



KODEN

INSTALLATION MANUAL

RADAR_{pc}

MDS-1100R

SERIES

Declaration of Conformity



This declaration is issued according to the Directive 2014/53/EU of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to making available on the market of radio equipment.

We, Koden Electronics Co., Ltd.; 5278 Uenohara Uenohara-shi, Yamanashi-Ken ; 409-0112, Japan declare as manufacturer under our sole responsibility that the Koden Marine Radar Koden

MDS-1100R Series

Intended for use as a RADARpc aboard non-SOLAS vessels and with RB809 also landbased use in industrial environment (Class A) to which this declaration relates conforms to the following standards:

- IEC 60945 - EMC related items
- IEC 62368-1:2014 (2. Edition) and Cor.1:2015
- EN 62368-1:2014/AC:2015/A11:2017
- EN 302 248 V2.1.1: 2016-11 (except clause 6.6 to 6.9)
- EN 55032:2015 – Radiated Emission Class A (only RB809)

Type names: MDS-1103R (4kW 1.2ft radome), MDS-1105R (4kW 2.0ft radome), MDS-1104R (4kW Open Scanner), MDS-1106R (6kW Open Scanner), MDS-1112R (12kW Open Scanner), MDS-1125R (25kW Open Scanner)

Consisting of: Radar Sensor Control Box: MDS-11R
Scanner Unit: RB804(4kW 1.2ft radome) or RB805(4kW 2.0ft radome) or RB806 (4kW open scanner) or RB807 (6kW open scanner) or RB808 (12kW open scanner) or RB809 (25kW open scanner)
Aerial: RW701A-03(3ft)for RB806 or RW701A-04(4ft) for RB806,RB807,RB808 or RW701A-06(6ft) for RB807,RB808,RB809

For assessment, see

EU-type examination (Module B) certificate no: T818509L-03-TEC issued by CTC advanced (0682), Germany

Software: Radar Control Box: KM-F76x (x is used as wildcard)

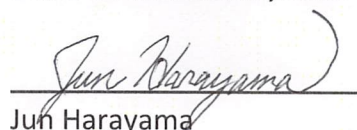
Frequency: 9410MHz ± 30MHz

Our product is also in compliance to Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronical equipment.

**EU representative: Koden Elektronik GmbH
Am Gewerbepark 15, D-64823 Gross-Umstadt, Germany**

**Point of contact: Koden Electronics Co.,Ltd.
5278 Uenohara, Uenohara-shi, Yamanashi-Ken, Japan
Mr. JUN HARAYAMA, Manager, Quality Assurance Dept.
Tel.: +81 554 20 5860 Fax: +81 554 20 5875**

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Jun Harayama

Manager, Quality Assurance Dept.

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When part of the document needs to be revised, the document has advanced revision number.

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(Note) MDS-1160R/1110R/1120R including Antenna Scanner unit: RB717A/718A/719A are not complied for CE Approval.

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Preface

[Precaution for safety issues]

Precaution for operation

- **Caution about rotating antenna:**

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

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

Powerful electromagnetic waves are emitted from the antenna during operation. These waves can cause ill effects on human bodies when exposed to continuous 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	50 W/m^2	10 W/m^2
4 kW / 1.2 feet antenna (Radome)	0.6 m	1.0 m	2.0 m
4 kW / 2 feet antenna (Radome)	0.8 m	1.2 m	2.6 m
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 Control Box 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 Control Box 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.

• Prohibited matter:

Any Control Box and Scanner unit combination other than specified in the manual is prohibited and will void manufacturer’s warranty.

• 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.

Warning

In accordance to EN55032:2015, this product is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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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) Attachment of accessories;
- (7) Planning and implementation of cable laying and connection;
- (8) 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

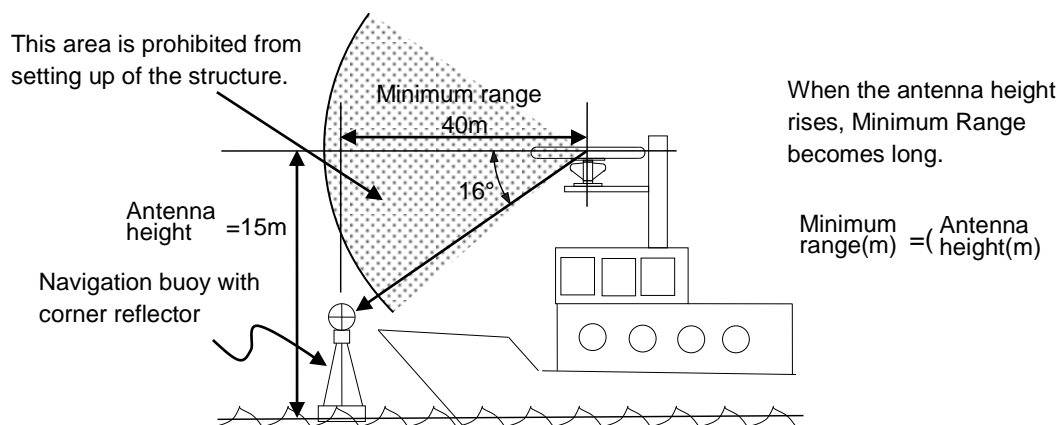
Please check the appearance of each unit carefully, confirm that they are dent and crack free. Moreover, please also check the interior of each unit and confirm that there is no electric or mechanical damage.

1.4 Selection of location for installation

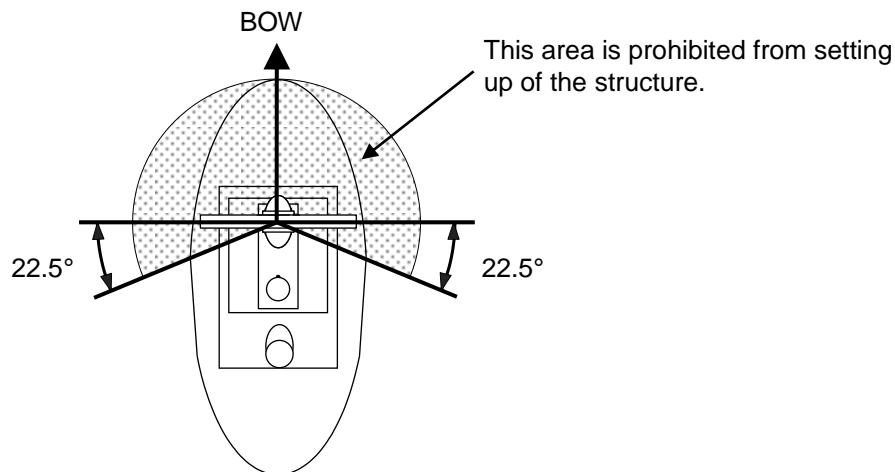
In order to obtain the maximum performance of the units, it is necessary to install them in consideration of matters as described below.

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.



Vertical chart of recommended antenna installation



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
RB804 (4kW)	2.0 m	1.4 m
RB805 (4kW)	2.0 m	1.4 m
RB806 (4kW)	2.0 m	1.4 m
RB807 (6kW)	1.2 m	0.8 m
RB808 (12kW)	1.4 m	0.9 m
RB809 (25kW)	1.4 m	0.9 m
RB717A (6kW)	1.4 m	0.95 m
RB718A (12kW)	1.4 m	0.95 m
RB719A (25kW)	1.2 m	0.65 m

1.4.2 Control Box

- (1) Choose the best location from humidity, spray and rain.
- (2) Keep sufficient maintenance area.
- (3) Keep as far as possible from other radio devices.
- (4) Keep safety distance from magnetic compass.

Table 1.2 Safety distance of compass from Control Box

Control Box type	Standard compass	Steering compass
MDS-11R	0.5 m	0.4 m

1.5 Cable wiring and interconnection

1.5.1 Antenna Scanner unit

- (1) The connecting cable between the Antenna-Scanner unit and the Control Box 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 Control Box

- (1) The Control Box should be grounded to the ship ground by using the gray wire of the power cable.

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Chapter 2 System configurations

2.1 Standard configuration list

MDS-1103R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna-Scanner unit	RB804	4 kW Radome 1.2 ft	8.3 kg	1
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	242J158055A-10M	With connectors on the both sides	10 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	B2WSM10X40U	For mounting Antenna-Scanner unit		4
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1104R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Scanner unit	RB806	4 kW	16.1 kg	1
	Antenna	RW701A-03	3 ft	5.0 kg	
		RW701A-04	4 ft	6.0 kg	
		RW701A-06	6 ft	8.0 kg	
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	242J159098B-15M	With connectors on the both sides	15 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M12-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1105R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Antenna-Scanner unit	RB805	4 kW Radome 2 ft	10.0 kg	1
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	242J158055A-10M	With connectors on the both sides	10 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M10-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1106R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Scanner unit	RB807	6 kW	18.1 kg	1
	Antenna	RW701A-04	4 ft	6.0 kg	
		RW701A-06	6 ft	8.0 kg	
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	CW-845-15M	With connectors on the both sides	15 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M12-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1112R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Scanner unit	RB808	12 kW	18.0 kg	1
	Antenna	RW701A-04	4 ft	6.0 kg	
		RW701A-06	6 ft	8.0 kg	
		RW701B-09	9 ft	12.0 kg	
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	CW-845-15M	With connectors on the both sides	15 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M12-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1125R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Scanner unit	RB809	25 kW	20.0 kg	1
	Antenna	RW701A-04	4 ft	6.0 kg	
		RW701A-06	6 ft	8.0 kg	
		RW701B-09	9 ft	12.0 kg	
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	CW-845-15M	With connectors on the both sides	15 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M12-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1160R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Scanner unit	RB717A	6 kW	18.1 kg	1
	Antenna	RW701A-04	4 ft	6.0 kg	
		RW701A-06	6 ft	8.0 kg	
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	242J159098B-15M	With connectors on the both sides	15 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M12-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1110R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Scanner unit	RB718A	12 kW	18.0 kg	1
	Antenna	RW701A-04	4 ft	6.0 kg	
		RW701A-06	6 ft	8.0 kg	
		RW701B-09	9 ft	12.0 kg	
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	242J159098B-15M	With connectors on the both sides	15 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M12-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare parts		See 2.3 Spare parts list		1 set

MDS-1120R

No.	Name	Type	Comment	Weight/ Length	Quantity
1	Scanner unit	RB719A	25 kW	20.0 kg	1
	Antenna	RW701A-04	4 ft	6.0 kg	
		RW701A-06	6 ft	8.0 kg	
		RW701B-09	9 ft	12.0 kg	
2	Control Box	MDS-11R		2.6 kg	1
3	Connecting cable	242J159098B-15M	With connectors on the both sides	15 m	1
4	Power cable	CW-259-2M	With a connector on the single side	2 m	1
5	Installation material	M12-BOLT.KIT	See 2.4 installation material list		1 set
6	Tapping screw	TPT5x20U	For mounting control box		4
7	Spare fuse		See 2.3 Spare parts list		1 set

2.2 Installation material list

M10-BOLT.KIT

No.	Name	Specification	Quantity	Usage
1	Hexagon bolt	B10X25U	4	Antenna-Scanner unit
2	Plain washer	2W10U	4	Antenna-Scanner unit
3	Spring washer	SW10U	4	Antenna-Scanner unit

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

2.3 Spare parts list

SP-MRD-109/111

No.	Name	Specification	Comment	Type (Dimension)	Quantity	Usage
1	Fuse	F-1065-15A	Normal type	Tubular (ϕ 6.4 x 30)	1	Main power
2	Fuse	MF51NN250V5A/ N20-250V	Normal type	Tubular (ϕ 5.2 x 20)	1	Motor power
3	Fuse	FGMB 250V/0.8A	Normal type	Tubular (ϕ 5.2 x 20)	1	High voltage power
4	Carbon brush	24Z125209B			1set	Antenna motor (For RB806/807/ 717A/718A/719A)

2.4 Option list

No.	Name	Specification	Comment	Weight /Dimension /Quantity
1	Rectifier unit	PS-010	5A fuse attached	3.5 kg
2	AC power cable	VV-2D8-3M	Without connectors on the both sides	3 m

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Chapter 3 Installation

3.1 Antenna Scanner unit

A radar's target detection capacity varies greatly depending on the fitted position of the scanner. An ideal fitting position is a location high above the ship's keel line where there is no obstacle all around the scanner. In an actual ship, such an ideal location is limited by various factors. Therefore, consider the following suggestions when you determine the place to install the scanner:

(a) Install scanner at a position as high as possible.

The higher the installation position, the longer the radio ranging distance. Install the scanner at a position as high as possible after considering the ship's hull structure and radar maintainability.

(b) Install scanner away from smoke-stack and mast.

If the scanner is installed at the same height as the smoke-stack or mast, radar waves may be blocked, creating shadow zones or generating false echoes. Therefore, do not install the scanner at such a position.

(c) Install scanner forward away from obstacle.

To avoid creating shadow zones or generating false echoes, install the scanner at a position nearer to the ship's bow away from obstacles. When installing the scanner on a mast, position it in front of the mast. (If obstacles cannot be avoided for the ship's structural reasons, refer to "Shifting away from obstacles" described below.)

(d) Do not install the scanner near hot or heat-generating items.

Do not install the scanner at a position where it may be subjected to smoke or hot air from smokestacks or heat from lamps.

(e) Install the scanner away from antennas of other equipment.

Install the scanner as far away from antennas of a direction finder, radio transceiver, etc. as possible.



(f) Make the cable length as short as possible.

Keep the distance from the Scanner to the Control Box within the standard cable length of 10 m. If you use longer cable for unavoidable reasons.

3.2 Shifting away from obstacles

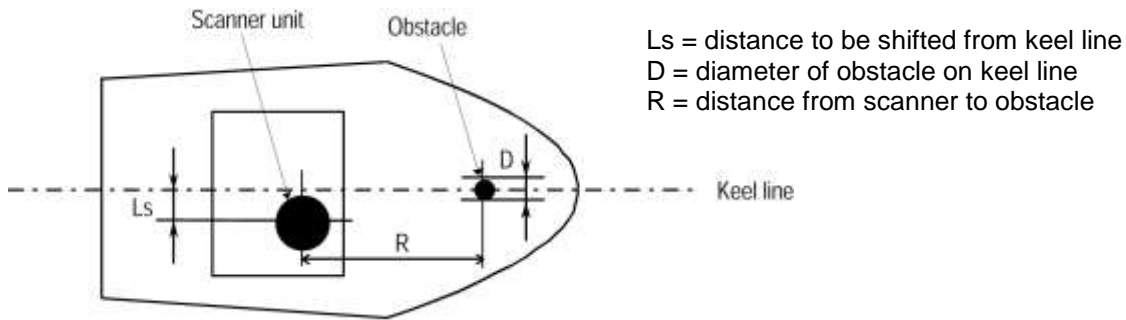
3.2.1 Shifting from keel line

By shifting the scanner position from the keel line to the starboard side of the ship, it is possible to move shadow zones to the port side, which makes it possible to keep clear vision in the bow direction. The distance to be shifted can be obtained by calculation depending on the distance from the scanner to

obstacles using the following equation:

$$L_s = 0.4R + D/2 \text{ [m]} \quad (\text{when } R < 15\text{m})$$

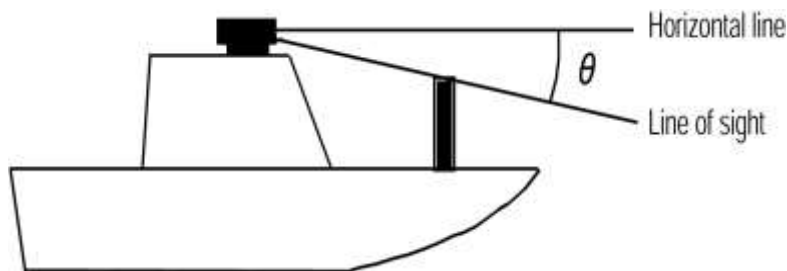
$$L_s = 0.025R + D/2 \text{ [m]} \quad (\text{when } R \geq 15\text{m})$$



Shifting the antenna from keel line

3.2.2 Obtaining sufficient dip angle

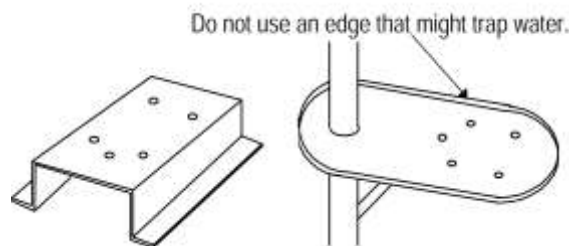
Raise the scanner position so that there is a sufficient dip angle (available between the line of sight from the scanner to the obstacle and the horizontal line). By raising the dip angle above 5 degrees, it is possible to prevent mid- and long-distance shadow zones. The radar cannot detect objects below the line of sight



Obtaining sufficient dip angle

3.3 Installation of the Scanner unit

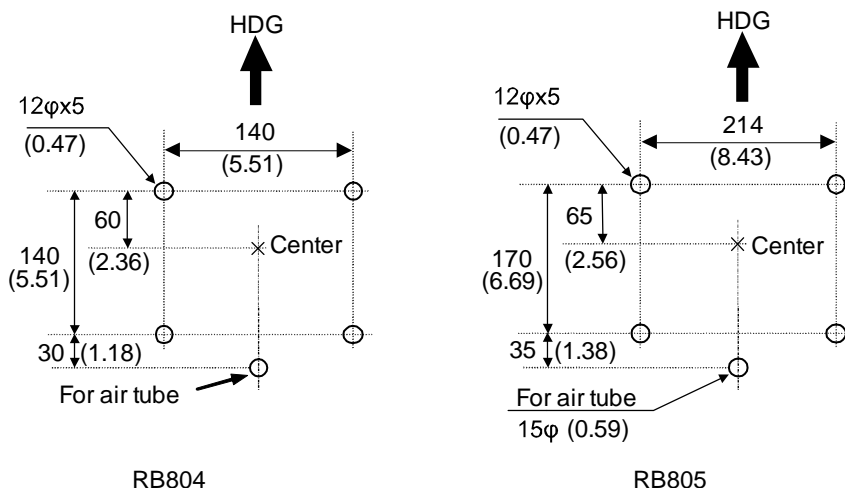
When you have decided the place of installation, prepare the mounting bracket or platform as shown in Figure below. If the surface of a platform or mounting base is not even, insert appropriate fairing materials such as spacers, etc. between the antenna pedestal and the mounting surface.



