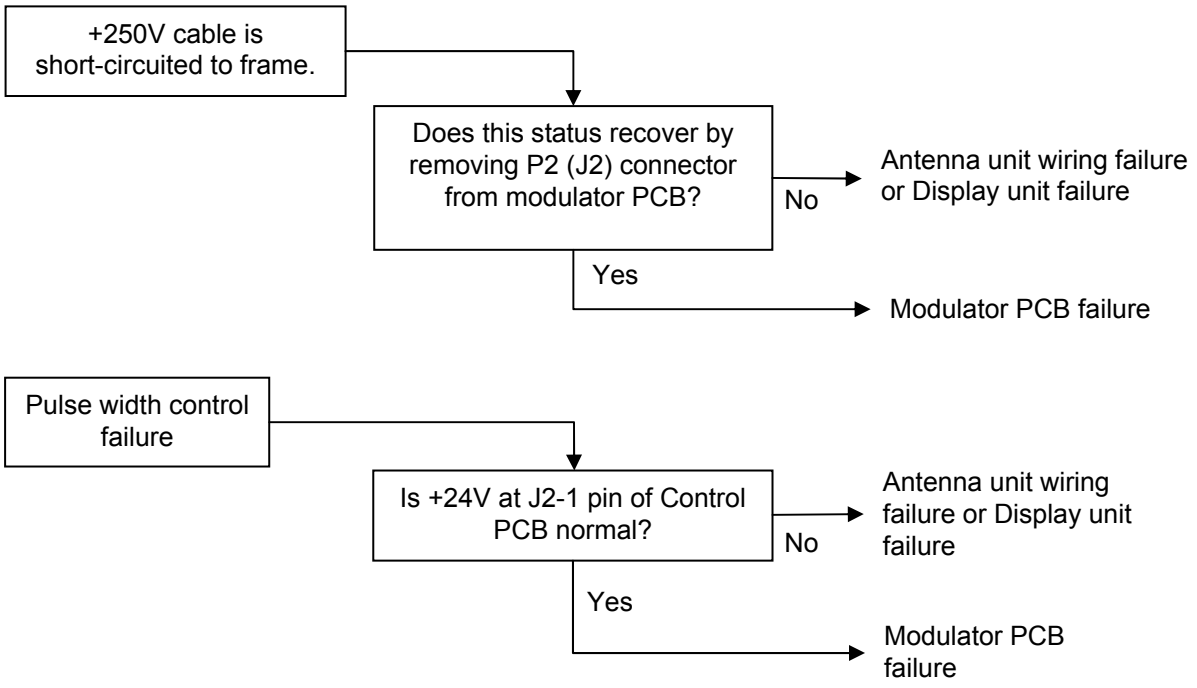

Auto tuning inoperable
Re-initialize auto tuning function.
Is auto tuning function operating normally?
No
IF PCB failure
Yes
End

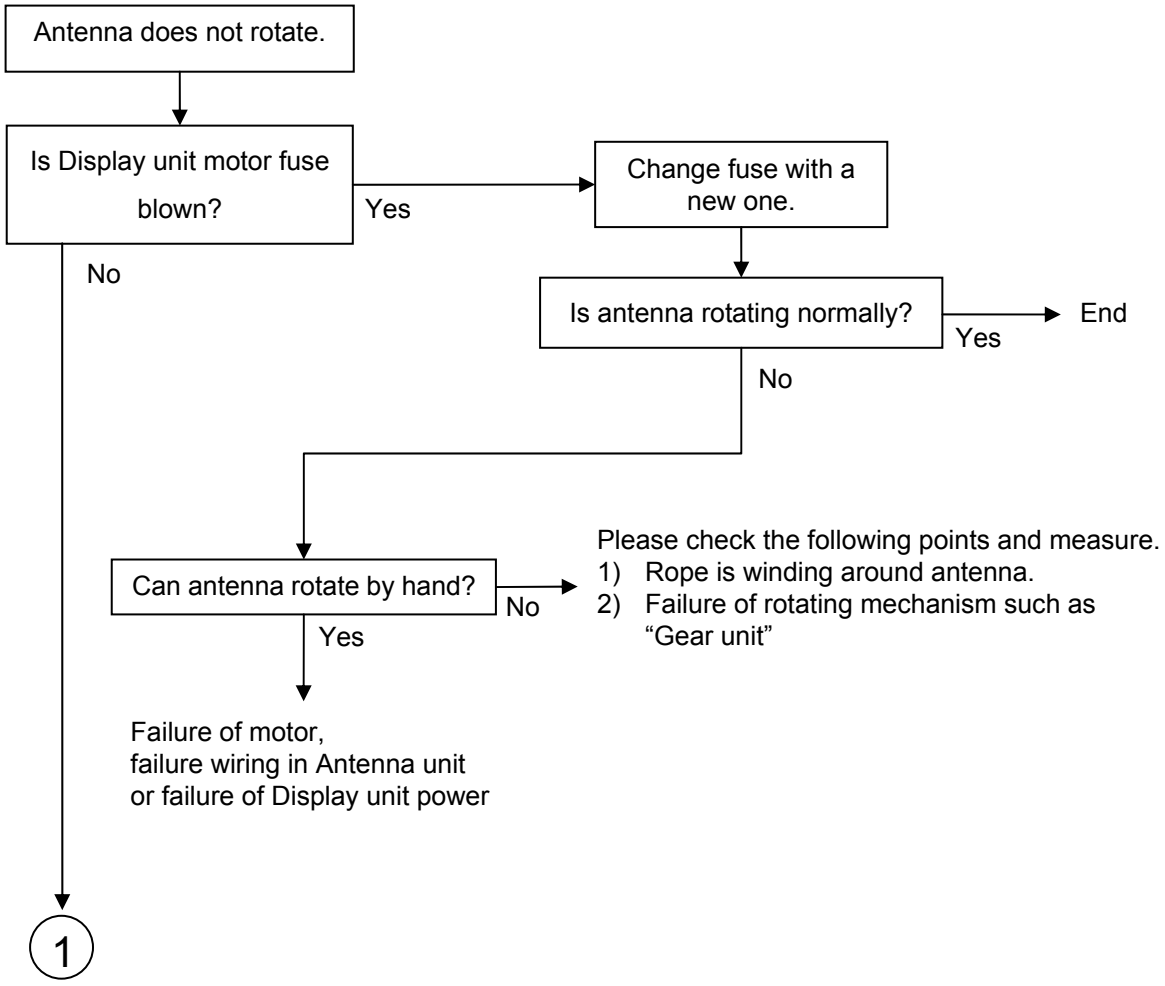

No radar picture is displayed. (No echo-receiving signal)
Is “Error, Antenna, Magnetron current” message displayed?
Yes
Magnetron failure
No
Is MIC monitor terminal voltage within +30 to +70 mV range?
No
MIC failure
Yes
Is “Video signal connection” in the antenna connection cable normal?
No
Fix error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

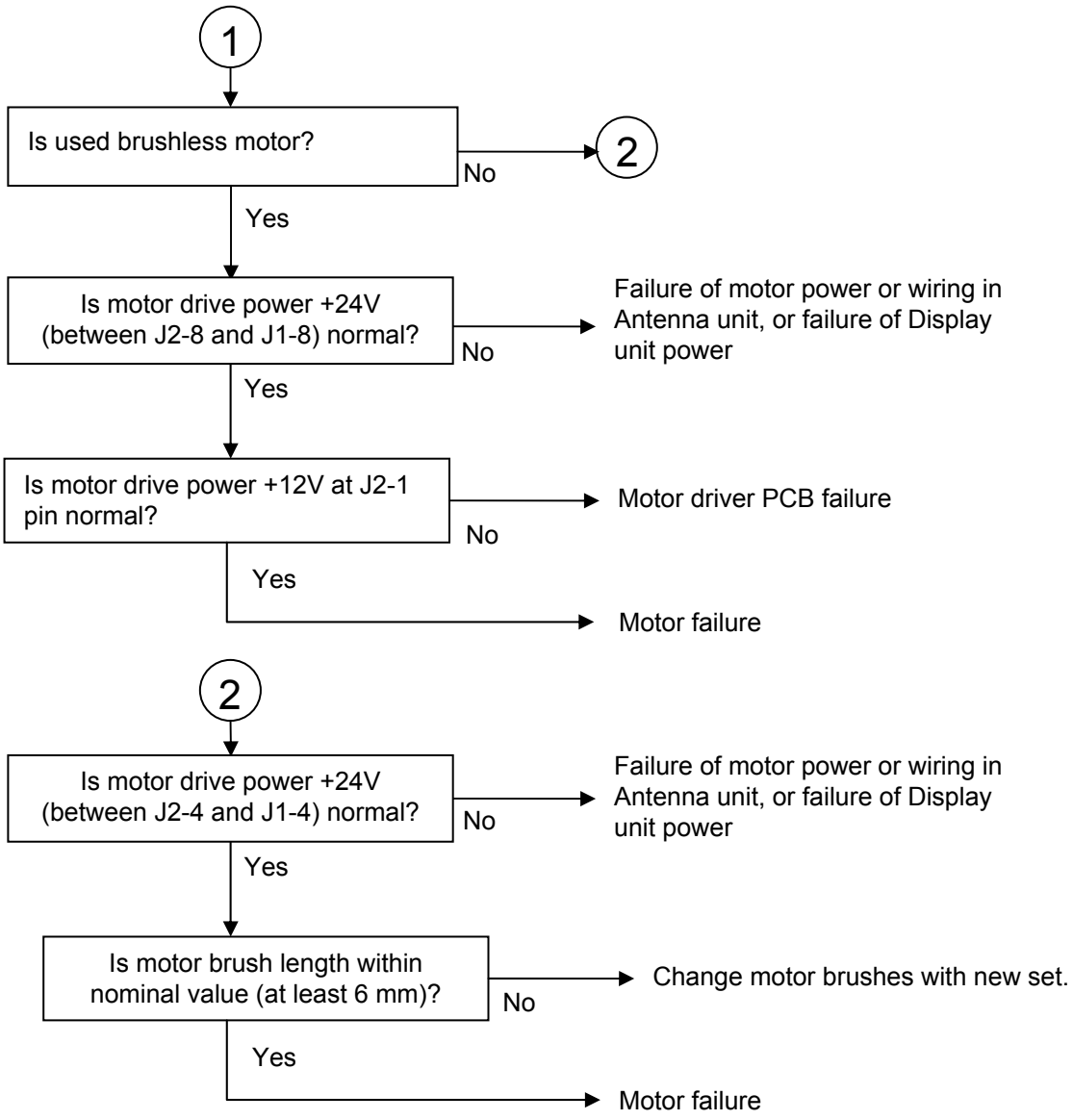

Low gain
Is error message “Antenna magnetron current abnormal.” displayed on the display?
Yes
Magnetron failure
No
Is MIC monitor output terminal voltage within +30 to +70 mV range?
No
MIC module failure
Yes
SCAN PCB failure

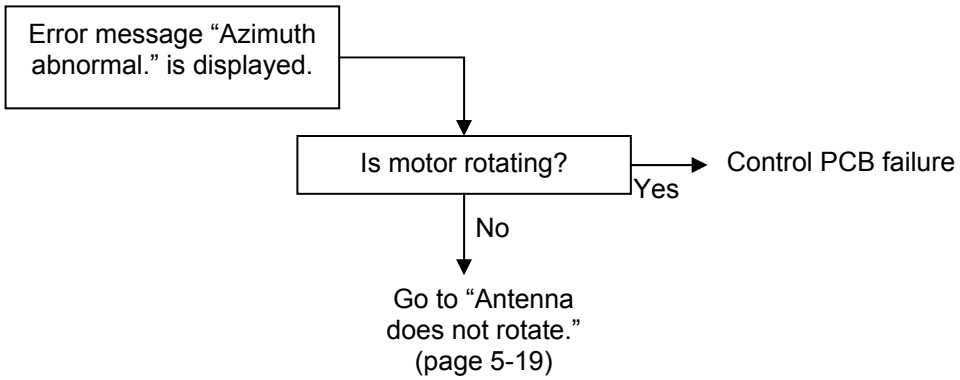
5.3.2.10.2 Antenna unit failure (RB807, RB808, RB809)

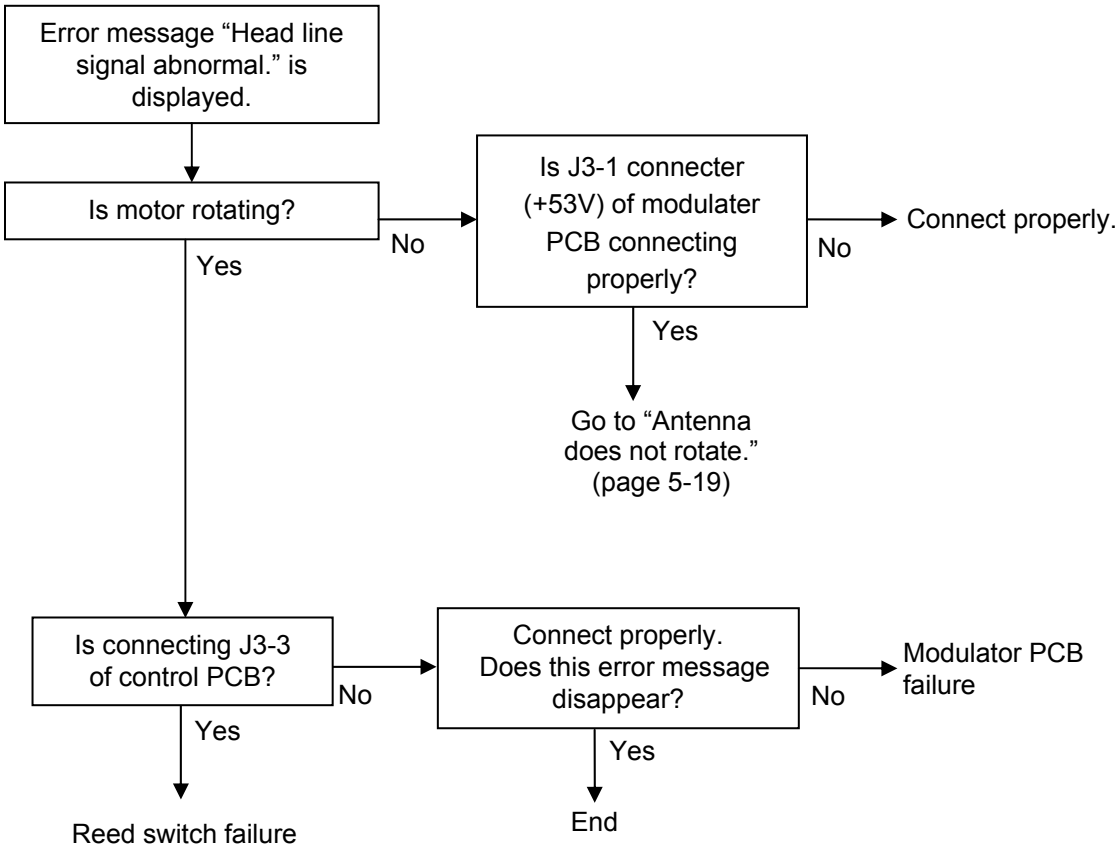


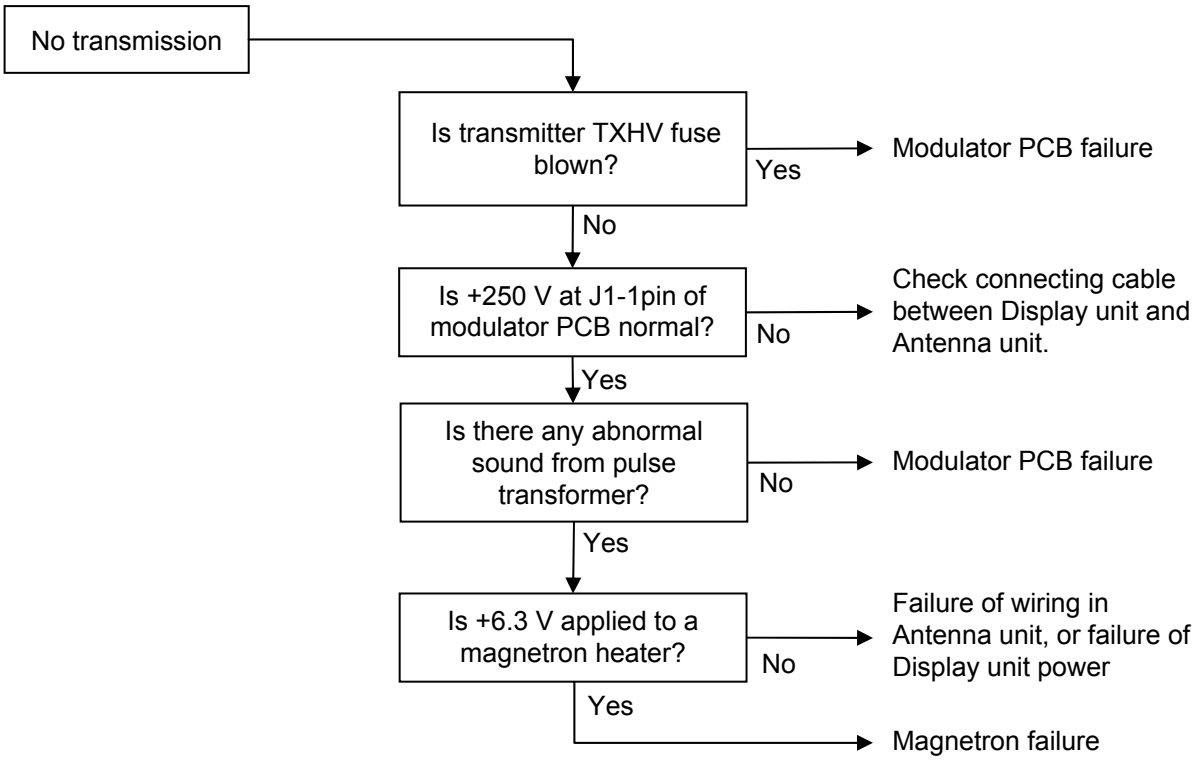

+250V cable is short-circuited to frame.
Does this status recover by removing P2 (J2) connector from modulator PCB?
No
Antenna unit wiring failure or Display unit failure
Yes
Modulator PCB failure
Pulse width control failure
Is +24V at J2-1 pin of Control PCB normal?
No
Antenna unit wiring failure or Display unit failure
Yes
Modulator PCB failure

