CE 0191

KODEN

OPERATION MANUAL

COLOR RADAR

MDC-1840BB/1841BB

MDC-1860BB/1810BB/1820BB

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-1800BB.SER.OM.E 0093142122-09

Declaration of Conformity

(As required by Article 6.3 of Directive 1999/5/EC-RTTE Directive)

Declares under his sole responsibility that the produced Marine Radar System manufactured by

Koden Electronics Co., Ltd.
5278 Uenohara
Uenohara-Shi,
Yamanashi-Ken
409-0112
Japan

Telephone +81 554 20 5865 **Telefax +81 554 20 5880**

Intended for Worldwide use as a Marine Radar for use aboard non-SOLAS vessels and identified by the type number MDC-1841BB / MDS-1840BB to which this declaration refers has been tested to the essential radio test suites required by the notified body and is in conformity with the standards

EN 60945 : 2002 (Clauses 9,10 & 12)
EN 62252 : 2004 (Clauses 4.8, 4.33, 5.8, 5.33 and Annex D)
ITU-R Recommendation RM.1177

and complies with the essential requirements of Directive 1999/5/EC

Conformity procedure under Annex IV of 1999/5/EC (Technical Construction file) has been undertaken by

QinetiQ (0191) Fort Cumberland Road, Eastney, Portsmouth, England.

The Technical Construction File is held by Mr Heinz Hoghoff at

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CE 0191

Kenichi Chiwaki, QA Manager.
Koden Electronics Co., Ltd.
04 Jul. 2005

Notified Body : QinetiQ
Statement Number: QQ-RTTE-12/05-01
: QQ-RTTE-14/05-01

Declaration of Conformity

(As required by Article 6.3 of Directive 1999/5/EC-RTTE Directive)

Declares under his sole responsibility that the produced Marine Radar System manufactured by

Koden Electronics Co., Ltd.
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Intended for Worldwide use as a Marine Radar for use aboard non-SOLAS vessels and identified by the type number MDC-1860BB / MDC-1810BB / MDC-1820BB to which this declaration refers has been tested to the essential radio test suites required by the notified body and is in conformity with the standards

EN 60945 : 2002 (Clauses 9,10 & 12)
EN 62252 : 2004 (Clauses 4.8, 4.33, 5.8, 5.33 and Annex D)
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12 Oct. 2005

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Notified Body : QinetiQ
Statement Number: QQ-RTTE-18/05-01
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AMENDMENT HISTORY

MDC-1860BB/1810BB/1820BB Series OPERATION MANUAL
Doc No: 0093142122

No.	Document No & Rev No.	Date (D/M/Y)	Amendments
0	93142122-00	10/12/03	First issue
1	93142122-01	14/01/04	Chapter 3, para 3.6: Entered the compass safe distance for Display and Operation unit. Chapter 5, para 5.2: Deleted "MAP" from the key switch, which was mistakenly printed.
2	93142122-02	25/02/04	Preface: Added "Operation of AIS." Chapter 1, 2, 4: Amended the power cable type name. Chapter 3: Added AIS spec. Chapter 6: Added the descriptions for AIS display, operation, etc. Chapter 4: Reedited 4.6.4 by adding 4.6.4.1 and 4.6.4.2 for Display installation methods. Reedited Para. 4.7.3 to add more details for GAIN/STC settings. Chapter 10: Added the AIS sentence.
3	93142122-03	01/04/04	Chapter 2, 4: Added Ferrite Core.
4	93142122-04	02/06/04	Chapter 3,4,10: Added Auto tune adjustment, NMEA formatter.
5	93142122-05	09/09/04	Chapter 6.4.1.7 SERIAL Chapter10.4.5 PIN NO
6	93142122-06	22/02/05	Chapter 1/Chapter 6.9 Added
7	0093142122-07	10/04/06	Declaration
8	0093142122-08	10/07/06	Chapter 3
9	0093142122-09	14/12/06	Cover
10			

Amendment policy

When any change is applied in the document, only the document number of the relevant sheet(s) and cover sheet are modified and the rest of the sheets are not changed. The document number is shown in the footer area, right or left bottom of each sheet.

Preface

Safety Notices

OPERATOR SAFETY

Watch for the rotating antenna:
The radar antenna will start to rotate without notice. For your safety, keep away from the area in the vicinity of the radar antenna.

Be aware of RF Radiation Hazard:
The active radar antenna radiates powerful RF energy. Continuous exposure to RF energy may cause harmful effects to the human body. It also causes Cardiac Pacemaker to malfunction. A person who uses a Cardiac Pacemaker should under no circumstances be exposed to RF radiation.

Most countries accept that RF power density levels below 100 W/m^2 cause no significant RF hazard.

Distance vs. specified RF Power Density Level

Power / antenna length	100 W/m^2	10 W/m^2
4 KW / 2 ft Aerial	0.80 m	2.54 m
4KW / 3 ft Aerial	0.90 m	2.85 m
4KW / 4 ft Aerial	1.01 m	3.20 m
6 KW / 4 ft Aerial	1.09 m	3.46 m
6 KW / 6 ft Aerial	1.30 m	4.10 m
12 KW / 4 ft Aerial	1.55 m	4.89 m
12 KW / 6 ft Aerial	1.84 m	5.81 m
25 KW / 4 ft Aerial	2.45 m	7.73 m
25 KW / 6 ft Aerial	2.82 m	8.91 m

Dangerous HIGH voltage inside:
Life threatening high voltage is present in the antenna and display units. This high voltage may be present even after the power switch has been turned off. The high voltage circuits are provided with protection covers and warning labels to avoid unintentional contact with these sections. For safety reasons, switch the power off

before accessing the internal circuitry and discharge any residual voltages in capacitors by an appropriate method. Only qualified personnel should attempt these maintenance procedures.

MAINTENANCE SAFETY

Beware of residual high voltages:

High voltages may remain in the capacitors and the anode cap on the Cathode Ray Tube several minutes after you have turned the power switch off. Wait at least five minutes or discharge them to ground before starting your inspection.

Make sure the main power supply is OFF:

To prevent an electrical injury due to erroneous power switching, make sure that the main power supply and the system power switch are both OFF. Also attach a safety label showing that service is in progress.

Avoid inhaling dust:

The dust could be a temporary health hazard. When cleaning inside of the equipment, avoid inhaling the dust.

Avoid static electricity:

Take care not to damage the ESDs (Electrostatic Sensitive Devices) due to static electricity from carpet and cloths.

Various symbols used in this manual

The following symbols are used in this manual. You are requested to be fully aware of the meaning of each symbol before carrying out inspection and maintenance on this radar system

Warning mark

Warning

To handle the equipment ignoring this sign may lead to fatal damage or injury to human body.

Alarm mark

Alarm

To handle the equipment ignoring this sign may lead to injury to human body or damage to the equipment.

Caution mark

Caution

To handle the equipment ignoring this sign may lead to a malfunction of the equipment.

Warning High Voltage mark

To handle the equipment ignoring this sign may lead to electrical shock to human body.

Prohibition mark

This sign indicates that a specified action is prohibited. The prohibited action will be shown in the vicinity of the mark.