Recommended mounting base or platform

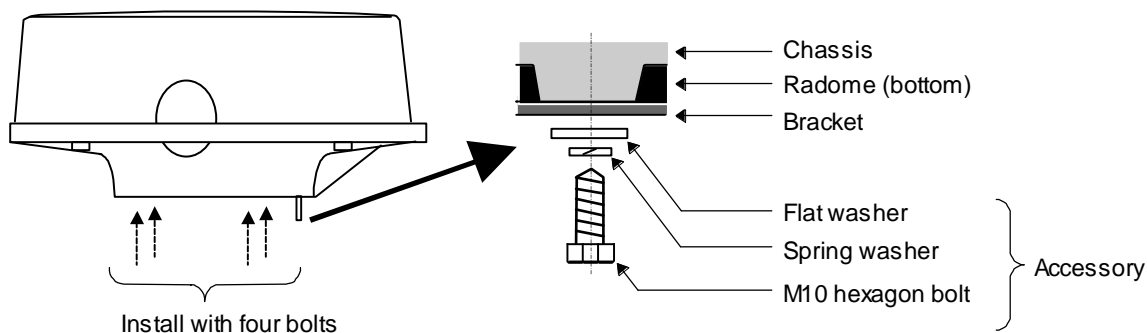
3.3.1 Installation of the RB804/805 Radome Antenna

Referring to the illustration below, make five (5) holes on the cradle and fix the bracket and the antenna together with hexagon bolts. If the thickness of the bracket is 9 to 14 mm, it can be installed with the supplied bolts. If not within this range, prepare bolts shown on the table below. To prevent the looseness from occurring, fortity with the commercially available loose-preventive silicon sealing. However, for preventing the looseness of the radome antenna, do not use the putty. The putty may deteriorate chemically the plastic material of the radome.



Unit: mm (inch)

Drawing of Work for Installation Holes on the Bracket



Specification of bracket thickness-wise installation bolt (In case of RB804)

Thickness of bracket	Bolt for fixing the antenna	Material	Remarks
4 to 11 mm (0.16 to 0.44 in)	M10x40 (pitch 1.5mm)	stainless	Included in accessories
11 to 19mm (0.44 to 0.75 in)	M10x45 (pitch 1.5mm)	stainless	

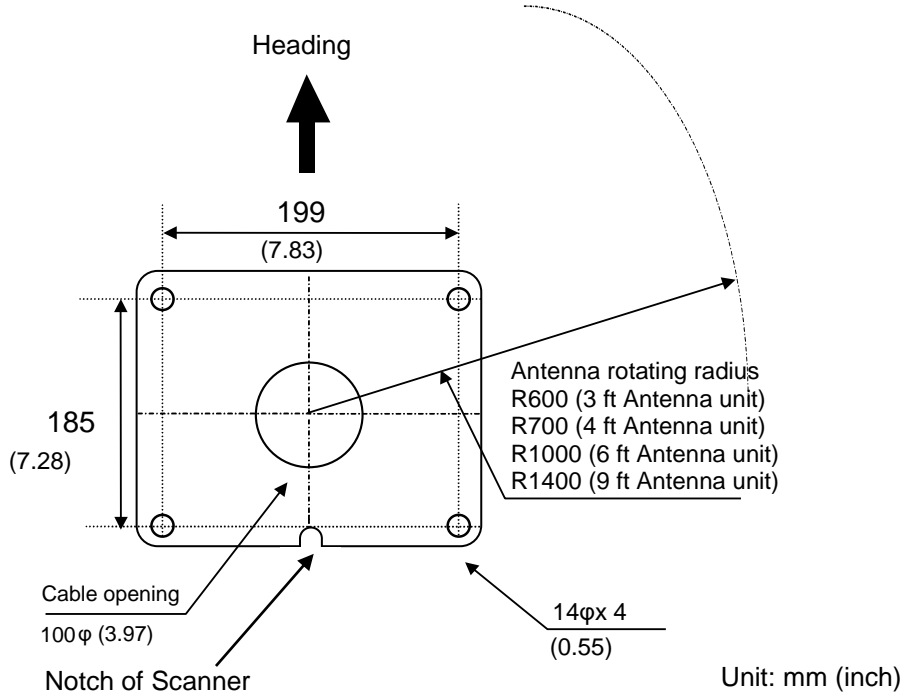
Specification of bracket thickness-wise installation bolt (In case of RB805)

Thickness of bracket	Bolt for fixing the antenna	Material	Remarks
4 to 9 mm (0.16 to 0.35 in)	M10x20 (pitch 1.5mm)	stainless	
9 to 14mm (0.35 to 0.55 in)	M10x25 (pitch 1.5mm)	stainless	Included in accessories
14 to 19 mm (0.55 to 0.75in)	M10x30 (pitch 1.5mm)	stainless	

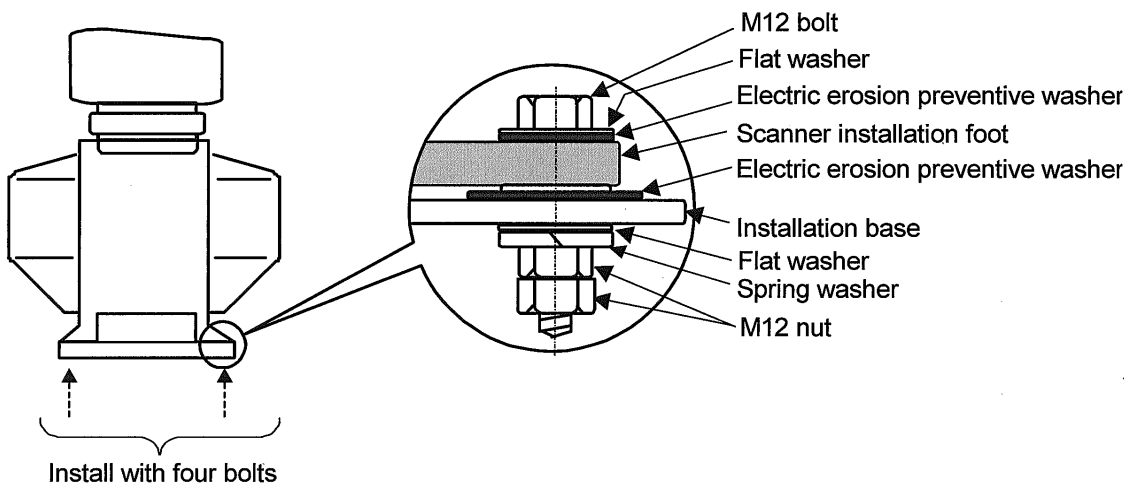
3.3.2 Setting of Open Antenna

As illustrated below, install the drive block, facing the cut portion of the installation base toward the stern. This makes it easier to perform the maintenance

1. Referring to the illustration below, make holes of 14mm diameter on the installation side of platform.
2. Place the Scanner unit at the specified position and fix it with four 12mm stainless bolts included in the installation material. If the thickness of the bracket is 9 to 14mm, the bracket can be installed with the supplied bolts. If not within this range, prepare the bolts shown on the table in the next page.



Plain view of mounting hole

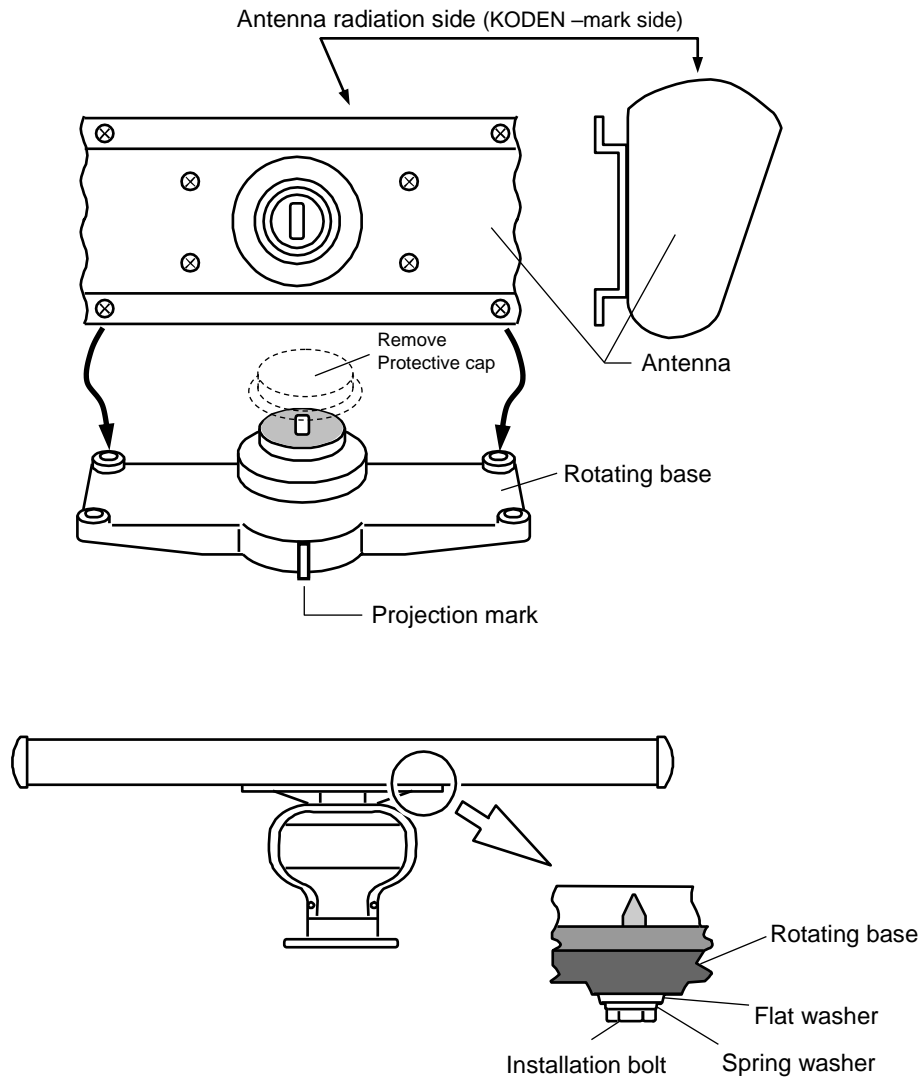


Specification of bracket thickness-wise installation bolt (In case of open antenna)

Thickness of bracket	Bolt for fixing the antenna	Material	Remarks
4 to 9 mm (0.16 to 0.35 in)	M12x50 (pitch 1.5mm)	stainless	
9 to 14mm (0.35 to 0.55 in)	M12x55 (pitch 1.5mm)	stainless	Included in accessories
14 to 19 mm (0.55 to 0.75in)	M12x60 (pitch 1.5mm)	stainless	

3.3.3 Installation of Antenna

1. Remove the protective cap covered on the output 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. Match 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.

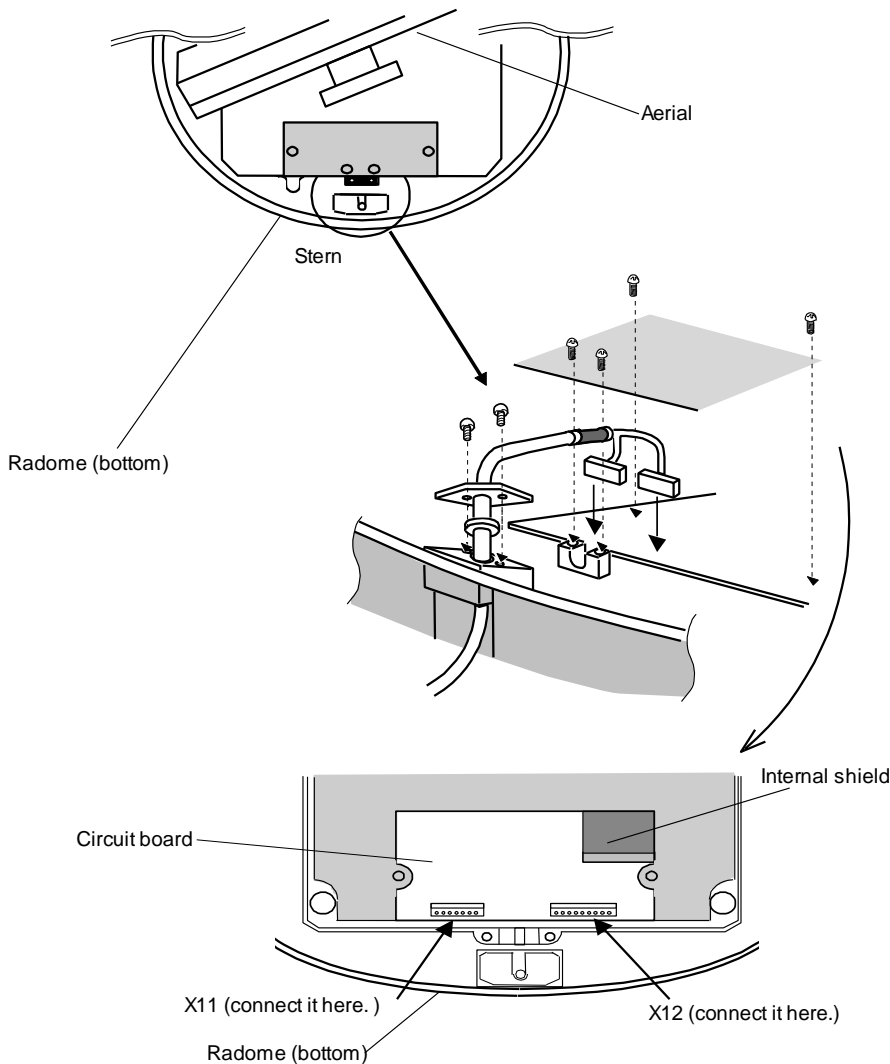


Fixing details of the OPEN antenna

3.4 Installation of the connecting cable

3.4.1 Radome Antenna 4kW (242J158055x: RB804/805_MDS-1103R/1105R)

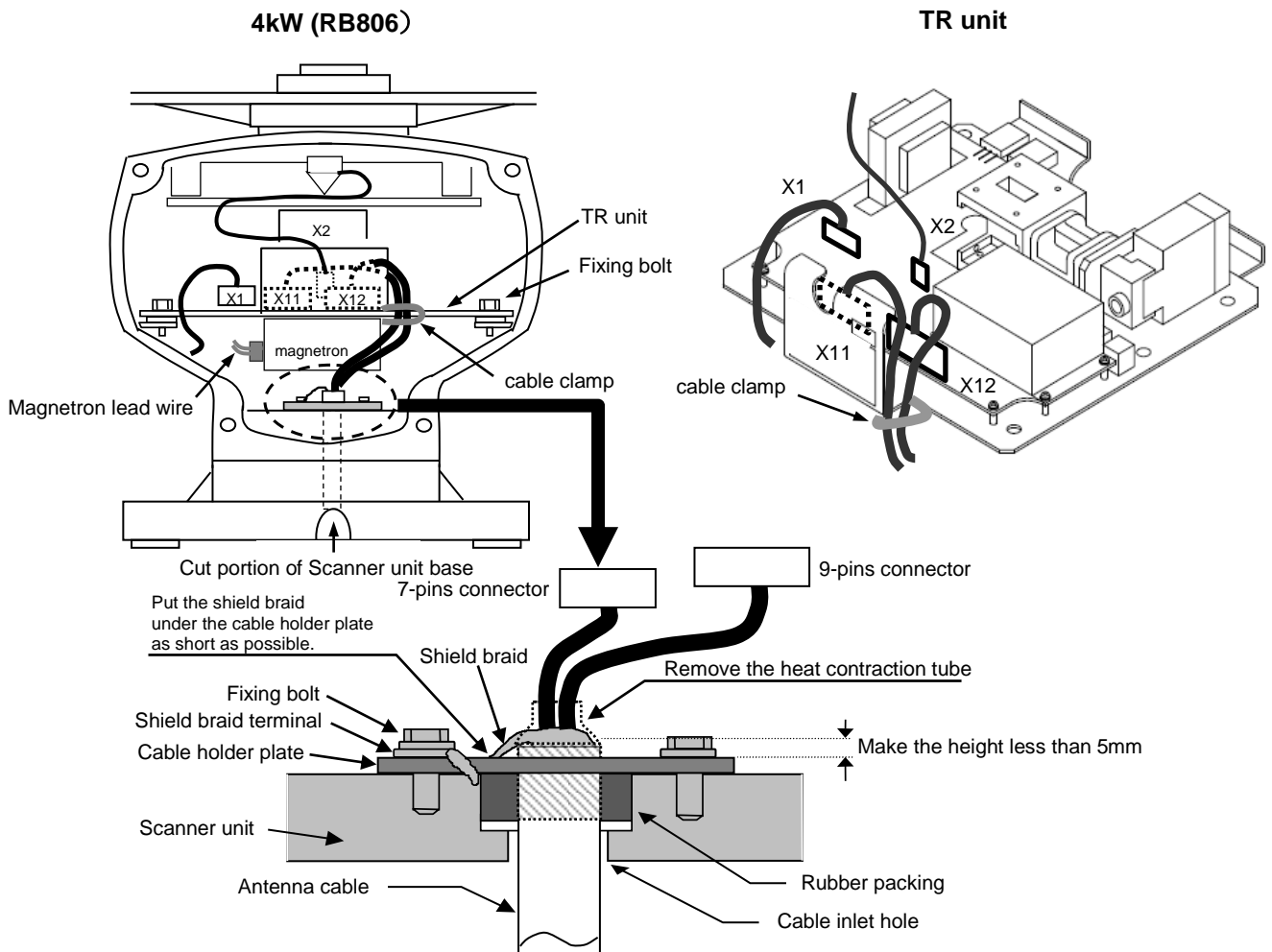
1. Confirm that the power of the Radar unit is turned off.
Remove the upper radome of the Antenna-Scanner unit, lifting upward not to touch the aerial inside. (4 pieces of fixing screw)
2. Peel off the tape fixing the aerial.
3. Remove the shield cover at the stern side.
4. Remove the holder plate for fixing the cable and the rubber ring
Thread the cable through the leading opening
Insert the rubber ring from both sides of the Scanner unit, thread it through the holder plate and fix it to the aerial with the screws.
5. Connect the 7-pin connector of the cable to X11 of the printed circuit board and the 9-pin connector to X12 respectively.
6. Install the shield cover. At this moment, install the shield of the cable in the groove, using the shield cover. But, be careful for the cable not to be caught by the unit and the cover.
7. Install the upper radome with caution not to touch the aerial. Orient the cover as shown in the illustration below. The screw positions are marked on the upper and lower radomes respectively. Install the radome, aligning these markings.



Installation of 4kW radome antenna cable

3.4.2 4kW Open Antenna unit (242J159098x: RB806_MDS-1104R)

1. Confirm that the power of the Radar unit is turned off.
Remove the front and back covers of the Scanner unit by loosening fixing bolts.
2. Remove the TR unit by disconnecting the connector X1 and X2 after loosening two fixing bolts of the TR unit. Please make sure magnetron does NOT touch metals.
3. Remove the cable holder plate and the rubber packing by loosening two bolts at the bottom of the Scanner unit box.
4. Antenna cable shall be taken into the Scanner unit box through the cable inlet hole.
5. 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.
6. Mount the TR unit after connecting the X1 and X2 connectors (removed in 2) by fixing bolts.
7. 7 pin connector shall be connected to X11 of the TR unit, 9 pin connector to X12.
8. Antenna cable shall be clamped onto the TR unit. Please make sure the antenna cable does NOT touch magnetron and magnetron lead wires.
9. The front and back covers of the Scanner unit shall be fixed by fixing bolts.