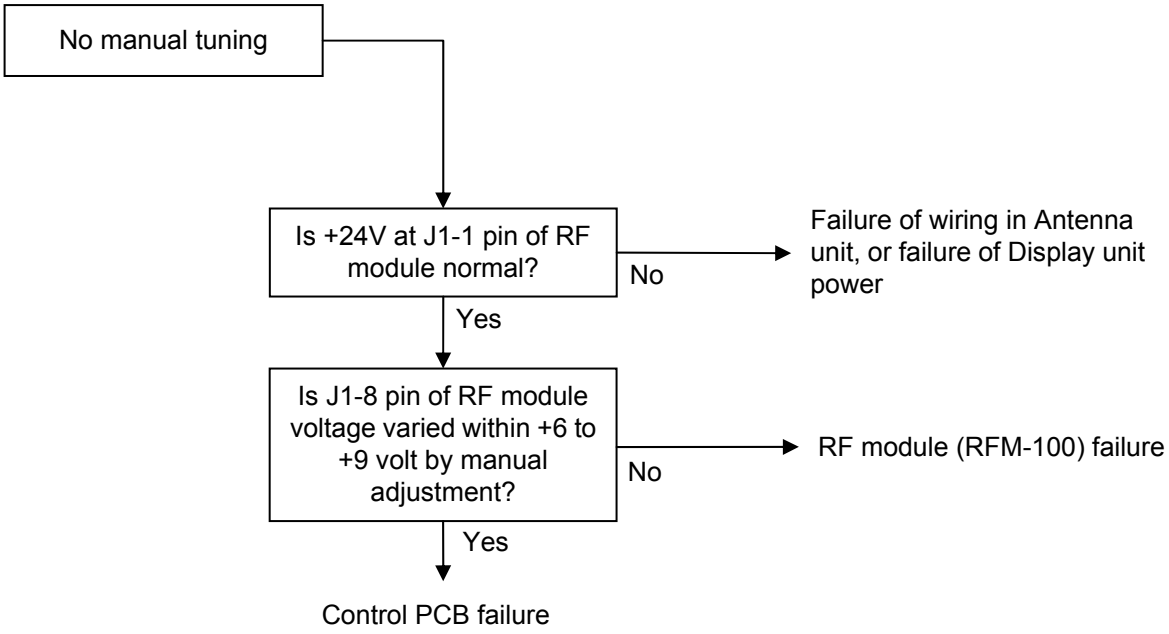

Antenna does not rotate.
Is Display unit motor fuse blown?
Yes
Change fuse with a new one.
No
Is antenna rotating normally?
Yes
End
No
Can antenna rotate by hand?
No
Please check the following points and measure.
1) Rope is winding around antenna.
2) Failure of rotating mechanism such as "Gear unit"
Yes
Failure of motor, failure wiring in Antenna unit or failure of Display unit power
1

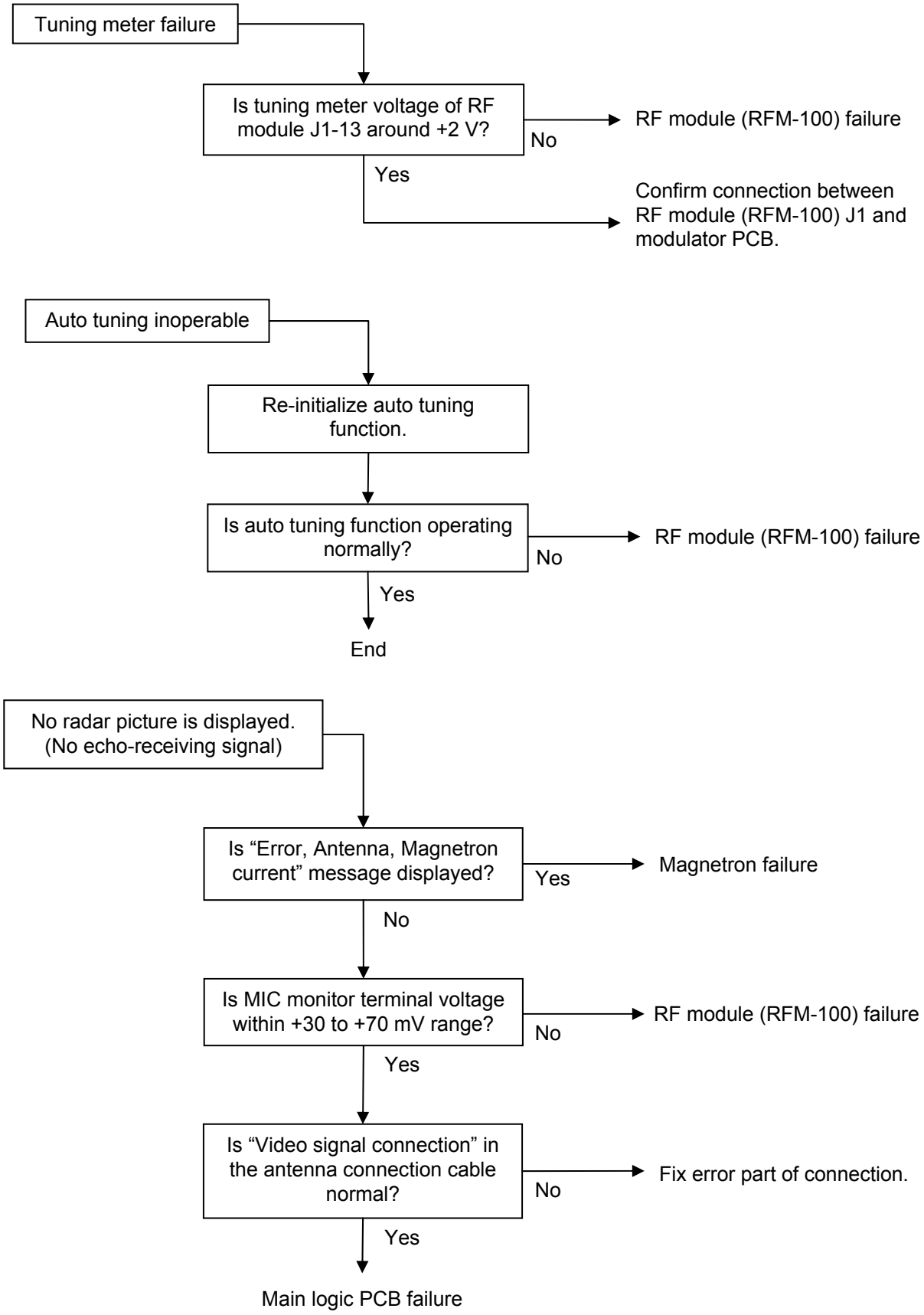

1
Is used brushless motor?
No
2
Yes
Is motor drive power +24V (between J2-8 and J1-8) normal?
No
Failure of motor power or wiring in Antenna unit, or failure of Display unit power
Yes
Is motor drive power +12V at J2-1 pin normal?
No
Motor driver PCB failure
Yes
Motor failure
2
Is motor drive power +24V (between J2-4 and J1-4) 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 brushes with new set.
Yes
Motor failure

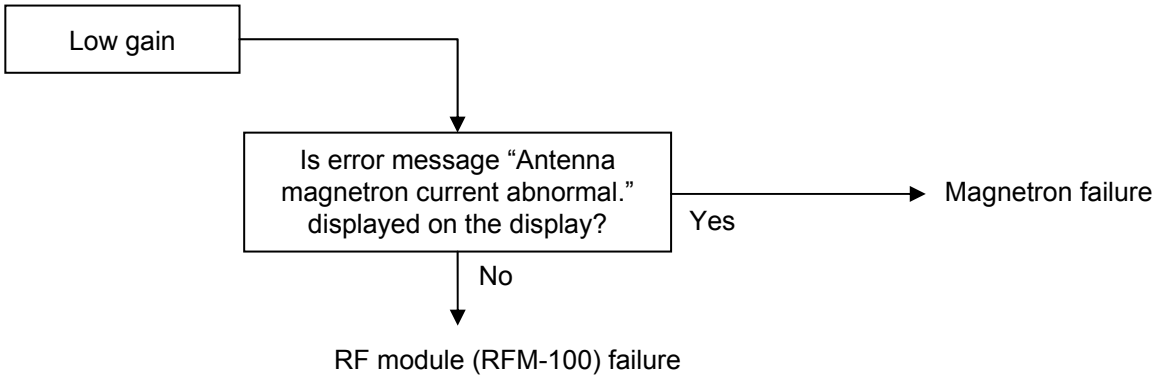

Error message “Azimuth abnormal.” is displayed.
Is motor rotating?
Yes
Control PCB failure
No
Go to “Antenna does not rotate.” (page 5-19)


Error message “Head line signal abnormal.” is displayed.
Is motor rotating?
No
Is J3-1 connecter (+53V) of modulater PCB connecting properly?
No
Connect properly.
Yes
Go to “Antenna does not rotate.” (page 5-19)
Yes
Is connecting J3-3 of control PCB?
No
Connect properly. Does this error message disappear?
No
Modulator PCB failure
Yes
Reed switch failure
Yes
End


No transmission
Is transmitter TXHV fuse blown?
Yes
Modulator PCB failure
No
Is +250 V at J1-1pin of modulator PCB normal?
No
Check connecting cable between Display unit and Antenna unit.
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


No manual tuning
Is +24V at J1-1 pin of RF module normal?
No
Failure of wiring in Antenna unit, or failure of Display unit power
Yes
Is J1-8 pin of RF module voltage varied within +6 to +9 volt by manual adjustment?
No
RF module (RFM-100) failure
Yes
Control PCB failure


Tuning meter failure
Is tuning meter voltage of RF module J1-13 around +2 V?
No
RF module (RFM-100) failure
Yes
Confirm connection between RF module (RFM-100) J1 and modulator PCB.
Auto tuning inoperable
Re-initialize auto tuning function.
Is auto tuning function operating normally?
No
RF module (RFM-100) 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 to +70 mV range?
No
RF module (RFM-100) 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 “Antenna magnetron current abnormal.” displayed on the display?
Yes
Magnetron failure
No
RF module (RFM-100) failure

5.4 On board repair

5.4.1 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 (φ6.4 x 30)	Normal blow	15 A
Modulator high voltage	Tubular (φ5.2 x 20)	Normal blow	0.8 A
Antenna drive motor	Tubular (φ5.2 x 20)	Normal blow	5A

Fuse location

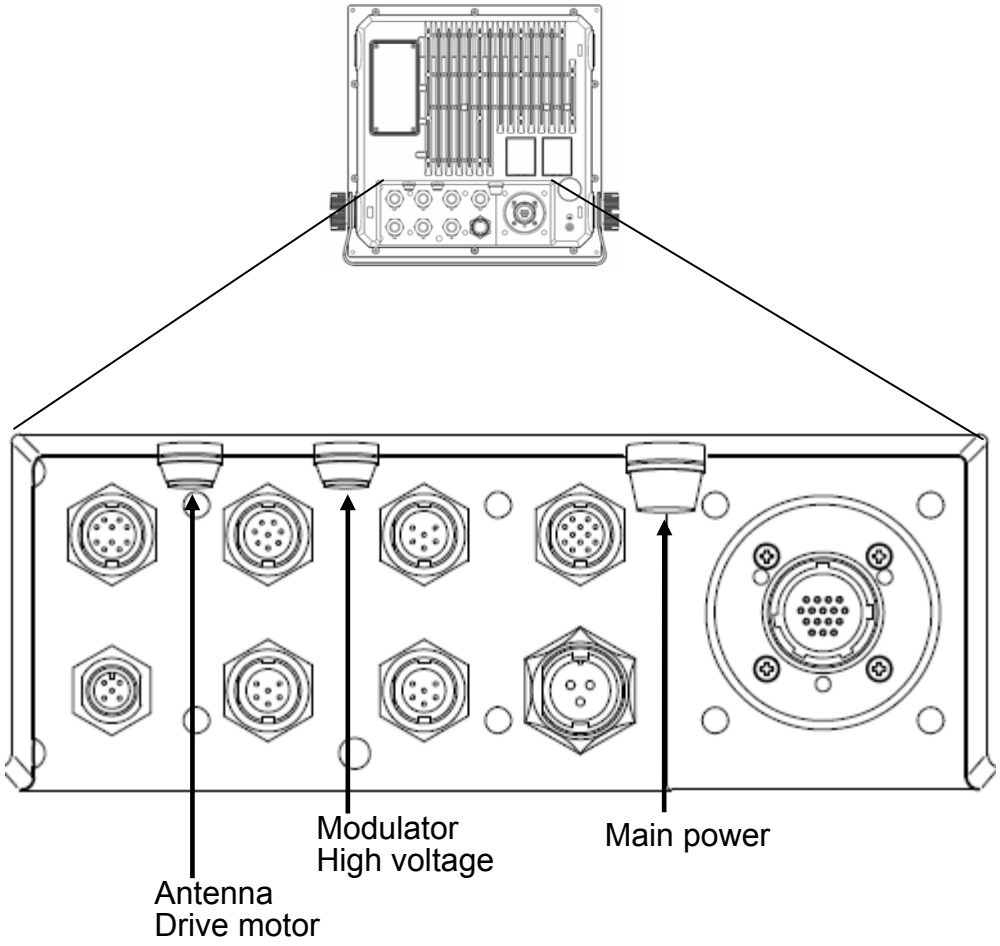


Figure 5.2 Fuse locations on display unit back panel

5.4.2 Replacement of Internal Battery

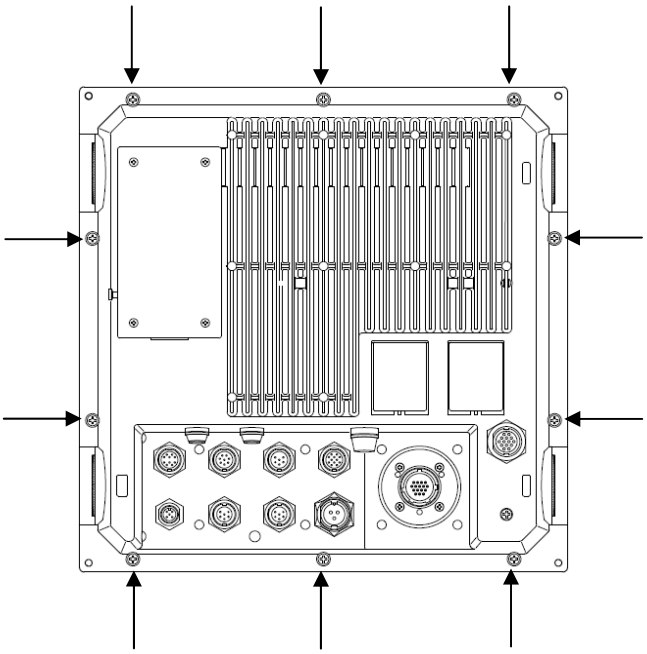
The Display unit has a battery built-in. Battery is used only for an internal clock.

When the battery runs low, the internal clock of the radar will not always work properly.

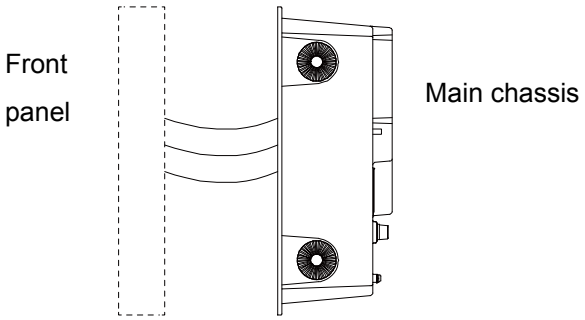
Please exchange the internal battery.

Exchange method of the internal battery is explained as below.

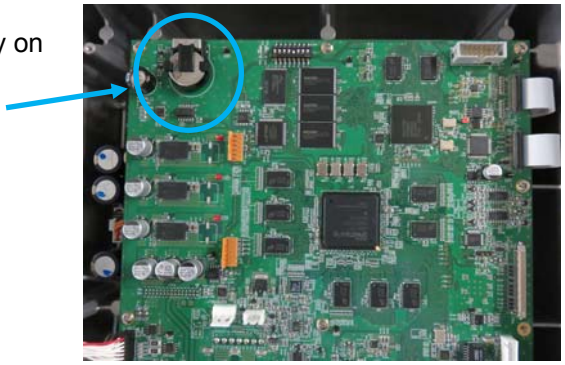
1. Remove 10 fixed screws on the back of the display unit.



2. Remove the front panel from the main chassis by disconnecting the internal cable.



3. Exchange the internal battery on the Logic PCB (E63-700*).
   Battery type name: CR2032



*Subject to version change

Chapter 6 Maintenance

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

For health safety reason, transmission is basically inhibited when antenna is not rotating. However when transmission is required for any reason without antenna rotation, following procedure is provided to do it.

***** Special Service Mode *****

1. Turn off the radar and remove the Antenna drive motor fuse according to Fig-5.2.
2. Turn on the radar at the Operation unit by pressing the POWER ON/OFF key while the OFF key is pressed.
   Keep pressing the OFF key until "NO ERROR DETECT" is displayed.
3. After preheating time of 3 minutes, press the STBY/TX key.
   If the magnetron is already heated, transmission is possible after 10 seconds, when "NO ERROR DETECT" indication disappears.