HOW TO USE THIS MANUAL

Scope of this manual

This manual provides necessary information for installation, operation and maintenance of MDC-1800BB series radar systems.

Organization of this manual

This manual is divided into chapters for quick and easy finding of the information you require. The titles and contents of each chapter are as follows:

Chapter 1: General Descriptions

- Outline of the equipment
- Equipment category
- EMC compliance statement
- System configuration
- Software type name used

Chapter 2: Equipment Supplied

- Standard equipment list
- Spare parts list
- Installation material list
- Optional items

Chapter 3: Technical Specifications

- Antenna specification
- Display specification
- ATA Specification
- Serial data and sentence used
- Power supply
- Compass Safe Distance
- Environmental specification
- Mechanical specification

Chapter 4: Installation

- Installation considerations
- Unpacking each component of the system
- Inspection of each component unit and accessories
- Setting the units
- Cable routing and connections
- Installation procedure
- Setting up after installation
- Setting up option

Chapter 5: Basic Operation

- Introduction
- Control panel layout
- Operating controls
- Getting started
- Basic radar operations

Chapter 6: Using The Menu

- RADAR MENU
- DISP MENU
- ADJUST MENU
- SYSTEM MENU
- MAINTENANCE MENU
- Operation of EPA
- Operation of ATA
- Operation of AIS

Chapter 7: Graphic Displays

- Entering Graphic Mode
- Selecting the Graphic Display/DISPLAY ITEM SELECT MENU
- Registering or modifying the NAVLINE data / NAVLINE DATA INPUT MENU

Chapter 8: Trouble Shooting And On Board Servicing

- Information required for service
- Self diagnosis functions provided
- Trouble shooting
- On board servicing

Chapter 9: Maintenance

- Periodic inspection and cleaning

Chapter 10: Technical References

- Serial input data sentence detail
- Tracking data output sentence detail
- Radar output sentence detail
- Interface requirements

Chapter 1

General Descriptions

Contents

Chapter 1 General Descriptions

1.1 Outline of the equipment

The MDC-1800BB series of radar is designed and manufactured to meet the IEC technical standards, shown below.

- IEC 60945 4th Edition 2002, General
- IEC 60872-2 and 3: EPA and ATA
- IEC 61162-1 and 2: Digital Interface
- IEC/PAS 60936-5: AIS (display on Radar)

The equipment is composed of two units, the antenna and the processor. The antenna unit comprises a 3ft, 4 ft or 6 ft aerial, which is mounted on the transceiver unit of either 4kW(For MDC-1840BB/1841BB), 6kW(For MDC-1860BB), 12 kW (For MDC-1810BB), or 25 kW (For MDC-1820BB) type. The 4 foot and 6 foot aerials are encapsulated in a water-sealed, durable plastic case. The transceiver unit is contained in a waterproof aluminum case.

1.2 Equipment category

The MDC-1800BB series of radar is composed of the component units in the following categories, specified in the IEC 60945 4th edition, Para 4.4.

Antenna Unit
(Type RB715A, RW701A-03/04/06 + RB716A/RB717A/RB718A/719A):
Exposed to the weather (formerly Class X)

Display Unit (Type MRM-100):
Protected from the weather (formerly Class B)

Operation Unit (Type MRO-100):
Protected from the weather (formerly Class B)

1.3 EMC compliance statement

This series of equipment has been tested and verified by the QinetiQ UK, according to the IEC 60945 4th Edition, in terms of Electro Magnetic Compatibility and atmospheric durability against the maritime environment.

1.4 System configuration

The MDC-1840BB, MDC-1841BB, MDC-1860BB, MDC-1810BB and MDC-1820BB radar sets are configured as follows:

Refer to Figure 1 for the system configuration of this series.

MDC-1840BB

Component Unit	Sub-unit	Type name
Antenna Unit		Not assigned
	Aerial, 3-foot	RW701A-03
	Aerial, 4-foot	RW701A-04
	Transceiver	RB716A (4kW)
Processor Unit		MRM-100
Operation Unit		MRO-100

MDC-1841BB

Component Unit	Sub-unit	Type name
Antenna Unit		RB715A (4kW)
Processor Unit		MRM-100
Operation Unit		MRO-100

MDC-1860BB

Component Unit	Sub-unit	Type name
Antenna Unit		Not assigned
	Aerial, 4-foot	RW701A-04
	Aerial, 6-foot	RW701A-06
	Transceiver	RB717A (6 kW)
Processor Unit		MRM-100
Operation Unit		MRO-100

MDC-1810BB

Component Unit	Sub-unit	Type name
Antenna Unit		Not assigned
	Aerial, 4-foot	RW701A-04
	Aerial, 6-foot	RW701A-06
	Transceiver	RB718A (12 kW)
Processor Unit		MRM-100
Operation Unit		MRO-100

MDC-1820BB

Component Unit	Sub-unit	Type name
Antenna Unit		Not assigned
	Aerial, 4-foot	RW701A-04
	Aerial, 6-foot	RW701A-06
	Transceiver	RB719A (25 kW)
Processor Unit		MRM-100
Operation Unit		MRO-100

1.5 Software type name used

The MDC-1800BB series of radar uses the following type of software:

NOTE: The asterisk (*) shows revision code, varied from A to Z.

Software Type	Application
KM-D56*	Radar logic board
KM-D62*	Gyro/Log Interface (Option: KSA-08A)
KM-D07*	ATA (Option: MRE-300)
KM-D63*	AIS Interface (Option: AIS-100)