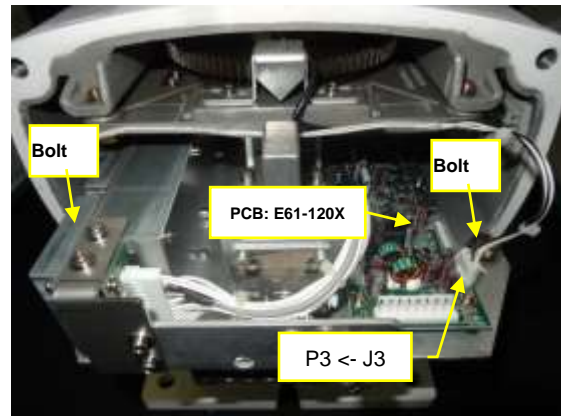


3.4.3 6kW Open Antenna unit (CW-845-xxM: RB807_MDS-1106R)

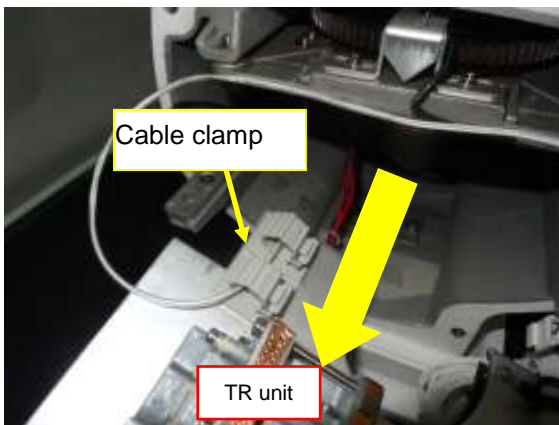
Make sure the radar system is turned off.



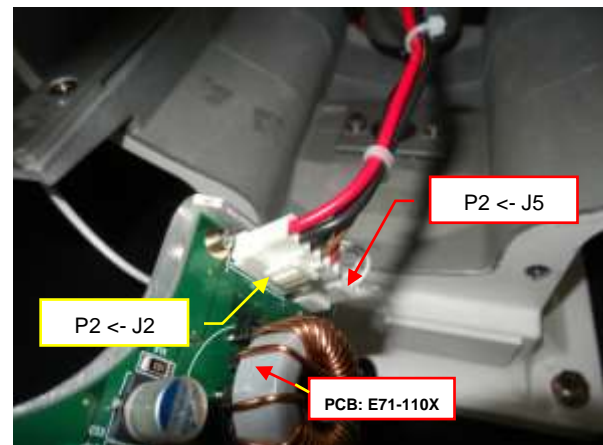
- 1) Remove back cover by loosening four fixing bolts.
(Tool: Wrench 13mm)



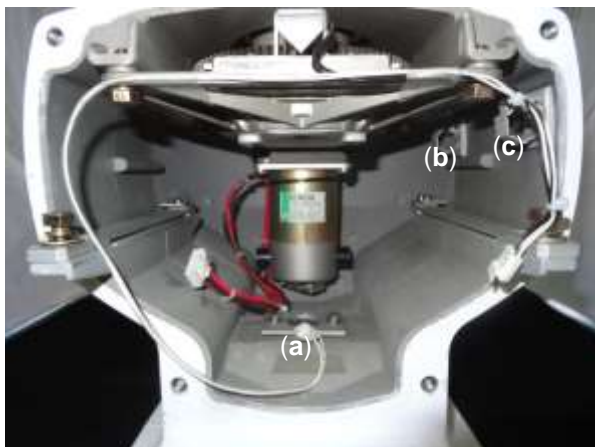
- 2) Disconnect connectors P3 from J3 [E61-120X].
Remove the two fixing bolts.
(Tool: Wrench 13mm)



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

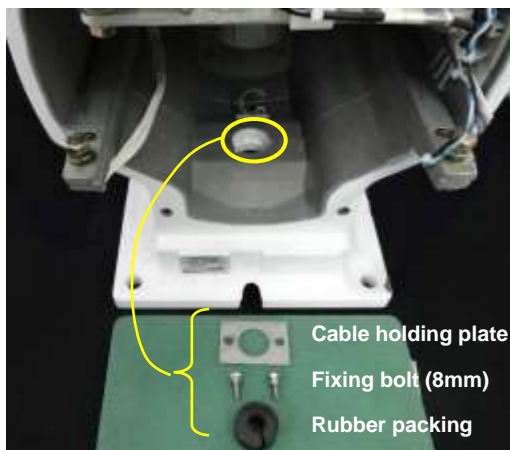


- 4) Disconnect connector P2 from J2 and P2 from J5.



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

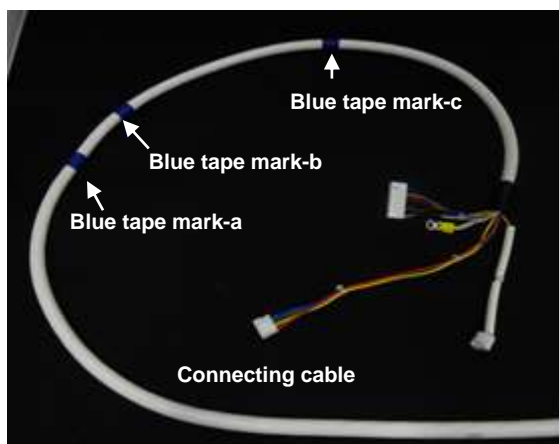
- (a) Cable holder plate
- (b) Cable clamp-b
- (c) Cable clamp-c



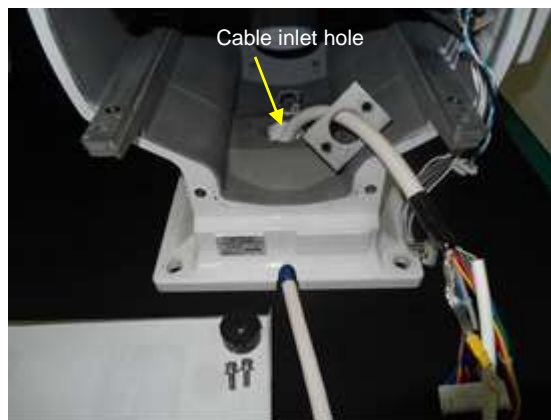
6) Remove two fixing bolts.

(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.



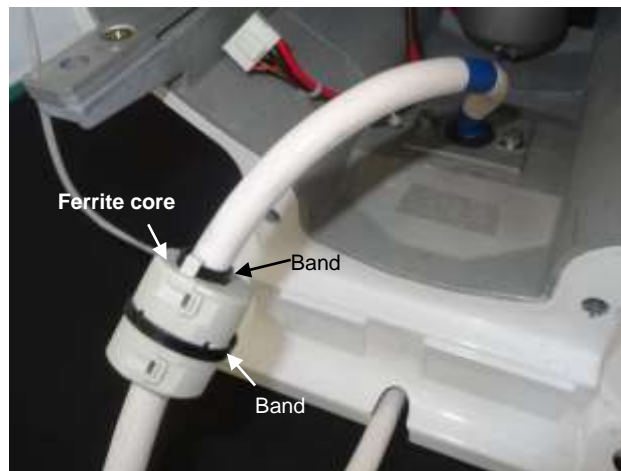
9) Attach rubber packing to the blue tape mark-a.



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

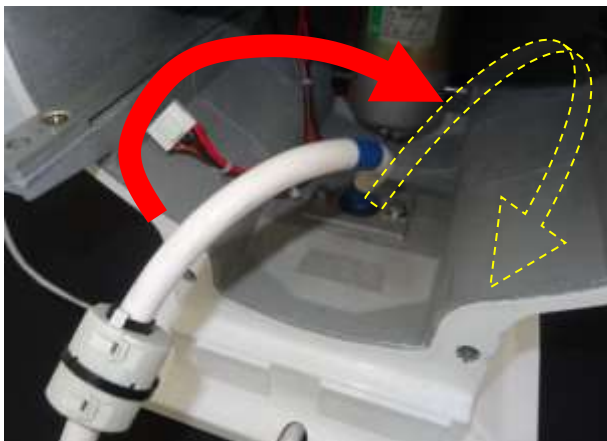


11) Attach the ferrite core from blue tape-b to 10cm end.

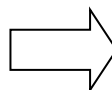


12) Secure the ferrite core in place by using provided bands.

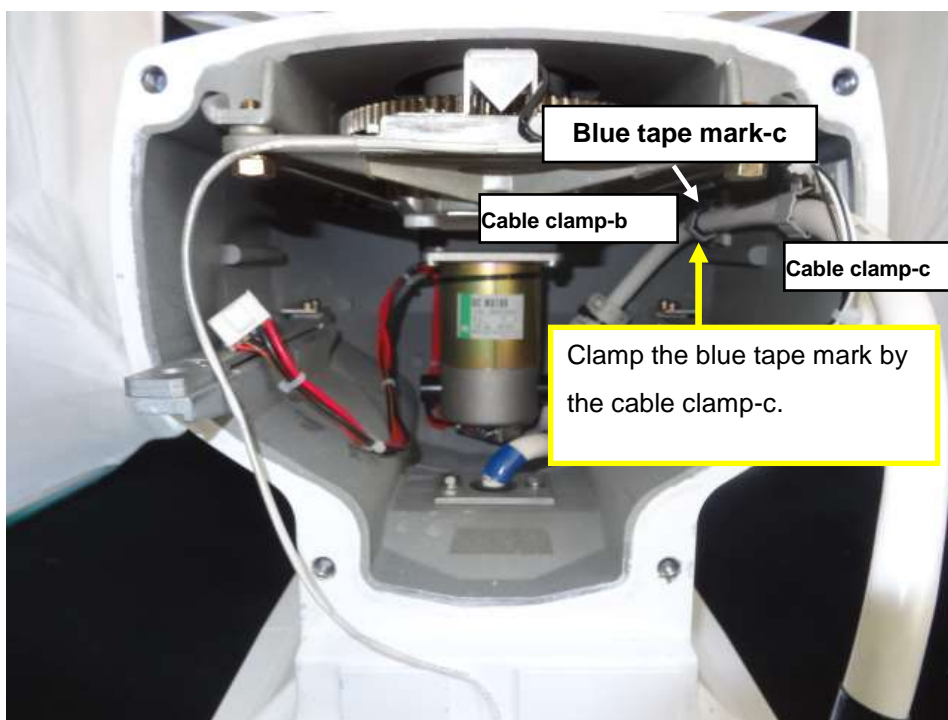
Note: The ferrite core and the bands are included with the installation material.



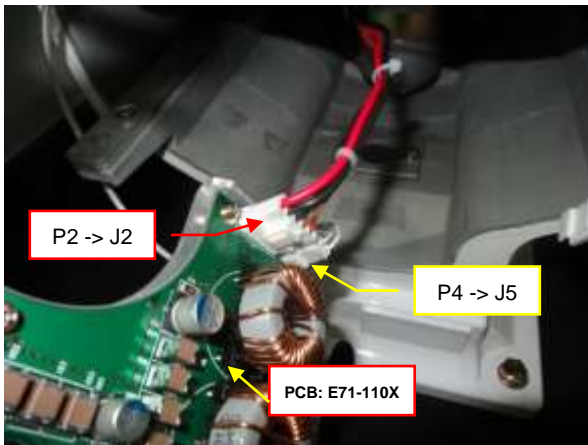
13) The cable placed in the far right under the motor.



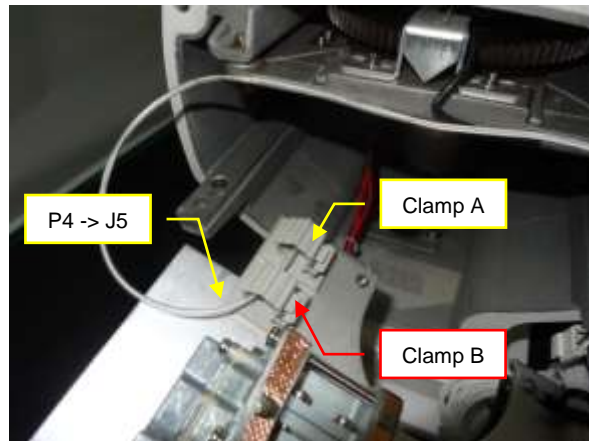
14) Clamp the cable by the cable clamp-b.



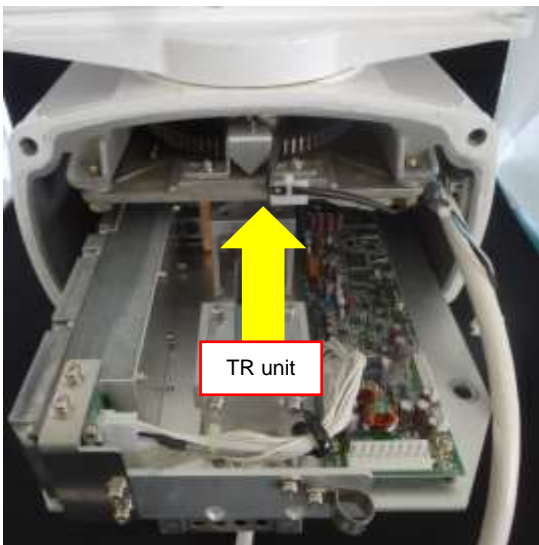
15) This picture is the view of the cable layout.
Clamp the blue tape mark-c by the cable clamp-c.



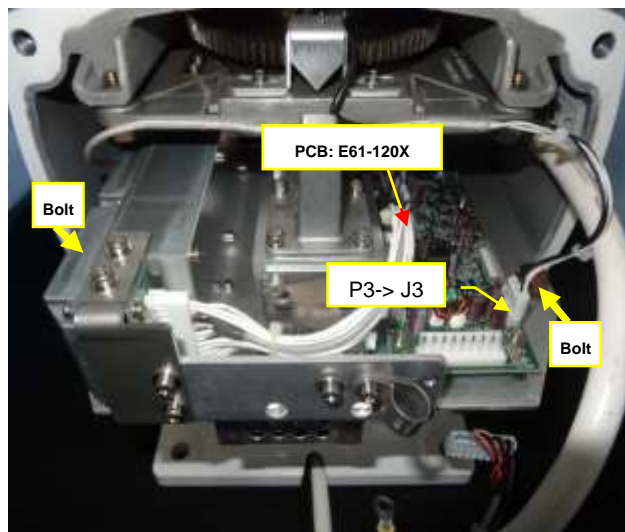
16) Connect connector P2 to J2 and P4 to J5. [PCB E71-110X].



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

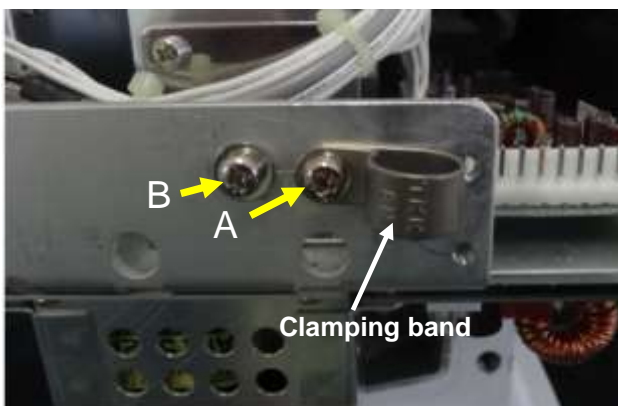


18) Insert TR unit in the scanner unit housing.

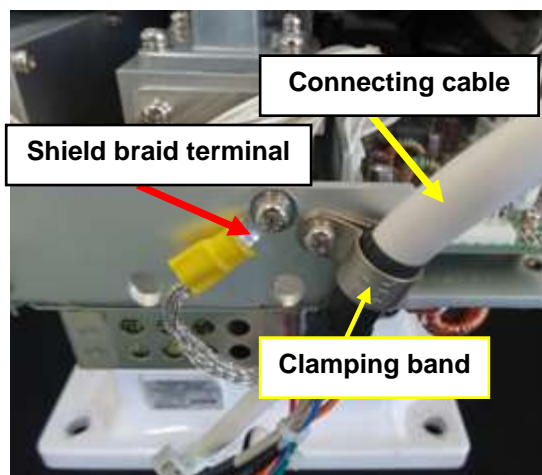


19) Connect connectors P3 to J3 [PCB E61-120X]

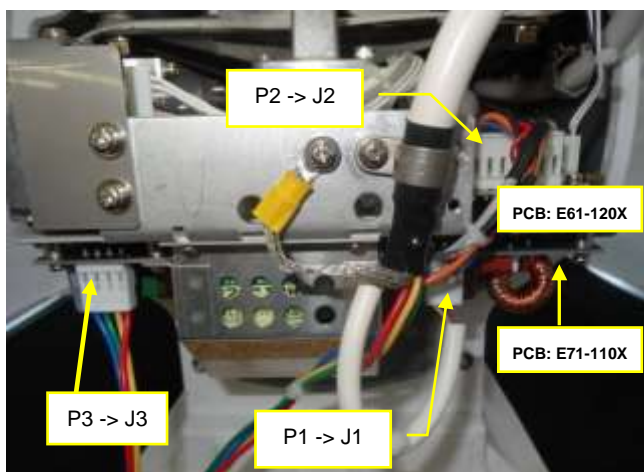
Fix the two fixing bolts.
(Tool: Wrench 13mm)



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].



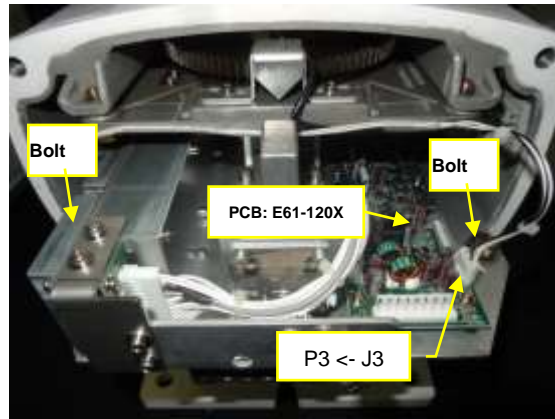
23) Attach the back cover by tightening four fixing bolts.
(Tool: Wrench 13mm)

3.4.4 12kW Open Antenna unit (CW-845-xxM: RB808_MDS-1112R)

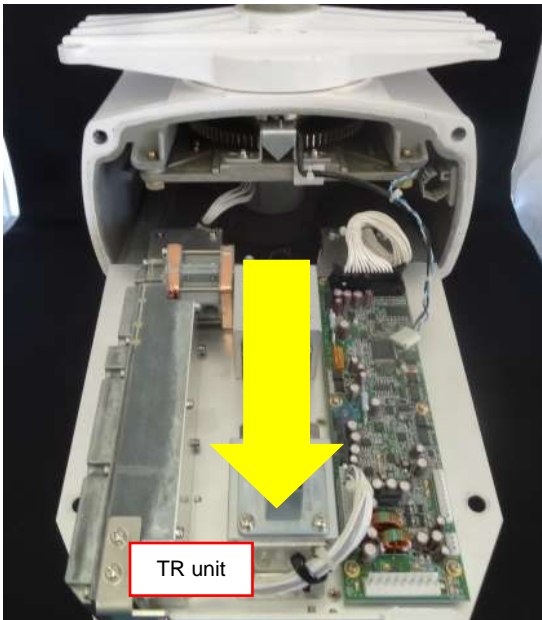
Make sure the radar system is turned off.