6.1 List of parts that have longevity

Radar uses parts that have the following longevities.

List of parts that have longevity

name	type	location	Life expectancy
Magnetron	MAF1421BY	RB806	3000 to 4000H
	MAF1562R	RB807	2000 to 3000H
	MAF1565N	RB808	2000 to 3000H
	M1568BS	RB809	1000 to 2000H
Geared motor	VGKC12-25N50L2XT6	RB808/809	5000H
	23G61668	RB806/807	5000H
Motor brush	24Z125209	RB806/807	2000H
Fan	F614T-12MC	RB809	70000H
LCD Unit	LQ150X1LX9K	MRD-109	50000H (25°C)
	NL10276BC24-13C	MRD-111	43000H (25°C)
Battery	CR2032	MRD-109/111 E63-700*	For storage : 1 year 1 hour operation in every week: 8 years

*Subject to version change

6.2 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.

6.2.1 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 display 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.

6.2.2 Annual inspection

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

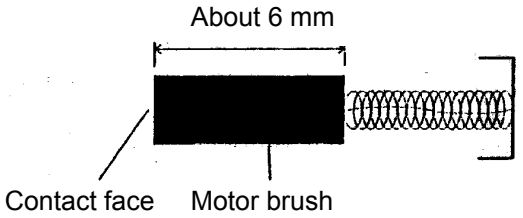


Figure 6.1 instructions for changing the motor brushes

(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 6.2).
(3) Fit the screw to the slot and rotate slowly to counterclockwise. 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

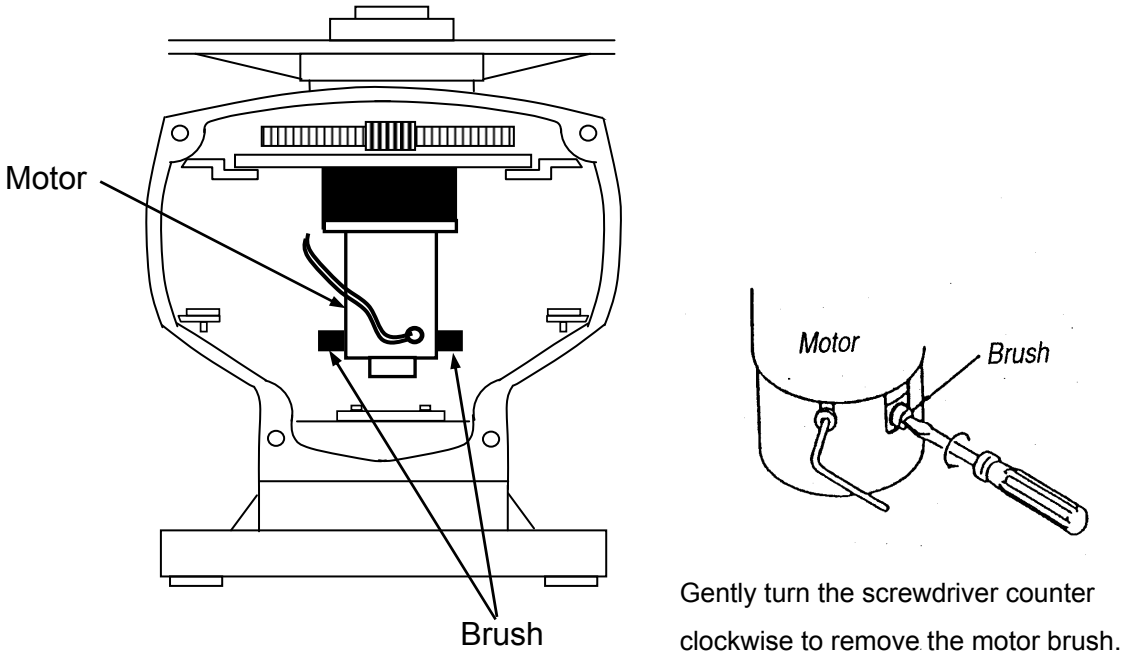
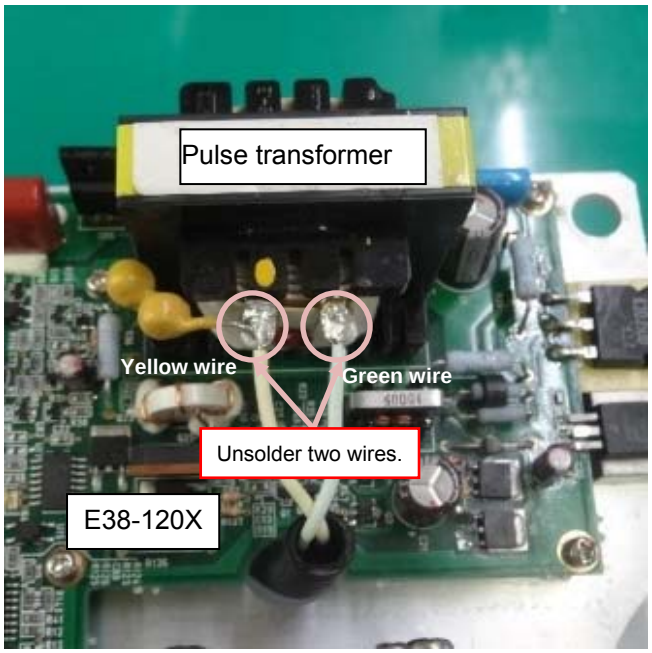


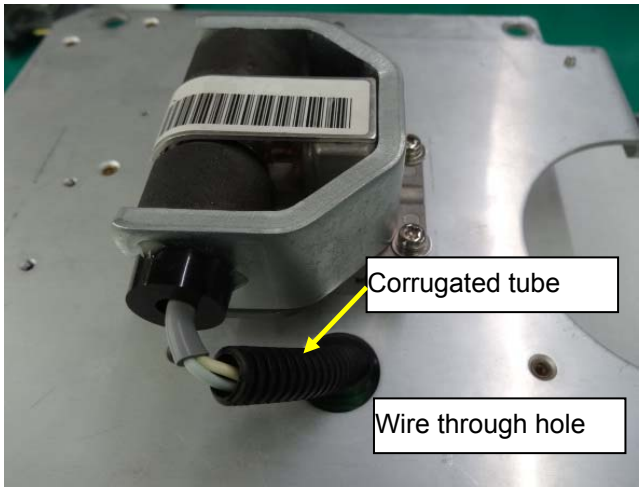
Figure 6.2 Replacing the motor brushes

6.3 Method of exchanging the magnetron

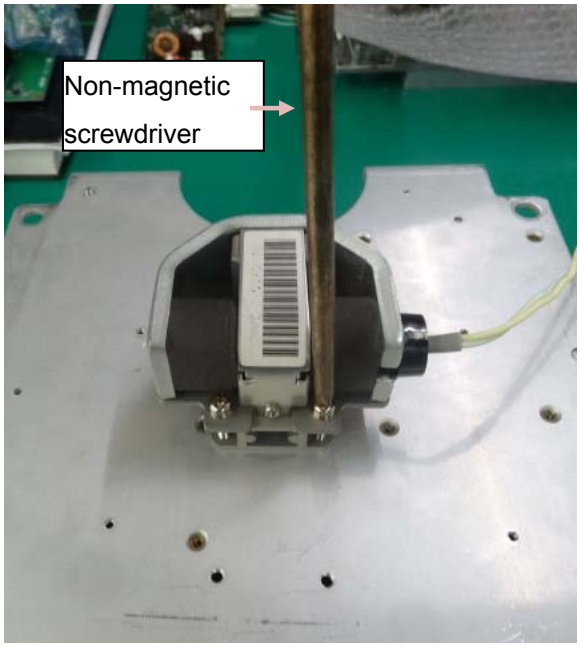
6.3.1 Magnetron replacement (RB806)



1) Unsolder the yellow wire and green wire from the pulse transformer terminals.

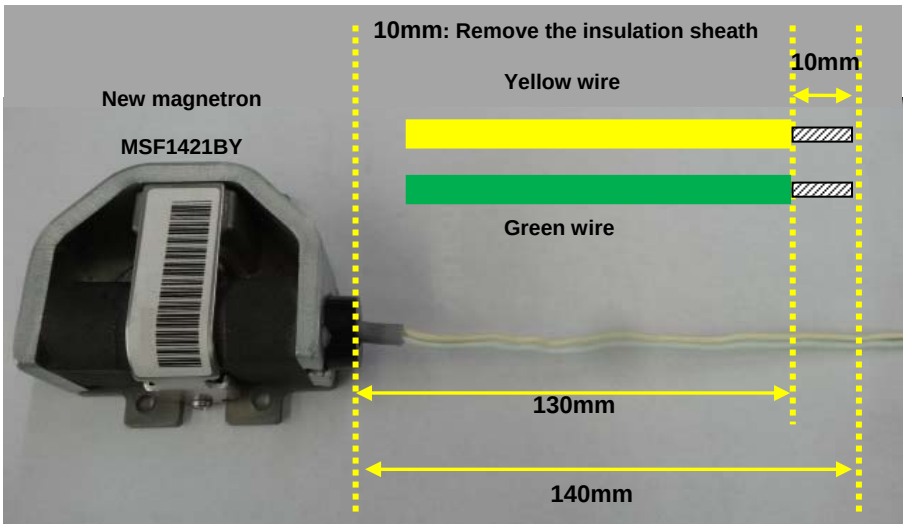


2) Pull out to wire through hole for wire, remove the corrugated tube.

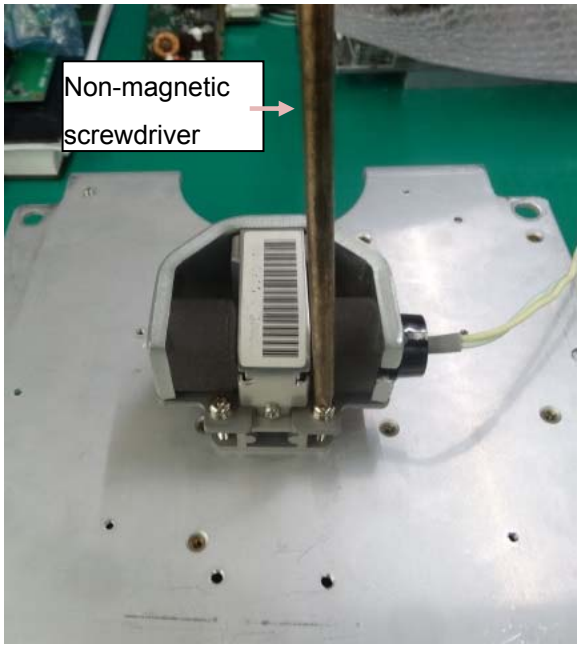


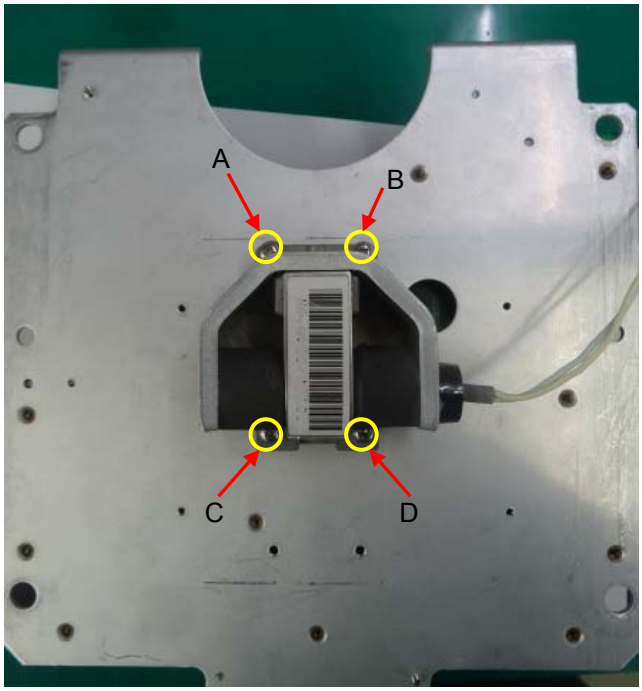
3) Remove four screws by non-magnetic screwdriver.

Caution:
Use a non-magnetic screwdriver,
because the contact of the metal tool with the magnetron will cause deterioration of its performance.

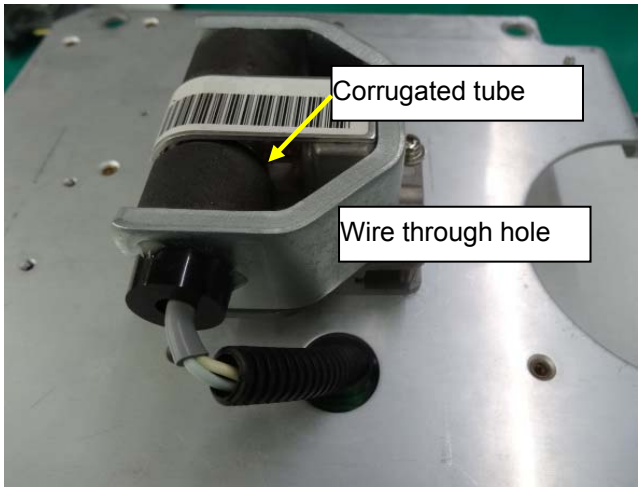


4) Following above picture cut the excess wires from magnetron.

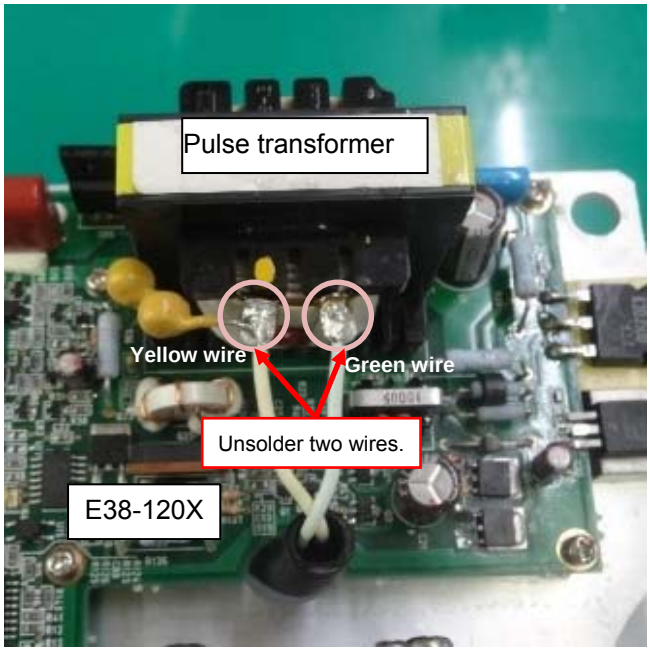




5) Fasten four screws by non-magnetic screwdriver.
Screw A, B: PWSM4X30B and washer (Quantity 2)
Screw C, D: PWSM4X24B (Quantity2)

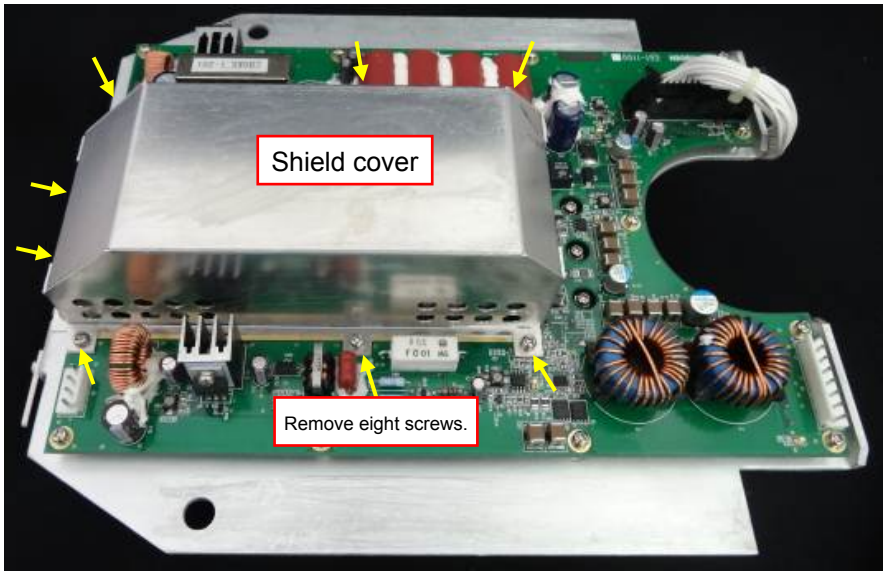


6) Covered with a corrugated tube to the wire, put in the Wire through hole.

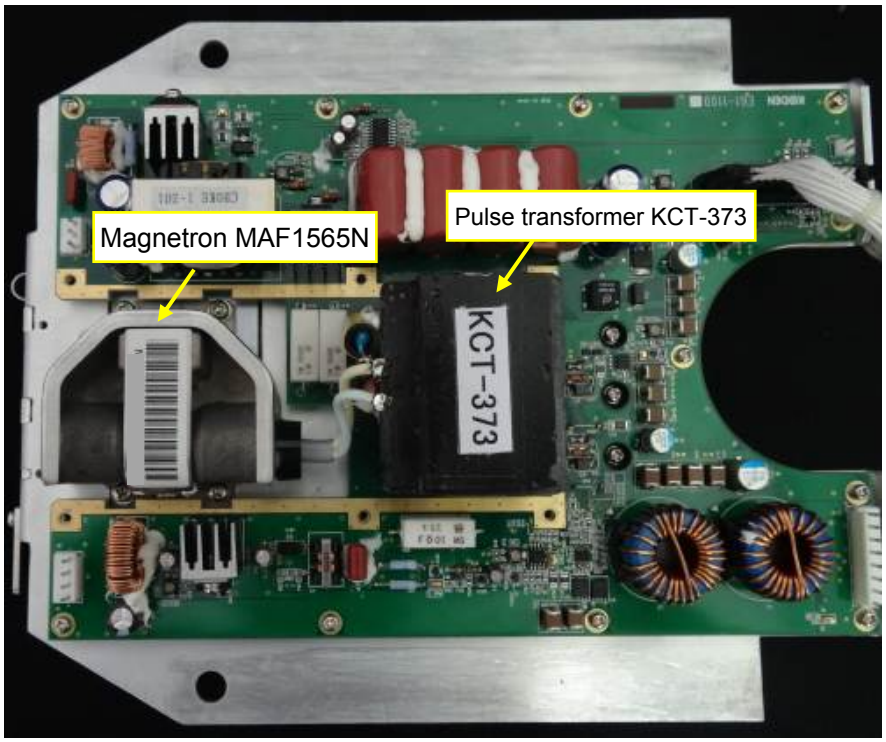


7) Solder the yellow wire and green wire to the pulse transformer terminals.