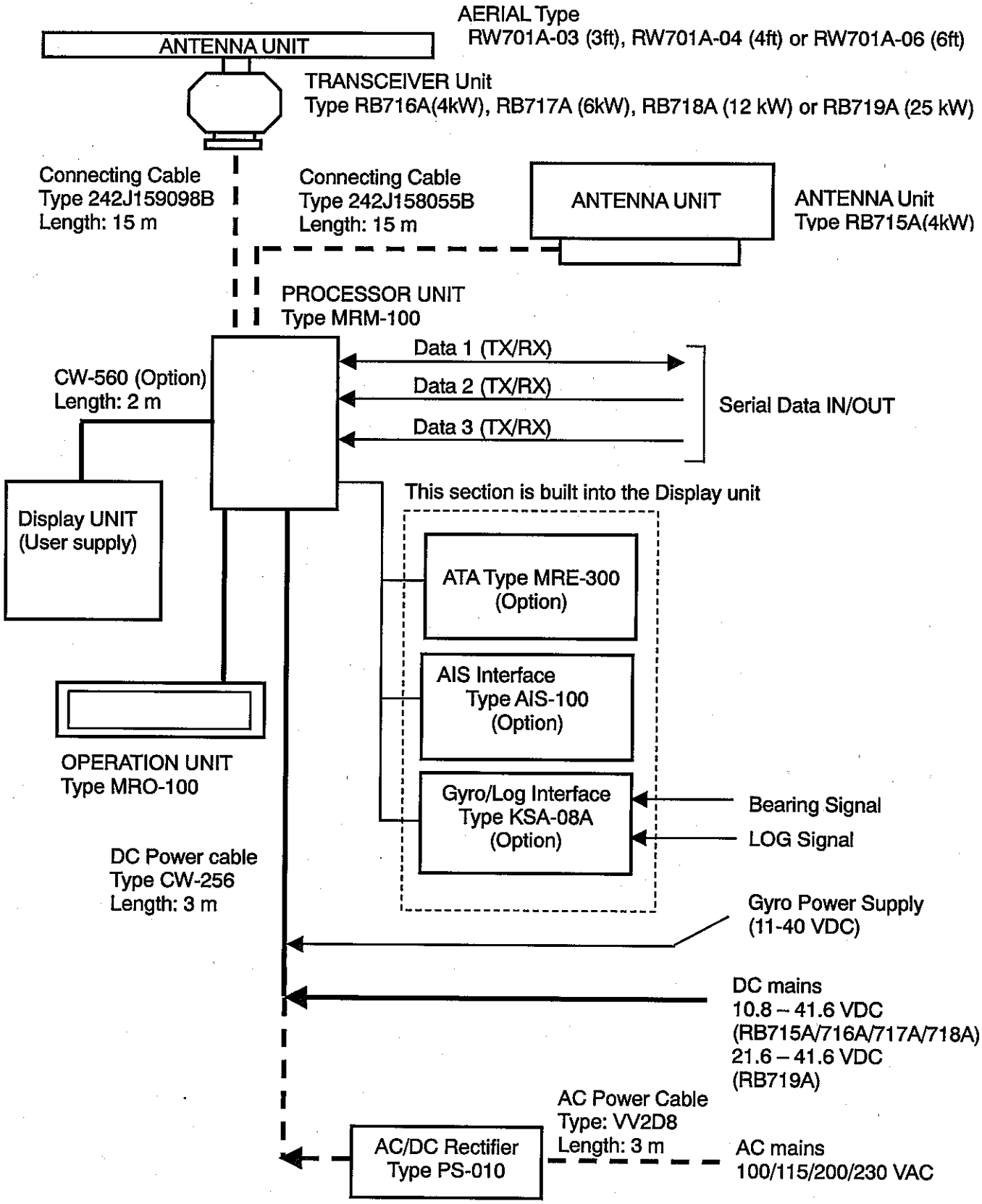


Figure 1.1 System configuration of MDC-1840BB/1841BB/1860BB/1810BB/1820BB series of radar

Chapter 2

Equipment Supplied

Contents

Chapter 2 Equipment Supplied

2.1 Standard equipment list

MDC-1840BB

No.	Item name	Type name	Remark	Weight/length	Q'ty
1	Aerial	RW701A-03/04	3ft / 4 ft	5 kg / 6 kg	1
2	Transceiver unit	RB716A	4 kW	16 kg	1
3	Processor unit	MRM-100		5.5 kg	1
4	Operation unit	MRO-100		2 kg	1
5	Connecting cable	242J159098B-15M	With connectors attached on both ends	15 m	1
6	Power cable	CW-256-2M	Cable with 5-pin connector on one end and fly leads on the other end	2 m	1
7	Display cable	CW-560-2M	Cable with D-SUB connector on both ends	2 m	1
8	Spare parts	SP-100	See spare parts list	Not specified	1 set
9	Installation materials	M12-BOLT.KIT	See installation material list	Not specified	1 set
10	Documents	MDC-1800BSER.OME	Operation manual	Not specified	1

MDC-1841BB

No.	Item name	Type name	Remark	Weight/length	Q'ty
1	Antenna	RB715A	4 kW, 2 ft (Radome)	10 kg	1
2	Processor unit	MRM-100		5.5 kg	1
3	Operation unit	MRO-100		2 kg	1
4	Connecting cable	242J158055B-15M	With connectors attached on both ends	15 m	1
5	Power cable	CW-256-2M	Cable with 5-pin connector on one end and fly leads on the other end	2 m	1
6	Display cable	CW-560-2M	Cable with D-SUB connector on both ends	2 m	1
7	Spare parts	SP-100	See spare parts list	Not specified	1 set
8	Installation materials	M10-BOLT.KIT	See installation material list	Not specified	1 set
9	Documents	MDC-1800BSER.OME	Operation manual	Not specified	1

MDC-1860BB

No.	Item name	Type name	Remark	Weight/length	Q'ty
1	Aerial	RW701A-04/06	4 ft / 6 ft	6 kg / 8 kg	1
2	Transceiver unit	RB717A	6 kW	17 kg	1
3	Processor unit	MRM-100		5.5 kg	1
4	Operation unit	MRO-100		2 kg	1
5	Connecting cable	242J159098B-15M	With connectors attached on both ends	15 m	1
6	Power cable	CW-256-2M	Cable with 5-pin connector on one end and fly leads on the other end	2 m	1
7	Display cable	CW-560-2M	Cable with D-SUB connector on both ends	2 m	1
8	Spare parts	SP-100	See spare parts list	Not specified	1 set
9	Installation materials	M12-BOLT.KIT	See installation material list	Not specified	1 set
10	Documents	MDC-1800BSER.OME	Operation manual	Not specified	1

MDC-1810BB

No.	Item name	Type name	Remark	Weight/length	Q'ty
1	Aerial	RW701A-04/06	4 ft / 6 ft	6 kg / 8 kg	1
2	Transceiver unit	RB718A	12 kW	17 kg	1
3	Processor unit	MRM-100		5.5 kg	1
4	Operation unit	MRO-100		2 kg	1
5	Connecting cable	242J159098B-15M	With connectors attached on both ends	15 m	1
6	Power cable	CW-256-2M	Cable with 5-pin connector on one end and fly leads on the other end	2 m	1
7	Display cable	CW-560-2M	Cable with D-SUB connector on both ends	2 m	1
8	Spare parts	SP-100	See spare parts list	Not specified	1 set
9	Installation materials	M12-BOLT.KIT	See installation material list	Not specified	1 set
10	Documents	MDC-1800BSER.OME	Operation manual	Not specified	1

MDC-1820BB

No.	Item name	Type name	Remark	Weight/length	Q'ty
1	Aerial	RW701A-04/06	4 ft / 6 ft	6 kg / 8 kg	1
2	Transceiver unit	RB719A	25 kW	21 kg	1
3	Processor unit	MRM-100		5.5 kg	1
4	Operation unit	MRO-100		2 kg	1
5	Connecting cable	242J159098B	With connectors attached on both ends	15 m	1
6	Power cable	CW-256-2M	Cable with 5-pin connector on one end and fly leads on the other end	2 m	1
7	Display cable	CW-560-2M	Cable with D-SUB connector on both ends	2 m	1
8	Spare parts	SP-100	See spare parts list	Not specified	1 set
9	Installation materials	M12-BOLT.KIT	See installation material list	Not specified	1 set
10	Documents	MDC-1800BSER.OME	Operation manual	Not specified	1

2.2 Spare parts list

MDC-1841BB (Common use)

No	Description	Rating	Remark	Shape (Dimensions)	Q'ty	Use
1	Fuse	15A	Normal blow	Tubular (ϕ6.3 x 32)	2	Main power supply
2	Fuse	5A	Normal blow	Tubular (ϕ 5 x 25)	2	Motor power supply
3	Fuse	0.3A	Normal blow	Tubular (ϕ 5 x 25)	2	High voltage power supply