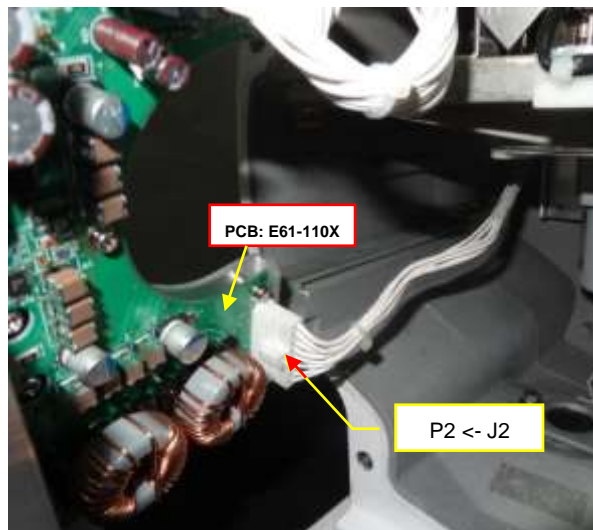
- 1) Remove back cover by loosening four fixing bolts.
(Tool: Wrench 13mm)



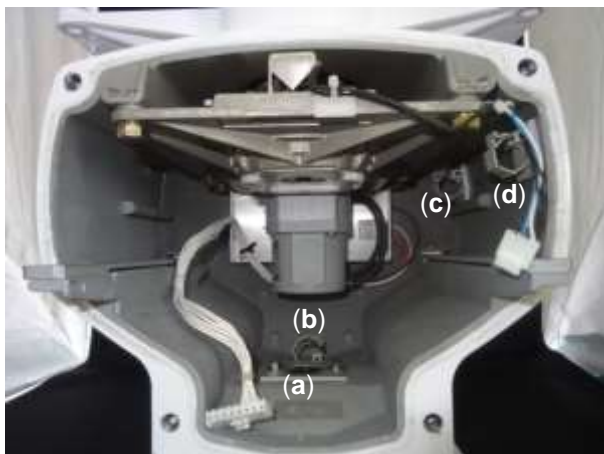
- 2) Disconnect connectors P3 from J3 [E61-120X].
Remove the two fixing bolts.
(Tool: Wrench 13mm)



- 3) Pull out the TR unit.

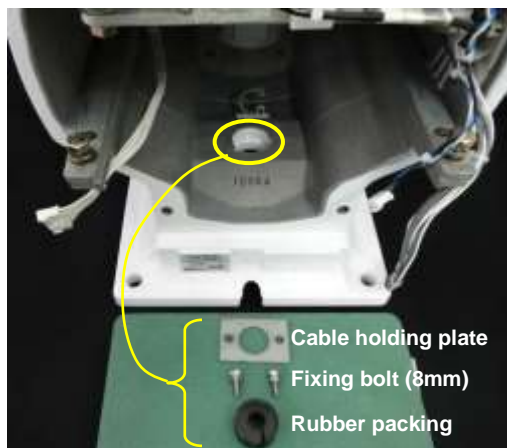


- 4) Disconnect connector P2 from J2 [E61-110X].



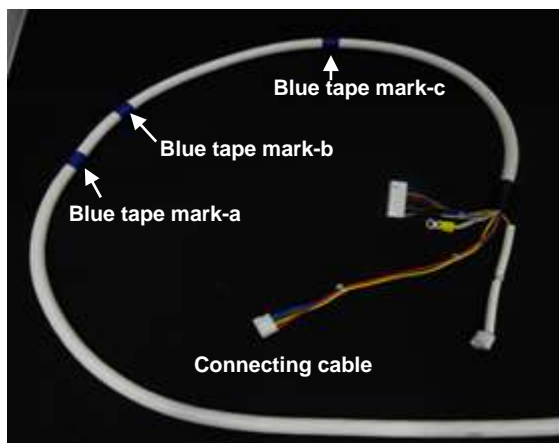
5) This picture is the view of the inside of the scanner unit housing.

- (a) Cable holding plate
- (b) Cable clamp-b
- (c) Cable clamp-c
- (d) Cable clamp-d

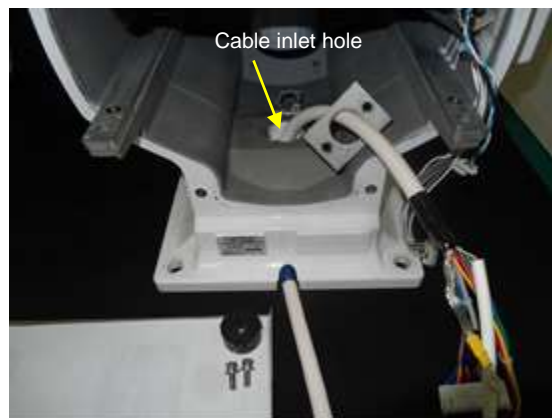


6) Remove two fixing bolts.
(Tool: Wrench 8mm)

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.



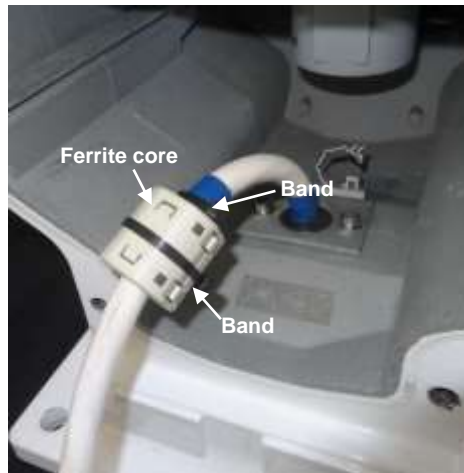
9) Attach rubber packing to the blue tape Mark-a.



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.

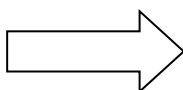


12) Secure the ferrite core in place by using provided bands.

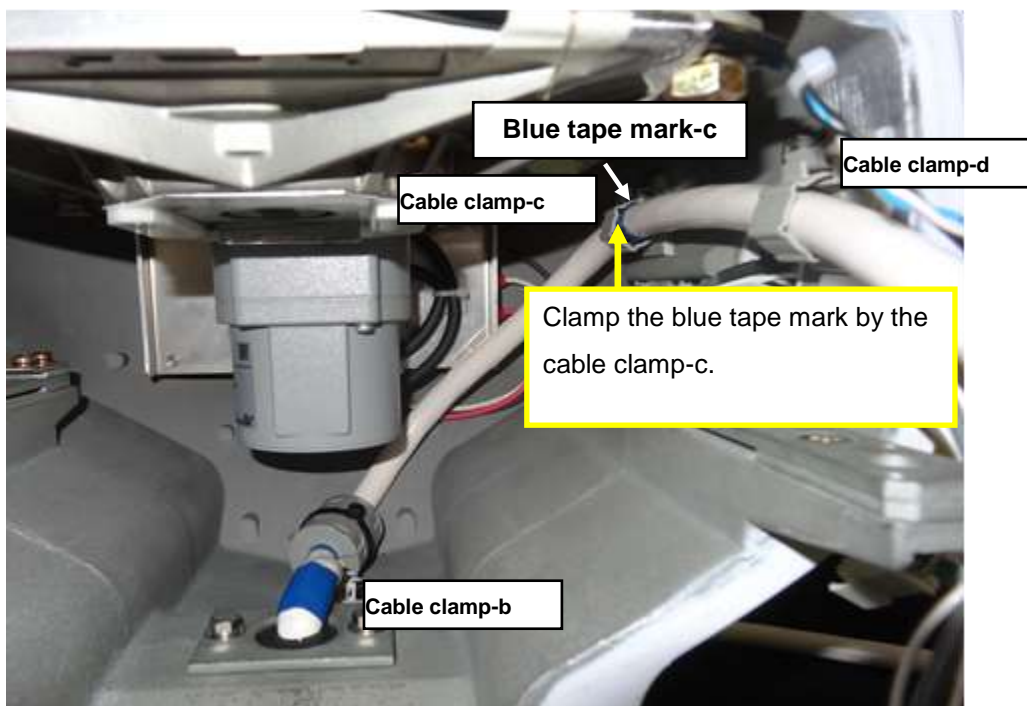
Note: The ferrite core and the bands are included with the installation material.



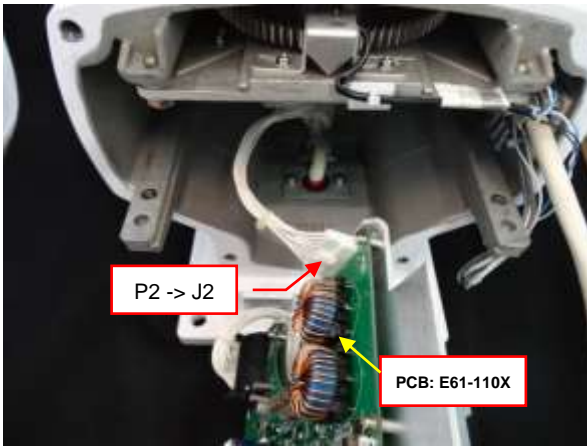
13) Tilt the cable with the ferrite core toward the cable clamp-b.



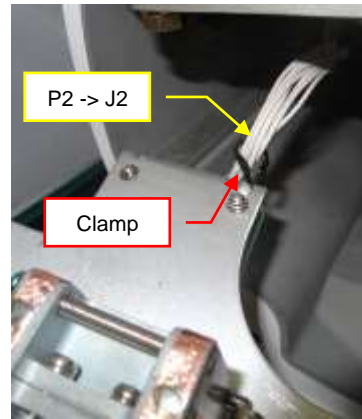
14) Clamp the cable by the cable clamp-b.



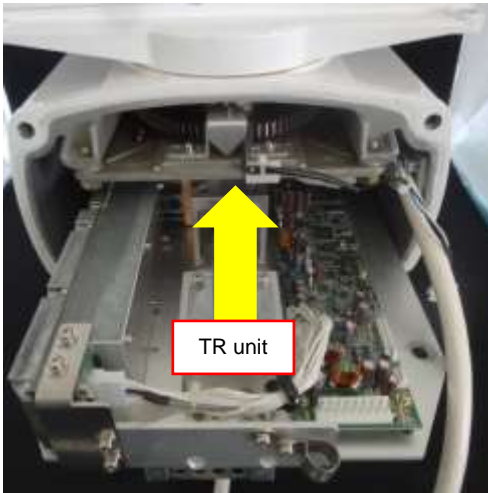
15) This picture is the view of the cable layout.
Clamp the blue tape mark-c by the cable clamp-c.



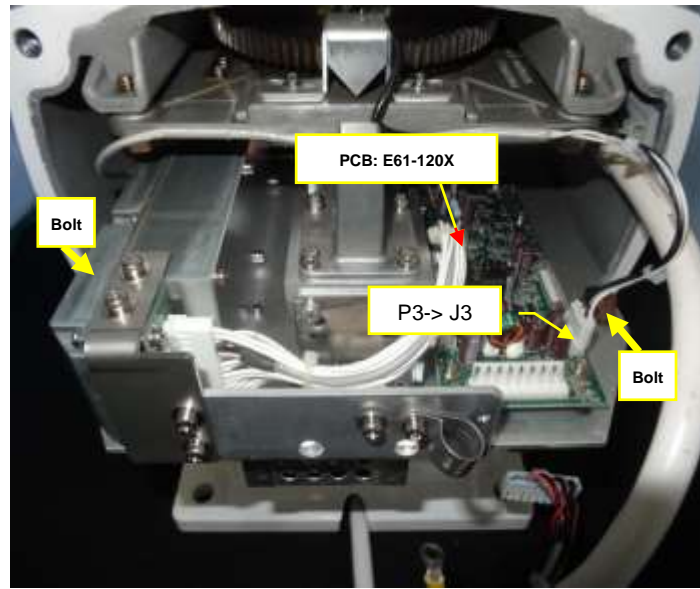
16) Connect connector P2 to J2 [PCB E61-110X].



17) Hook the P2 to J2 to the clamp.

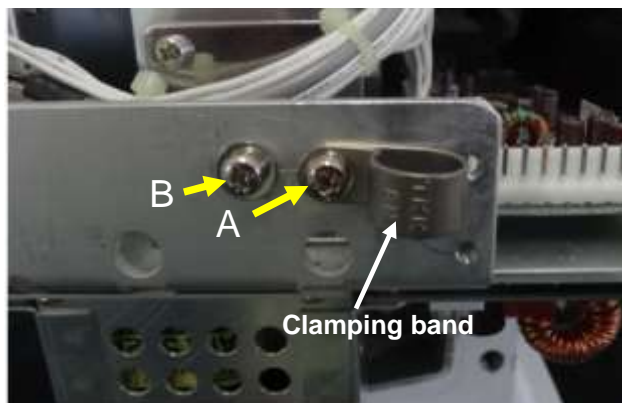


18) Insert TR unit in the scanner unit housing.

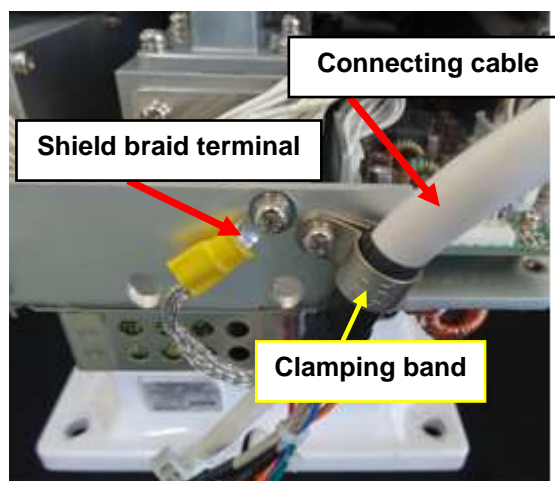


19) Connect connectors P3 to J3 [PCB E61-120X]

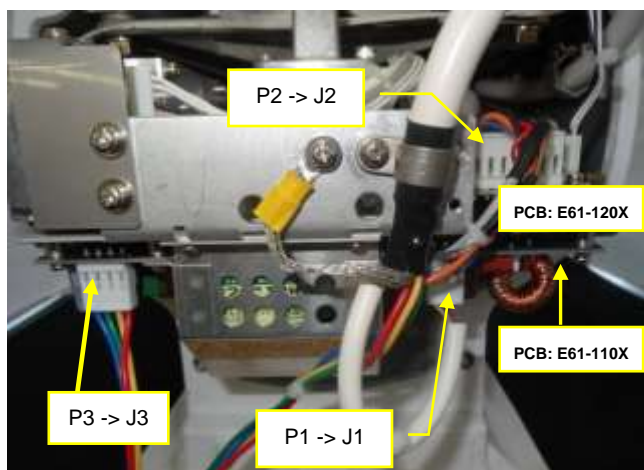
Fix the two fixing bolts.
(Tool: Wrench 13mm)



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].



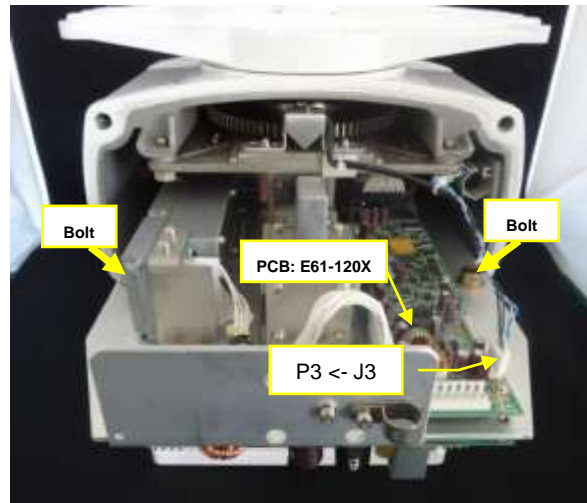
23) Attach the back cover by tightening four fixing bolts.
(Tool: Wrench 13mm)

3.4.5 25kW Open Antenna unit (CW-845-xxM: RB809_MDS-1125R)

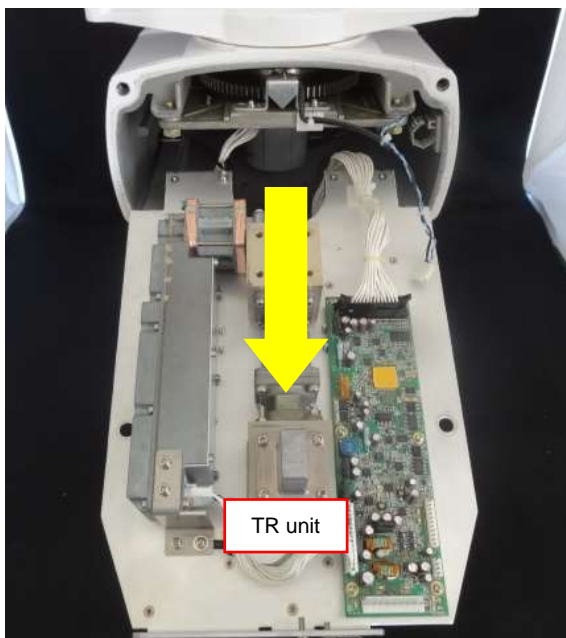
Make sure the radar system is turned off.



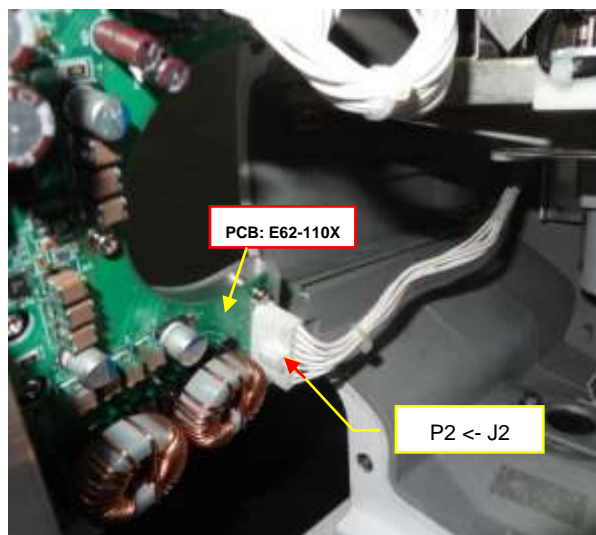
- 1) Remove the back cover by loosening four fixing bolts.
(Tool: Wrench 13mm)



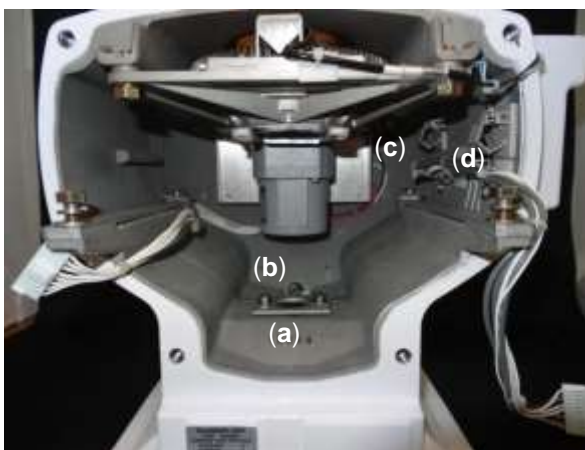
- 2) Disconnect connectors P3 and P4 from J3 and J4 [E61-120X].
Remove the two fixing bolts.
(Tool: Wrench 13mm)



- 3) Pull out the TR unit.