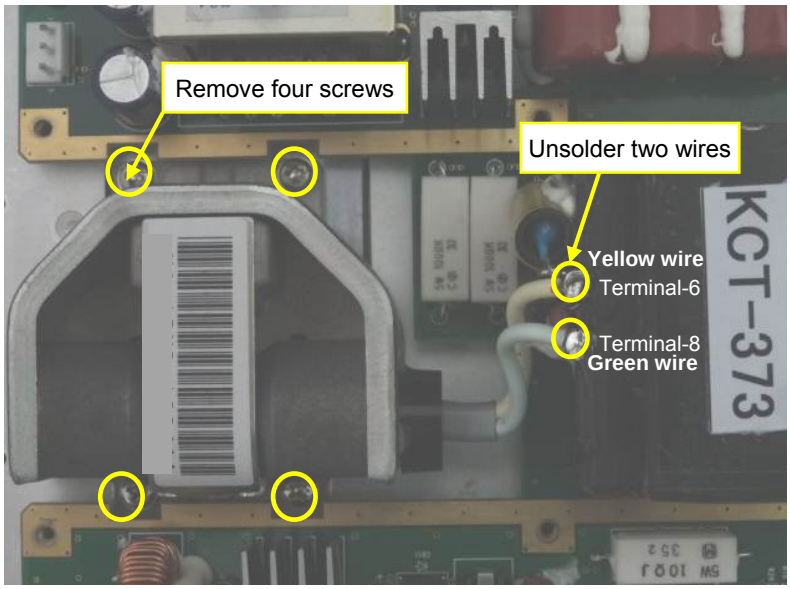
6.3.2 Magnetron replacement (RB807, RB808)



1) Remove the eight screws that secure the shield cover.
Remove the shield cover from the PCB [E61-110X] or [E71-110X].



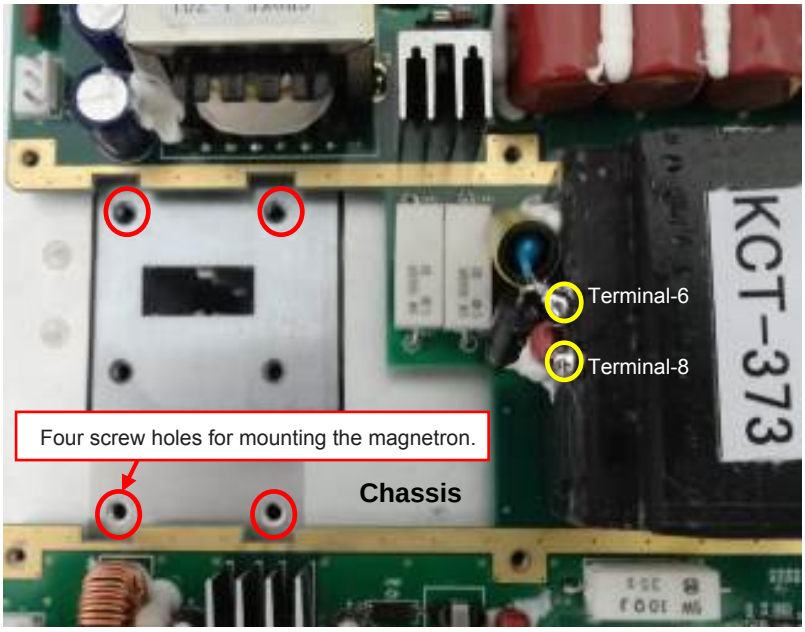
2) This picture is the view of the magnetron [MAF1565N] or [MAF1562R] and the pulse transformer [KCT-373]



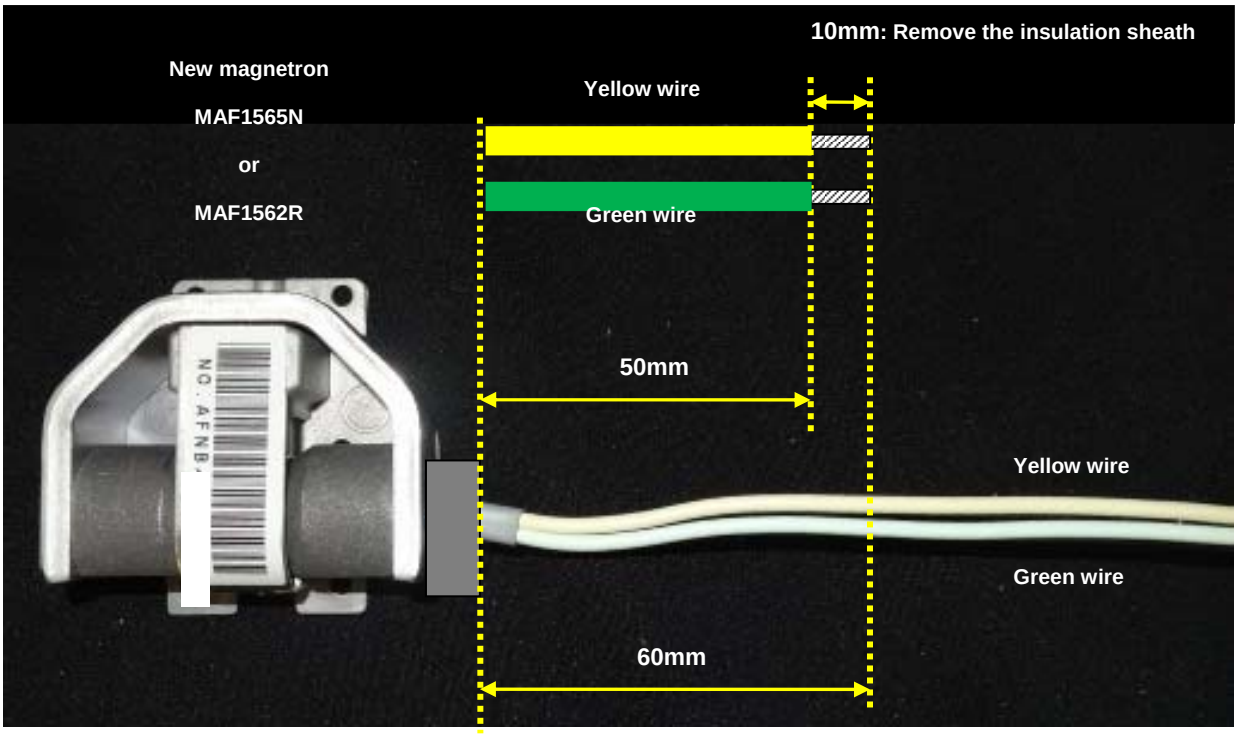
3) Unsolder the yellow wire and green wire from the pulse transformer terminals.

Remove the four screws that secure the magnetron.

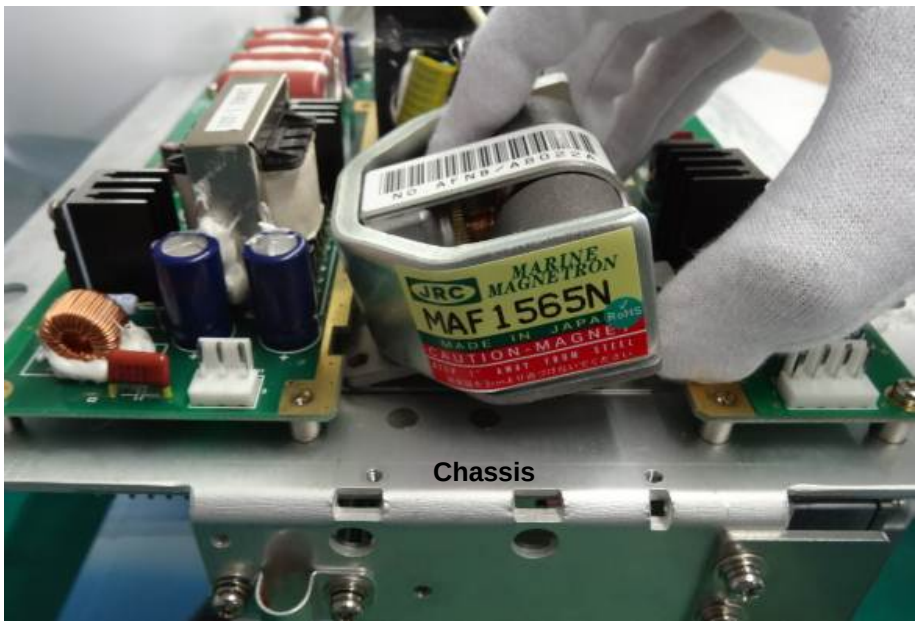
Remove the magnetron from the chassis.



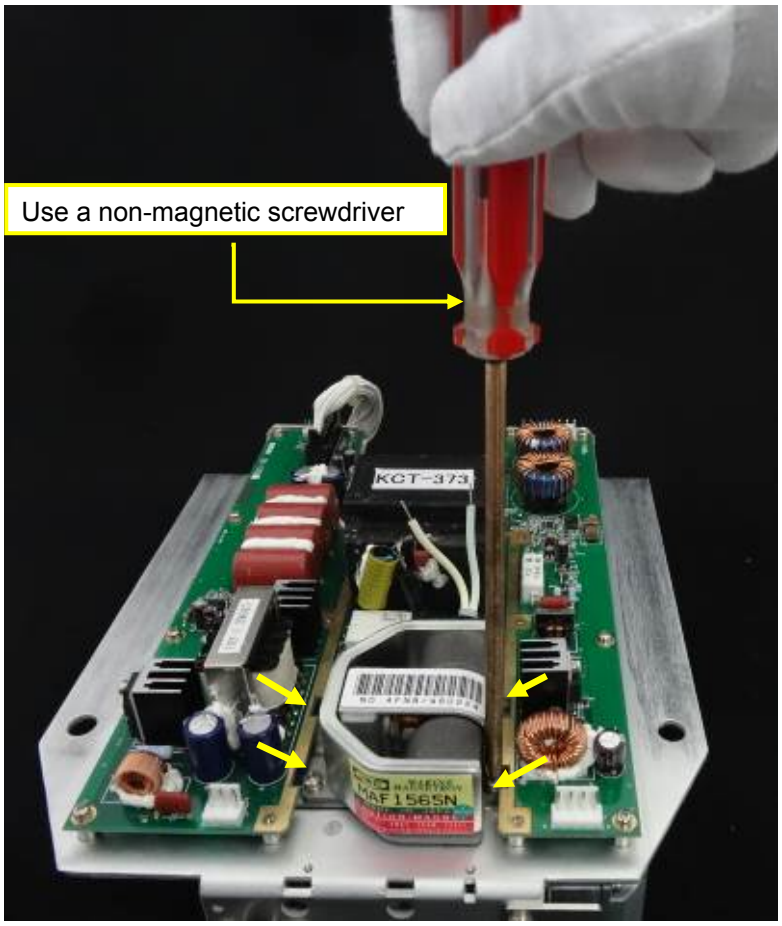
4) This picture is the view of the modulator with magnetron removed.



5) Following above picture cut the excess wires from magnetron.



6) Attach new magnetron to chassis.

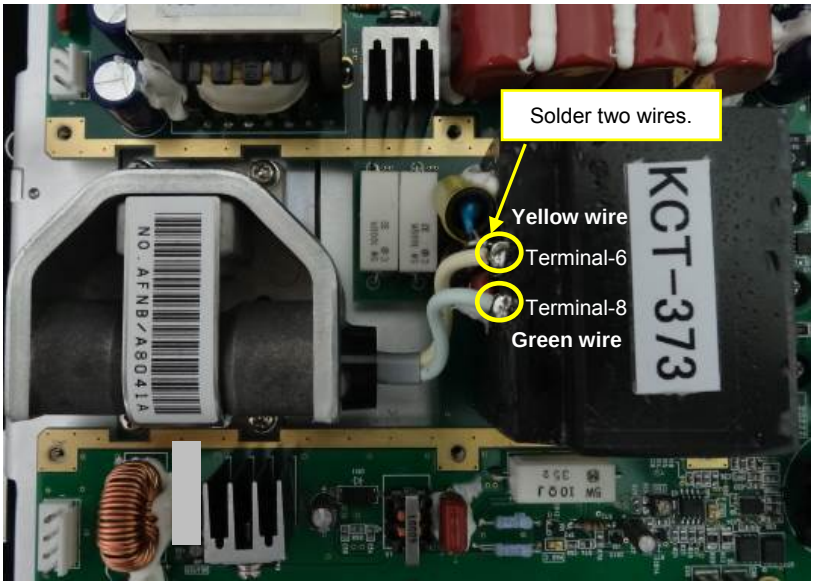


7) Fasten four screws by non-magnetic screwdriver.

Screw: PWSM 4x12B (Quantity 4)

Caution:

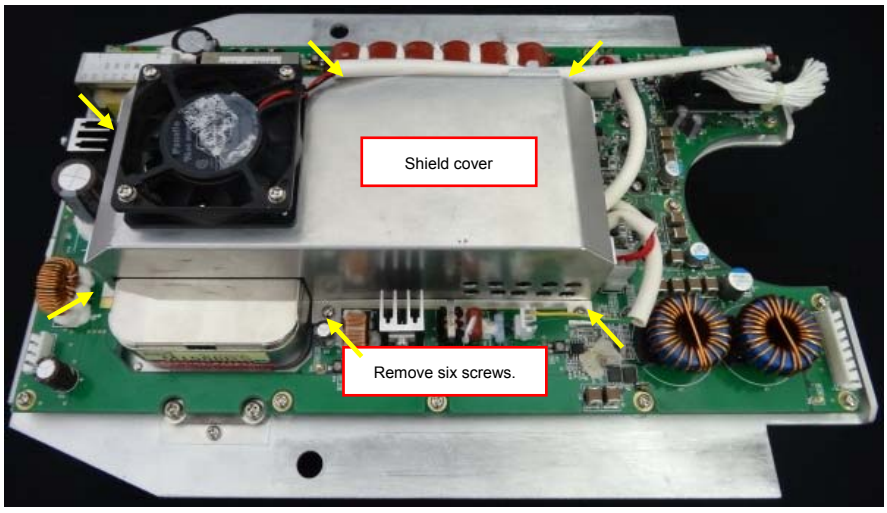
Use a non-magnetic screwdriver, because the contact of the metal tool with the magnetron will cause deterioration of its performance.



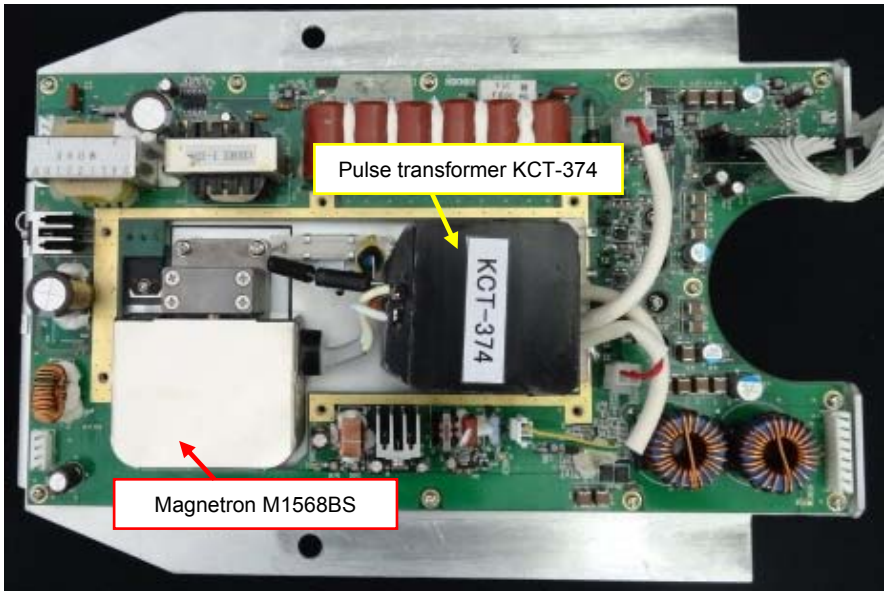
8) Solder the yellow wire and green wire to the pulse transformer terminals.

Attach the shield cover to the PCB [E61-110X] or [E71-110X].