MDC-1840BB/1860BB/1810BB/1820BB (Common use)

No	Description	Rating	Remark	Shape (Dimensions)	Q'ty	Use
1	Fuse	15A	Normal blow	Tubular (ϕ6.3 x 32)	2	Main power supply
2	Fuse	5A	Normal blow	Tubular (ϕ 5 x 25)	2	Motor power supply
3	Fuse	0.3A	Normal blow	Tubular (ϕ 5 x 25)	2	High voltage power supply
4	Motor brush	24Z125209B	Not specified	Not specified	1 set	Antenna motor

2.3 Installation material list

MDC-1841BB

No	Description	Rating	Q'ty	Use
1	Hexagonal bolt	B10X25U	4	Antenna unit
2	Plain washer	2W10U	8	Antenna unit
3	Spring washer	SW10U	4	Antenna unit
4	Ferrite core	E04RA400270150	1	Processor unit

MDC-1840BB/1860BB/1810BB/1820BB (Common use)

No	Description	Rating	Q'ty	Use
1	Hexagonal bolt	B12X55U	4	Antenna unit
2	Nut	N12U	8	Antenna unit
3	Plain washer	2W12U	8	Antenna unit
4	Spring washer	SW12U	4	Antenna unit
5	Ferrite core	E04RA400270150	1	Processor unit

2.4 Optional items

MDC-1840BB/1841BB/1860BB/1810BB/1820BB (Common use)

No.	Description	Rating	Remark	Weight/length/Q'ty
1	Gyro/Log Interface	KSA-08A	Built into the display unit	Not specified
2	ATA	MRE-300	Built into the display unit	Not specified
3	AIS Interface	AIS-100	Built into the display unit	Not specified
4	Navigator connecting cable	CW-387-5M	One end with 8-pin connector and flying leads on the other end	for AIS (5 m)
		CW-376-5M	One end with a 6-pin connector and flying leads on the other end	for GPS etc. (5 m)
		CW-388-5M	One end with 10-pin connector and flying leads on the other end	for Gyro/Log (5 m)
		CW-561-10M	With 12-pin connector on both ends	for REMOTE (10 m)
5	Display cable	CW-560-2M	With 15-pin connectors on both ends	for Display Monitor (2 m)
6	Rectifier	PS-010	With two 5 A fuses	3.5 kg
7	AC power cable	VV-2D8-3M	Flying leads on both ends	3 m
8	Connecting cable in extra length for RB715A	242J158055C-20M	Connectors attached on both ends	20 m
		242J158055D-30M		30 m
		242J158055E-XM (See NOTE)		100 m max

9	Connecting cable in extra length for RB716A/RB717A/ RB718A/RB719A	242J159098C-20M	Connectors attached on both ends	20 m
		242J159098D-30M		30 m
		242J159098E-XM (See NOTE)		100 m max

NOTE: The length of the cable is specified by the customer within 100 meters

Chapter 3

Technical Specification

Contents

Chapter 3 Technical Specifications

3.1 Antenna specification

Model name	MDC-1840BB	MDC-1841BB	MDC-1860BB	MDC-1810BB	MDC-1820BB
Aerial length	3 feet / 4 feet	2 feet	4 feet / 6 feet		
Peak power output	4kW		6kW	12kW	25kW
Frequency	9410 +/- 30 MHz				
Beam width Horizontal	2.5° / 1.8°	3.9°	1.8° / 1.2		
Vertical	22°	25°	22°		
Side lobes Within +/- 10°	Better than –23dB	Better than –20dB	Better than –23dB		
Outside +/- 10°	Better than –30 dB	Better than –20dB	Better than –30 dB		
Rotation	24/48 r.p.m.				

Transmission pulse	4 kW	6 kW/12 kW	25 kW
width S (Short pulse)	0.08 µs / 2000 Hz	0.08 µs / 4000 Hz	0.08µs/2000Hz
M1 (Medium 1 pulse)	0.25 µs / 1500 Hz	0.25 µs / 2000 Hz	0.3µs/1300Hz
M2 (Medium 2 pulse)	0.8 µs / 600 Hz	0.5 µs / 1000 Hz	0.6µs/800Hz
L (Long pulse)	0.8 µs / 600 Hz	1.0 µs / 500 Hz	1.2 µs / 500Hz, 450Hz(96NM)

IF center frequency	60 MHz
IF bandwidth	15 MHz (S, M1) / 3 MHz (M2, L)
Noise figure	Better than 6 dB
Operation in wind	100 knots as relative
Water proofing grade	IPX6 (IEC60529)

3.2 Processor specification

Effective diameter	269 mm (at 18 inch LCD monitor)
Resolution	1280 x 1024 pixels
Video level	8 levels
Presentation mode	Head-up, north-up, course-up and true motion
Range scale (NM)	1/8 1/4 1/2 3/4 1.5 3 6 12 24 48 (4 kW) 64 (6 kW) 72 (12 kW) 96 (25 kW)
Rings interval (NM)	1/16 1/8 1/4 1/2 1 2 4 8 (4 kW) 16 (6 kW) 12 (12 kW) 16 (25 kW)
Off-centering	Sweep origin can be moved to any point within 2/3 of the screen radius.

Trail display interval	Every scan, 15 sec, 30 sec, 1 min, 3 min, 6 min, 12 min and OFF
Alarm	Entry alarm [alarm range (Minimum 0.5 NM), depth and bearing can be varied]
EPA	Up to 10 targets can be plotted, 5 points for one target each
ATA (Option)	Display of acquire/track data of up to 10 targets and Guard Zone are available. Display of guard zone is also available (any alarm range, width and bearing can be set).
Data available for EPA and ATA	Speed, course, CPA, TCPA, distance, bearing and age (time elapsed since the first plot, applicable to EPA only).
Minimum detectable range	20 meters at 1/8 nm range
Range resolution	20 meters at 1/8 nm range
Range data accuracy	70 meters or 1% of the range scale selected, whichever is the greater.
Bearing data accuracy	+/-1° maximum
Navigation data display	Data of own ship's position (latitude/longitude)

3.3 ATA specification (Option)

Acquisition	Manual
Tracking	Automatic
Number of targets tracked	Up to 10 targets
Numerical data output	Distance, bearing, speed, CPA and TCPA
Alarm	Collision alarm and lost alarm
On screen display	Symbols (acquired target, tracked target, target with data display and lost target), target number and vectors.
Display mode	Relative and True
Tracking distance range	Up to 40.0 nm
ATA data output	To be taken via the DATA 1 connector on the display rear panel. Signal level: RS422 Data format: IEC1162-1

3.4 AIS specification (Option)

Number of targets displayed	Up to 64 activated targets and sleeping targets in total
Numerical data indication	MMSI, CPA, TCPA, CSE/COG, STW/SOG
On screen display	Symbols, target number and vectors.
Indication limit range	1.0 to 20.0 nm
AIS data input	To be taken via the AIS connector on the display rear panel. Signal level: RS422 Data format: IEC61162-2 Formatter: ALR, VDO, VDM

3.5 Serial data and sentence used

Serial data: IEC 61162-1 or NMEA 0183 ver 2.30

Sentence: BWC, GGA, GLC, GLL, HDT, RMB, RTE, VBW, VDR, VHW, VTG, WPL

3.6 Power Supply

Mains Input Voltage: 24 VDC / 32 VDC

Input Voltage Tolerance: 10.8 VDC – 41.6 VDC
(for MDC-1840BB/1841BB/1860BB/1810BB)
21.6 VDC – 41.6 VDC (for MDC-1820BB)

Input Power: 170 W nominal at 24 VDC

Transient Protection:

To the requirements of IEC 60945 4th Edition.