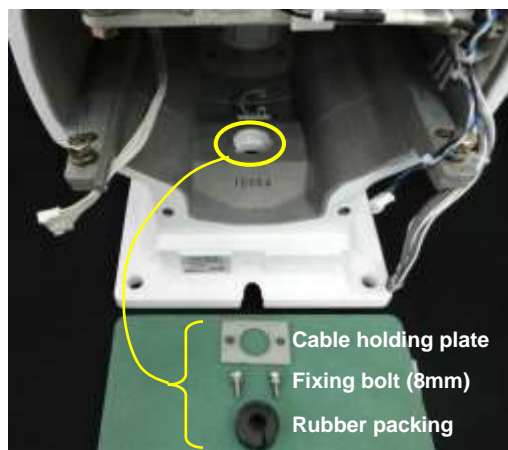


- 4) Disconnect connector P2 from J2 [E62-110X].



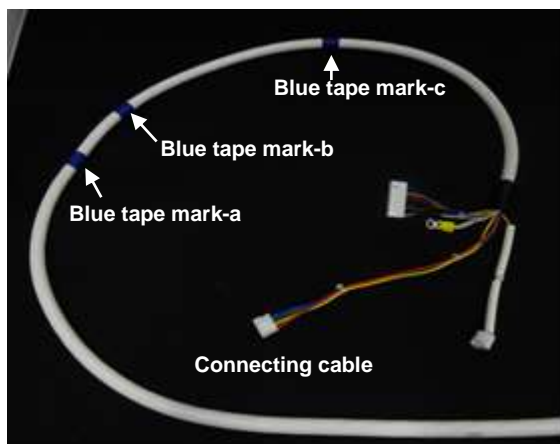
5) This picture is the view of the inside of the scanner unit housing.

- (a) Cable holding plate
- (b) Cable clamp-b
- (c) Cable clamp-c
- (d) Cable clamp-d

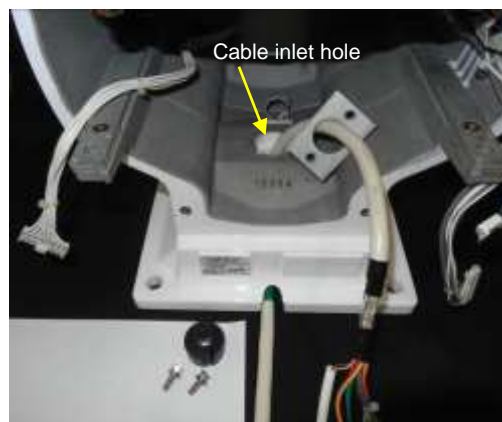


6) Remove the fixing two bolts.
(Tool: Wrench 8mm)

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.



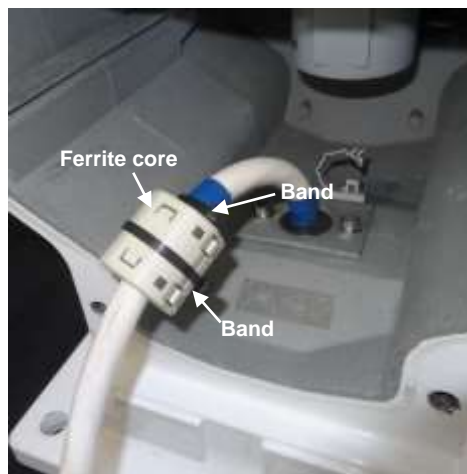
9) Attach rubber packing to the blue tape Mark-a.



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

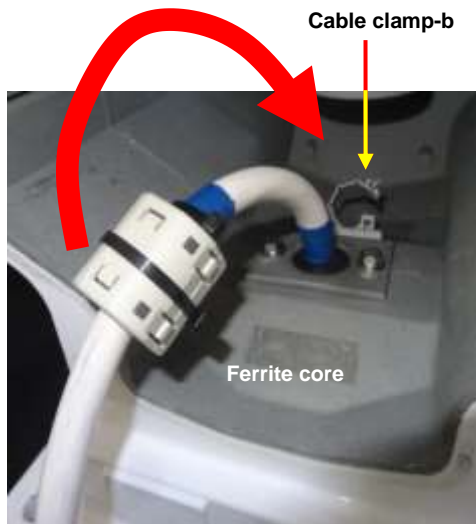


11) Attach the ferrite core to side of the blue tape mark-b.

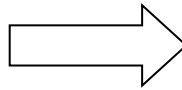


12) Secure the ferrite core in place by using provided bands.

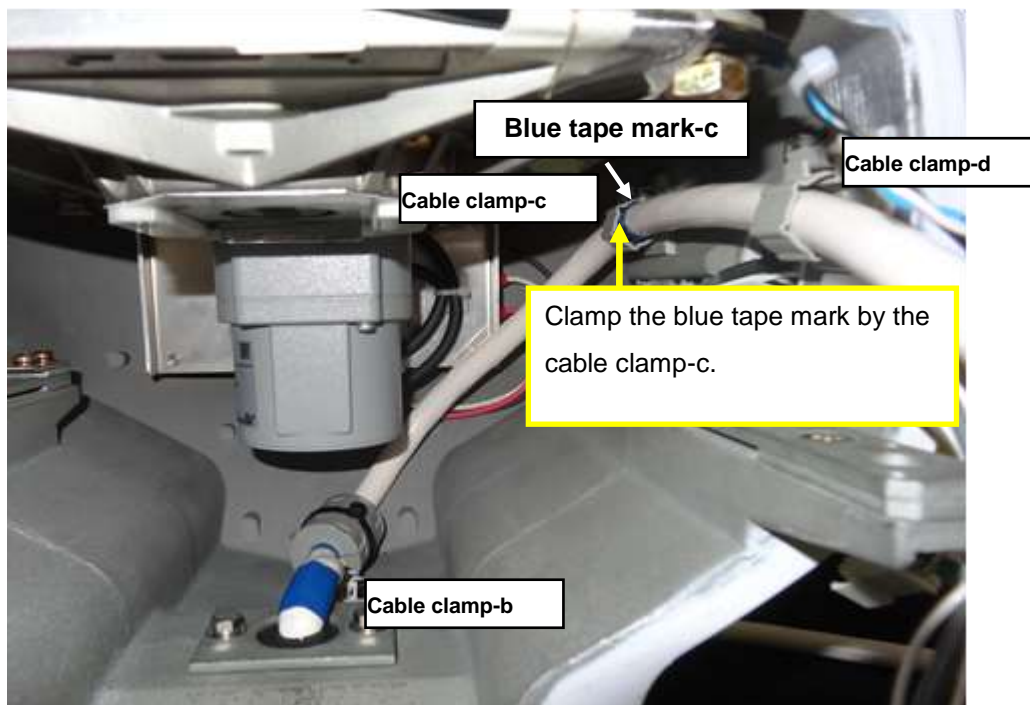
Note: The ferrite core and the bands are included with the installation material.



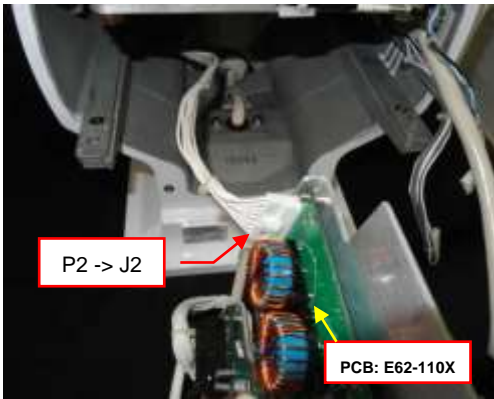
13) Tilt the cable with the ferrite core toward the cable clamp-b.



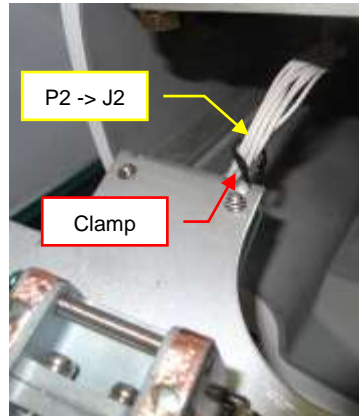
14) Clamp the cable by the cable clamp-b.



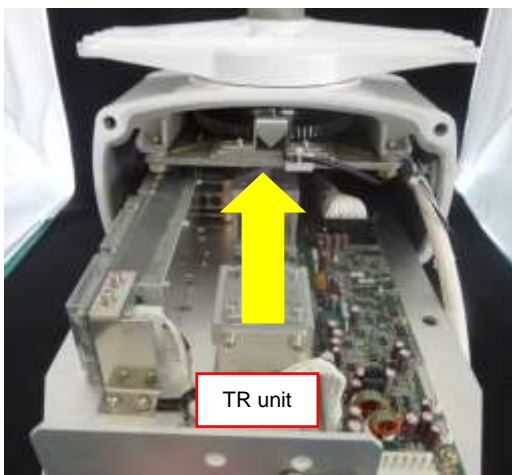
15) This picture is the view of the cable layout.
Clamp the blue tape mark-c by the cable clamp-c.



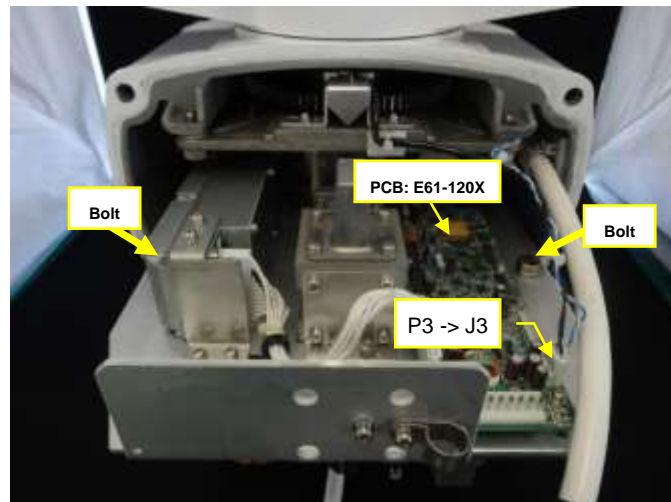
16) Connect connector P2 to J2 [PCB 62-110X].



17) Hook the P2 to J2 to the clamp.

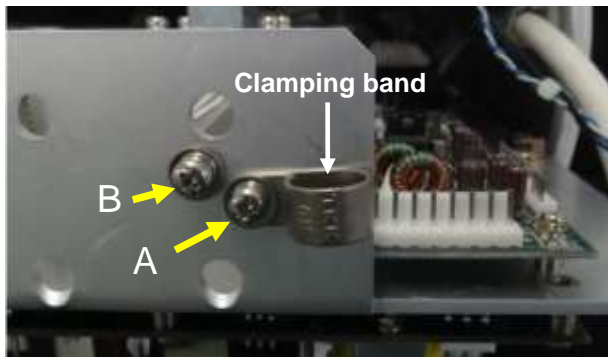


18) Insert the TR unit in the scanner unit housing.

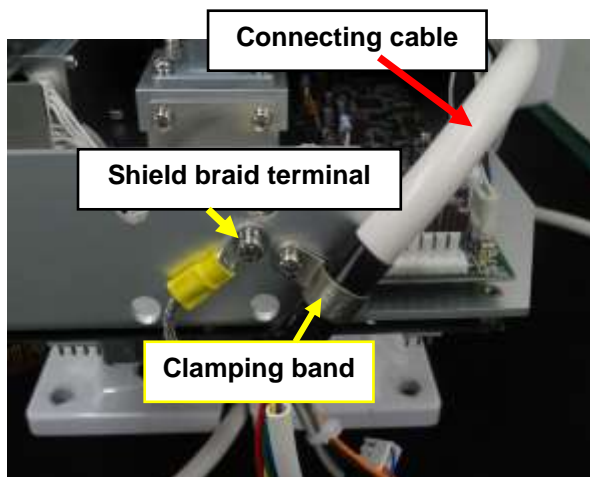


19) Connect connectors P3 and P4 to J3 and J4 [PCB E61-120X]

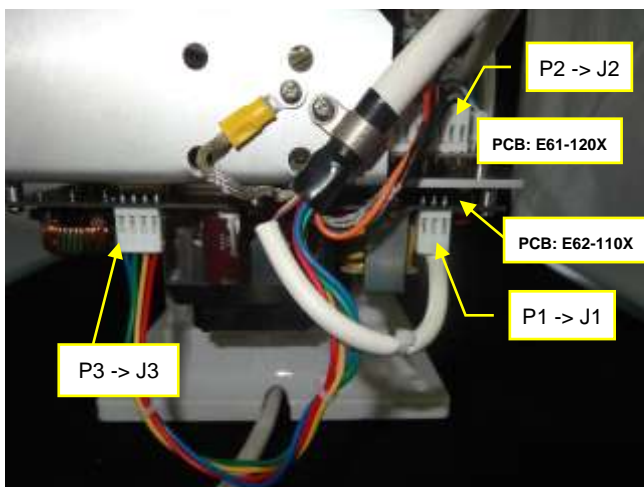
Fix the two fixing bolts.
(Tool: Wrench 13mm)



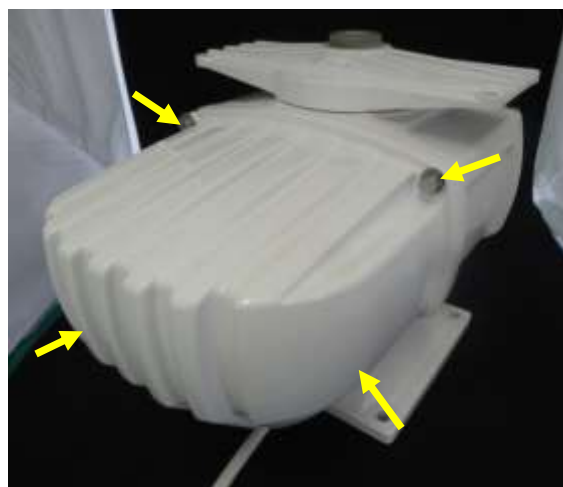
20) Remove screw-A and screw-B.



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



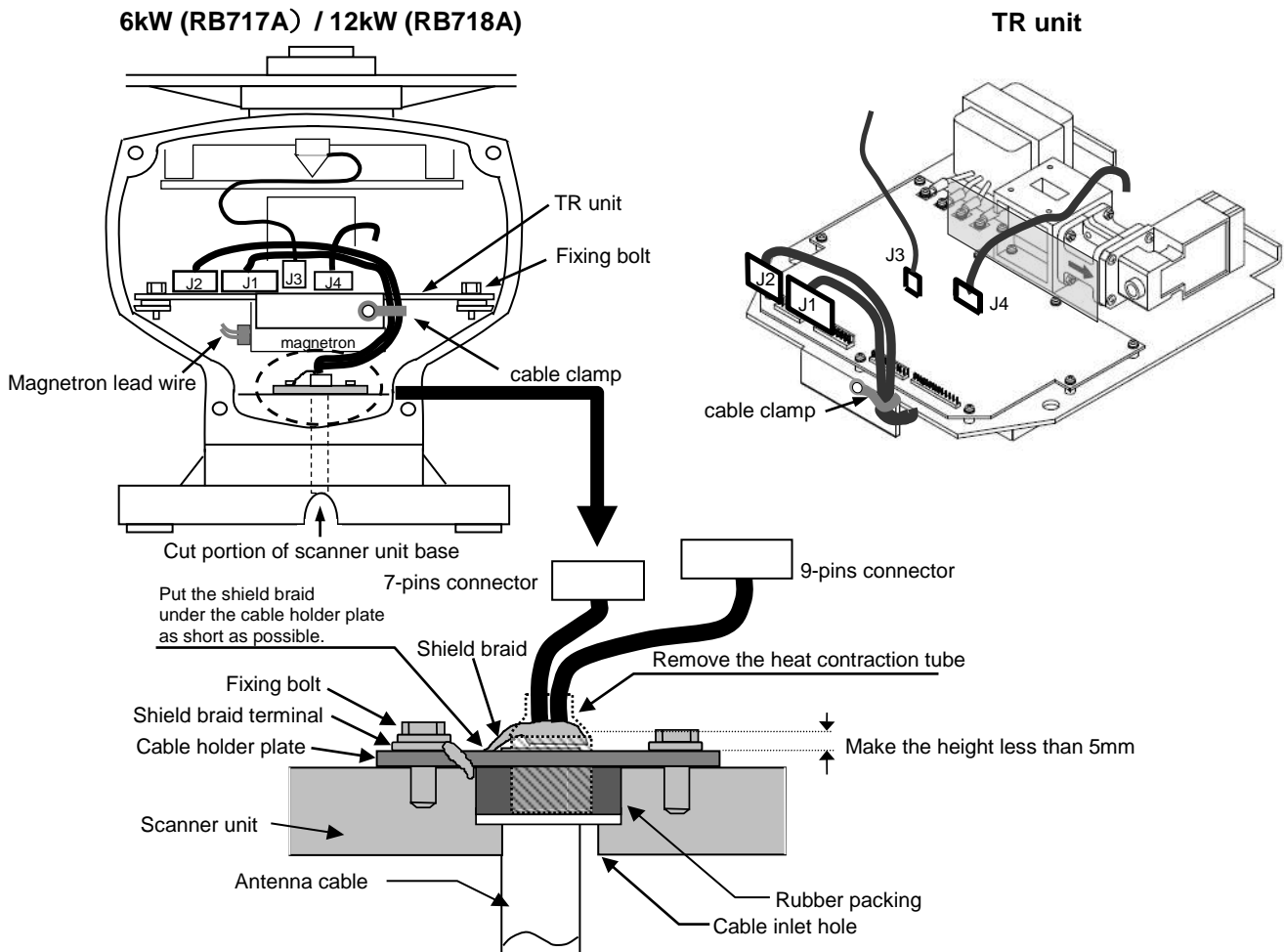
22) Connect connector P2 to J2 [PCB E61-120x].
Connect connectors P1 and P3 to J1 and J3 [PCB E62-110X].