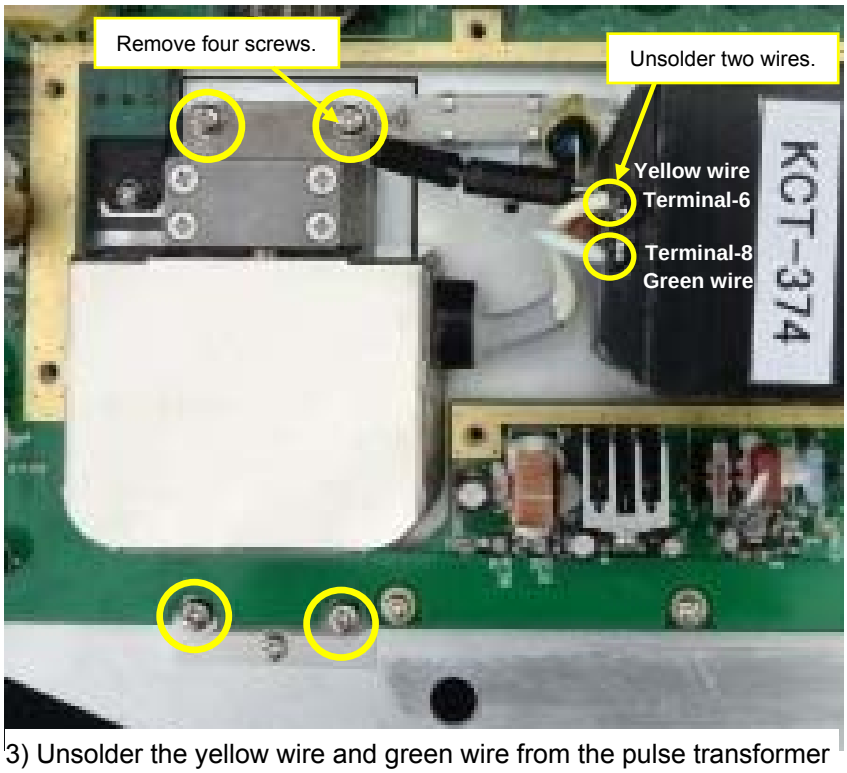
6.3.3 Magnetron replacement (RB809)



1) Remove the six screws that secure the shield cover.
   Remove the shield cover from the PCB [E62-110X].



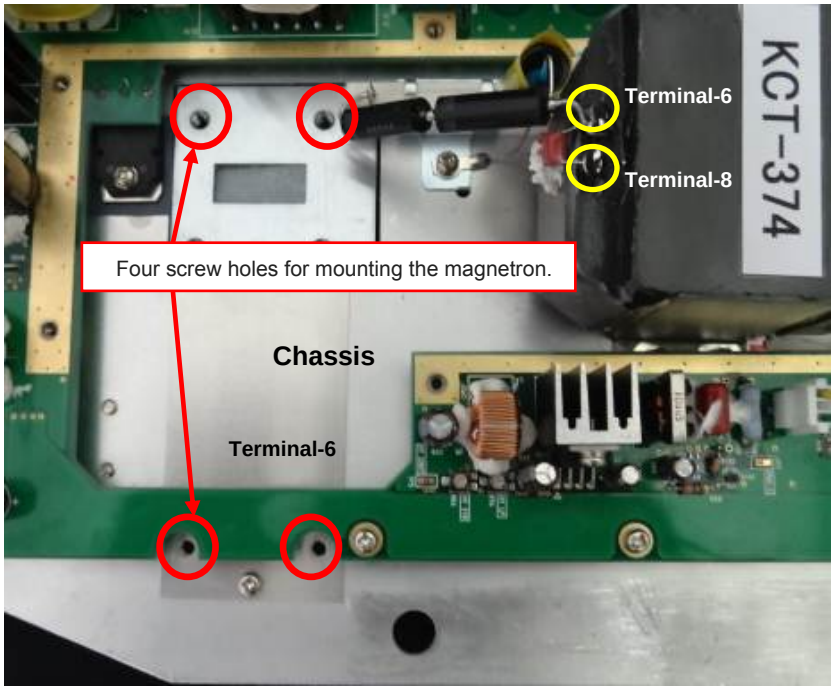
2) This picture is the view of the magnetron [M1568BS] and the pulse transformer [KCT-374].



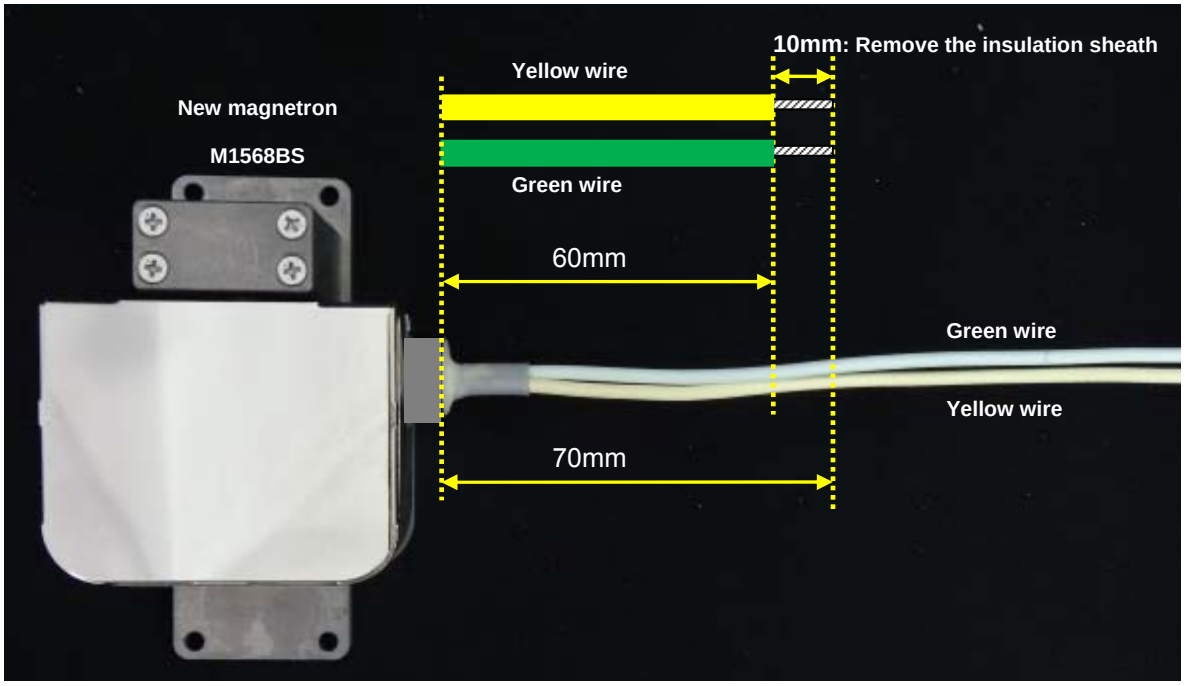
3) Unsolder the yellow wire and green wire from the pulse transformer terminals.

Remove the four screws that secure the magnetron.

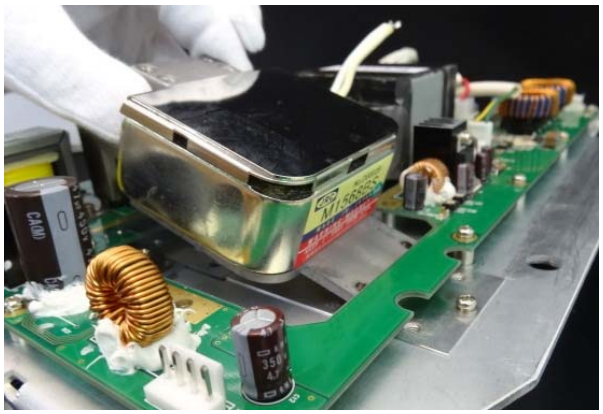
Remove the magnetron from the chassis.



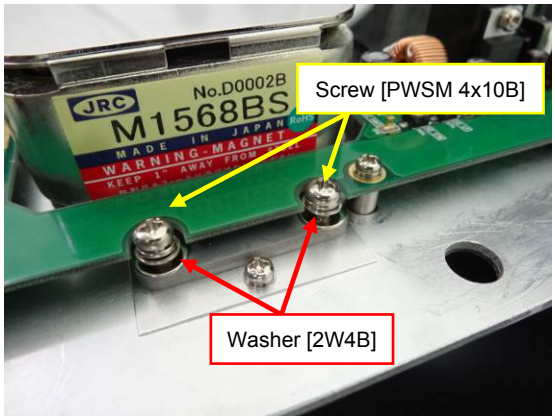
4) This picture is the view of the modulator with magnetron removed.



5) Following above picture cut the excess wires from magnetron.

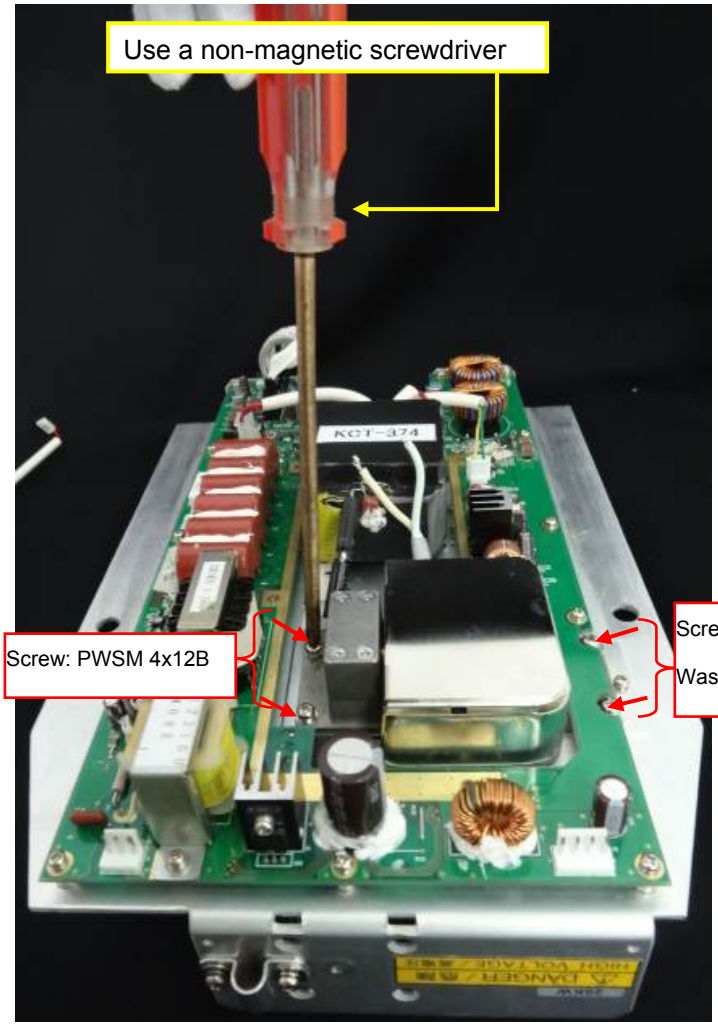


6) Attach new magnetron to the chassis.



7) With magnetron in place on this side use screw [PWSM4x10B] and the washer [2W4B].

On the other side, use the screw [PWSM 4x12B]



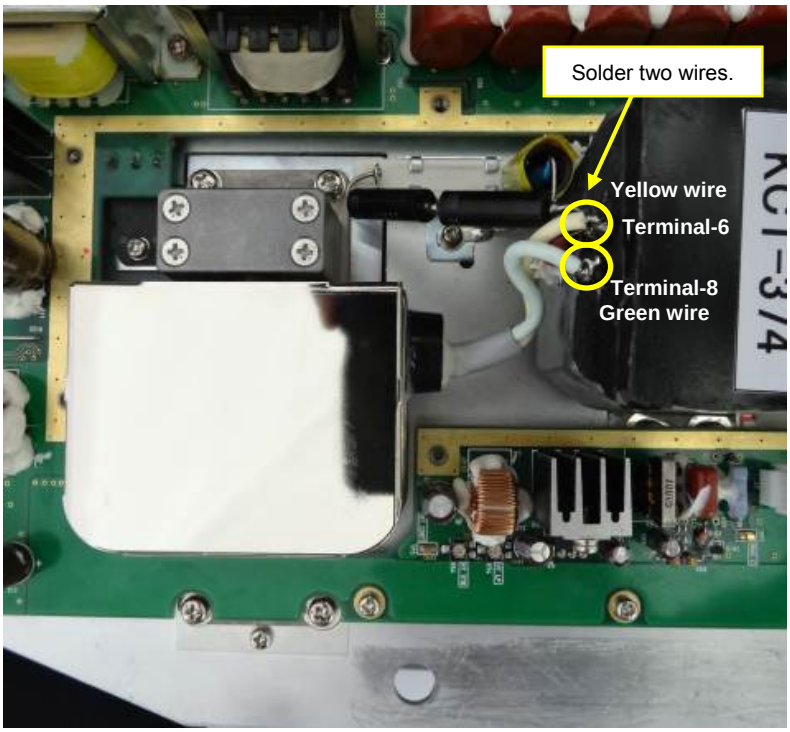
8) Fasten four screws by non-magnetic screwdriver.

Screw: PWSM 4x12B (Quantity 2)
PWSM 4x10B (Quantity 2)

Washer: 2W4B (Quantity 2)

Caution:

Use a non-magnetic screwdriver, because the contact of the metal tool with the magnetron will cause deterioration of its performance.



9) Solder the yellow wire and green wire to the pulse transformer terminals.

Attach the shield cover to the PCB [E62-110X].

Chapter 7 Input/output data

7.1 Details of the data input format

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

Heading

THS	True heading and status
	$ -- THS, x.x, a*hh<CR><LF> Check sum Mode indicator* Heading, degrees true Note for IMO mode II, IN, HE, HN, HC, GA, GP, GL, GN and SN are accepted. Note* mode indicator A=Autonomous valid E=Estimated invalid M=Manual input invalid S=Simulator mode invalid V=Data not valid invalid

HDT	Heading true
	$ -- HDT, x.x, T*hh<CR><LF> Check sum Heading, degrees true Note for IMO mode II, IN, HE, HN, HC, GA, GP, GL, GN and SN are accepted.

HDG	Heading, deviation and variation
	$ -- HDG, x.x, x.x, E/W, x.x, E/W, *hh<CR><LF> Check sum Magnetic variation, degrees Magnetic variation, degrees Magnetic sensor heading, degrees Note: This sentence is not accepted for IMO radar.

HDM	Heading Magnetic
	$ -- HDM, x.x, M*hh<CR><LF> Check sum Heading, degrees magnetic Note: This sentence is not accepted for IMO radar.

VTG	Course over ground and ground speed
	$ -- VTG, x.x, T, x.x, M, x.x, N, x.x, K, a*hh<CR><LF> Check sum Mode indicator A/P/D=Valid, E/M/S/N=Invalid Speed over ground, km/h Speed over ground, knots Course over ground, degrees magnetic Course over ground, degrees true

RMC	Recommended minimum specific GNSS data

$ -- RMC, hhmmss.ss, A, llll.ll, N/S, yyyyy.yy, E/W,, , , , , a, a*hh<CR><LF>

- hhmmss.ss: UTC of position fix
- A: Status, A=Valid V=Invalid
- llll.ll: Latitude, N/S
- yyyyy.yy: Longitude, E/W
- Not used
- a: Mode indicator A/D/P/R/F=Valid E/M/S/N=Invalid
- hh: Check sum
- Navigation status S=Safe C=Caution U=Unsafe V=Not valid

Note: This sentence is not accepted for IMO radar.

RMA	Recommended minimum specific LORAN-C data

$ -- RMA, A, llll.ll, N/S, yyyyy.yy, E/W, x.x, x.x, x.x, x.x, x.x, a, a*hh<CR><LF>

- A: Status, A=data valid, V=blink, cycle or SNR
- llll.ll: Latitude, degrees N/S
- yyyyy.yy: Longitude, degrees E/W
- x.x: Not used
- x.x: Speed over ground, knots
- x.x: Course over ground, degrees true
- x.x: Not used
- a: Mode indicator, A/D=valid E/M/S/N=invalid
- hh: Check sum

Note: This sentence is not accepted for IMO radar.

Speed

VBW	Dual ground/water speed

$ -- VBW, x.x, x.x, A, x.x, x.x, A, x.x, A, x.x, A*hh<CR><LF>

- x.x: Longitudinal water speed, knots
- x.x: Tranverse waterspeed, knots
- A: Status water speed, A=Valid, Invalid
- x.x: Longitudinal ground speed, knots
- x.x: Transverse ground speed, knots
- A: Status ground speed, A=Valid, V=Invalid
- x.x, A, x.x: These fields are not used
- A*hh: Check sum

Note for IMO mode
II, IN, VD, GA, GP, GL, GN, SN, VM and VW are accepted.

VTG	Course over ground and ground speed

$ -- VTG, x.x, T, x.x, M, x.x, N, x.x, K, a*hh<CR><LF>

- x.x: Course over ground, degrees true
- T
- x.x: Course over ground, degrees magnetic
- M
- x.x: Speed over ground, knots
- N
- x.x: Speed over ground, km/h
- K
- a: Mode indicator A/P/D=Valid, E/M/S/N=Invalid
- hh: Check sum

Note for IMO mode
II, IN, VD, GA, GP, GL, GN, SN, VM and VW are accepted.

VHW	Water speed and heading

$ -- VHW, x.x, T, x.x, M, x.x, N, x.x, K*hh<CR><LF>

- x.x: Heading, degrees true
- T
- x.x: Heading, degrees magnetic
- M
- x.x: Speed, knots
- N
- x.x: Speed, km/h
- K
- hh: Check sum

Note for IMO mode
II, IN, VD, GA, GP, GL, GN, SN, VM and VW are accepted.

Set and Drift

VDR	Set and drift
	$ -- VDR, x.x, T, x.x, M, x.x, N*hh<CR><LF> x.x: Direction, degrees true T: — x.x: Direction, degrees magnetic M: — x.x: Current speed, knots N: — hh: Check sum

Time and date

ZDA	Time and date
	$ -- ZDA, hhmmss.ss, xx, xx, xxxx, xx, xx*hh<CR><LF> hhmmss.ss: UTC xx: Day, 01 to 31 (UTC) xx: Month , 01 to 12 (UTC) xxxx: Year (UTC) xx: Local zone hours (00 h to +/-13 h) xx: Local zone minutes (00 to +59) hh: Check sum

RMC	Recommended minimum specific GNSS data
	$ -- RMC, hhmmss.ss, A, llll.ll, N/S, yyyyy.yy, E/W,,,,,, a, a*hh<CR><LF> hhmmss.ss: UTC of position fix A: Status, A=Valid V=Invalid llll.ll: Latitude, N/S yyyyy.yy: Longitude, E/W ,,,,,: Not used a: Navigation status S=Safe C=Caution U=Unsafe V=Not valid a: Mode indicator A/D/P/R/F=Valid E/M/S/N=Invalid hh: Check sum Note: This sentence is not accepted for IMO radar.