Reversed polarity protection: Protected by the Main Fuse.

AC Operation

Rectifier Unit Type PS-010 is required.

Input voltage range: 115/230 VAC

Input voltage tolerance: +/- 10%

Input voltage frequency range: 47 to 63 Hz

Input Power: 220 W

3.7 Compass Safe Distance

Component Unit	Type Name	Standard	Steering
Antenna	RB715A	1.4 m	0.95 m
	RB716A/RW701A-03	1.4 m	0.95 m
	RB716A/RW701A-04	1.4 m	0.95 m
	RB717A/RW701A-04	1.4 m	0.95 m
	RB717A/RW701A-06	1.4 m	0.95 m

Antenna	RB718A/RW701A-04	1.4 m	0.95 m
	RB718A/RW701A-06	1.4 m	0.95 m
	RB719A/RW701A-04	1.4 m	0.95 m
	RB719A/RW701A-06	1.4 m	0.95 m
Processor Unit	MRM-100	1.6 m	1.15 m
Operation Unit	MRO-100	0.60 m	0.40 m

3.8 Environmental specification

To the requirements of IEC 60945 4th Edition. The measure environmental specifications are as follows:

(1) Temperature and humidity

	Operating temperature	Storage temperature	Humidity
Antenna	-25°C - +55°C	+70°C	93%+/-3% at +40°C
Processor	-15°C - +55°C	+55°C	93%+/-3% at +40°C

(2) Vibration

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

13.2 Hz up to 100Hz: Maximum acceleration 7 m/s^2 constant

3.9 Mechanical specification

Dimensions: W (Width) x Depth x Height, Unit in mm

Weight: Unit in kg

Antenna:

RB715A: 636 x 636 x 255, 10kg

RB716A: 280 x 390 x 450, 21 kg (for 3ft system), 22 kg (for 4ft system)

RB717A/718A: 280 x 390 x 450, 23 kg (for 4ft system), 25 kg (for 6ft system)

RB719A: 280 x 470 x 450, 27 kg (for 4ft system), 29 kg (for 6ft system)

Aerial Swing circle: 1034 for 3 ft, 1346 for 4 ft, 1970 for 6 ft

Processor unit (MRM-100):

320 x 122 x 320, 5.5 kg

Operation unit (MRO-100):

354 x 130 x 49, 2 kg

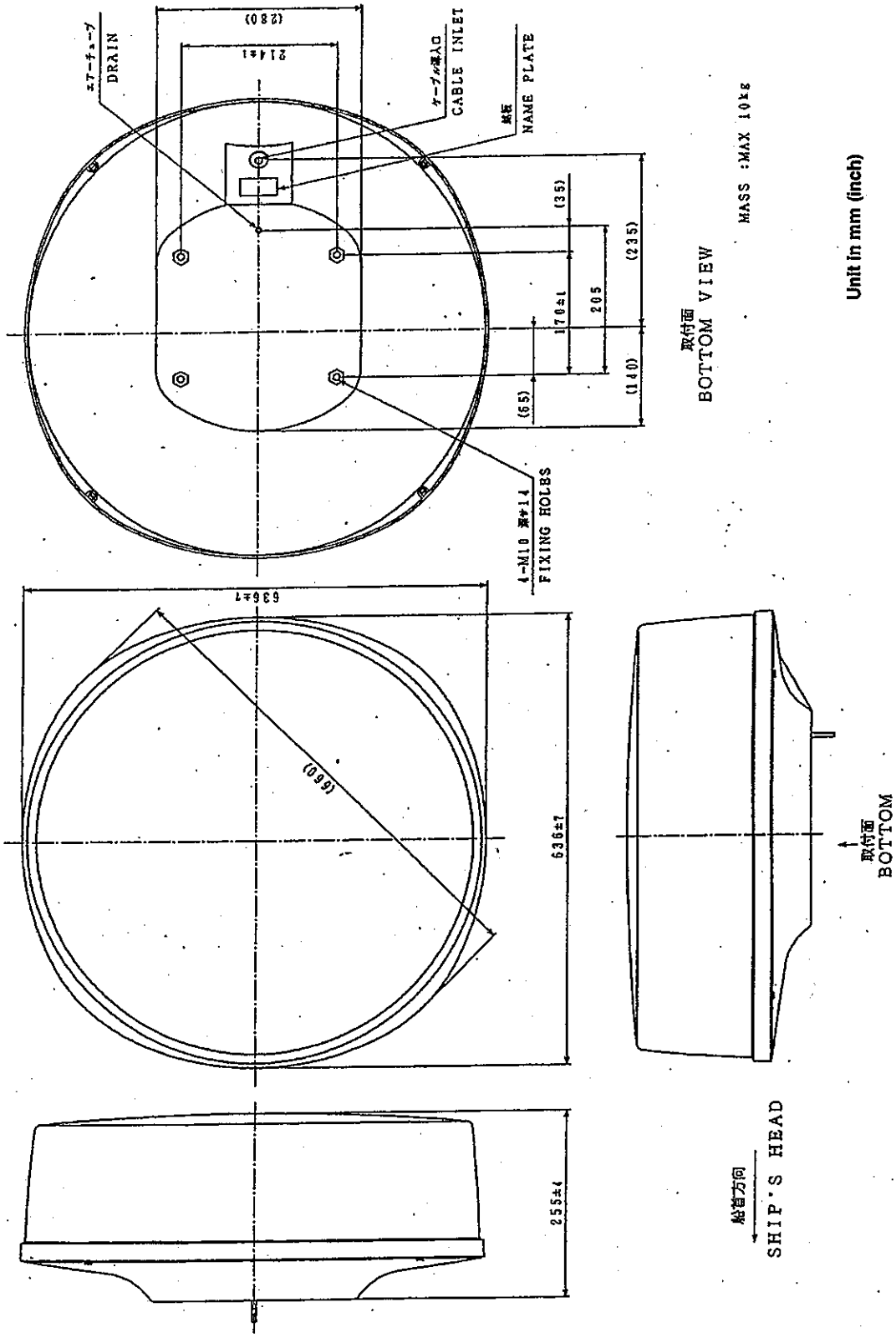
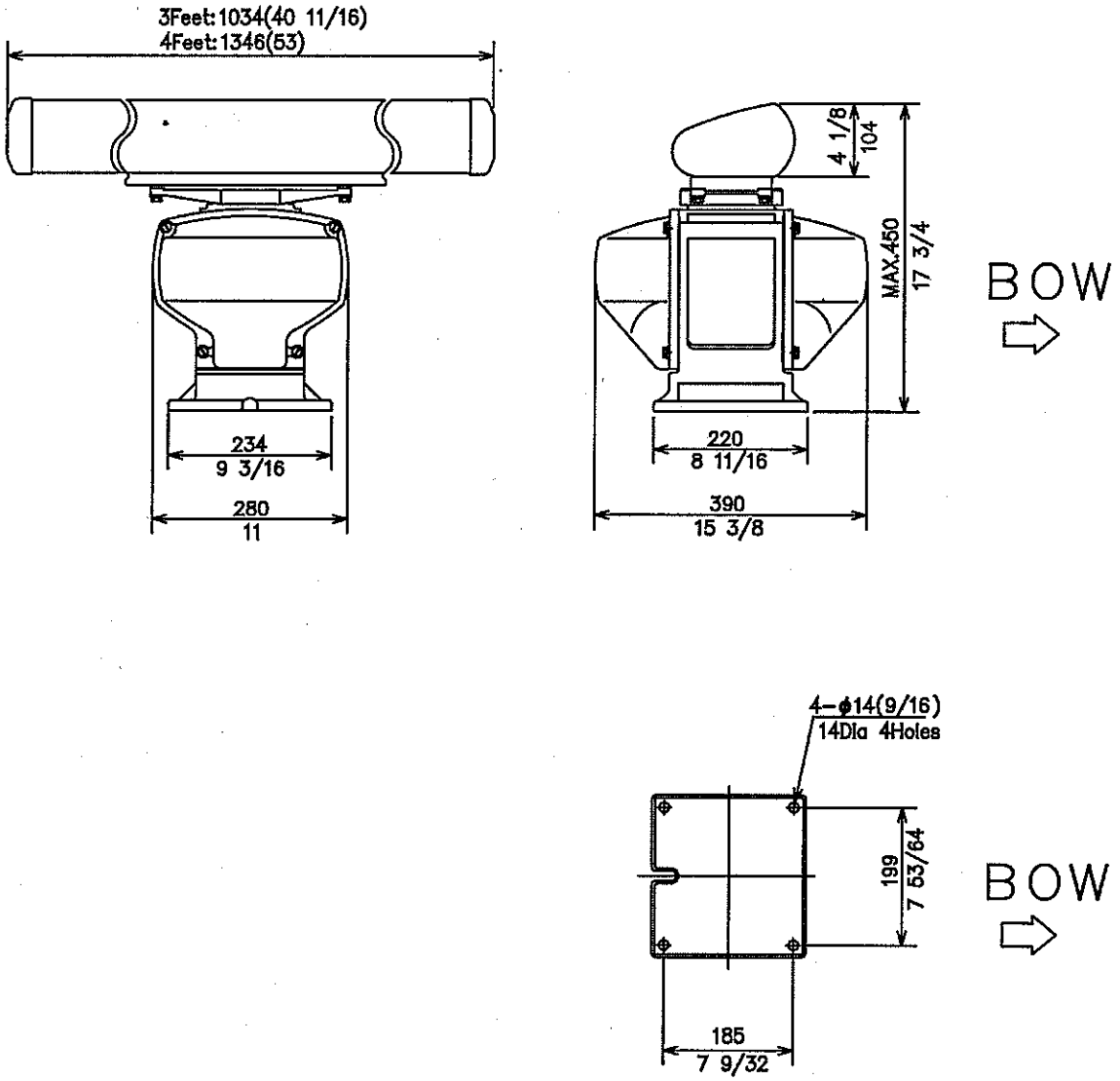