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

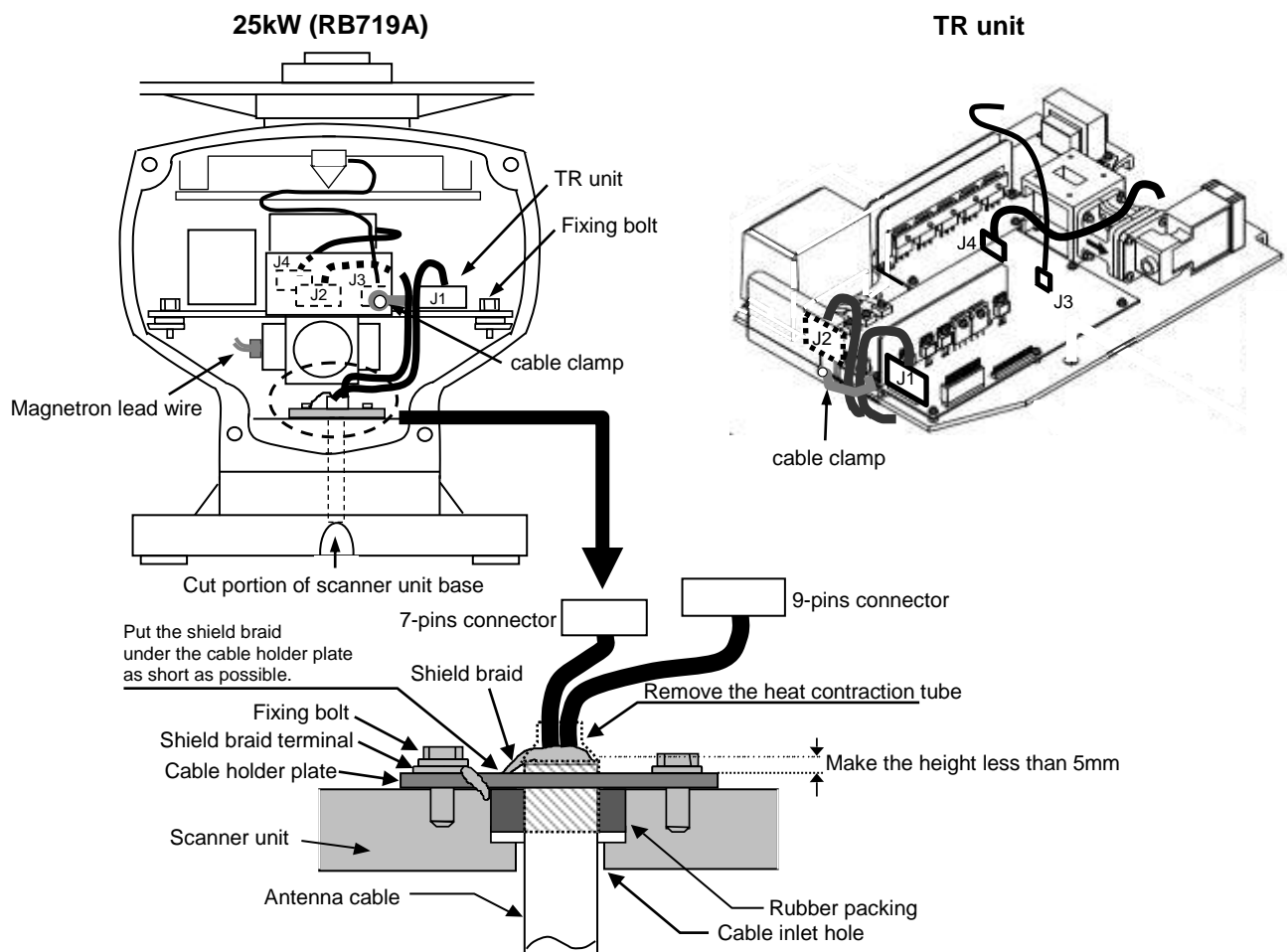
3.4.6 6kW Open Antenna unit (242J159098x: RB717A_MDS-1160R), 12kW Open Antenna unit (242J159098x: RB718A_MDS-1110R)

- (1) 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 J3 and J4 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 J3 and J4 connectors (removed in 3) by fixing bolts.
- (8) 7 pin connector shall be connected to J2 of the TR unit, 9 pin connector to J1.
- (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.



3.4.7 25kW Open Antenna unit (242J159098x: RB719A_MDS-1120R)

- (1) 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 J3 and J4 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 J3 and J4 connectors (removed in 3) by fixing bolts.
- (8) 7 pin connector shall be connected to J2 of the TR unit, 9 pin connector to J1.
- (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.

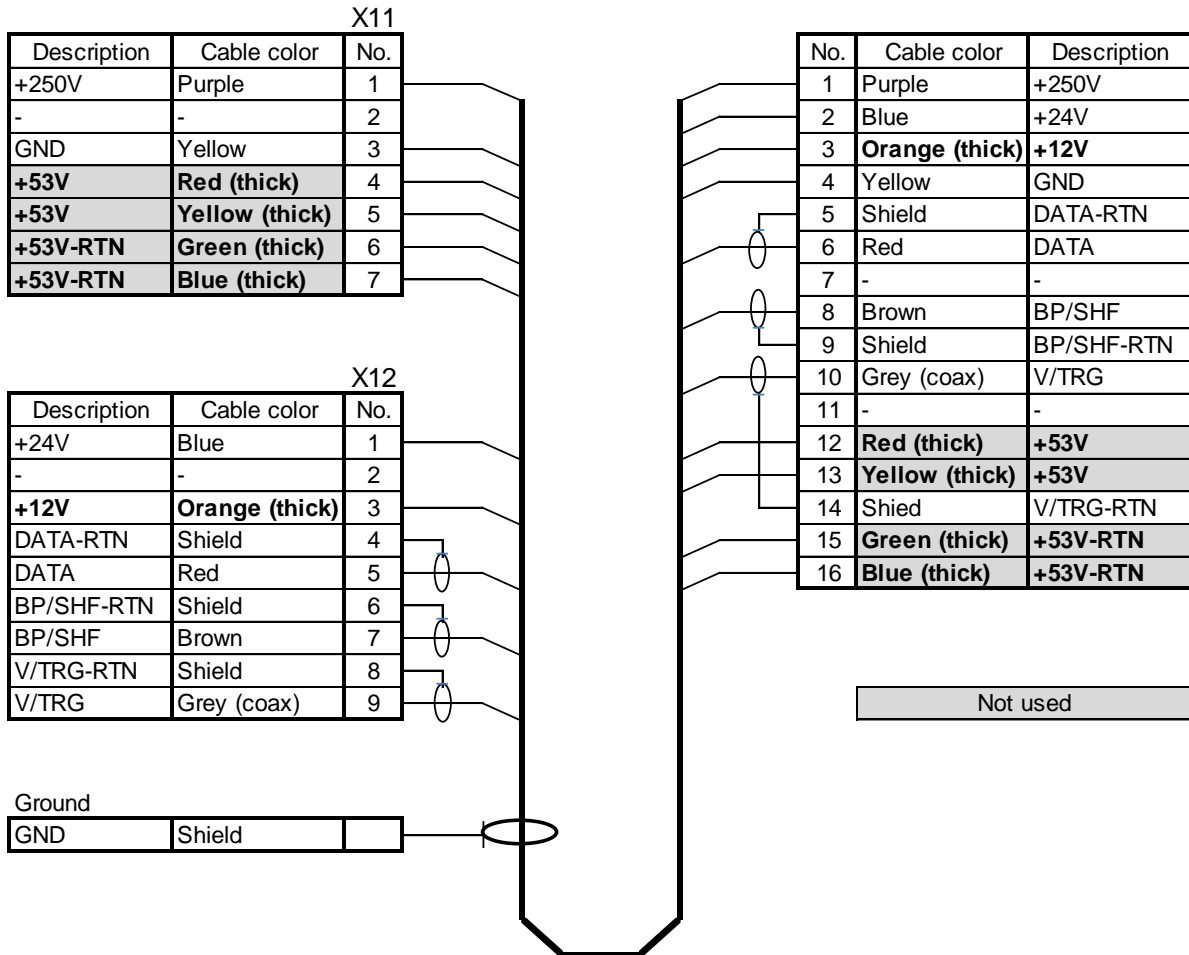


3.5 Interconnection diagram of cable

3.5.1 242J158055x (MDS-1103R/1105R)

Antenna-Scanner unit

Control unit

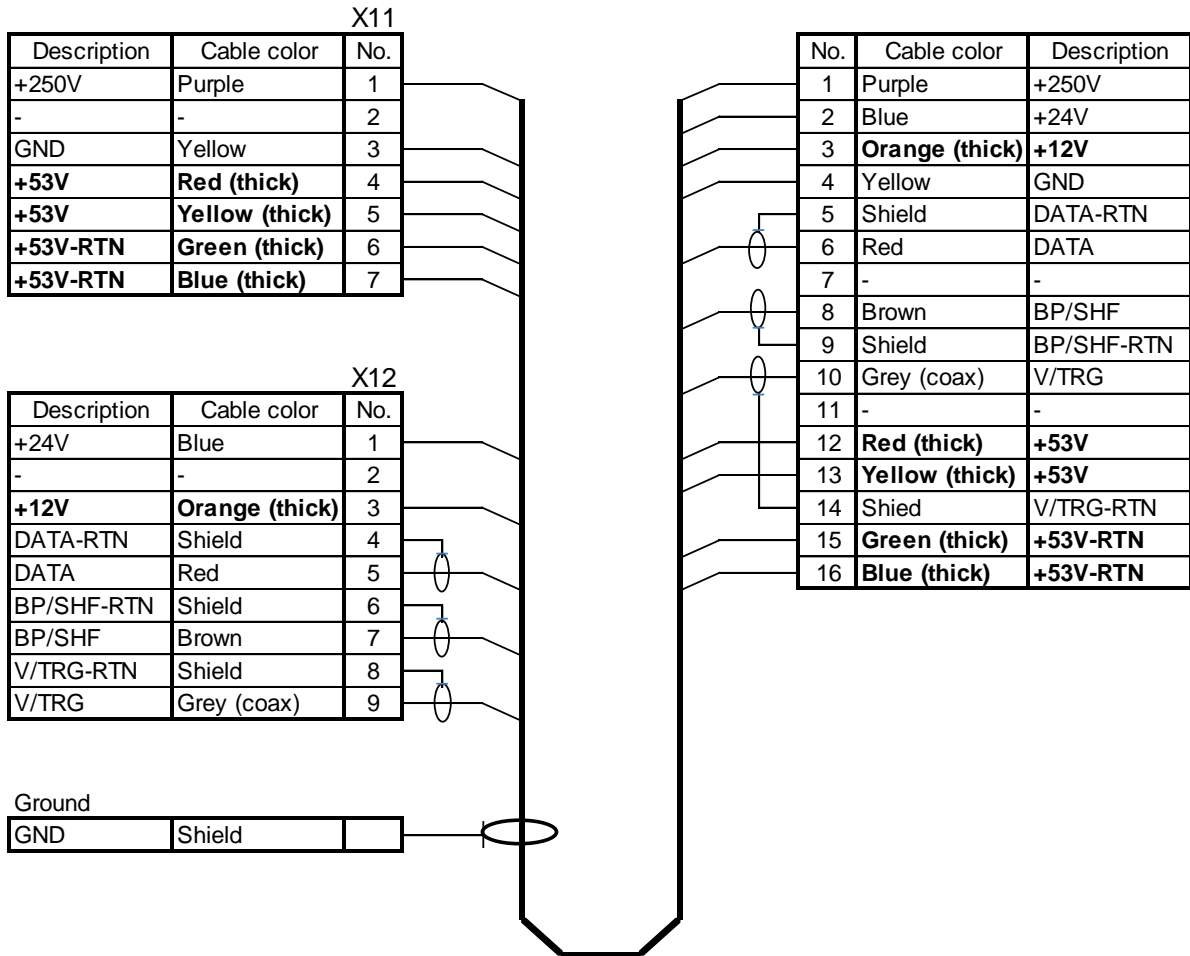


Interconnection of cable (242J158055x) between Antenna-Scanner unit and Control Box

3.5.2 242J159098x (MDS-1104R/1160R/1110R/1120R)

Antenna-Scanner unit

Control unit

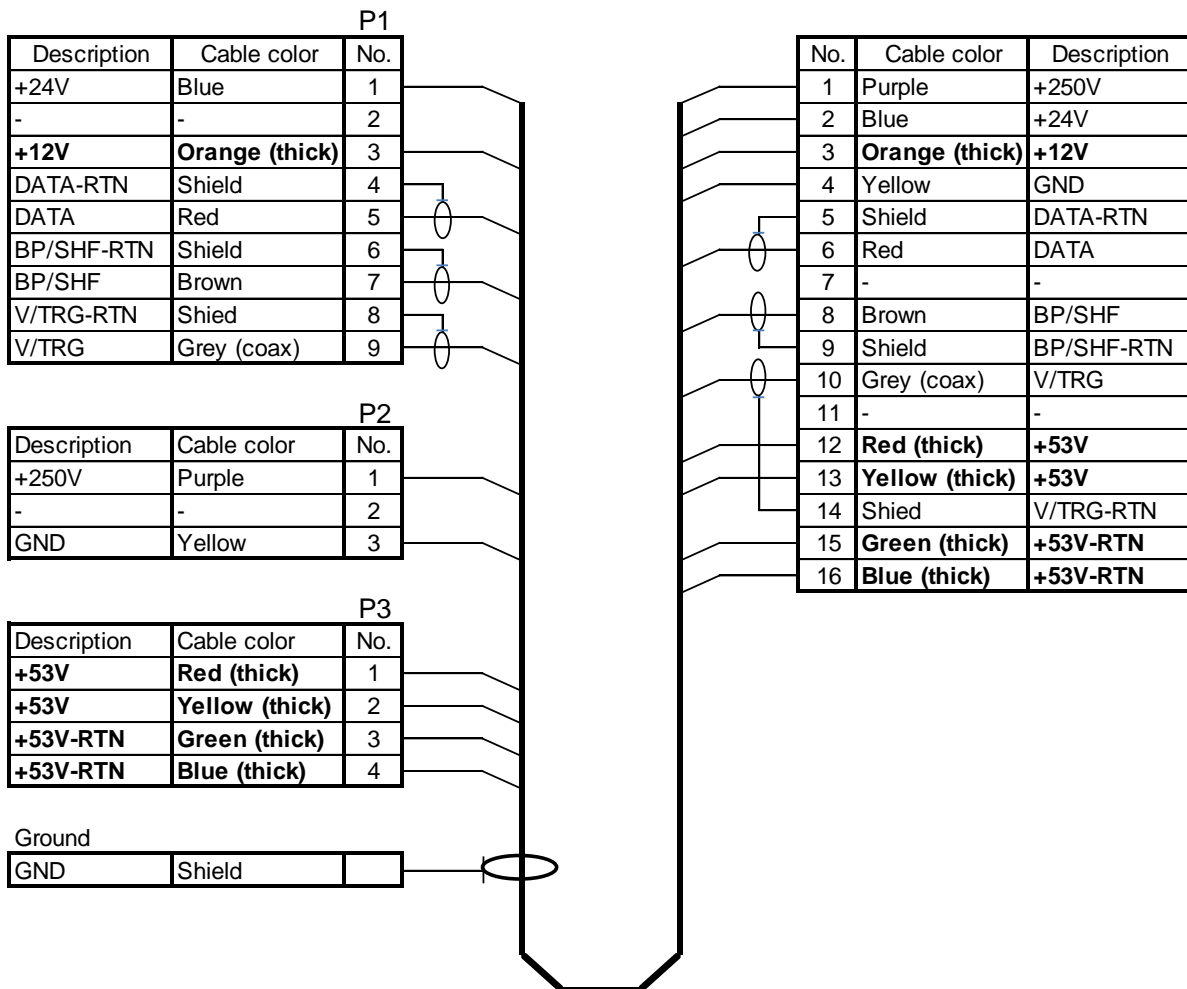


Interconnection of cable (242J159098x) between Antenna-Scanner unit and Control Box