GGA	Global positioning system (GPS) fix data
	$ -- GGA, hhmmss.ss, llll.ll, N/S, yyyyy.yy, E/W, a, , , , , , , , *hh<CR><LF> hhmmss.ss: UTC of position llll.ll: Latitude yyyyy.yy: Longitude a: GPS quality indicator 1/2/3/4/5=Valid, 0/6/7/8=Invalid 0=Fix not invalid or invalid 1=GPS SPS mode 2=Differential GPS, SPS mode 3=GPS PPS mode 4=Real time Kinematic 5=Float RTK 6=Estimated mode 7=Manual input mode 8=Simulator mode ,,,,,,,: These field is not used. *hh: Check sum Note for IMO mode II, IN, GA, GP, GL, GN and SN are accepted.

Note: RMC and GGA sentence is used for only time data

Latitude/Longitude

GLL	Geographic position – Latitude/longitude
	$ -- GLL, llll.ll, N/S, yyyyy.yy, E/W, hhmmss.ss, A, a*hh<CR><LF> llll.ll: Latitude N/S: — yyyyy.yy: Longitude E/W: — hhmmss.ss: UTC is not used A: Status A: Data valid V: Data invalid a: Mode indicator* Note* Mode indicator A=Autonomous (Valid) D=Differential (Valid) E=Estimated (Invalid) M=Manual input (Ivalid) S=Simulator (Invalid) N=Data not valid hh: Check sum Note for IMO mode II, IN, GA, GP, GL, GN, SN and LC are accepted.

GGA — Global positioning system (GPS) fix data

$ -- GGA, hhmmss.ss, llll.ll, N/S, yyyyy.yy, E/W, a, , , , , , , , *hh<CR><LF>

- hhmmss.ss: UTC of position
- llll.ll: Latitude
- N/S
- yyyyy.yy: Longitude
- E/W
- a: GPS quality indicator
  - 0=Fix not invalid or invalid
  - 1=GPS SPS mode
  - 2=Differential GPS, SPS mode
  - 3=GPS PPS mode
  - 4=Real time Kinematic
  - 5=Float RTK
  - 6=Estimated mode
  - 7=Manual input mode
  - 8=Simulator mode
  - 1/2/3/4/5=Valid, 0/6/7/8=Invalid
- , , , , , , , : These field is not used.
- hh: Check sum

Note for IMO mode
ll, IN, GA, GP, GL, GN and SN are accepted.

GNS — GNSS fix data

$ -- GNS, hhmmss.ss, llll.ll, N/S, yyyyy.yy, E/W, c--c, , , , , , , a*hh<CR><LF>

- hhmmss.ss: Not used
- llll.ll: Latitude
- N/S
- yyyyy.yy: Longitude
- E/W
- c--c: Mode indicator
  - A/D/P/R/F=Valid
  - E/M/S/N=Invalid
  - GN, GP: first character
  - GL: second character
  - GA: third character
- , , , , , , : Not used
- a: Navigation status indicator
  - S=Safe
  - C=Caution
  - U=Unsafe
  - V=Navigational status not used
- hh: Check sum

Note for IMO mode
GN, GP, GL and GA are accepted.

RMC — Recommended minimum specific GNSS data

$ -- RMC, hhmmss.ss, A, llll.ll, N/S, yyyyy.yy, E/W, , , , , , a, a*hh<CR><LF>

- hhmmss.ss: UTC of position fix
- A: Status, A=Valid V=Invalid
- llll.ll: Latitude, N/S
- yyyyy.yy: Longitude, E/W
- , , , , , : Not used
- a: Mode indicator
  - A/D/P/R/F=Valid
  - E/M/S/N=Invalid
- a: Navigation status
  - S=Safe
  - C=Caution
  - U=Unsafe
  - V=Not valid
- hh: Check sum

RMA — Recommended minimum specific LORAN-C data

$ -- RMA, A, llll.ll, N/S, yyyyy.yy, E/W, x.x, x.x, x.x, x.x, x.x, a, a*hh<CR><LF>

- A: Status, A=data valid, V=blink, cycle or SNR
- llll.ll: Latitude, degrees N/S
- yyyyy.yy: Longitude, degrees E/W
- x.x, x.x: Not used
- x.x: Speed over ground, knots
- x.x: Course over ground, degrees true
- x.x: Not used
- a: Mode indicator, A/D=valid E/M/S/N=invalid
- hh: Check sum

Note: This sentence is not accepted for IMO radar.

Datum

DTM — Datum reference

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

- ccc: Local datum
- a: Local datum subdivision code
- x.x: Lat offset min, N/S
- a
- x.x: Lon offset min, E/W
- a
- x.x: Altitude offset, m
- ccc: Reference datum
- hh: Check sum

	Reference datum	Local datum
WGS84	W84	W84
WGS72	W72	W72
SGS85	S85	S85
PE90	P90	P90
User defined	-	999

Alarm and alert handling

ALF — Alert sentence

$ -- ALF, x, x, x, hhmmss.ss, a, a, a, aaa, x.x, x.x, x.x, x, c---c *hh<CR><LF>

- hhmmss.ss: Time of last change
- x: Sequential message identifier, 0 to 9
- x: Sentence number, 1 to 2
- x: Total number of ALF sentences for this message, 1 to 2
- a: Alert category, A, B or C
- a: Alert priority, E, A, W or C*
- a: Alert state, A, S, N, O, U or V**
- aaa: Manufacturer mnemonic code
- x.x: Alert identifier
- x.x: Alert instance, 1 to 999999
- x.x: Revision counter, 1 to 99
- x: Escalation counter, 0 to 9
- c---c: Alert text
- hh: Check sum

Note* Alert priority
E=Emergency Alerm (for use w ith Bridge Alert Management)
A=Alarm
W:Warning
C=Caution

Note** Alert state
V=Active-Unacknow ledge
S=Active-Silenced
A=Active-Acknow ledge or active
O=Active-Responsibility transferred
U=Rectified-Unacknow ledge
N=Normal

ALC — Cyclic alert list

$ -- ALC, xx, xx, xx, x.x, aaa, x.x, x.x, x.x, ·····, aaa, x.x, x.x, x.x *hh<CR><LF>

- xx: Total number of sentences for this message, 01 to 99
- xx: Sentence number, 01 to 99
- xx: Sequential message identifier, 00 to 99
- x.x: Number of alert entries
- aaa: Manufacturer mnemonic code
- x.x: Alert identifier
- x.x: Alert instance
- x.x: Revision counter Alert entry 1
- aaa, x.x, x.x, x.x: Additional Alert entries
- hh: Check sum

ARC — Alert command refused

$ -- ARC, hhmmss.ss, aaa, x.x, x.x, c*hh<CR><LF>

- hhmmss.ss: Relese time
- aaa: Manufacturer mnemonic code
- x.x: Alert identifier
- x.x: Alert instance, 1 to 999999
- c: Refused alert command, A, Q, O or S*
- hh: Check sum

Note*
A: Acknowledge
Q: Request / repeat information
O: Responsibility transfer
S: Silence

ALR — Set alarm state

$ -- ALR, hhmmss.ss, xxx, A, A, c---c *hh<CR><LF>

- hhmmss.ss: Time of alarm condition change, UTC
- xxx: Unique alarm number (identifier) at alarm source
- A: Alarm condition (A=threshold exceeded, V=not exceeded)
- A: Alarm's acknow ledge state, A=acknow ledged V=unacknow ledged
- c---c: Alarm's description text
- hh: Check sum

ACN — Alert command

$ -- ACN, hhmmss.ss, aaa, x.x, x.x, c, a*hh<CR><LF>

- hhmmss.ss: Relese time
- aaa: manufacture mnemonic code
- x.x: Alert identifier
- x.x: Alert instance, 1 to 999999
- c: Alert command, A, Q, O or S*
- a: Sentence status flag: "C"
- hh: Check sum

Note* Alert command
A: Acknow ledge
Q: Request / repeat information
O: Responsibility transfer
S: Silence

ACK	Acknowledge alarm
	$ -- ACK, xxx *hh<CR><LF> Check sum Unique alarm number (identifier) at alarm source

Heartbeat

HBT	Heartbeat supervision sentence
	$ -- HBT, x.x, A, x*hh<CR><LF> Check sum Sequential sentence identifier Equipment status A=Yes, V=No Configured repeat interval

AIS target and own ship information

VDM	AIS VHF data-link message
	! -- VDM, x, x, x, a, s--s, x*hh<CR><LF> Check sum Number of fill-bits, 0 to 5 Encapsulated ITU-R M.1371 radio message (Message part, 6bit fields) AIS channel (A/B) Message number, 1 to 9 Sentence number, 1 to 9 Total number of sentences needed to transfer the message, 1 to 9

VDO	AIS VHF data-link own-vessel report
	! -- VDO, x, x, x, a, s--s, x*hh<CR><LF> Check sum Number of fill-bits, 0 to 5 Encapsulated ITU-R M.1371 radio message (Message part, 6bit fields) AIS channel (A/B) Message number, 1 to 9 Sentence number, 1 to 9 Total number of sentences needed to transfer the message, 1 to 9

Waypoint Latitude/Longitude, ID

RMB	Recommended minimum navigation information
	$ -- RMB, A, x.x, a, c--c, c--c, llll.ll, N/S, yyyyy.yy, E/W, x.x, x.x, x.x, A, a*hh<CR><LF>

Status A=Valid V=Data Invalid
Cross track error
Direction to steer L/R
Not used
Destination waypoint ID
Destination waypoint latitude, N/S
Destination waypoint longitude, E/W
Range to destination, nautical miles
Bearing to destination, degrees natical miles
Not used
Mode indicator A/D=valid E/M/S/N=invalid
Check sum

BWC	Bearing and distance to waypoint – Great circle
	$ -- BWC, hhmmss.ss, llll.ll, N/S, yyyyy.yy, E/W, x.x, T, x.x, M, x.x, N, c--c, a*hh<CR><LF>

UTC of observation
Waypoint latitude N/S
Waypoint longitiude E/W
Bearing, digrees true
Bearing, digrees magnetic
Distance, nautical miles
Waypoint ID
Mode indicator*
Check sum
Note* Mode indicator A/D=Valid E/M/S/N=Invalid

RTE	Routes
	$ -- RTE, x.x, x.x, a, c--c, c--c, c--c, ... c--c *hh<CR><LF>

Total number of sentences
Sentence number
Message mode C=complete route, all waypoints W=working route, first listed waypoint is "FROM" second is "TO" and remaining are rest of route
Route identifier
Waypoint identifire (FROM, TO)
Additional waypoint identifiers
Waypoint "n" identifier
Check sum

WPL	Waypoint location
	$ -- WPL, llll.ll, N/S, yyyyy.yy, E/W, c--c *hh<CR><LF>

Waypoint latitude, N/S
Waypoint longitude, E/W
Waypoint identifier
Check sum

Waypoint Bearing/Distance

RMB	Recommended minimum navigation information
	$ -- RMB, A, x.x, a, c--c, c--c, llll.ll, N/S, yyyyy.yy, E/W, x.x, x.x, x.x, A, a*hh<CR><LF>

Status
A=Valid
V=Data Invalid

Cross track error

Direction to steer
L/R

Not used

Destination w aypoint ID

Destination w aypoint latitude, N/S

Destination w aypoint longitude, E/W

Range to destination, nautical miles

Bearing to destination, degrees natical miles

Not used

Mode indicator
A/D=valid
E/M/S/N=invalid

Check sum

BWC	Bearing and distance to waypoint – Great circle
	$ -- BWC, hhmmss.ss, llll.ll, N/S, yyyyy.yy, E/W, x.x, T, x.x, M, x.x, N, c--c, a*hh<CR><LF>

UTC of observation

Waypoint latitude N/S

Waypoint longitiude E/W

Note* Mode indicator
A/D=Valid
E/M/S/N=Invalid

Bearing, digrees true

Bearing, digrees magnetic

Distance, nautical miles

Waypoint ID

Mode indicator*

Check sum

Cross-track error, measured

RMB	Recommended minimum navigation information
	$ -- RMB, A, x.x, a, c--c, c--c, llll.ll, N/S, yyyyy.yy, E/W, x.x, x.x, x.x, A, a*hh<CR><LF>

Status
A=Valid
V=Data Invalid

Cross track error

Direction to steer
L/R

Not used

Destination w aypoint ID

Destination w aypoint latitude, N/S

Destination w aypoint longitude, E/W

Range to destination, nautical miles

Bearing to destination, degrees natical miles

Not used

Mode indicator
A/D=valid
E/M/S/N=invalid

Check sum

XTE	Cross-track error, measured
	$ -- XTE, A, A, x.x, a, N, a*hh<CR><LF>

Status: A=data valid, V=invalid

Status: A=data valid, V=LORAN-C cycle lock w arning flag

Magnitude of cross-track error

Direction to steer, L/R

Mode indicator A/D=Valid, E/M/S/N=Invalid

Check sum

Route

RTE	Routes
	$ -- RTE, x.x, x.x, a, c--c, c--c, c--c, ... c--c *hh<CR><LF>

Check sum
waypoint "n" identifier
Additional waypoint identifiers
Waypoint identifire (FROM, TO)
Route identifier
Message mode
C=complete route, all waypoints
W=working route, first listed waypoint is "FROM"
second is "TO" and remaining are rest of route
Sentence number
Total number of sentences

WPL	Waypoint location
	$ -- WPL, llll.ll, N/S, yyyyy.yy, E/W, c--c *hh<CR><LF>

Check sum
Waypoint identifier
Waypoint longitude, E/W
Waypoint latitude, N/S

Depth

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

Check sum
Maximum range scale in use
Offset from transducer, in metres
Water depth relative to the transducer, in metres

DBT	Depth below transducer
	$ -- DBT, x.x, f, x.x, M, x.x, F *hh<CR><LF>

Check sum
Water depth, fathoms
Water depth, m
Water depth, feet

Temp

MTW	Water temperature
	$ -- MTW, x.x, C *hh<CR><LF>

Check sum
Temperature, degrees C

Loran-C position (LOP)

GLC	Geographic Position Loran-C
	$ -- GLC, xxxx, x.x, a, x.x, a, x.x, a, x.x, a, x.x, a, x.x, a *hh<CR><LF> These fields are not used. TD1 status* TD2 status* TD3 status* TD4 status* TD5 status* Check sum Note: When only two TD data are effective, TD data is displayed. Note*: Status A=Valid B=Blink warning C=Cycle warning S=SNR warning

Wind

MWD	Wind direction and speed
	$ -- MWD, x.x, T, x.x, M, x.x, N, x.x, M, *hh<CR><LF> Wind direction, 0° to 359° true Wind direction, 0° to 359° magnetic Wind speed, knots Wind speed, m/s Check sum

ROT

ROT	Rate of turn
	$ -- ROT, x.x, A, *hh<CR><LF> Rate of turn, °/min "-" bow turns to port Status, A=Valid V=Invalid Check sum

GNSS satellite fault detection

GBS	GNSS satellite fault detection
	$ -- GBS, hhmmss.ss, x.x, x.x, x.x, xx, x.x, x.x, x.x, h, h *hh <CR><LF> This field is not used. Expected error in latitude Expected error in longitude These fields are not used. Check sum

7.2 Details of TT tracking data output

Data standard name: IEC61162-1 or IEC61162-2

Target data of the automatic tracking unit is provided via data connectors (J3, J5, J6) on the back panel.

TTD	Tracked target data
	! RATTD, hh, hh, x, s--s, x*hh<CR><LF> Check sum Number of fill-bits, 0 to 5 Encapsulated tracked target data Sequential message identifier, 0 to 9 Hex sentence number, 01 to FF Total hex number of sentences needed to transfer the message, 01 to FF

TLB	Target label
	$ RATLB, x.x, c--c, x.x, c--c, …x.x, c--c *hh<CR><LF> Check sum Additional label pairs (x.x, c--c) Label assigned to target 'n' Target number 'n' reported by the device

TTM	Tracked target message
	$ RATTM, xx, x.x, x.x, T, x.x, x.x, T, x.x, x.x, N, c--c, a, a, hhmmss.ss, a, *hh<CR><LF> Target distance from own ship Target number, 00 to 99 Bearing from own ship, degrees true Target course, degrees true Target speed Distance of closest -point-of-approach Time to CPA (min) Speed/ distance units, N Target label Target status L=Lost Q=Query T=Tracking Reference target=R, null otherwise UTC Type of acquisition A=Automatic M=Manual R=Recorded Check sum

7.3 Details of the radar data output

Data standard name: IEC61162-1 or IEC61162-2

Own ship data and radar system data are provided via data connectors (J3, J5, J6) on the back panel.