Figure 3.1 External dimensions of the Antenna unit, RB715A



重量 : 21kg (3ft)
22kg (4ft)

Weight: 46 lb (3ft)
49 lb (4ft)

Figure 3.2 External dimensions of the Antenna unit, RB716A

[Antenna unit]

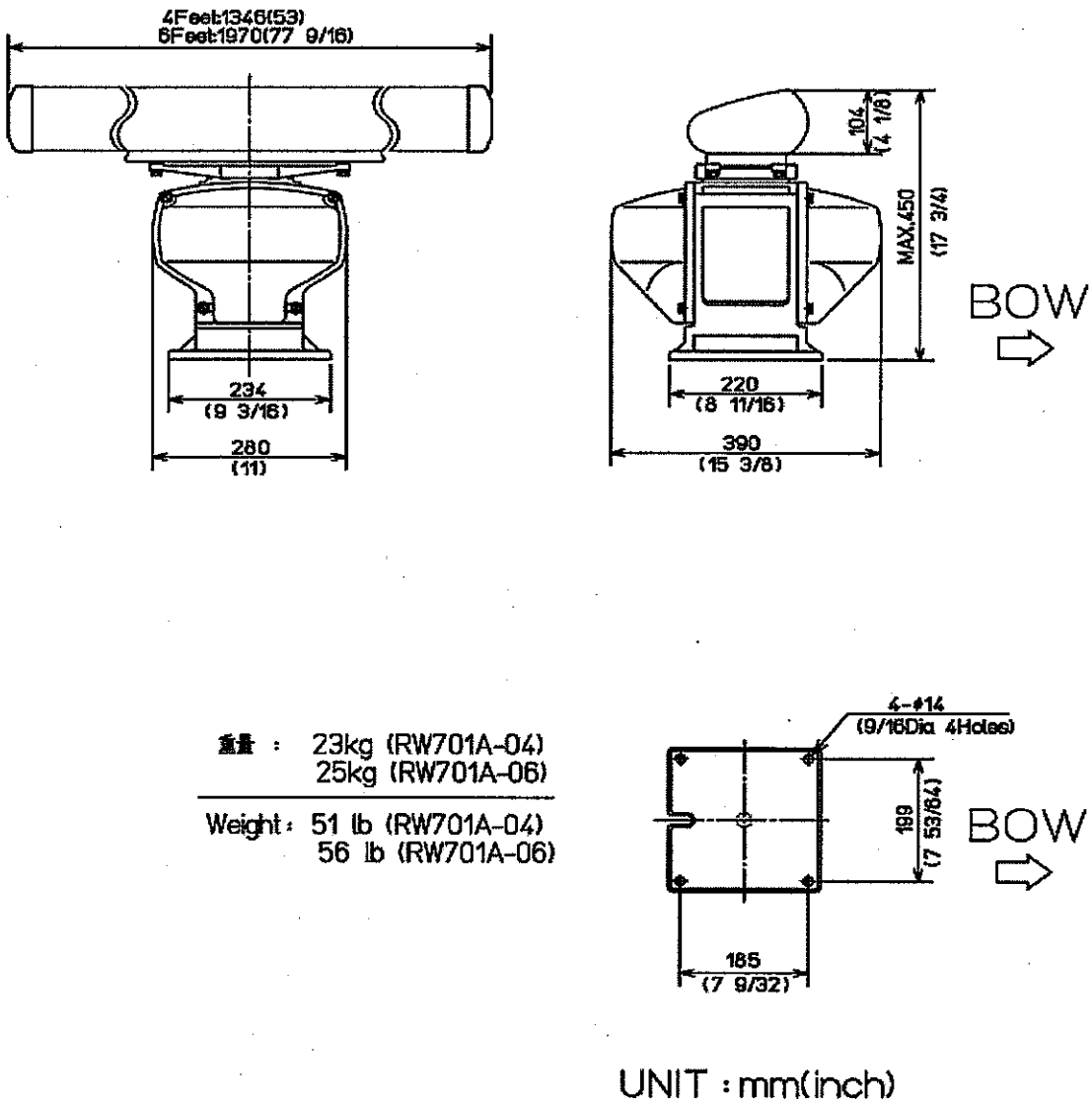


Figure 3.3 External dimensions of the Antenna unit, RB717A / RB718A