3.5.3 CW-845 (MDS-1106R/1112R/1125R)

Antenna-Scanner unit

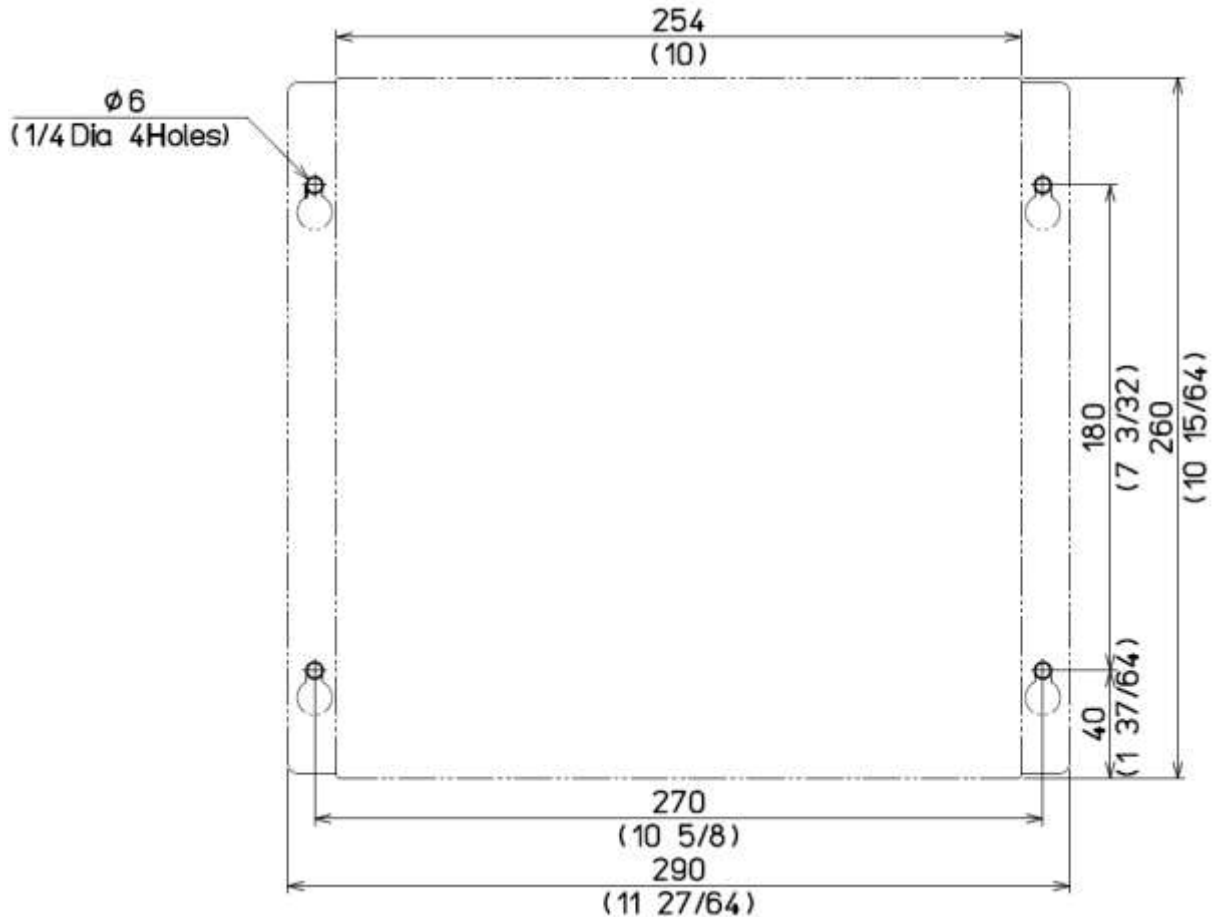
Control unit



Interconnection of cable (CW-845) between Antenna-Scanner and Control Box

3.6 Installation of the Control Box

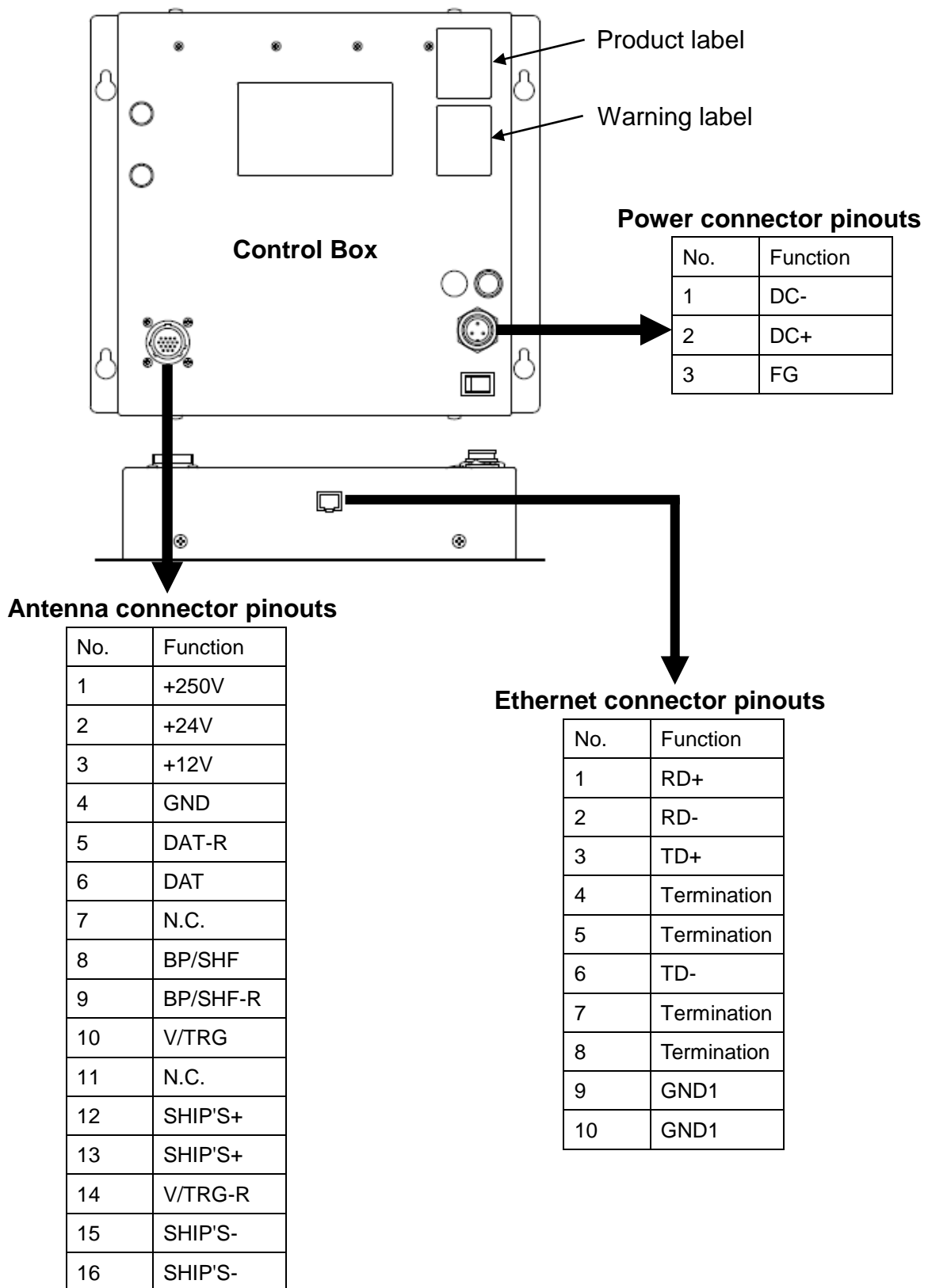
After you have finished installing the scanner unit, install the Control Box in the same way. Choose a proper bolt length according to the thickness of the surface on which you are going to install the Control Box. The hole diameter is different when using the bolts or the tapping screws. When using tapping screws, drill holes in a matched size. When using bolts and nuts, drill the holes of 6 mm (0.24 in.) diameter. When you have finished, install the pedestal part first and then the Control Box.



Dimensions of the fixing hole positions

Unit: mm (inch)

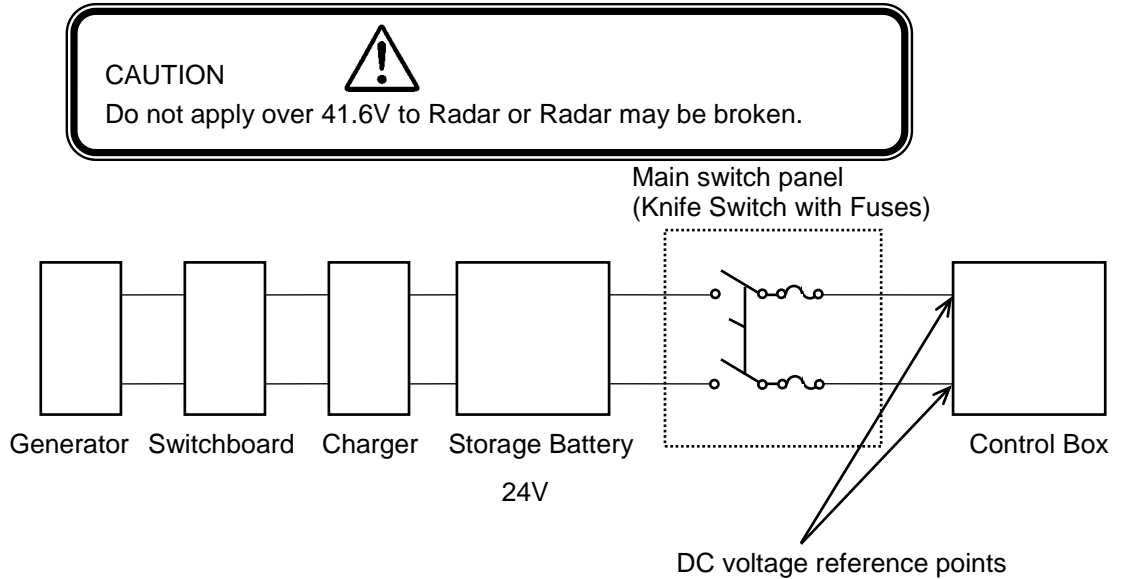
3.6.1 Control Box connector pinouts



Control Box – Connector pinouts

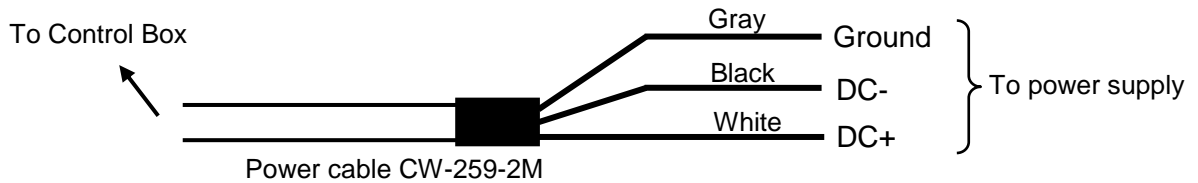
3.6.2 Power supply wiring

Power should be fed through a switch and protective fuses (or circuit breakers), as shown below.



Typical power supply switch wiring

Fit the power supply cable (included with your radar) to the receptacle labeled "POWER" on the Control Box and connect to power supply as followings.



Details of the Power Supply cable connections

3.7 Connecting the PC

The connections of the Control Box can be made straight to the PC or via an Ethernet Hub. Use the following instructions for connections.

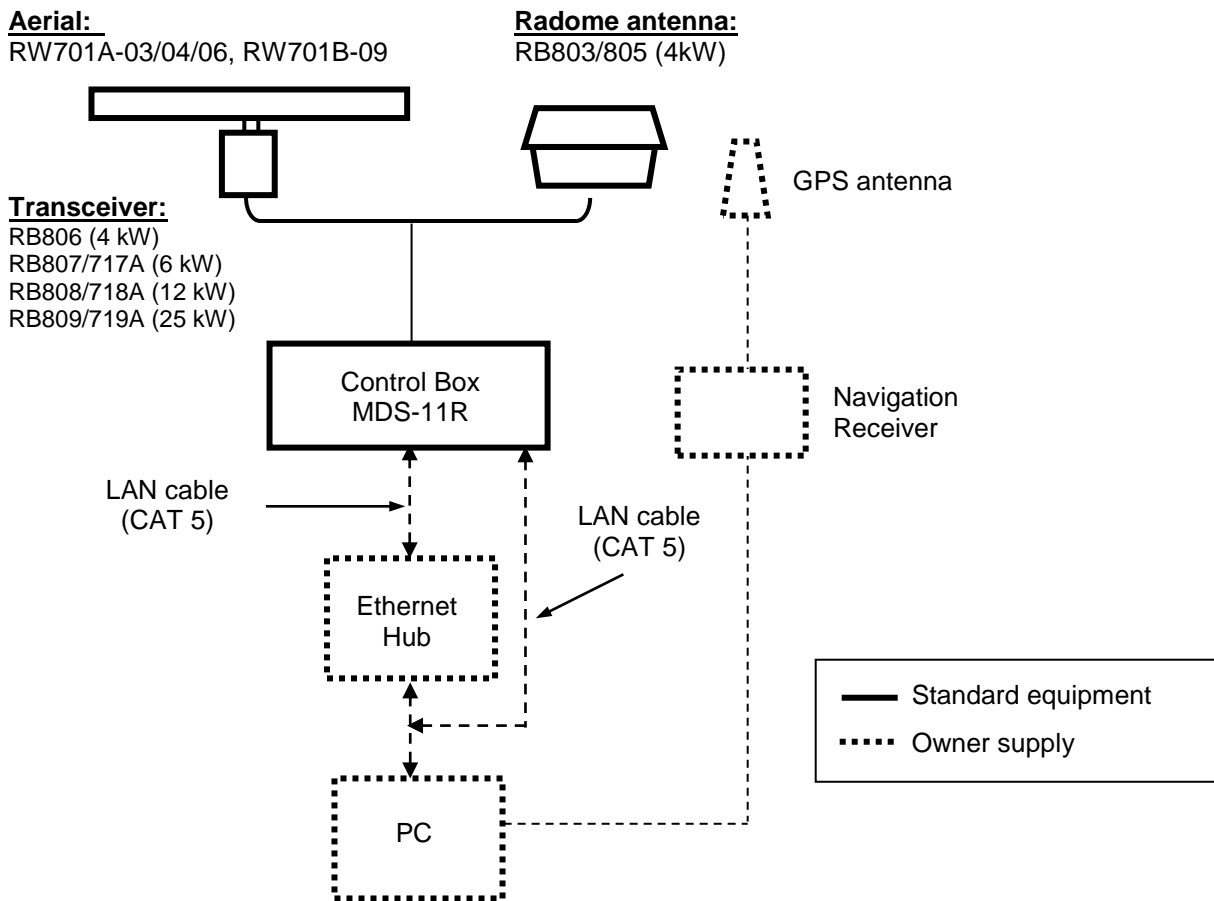
3.7.1 Ethernet (LAN) interface cable connection

Connection via the Ethernet Hub:

Connect the Control Box to the Ethernet Hub unit with optional LAN cable (straight type, 2 m length). From the Hub unit to the PC, use a commercially available LAN cable (straight type) for connection.

Connection without the Ethernet Hub:

Use the standard LAN cable (cross type, 2 m length) to connect the Control Box to the PC.



Ethernet (LAN) Interface Cable Connection

Chapter 4 Specifications

4.1 Antenna Specification

		MDS-1103R/ MDS-1105R	MDS-1104R	MDS-1106R/ MDS-1160R	MDS-1112R/ MDS-1110R	MDS-1125R/ MDS-1120R
Aerial		1.2/2feet Radome	3/4/6feet Open Array	4/6feet Open Array	4/6/9feet Open Array	
Peak power output		4kW	4kW	6kW	12kW	25kW
Transmit frequency		9410 ± 30 MHz				
Beam width	Horizontal	5.9°/3.9°	2.5°/1.8°/1.2°	1.8°/1.2°	1.8°/1.2°/0.8°	
	Vertical	25°	22°	22°	22°/22°/25°	
Rotation		24/48rpm			24/42rpm (MDS-1112R/1125R) 24/48rpm (MDS-1110R/1120R)	
Pulse length/PRF		0.08µs/2000Hz 0.15µs/1800Hz 0.3µs/1500Hz 0.5µs/800Hz 1.0µs/500Hz		0.08µs/2500Hz 0.25µs/2000Hz 0.5µs/1000Hz 0.7µs/700Hz 1.0µs/500Hz 1.0µs/450Hz		0.08µs/2000Hz 0.3µs/1600Hz 0.6µs/800Hz 0.8µs/600Hz 1.2µs/470Hz 1.2µs/400Hz
IF center frequency		60MHz				
IF bandwidth		15MHz/3MHz				
Noise figure		6.5dB nominal				
Operating temperature		-25°C to +55°C				
Wind force		100 knots relative				
Water resistance		IPX6 (IEC60945)				
Range scales (NM)		1/8, 1/4, 1/2, 3/4, 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64, 72, 96				
Minimum range		Better than 25 m on 1/8 NM range				
Range discrimination		Better than 25 m				
Range accuracy		Better than 8 m or 0.9% of maximum range of the scale in use				
Bearing accuracy		Better than 1°				
Other functions		Gain, STC, FTC, interference rejection, target expansion				

4.2 Interface Specification (MDS-11R to PC)

Communication mode	10BASE-T/100BASE-TX (Ethernet)
Data rate	10Mbps/100Mbps
Output	Radar image video by proprietary protocol
Input	Radar control by proprietary protocol

4.3 Power Supply Specification

	MDS-1103R/ MDS-1105R	MDS-1104R	MDS-1106R MDS-1160R	MDS-1112R MDS-1110R	MDS-1125R MDS-1120R
Power supply	21.6 to 41.6 VDC				
Power consumption	60W or less	70W or less	90W or less	110W or less	150W or less
Warm-up time	2 min				3 min

4.4 Compass Safe Distance

Component Unit	Type Name	Standard	Steering
Antenna unit	RB804	2.0 m	1.4 m
	RB805	2.0 m	1.4 m
	RB806	2.0 m	1.4 m
	RB807	2.0 m	1.4 m
	RB808	2.0 m	1.4 m
	RB809	2.0 m	1.4 m
	RB717A	1.4 m	0.95 m
	RB718A	1.4 m	0.95 m
	RB719A	1.2 m	0.65 m
Control Box	MDS-11R	0.5 m	0.4 m

4.5 Environmental Specification

To the requirements of IEC 60945 3rd Edition. The major environmental specifications are as follows:

(1) Temperature and humidity

	Operating temperature	Storage temperature	Humidity
Antenna unit	-25°C to +55°C	+77°C	93%+/-3% at +40°C
Control Box	-15°C to +55°C	+55°C	93%+/-3% at +40°C

(2) Vibration

2-5 Hz up to 13.2 Hz: Amplitude +/-1mm +/-10% (Maximum acceleration 7m/s² at 13.2 Hz)

13.2 Hz up to 100 Hz: Maximum acceleration 7 m/s² constant

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Chapter 5 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.

5.1 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
	MSF1422B	RB717A	2000 to 3000H
	MSF1425B	RB718A	2000 to 3000H
	M1458A	RB719A	1000 to 2000H
Geared motor	VGKC12-25N50L2XT6	RB808/809	5000H
	23G61668	RB806/807/717A/718A/719A	5000H
Motor brush	24Z125209	RB806/807/717A/718A/719A	2000H
Fan	F614T-12MC	RB809/719A	70000H

5.2 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.

5.2.1 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.

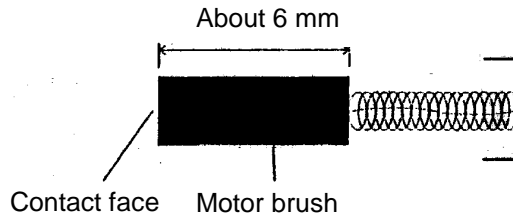


Never turn on the power of radar system under inspection.

- (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.


5.2.2 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.

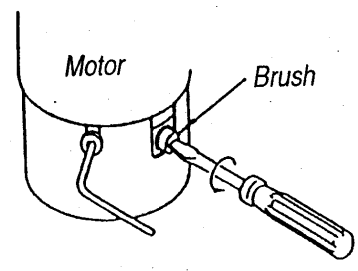
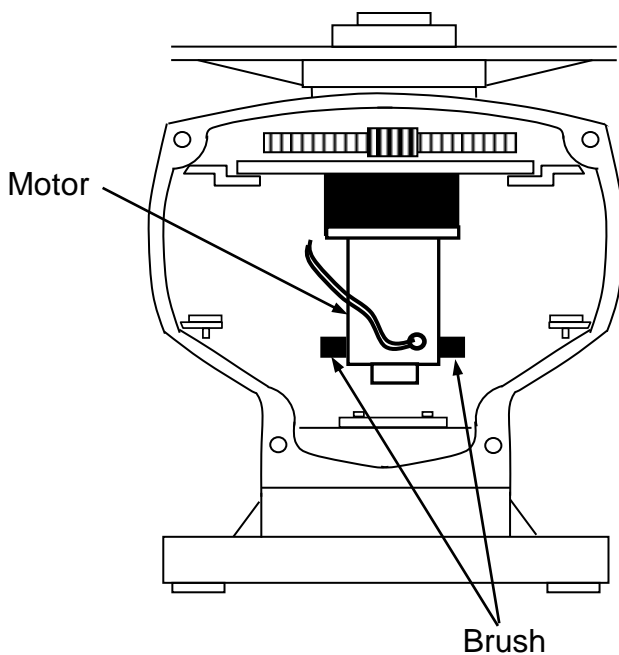


Instructions for changing the motor brushes

- (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.
- (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



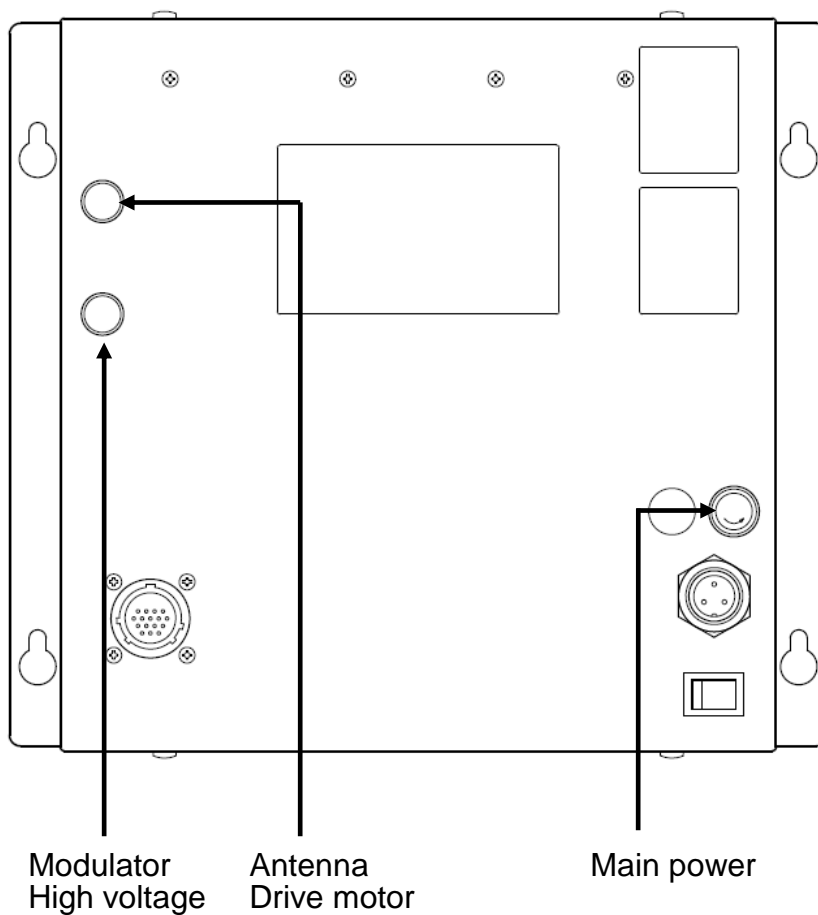
Gently turn the screwdriver counter clockwise to remove the motor brush.