Radar system data

RSD	Radar system data
	$ -- 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> Origin 1 Range Origin1 Bearing VRM1 Bearing EBL1 Bearing Origin2 Range Origin2 Beraing VRM2 Bearing EBL2 Beraing Cursor range Cursor Bearing Display Range Range unit K=km/h N=NM S=SM/h Check sum Display mode C=Course up H=Head up N=North up

Own ship data

OSD	Own ship data
	$RAOSD, x.x, A, x.x, a, x.x, a, x.x, x.x, a*hh<CR><LF> Heading, degrees true Heading status, A=data valid, V=data in valid Vessel course, degrees true Course refference, B/M/W/R/P* Vessel speed Speed reference, B/M/W/R/P* Vessel set, degrees true Vessel drift (speed) Speed unit, K=km/h, N=knots, S=statute miles/h Check sum Note* Reference B=Bottom tracking log M=Manually entered W=Water referenced R=Radar tracking (or fixed target) P=Positioning system ground reference

Alarm

ALF	Alert sentence
	$ -- ALF, x, x, x, hhmmss.ss, a, a, a, aaa, x.x, x.x, x.x, x, c---c *hh<CR><LF> Total number of ALF sentences for this message, 1 to 2 Sentence number, 1 to 2 Sequential message identifier, 0 to 9 Time of last change Alert category, A, B or C Alert priority, E, A, W or C* Alert state, A, S, N, O, U or V** Manufacturer mnemonic code Alert identifier Alert instance, 1 to 999999 Revision counter, 1 to 99 Escalation counter, 0 to 9 Alert text Check sum Note* Alert priority E=Emergency Alerm (for use with Bridge Alert Management) A=Alarm W:Warning C=Caution Note** Alert state V=Active-Unacknowledge S=Active-Silenced A=Active-Acknowledge or active O=Active-Responsibility transferred U=Rectified-Unacknowledge N=Normal

ARC	Alert command refused

$ -- ARC, hhmmss.ss, aaa, x.x, x.x, c*hh<CR><LF>

- hhmmss.ss: Relese time
- aaa: Manufacturer mnemonic code
- x.x: Alert identifier
- x.x: Alert instance, 1 to 999999
- c: Refused alert command, A, Q, O or S*
- hh: Check sum

Note*
A: Acknowledge
Q: Request / repeat information
O: Responsibility transfer
S: Silence

ALR	Set alarm state

$ -- ALR, hhmmss.ss, xxx, A, A, c---c *hh<CR><LF>

- hhmmss.ss: Time of alarm condition change, UTC
- xxx: Unique alarm number (identifier) at alarm source
- A: Alarm condition (A=threshold exceeded, V=not exceeded)
- A: Alarm's acknow ledge state, A=acknow ledged V=unacknow ledged
- c---c: Alarm's description text
- hh: Check sum

ACN	Alert command

$ -- ACN, hhmmss.ss, aaa, x.x, x.x, c, a*hh<CR><LF>

- hhmmss.ss: Relese time
- aaa: manufacture mnemonic code
- x.x: Alert identifier
- x.x: Alert instance, 1 to 999999
- c: Alert command, A, Q, O or S*
- a: Sentence status flag: "C"
- hh: Check sum

Note* Alert command
A: Acknow ledge
Q: Request / repeat information
O: Responsibility transfer
S: Silence

ACK	Acknowledge alarm

$ -- ACK, xxx *hh<CR><LF>

- xxx: Unique alarm number (identifier) at alarm source
- hh: Check sum

Heartbeat

HBT	Heartbeat supervision sentence
	$ -- HBT, x.x, A, x*hh<CR><LF> Check sum Sequential sentence identifier Equipment status A=Yes, V=No Configured repeat interval

Activity information

EVE	General event message
	$ -- EVE, hhmmss.ss, c--c, c--c*hh<CR><LF> Check sum Event description Tag code used for identification of source of event Event time

7.4 Interface specification

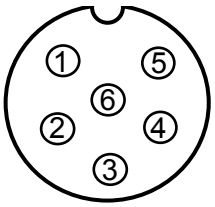
7.4.1 Serial data input/output specification

Input connector: J3, J5 and J6

Connector used: BD-06PMMP-LC7001

Connector acceptable: BD-06BFFA-LL6001

J3, J5 and J6
Data connector pin assignment
(Display unit upper view)



Data connector pin assignment

Pin number	Signal name	
	J3, J5	J6
1	Shield	Shied
2	OUT-A	OUT-A
3	OUT-B	OUT-B
4	IN-A	IN-A
5	IN-B	IN-B
6	+12V	NC

Note: +12V of pin no.6 of J3 and J5 is used for power supply of Junction box JB-35 or other device such as GPS sensor.

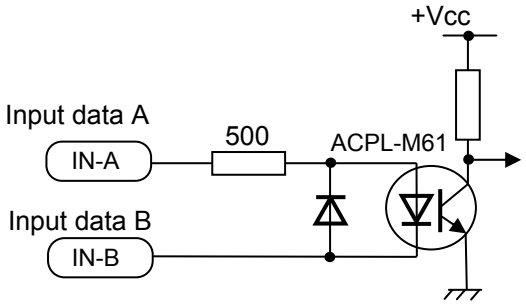
Serial data input (Listener):

Standard-type signal conforming to IEC61162-1 or IEC 61162-2 is acceptable.

Input load: 500 Ohm

Circuit configuration: Photo coupler

Type ACPL-M61 (Avago)



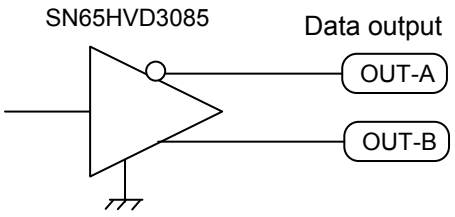
Serial data input circuit

Serial data output (Talker):

Standard-type signal conforming to IEC61162-1 or IEC 61162-2 is transmittable.

Circuit configuration: RS422 driver IC

Type SN65HVD3085 (TI）



Serial data output circuit

7.4.2 External buzzer and external monitor signal specification

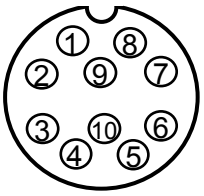
Output connector name: Monitor & Buzzer

Connector used: BU-10PMMP-LC7001

Connector acceptable: BU-10BFFA-LL7001

Pin location is shown below.

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



External monitor and buzzer output connector pin assignment

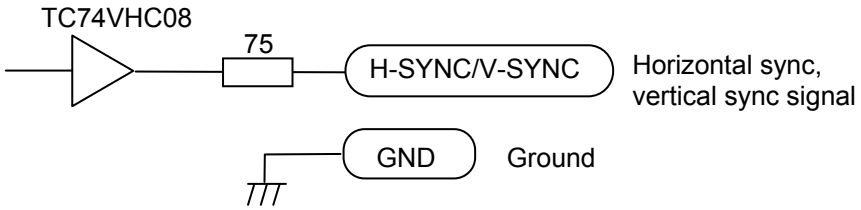
Pin number	Signal name
1	RVD
2	R-GND
3	GVD
4	G-GND
5	BVD
6	B-GND
7	H-SYNC
8	V-SYNC
9	ALARM
10	ALARM

Signal specification

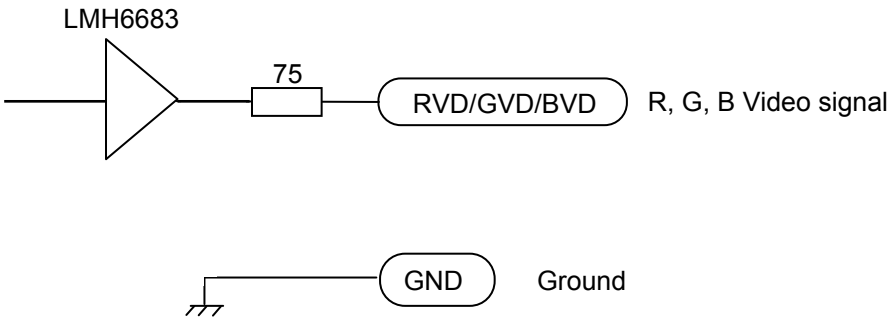
Signal name	Frequency	Polarity	Signal width	Level	Impedance
Horizontal sync signal (H-SYNC)	48.363 kHz	Negative	2.092 µs	TTL	200 Ω
Vertical sync signal (V-SYNC)	60.0 Hz	Negative	124 µs	TTL	200 Ω
R, G, B Video signal	-	Positive	-	0.7 V p-p	75 Ω
External buzzer output	-	-	Contact*	-	Capacity 1A

* Alarm contact will close in case of failure.

7.4.2.1 Circuit fot horizontal sync, vertical sync signal output



7.4.2.2 Circuit for R, G, B video signal



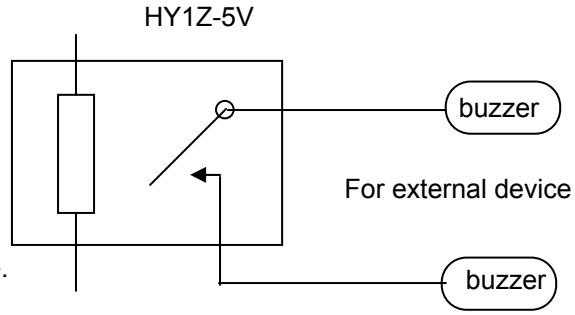
7.4.2.3 Buzzer output specification

Max. switching voltage 30 V

Max. current capacity 1 A

(Resistive load)

Note: Buzzzer output contact will close in case of failure.



7.4.3 Serial data input/output specification (AIS)

I/O connector AIS (J2)

Connector used: BD-08PMMP-LC7001

Connector acceptable: BD-08BFFA-LL6001

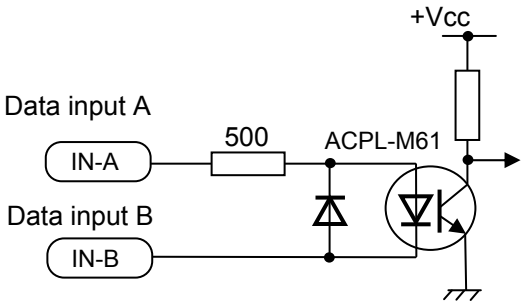
Serial data input (Listener):

Standard signals conforming to IEC61162-2 is acceptable.

Input load 500 Ohm

Circuit configuration: Photo coupler

Type ACPL-M61 (Avago)



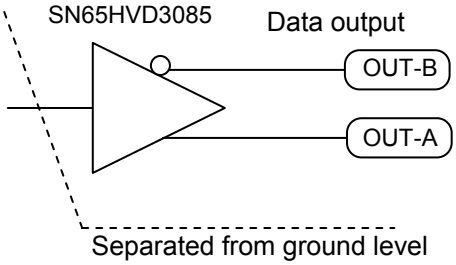
Serial data input circuit

Serial data output circuit (Talker):

Standard signals conforming to IEC61162-2 can be output.

Circuit configuration: RS422 Driver/Receiver IC

Type SN65HVD3085 (TI)

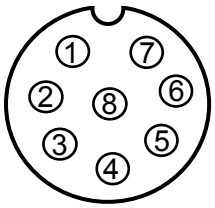


Serial data output circuit

J2

Data connector pin assignment

(Display unit upper view)



Data connector pin assignment

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

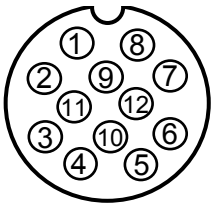
7.4.4 Radar input/output signal specification

I/O connector: Inter-switch (J8)

Connector used: BU-12PMMP-LC7001

Connector acceptable: BU-12BFFA-LL7001

J8
Inter-switch connector pin assignment
(Display unit 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

7.4.5 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
Galileo positioning system	GA	GAL
Global positioning system (GPS)	GP	GPS (See below)
Global positioning system (DGPS)	GP	DGPS (See below)
GLONASS positioning system	GL	GLONASS
Global navigation satellite system	GN	GNSS
Heading sensors: compass, magnetic	HC	HC
: gyro, north seeking	HE	GYRO
: gyro, non-north seeking	HN	GYRO
Integrated instrumentation	I I	INS
Integrated navigation	IN	INS
Loran-C	LC	LC
Electronic positioning system	SN	EPFS
Velocity sensors: Doppler, general	VD	DLOG
: magnetic 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 is based on the operational status display in the GLL and GGA sentences. Refer to “7.1 Details of the data input format” (GLL and GGA sentences).