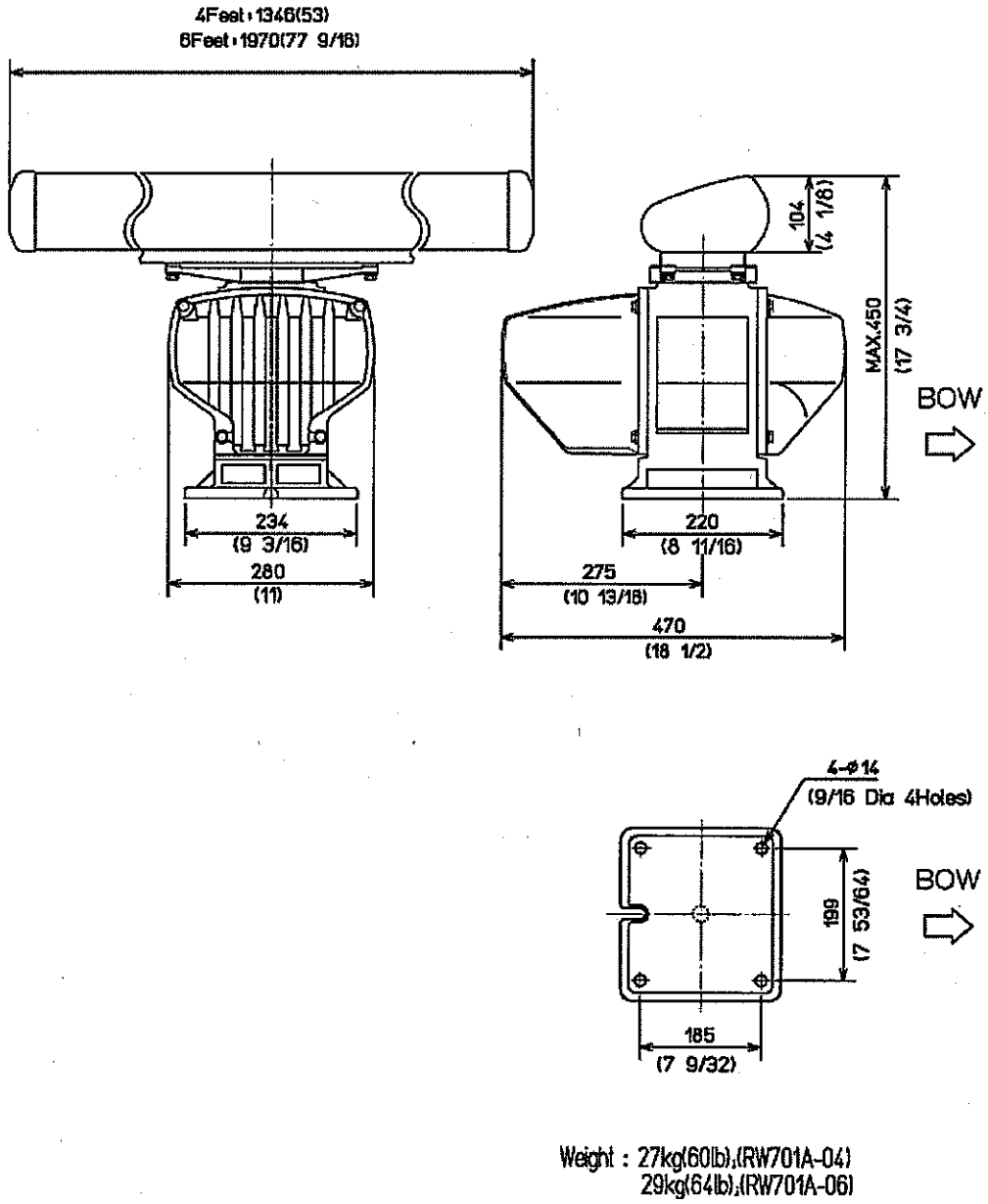


Figure 3.4 External dimensions of the Antenna unit, RB719A

[Processor unit]

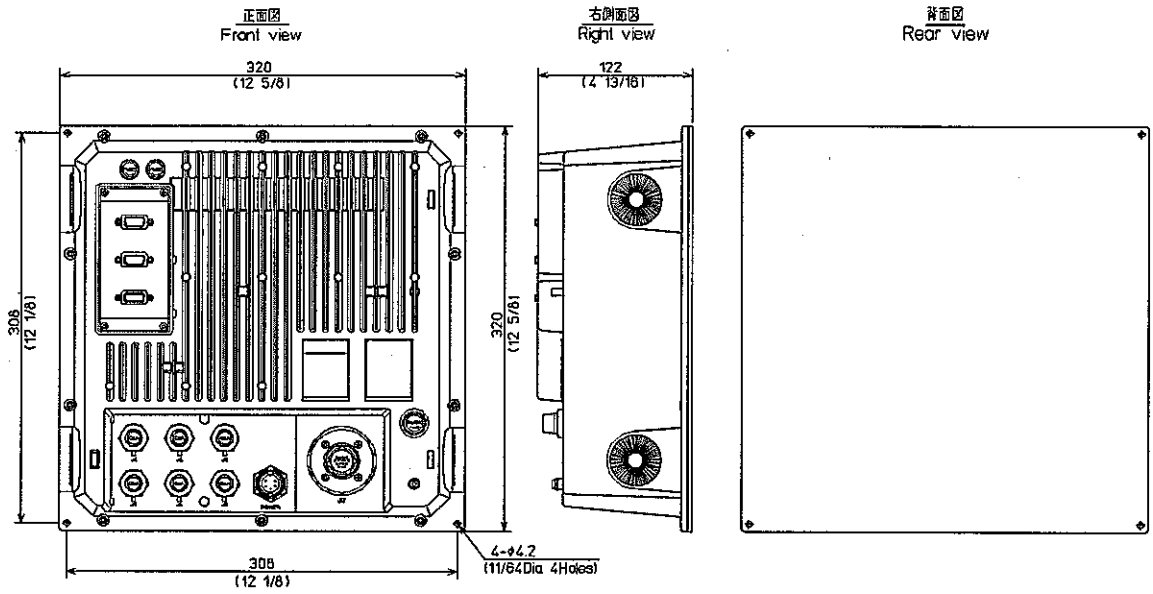


Figure 3.5 External dimensions of the Processor unit, MRM-100

[Operation unit]