5.3 On board repair

5.3.1 Replacement of fuse

Fuse type and rating

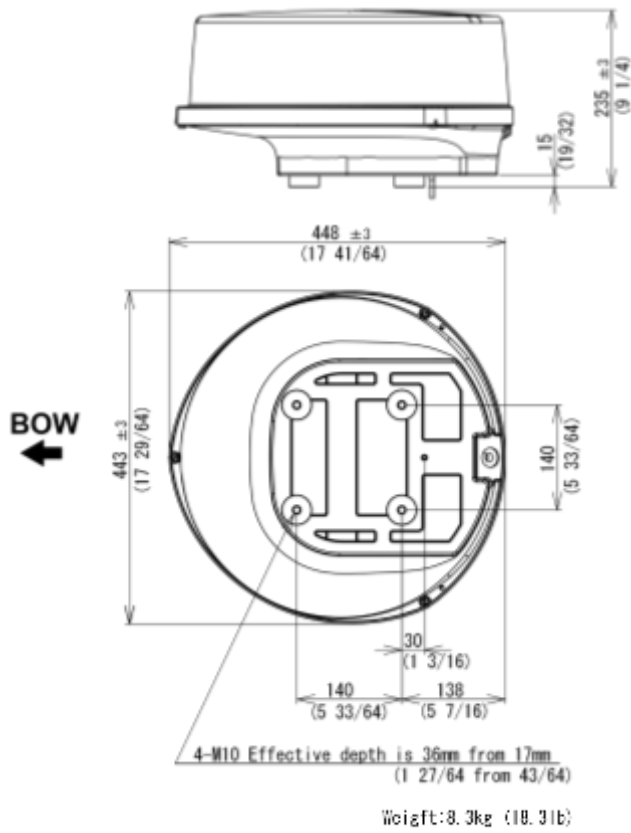
Application	Type, dimension (mm)	Fuse characteristic	Rating
Main power	Tubular ($\phi 6.4 \times 30$)	Normal blow	15 A
Modulator high voltage	Tubular ($\phi 5.2 \times 20$)	Normal blow	0.8 A
Antenna drive motor	Tubular ($\phi 5.2 \times 20$)	Normal blow	5A



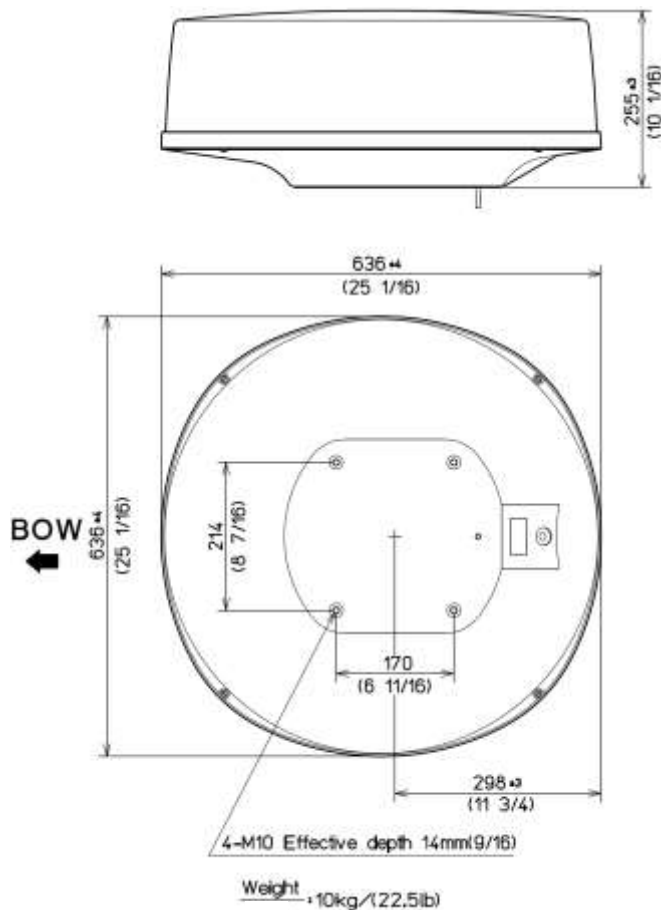
Fuse locations

5.3.2 External view and dimensions

RB804

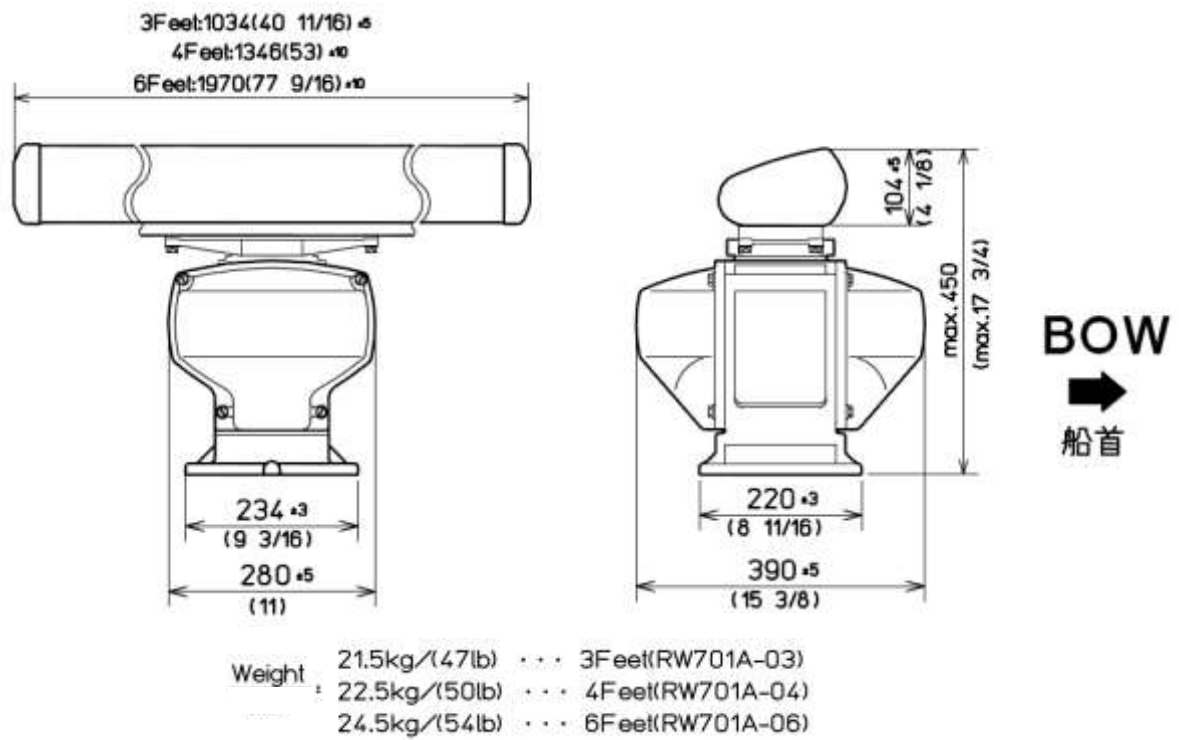


RB805

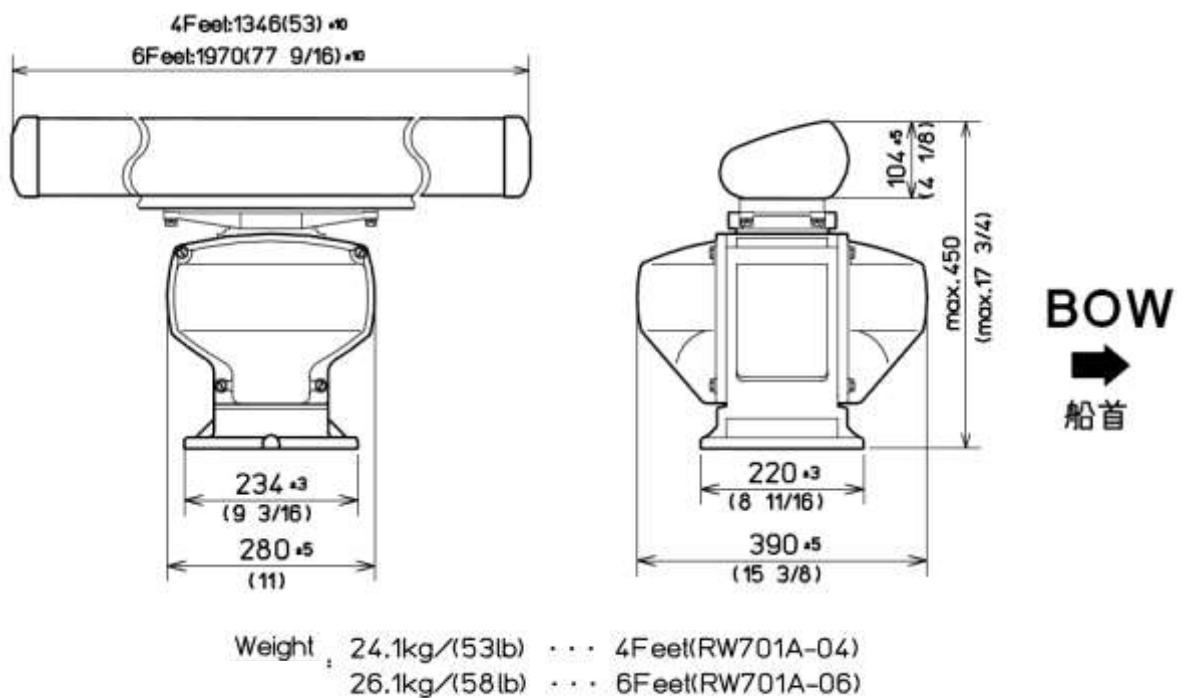


Unit: mm (inch)

RB806

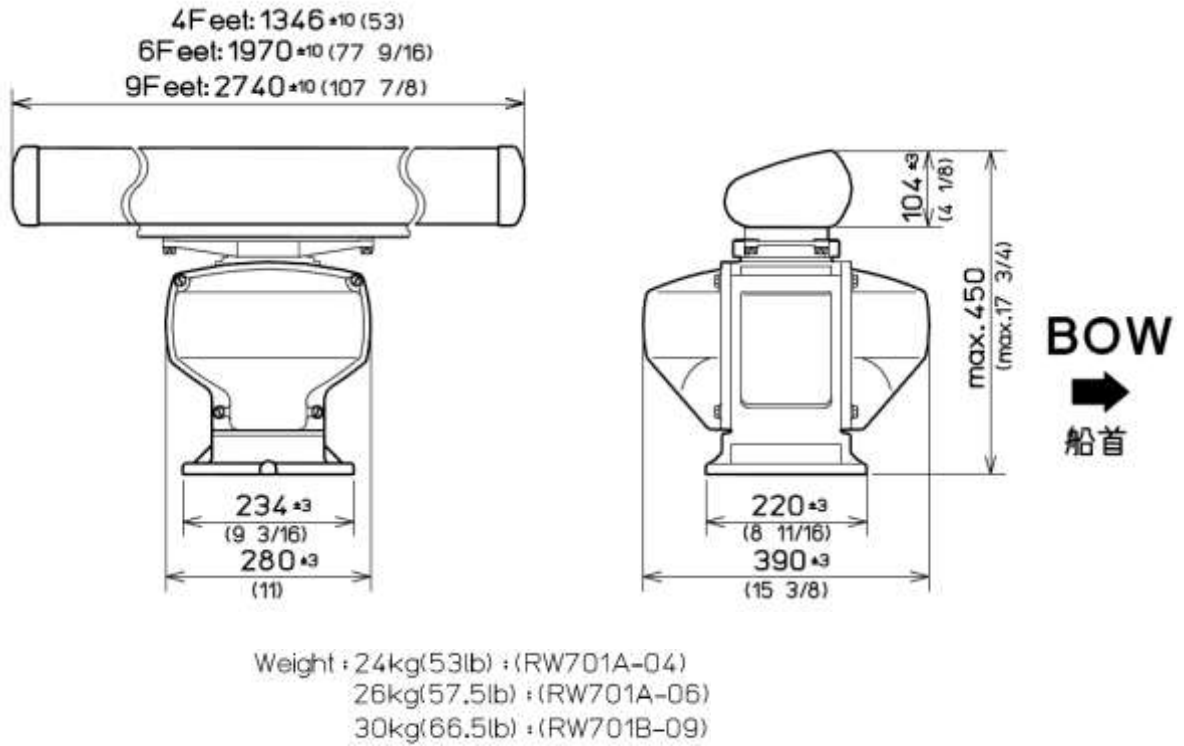


RB807/717A

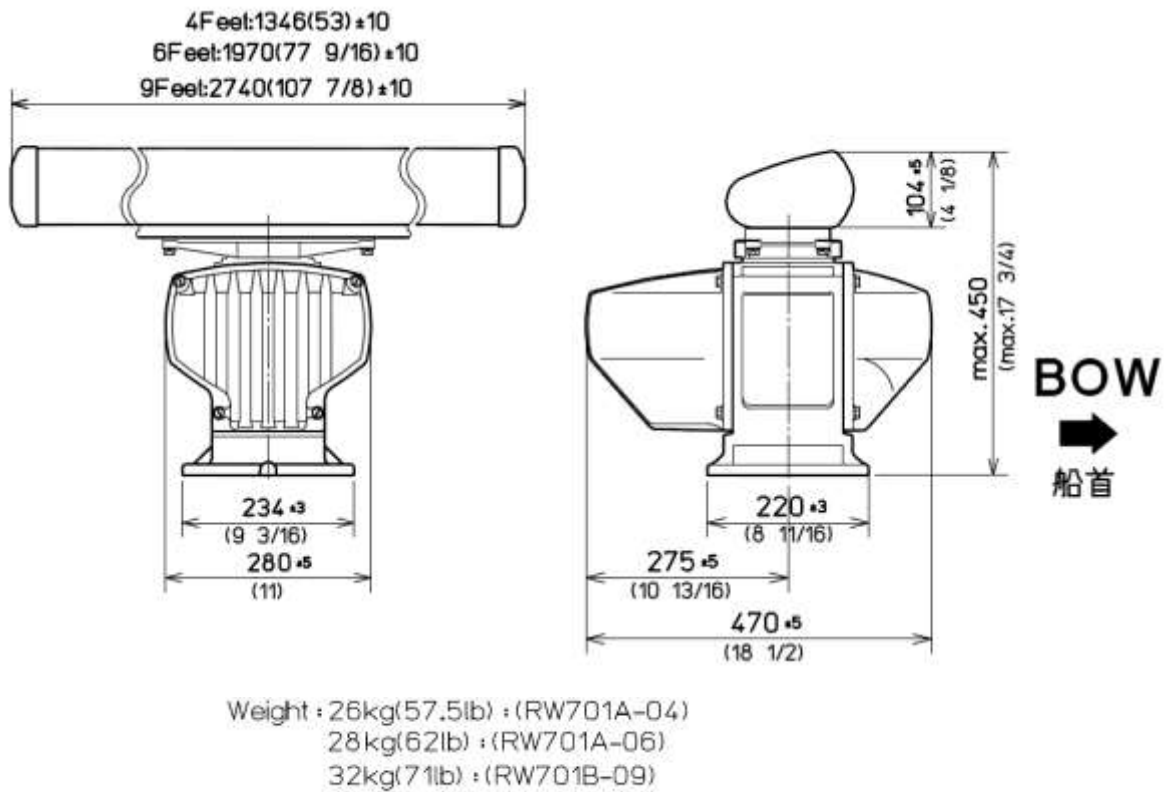


Unit: mm (inch)

RB808/718A

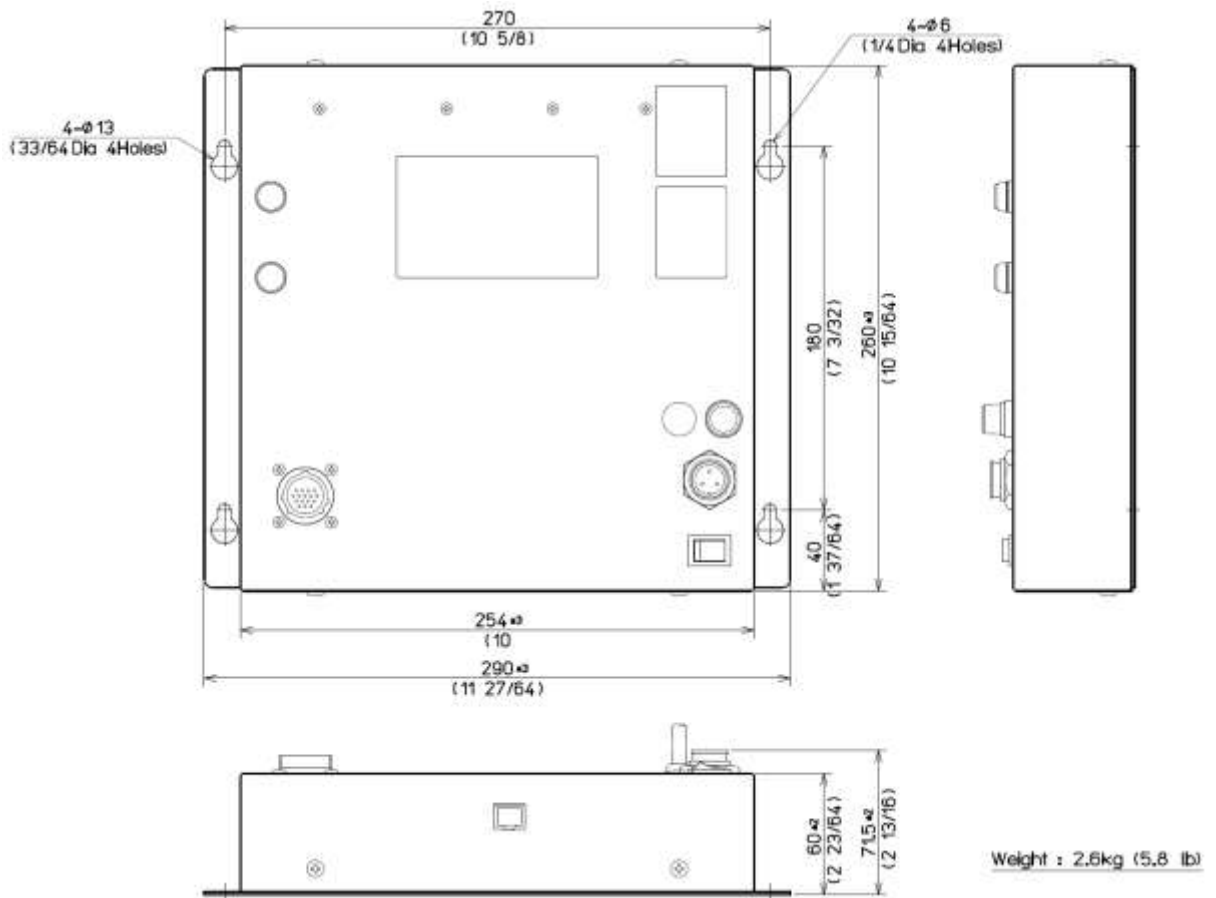


RB809/719A



Unit: mm (inch)

MDS-11R



Unit: mm (inch)



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