7.4.6 Priority of talker device code

Heading

II > IN > HE > HN > HC > GN > GP > GL > GA > SN

Speed

II > IN > VD > GN > GP > GL > GA > SN > VM > VW

Position

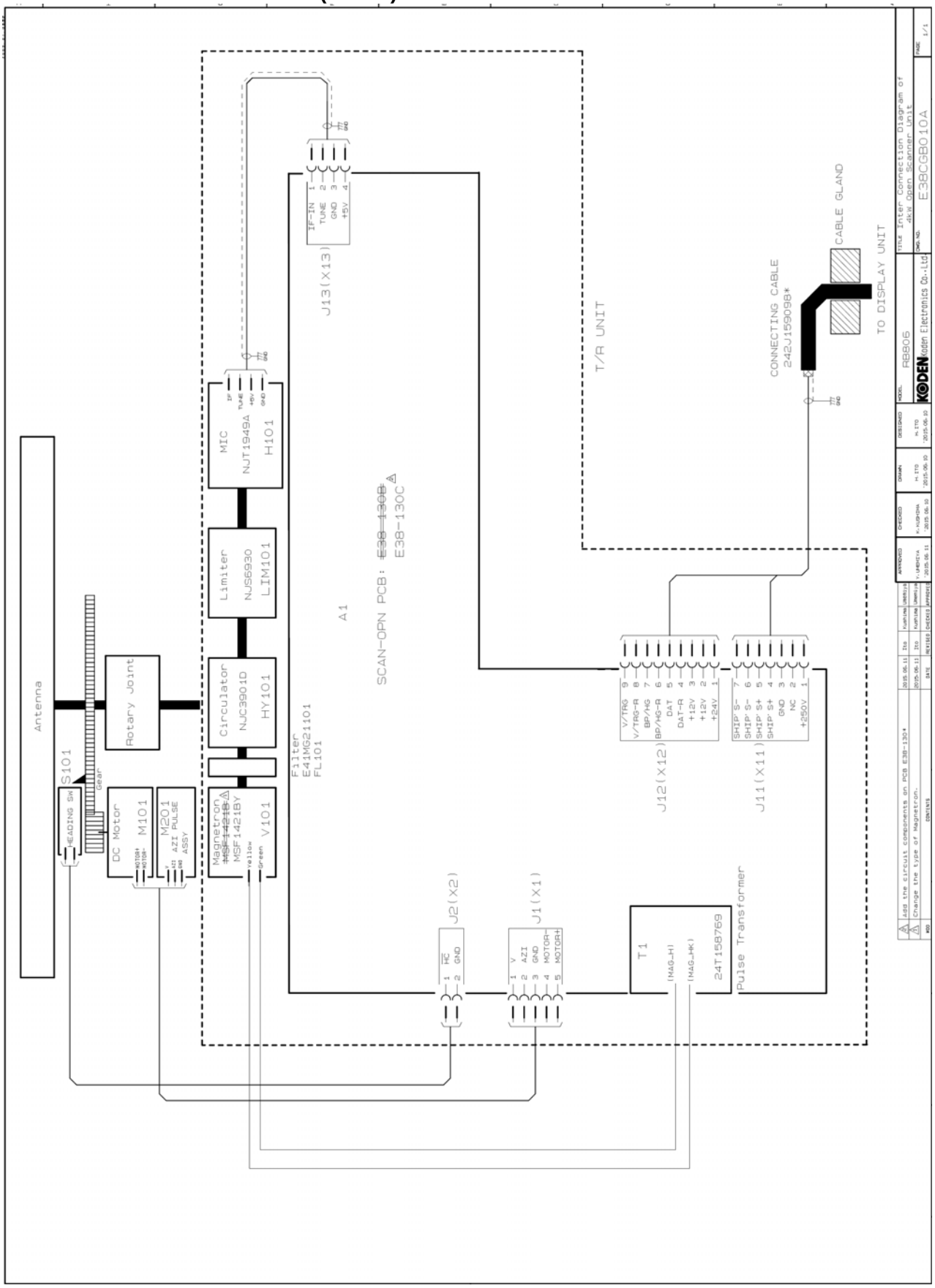
II > IN > GN > GP > GL > GA > SN > LC

GNS

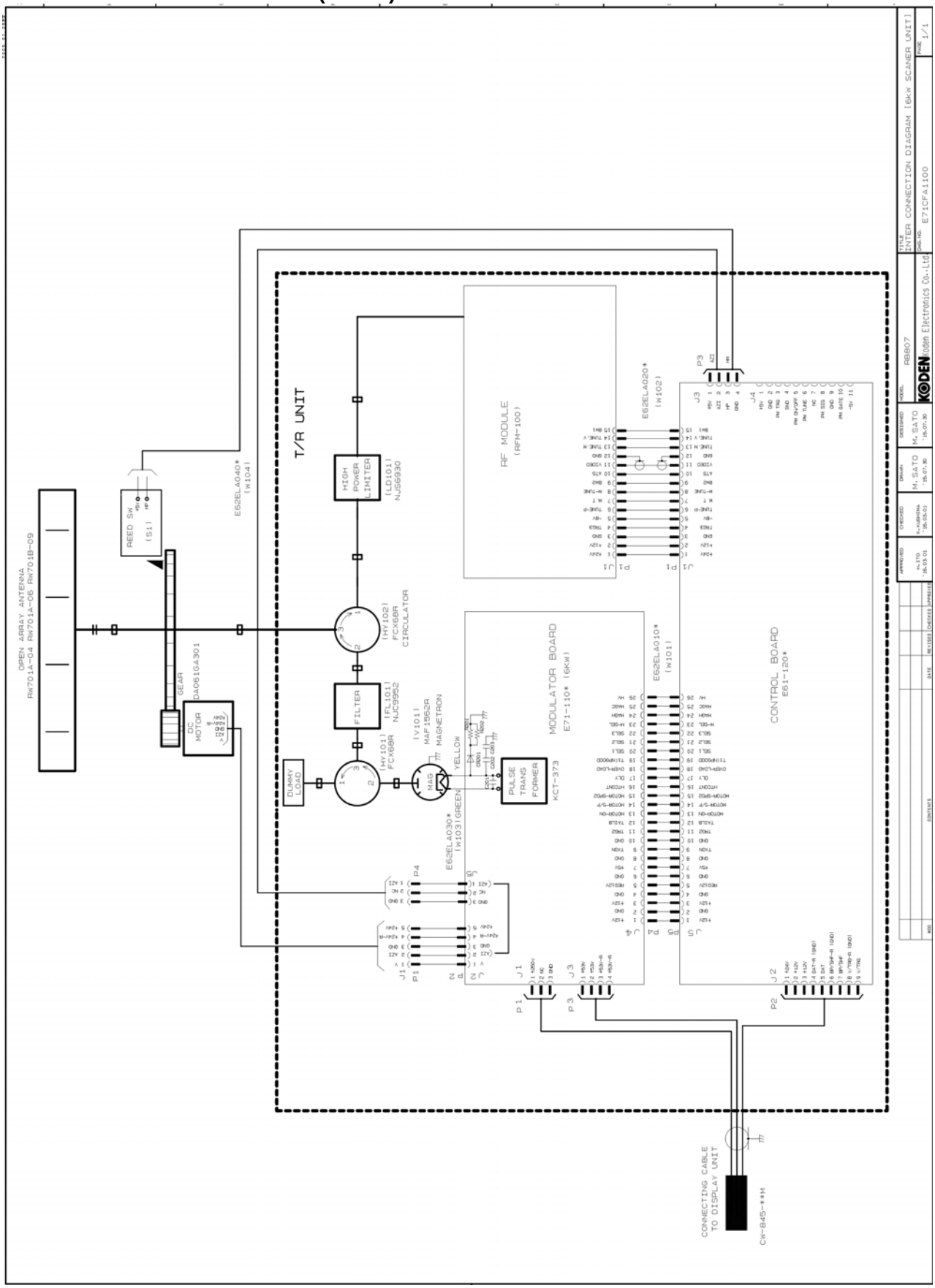
GN > GP > GL > GA

- This page intentionally left blank.-

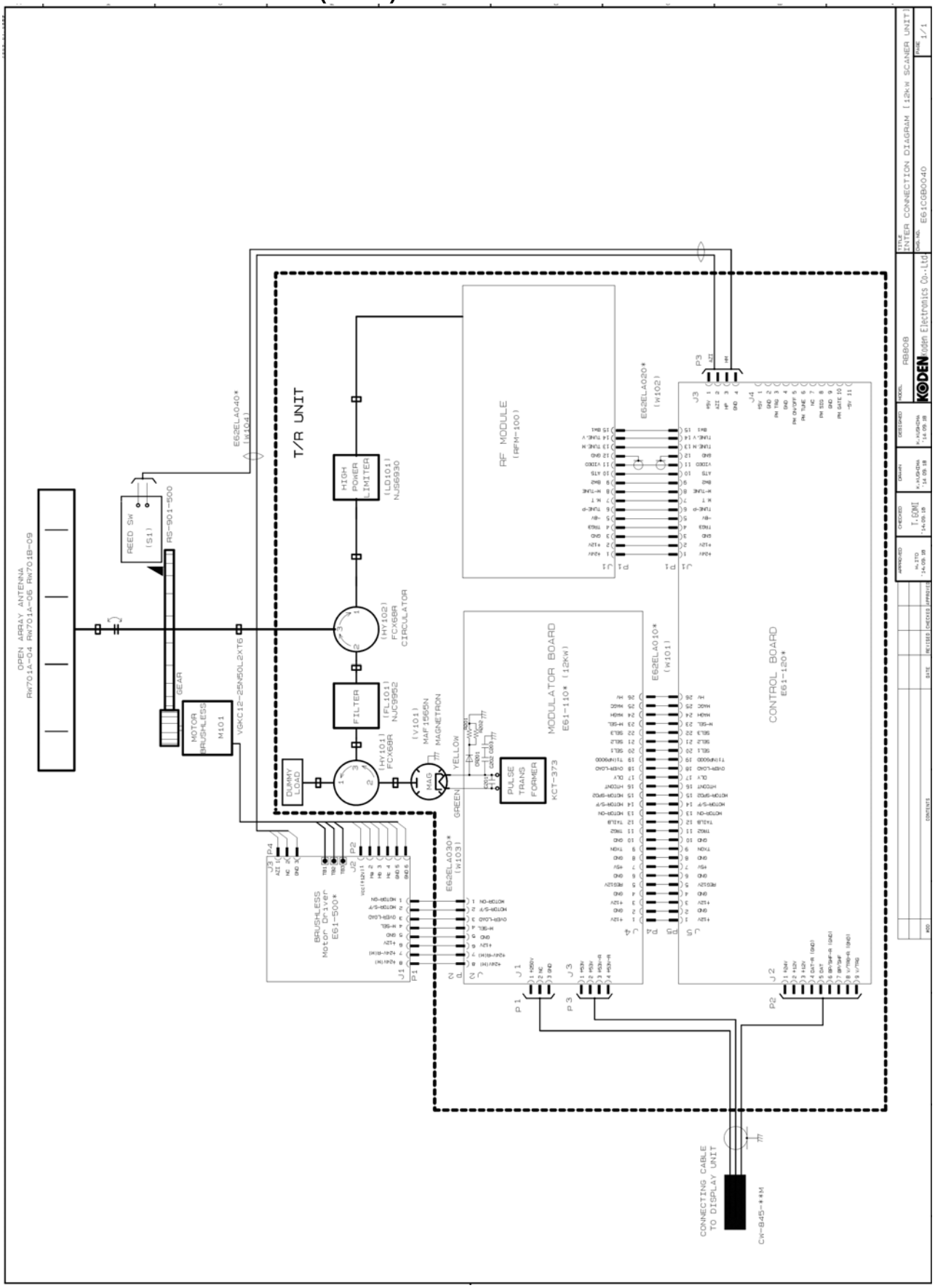
INTER CONNECTION DIAGRAM (RB806)



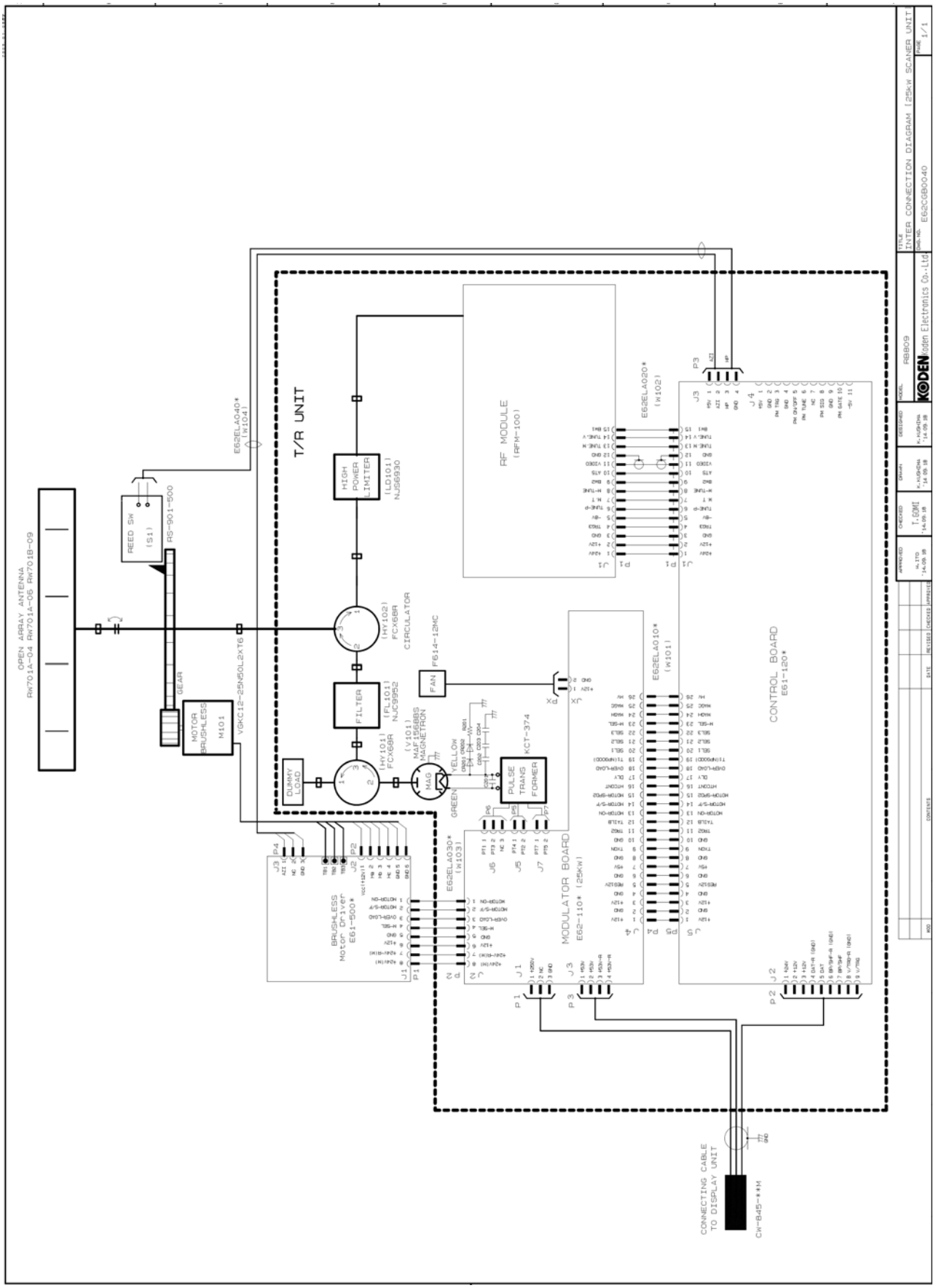
INTER CONNECTION DIAGRAM (RB807)



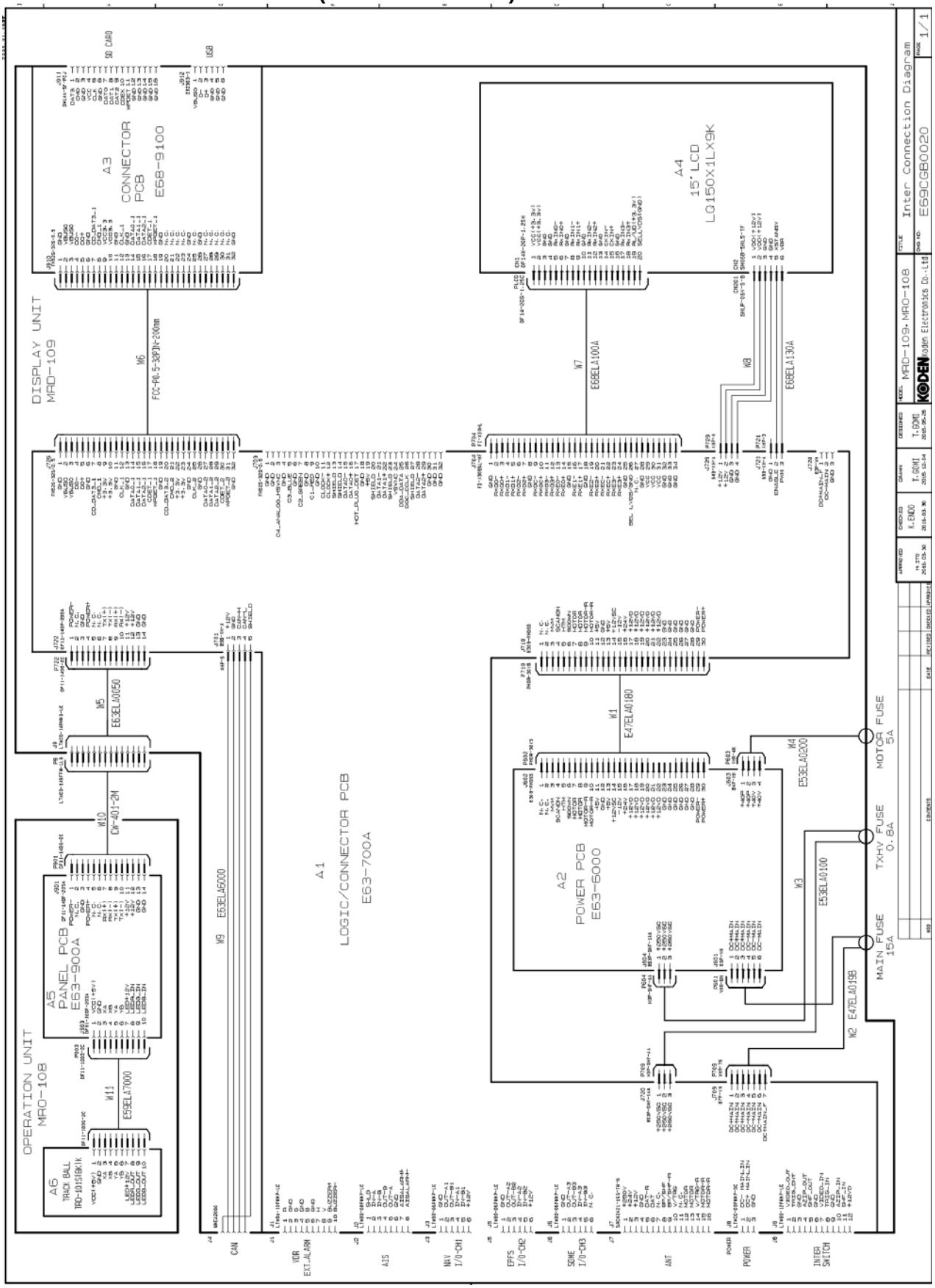
INTER CONNECTION DIAGRAM (RB808)



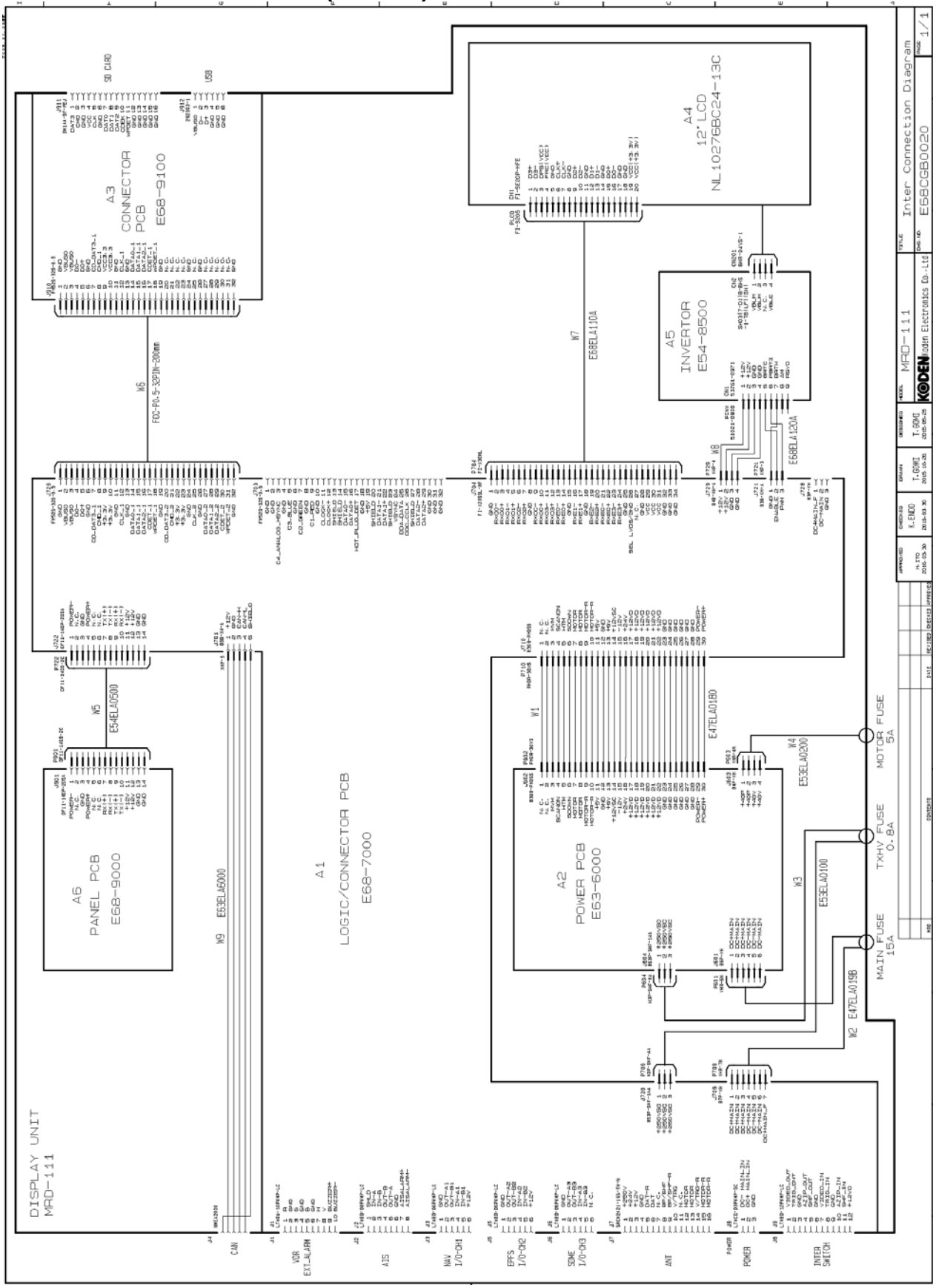
INTER CONNECTION DIAGRAM (RB809)



INTER CONNECTION DIAGRAM (MRD-109/MRO-108)



INTER CONNECTION DIAGRAM (MRD-111)



KODEN

Koden Electronics Co., Ltd.

Tamagawa Office:
2-13-24 Tamagawa, Ota-ku, Tokyo, 146-0095 Japan
Tel: +81-3-3756-6501 Fax: +81-3-3756-6509
Uenohara Office:
5278 Uenohara, Uenohara-shi, Yamanashi, 409-0112 Japan
Tel: +81-554-20-5860 Fax: +81-554-20-5875

www.koden-electronics.co.jp

Printed in Japan