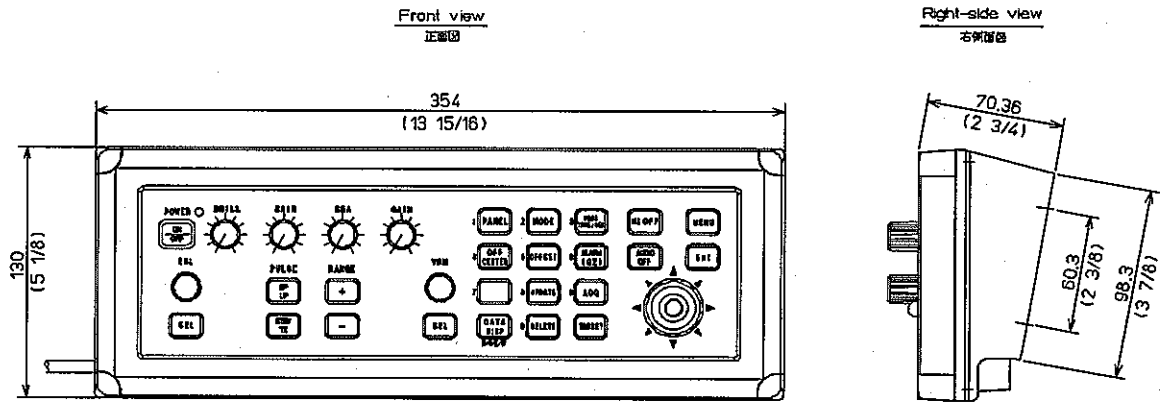


Figure 3.6 External dimensions of Operation Unit, MRO-100

Chapter 4

Installation

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Chapter 4 Installation

4.1 Installation considerations

General

Qualified service personnel should perform the installation of the MDC-1800BB series. The installation comprises the following operations.

(1) Unpacking each component of the system.
(2) Inspection of the exterior of each component unit and accessory.
(3) Checking the ship's mains voltage and current capacity.
(4) Determining the site of installation
(5) Installing the Antenna Unit.
(6) Installing the Display Unit
(7) Installing the accessory items
(8) Planning the cable routing and connections
(9) Commissioning

4.2 Unpacking each component of the system

Unpack your package and check if all of the items stated in the packing list are contained in the package. If not, report this to the insurance agent for tracing missing goods or refund.

4.3 Inspection of each component unit and accessories

Carefully check the exterior of each component unit for dents, damage, etc. Also check the inside of component units for electrical and mechanical damage. The Cathode Ray Tube is a fragile item, which is easily broken if the display unit is accidentally dropped.

4.4 Setting the units

To achieve best operational performance, the following factors must be considered.

4.4.1 Antenna Unit

(1) The radar antenna should be mounted on the center line of your ship where no large obstacles interfere with the path of the radar beam.
(2) Location should be as high as possible, however, keep in mind that nearby objects may be overlooked if mounted too high. Also note that the higher the antenna, the higher the level of sea clutter.
(3) The mounting surface should be as flat as possible and approximately parallel with the vessel's water line.

(4) The antenna unit should be positioned forward of large structure and exhaust stacks, to avoid causing blind sectors on the radar screen as well as contamination from engine exhaust on the radar antenna aperture.
(5) Provide sufficient servicing space.

4.4.2 Processor Unit, Operation Unit and Display

Processor Unit:

(1) Select a position safe and free of dampness, water spray, rain and direct sunlight.
(2) Provide enough space for servicing.

Operation Unit:

(1) Select a position near the display for easy access and operation. Also consider the length of the connecting cable that is 2 m.

Display (User purchased item):

(1) Position the display unit as far as possible away from other radio equipment.
(2) Keep a safe distance from the magnetic compass: standard: x.xx m, steering: x.xx m.
(3) Select a location that provides good observation to radar screen and outside environment.
(4) Locate the display so that it provides easy viewing from all likely operator's positions.
(5) Select a position safe and free of dampness, water spray, rain and direct sunlight.
(6) Provide enough space for servicing. Consider access to the rear panel for connecting various cables.
(7) Position the display unit as far as possible away from other radio equipment.

4.5 Cable routing and connections

4.5.1 Antenna

(1) The cable connecting the antenna and display should be run separately away from other cables such as, radio antenna feeders, power cables, etc. Under no circumstances should it be in parallel arrangement with other cables. These precautions are essential to avoid radio interference to/from other equipment installed on the ship. If this is not possible, either cable set should be screened with metal conduit or another form of shielding.
(2) Cable should be run as short as possible but be kept within the standard length to achieve best radar performance.
(3) The copper braids of the cable must be grounded via a grounding stud in the transceiver unit.

4.5.2 Processor Unit

(1) The processor unit must be grounded to the hull via a grounding stud at the rear of the processor unit.

4.6 Installation procedure

4.6.1 Installing the Transceiver Unit

When mounting the unit, position the transceiver unit as shown, so that a notched part of the transceiver base is directed towards the aft. This arrangement simplifies cable fitting and servicing. Also take note of the precautions detailed in paragraph 4.4.1 when you attempt to install the antenna unit.

(1) Drill four fixing holes of 14 mm (12 mm for Radome) diameter on the fitting surface of a radar platform, as shown in Figure 4.1.

(2) Fit the transceiver unit on the position and fix it using the 12 mm (10 mm for Radome) stainless bolts prepared as installation materia

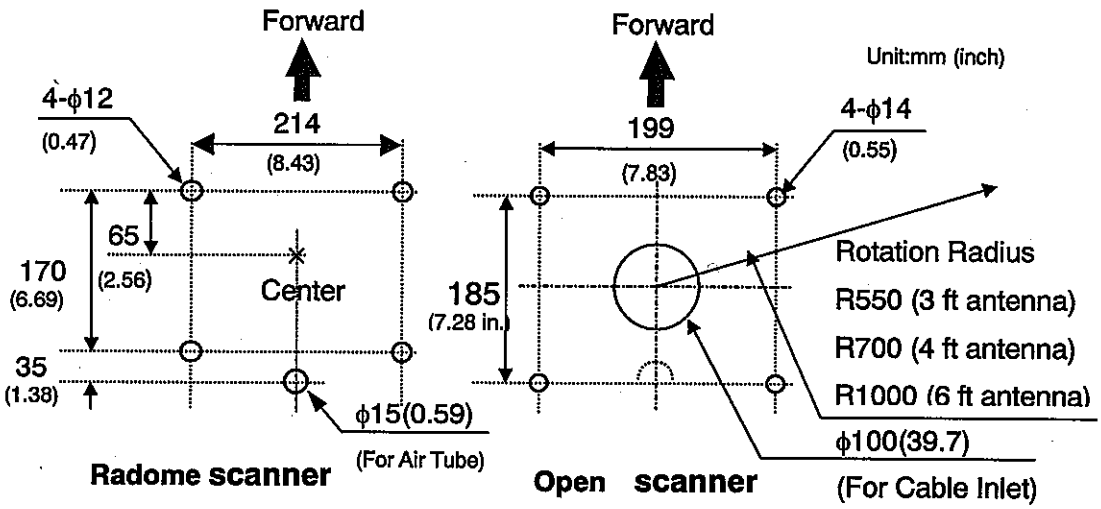


Figure 4.1 Plan view of fixing holes

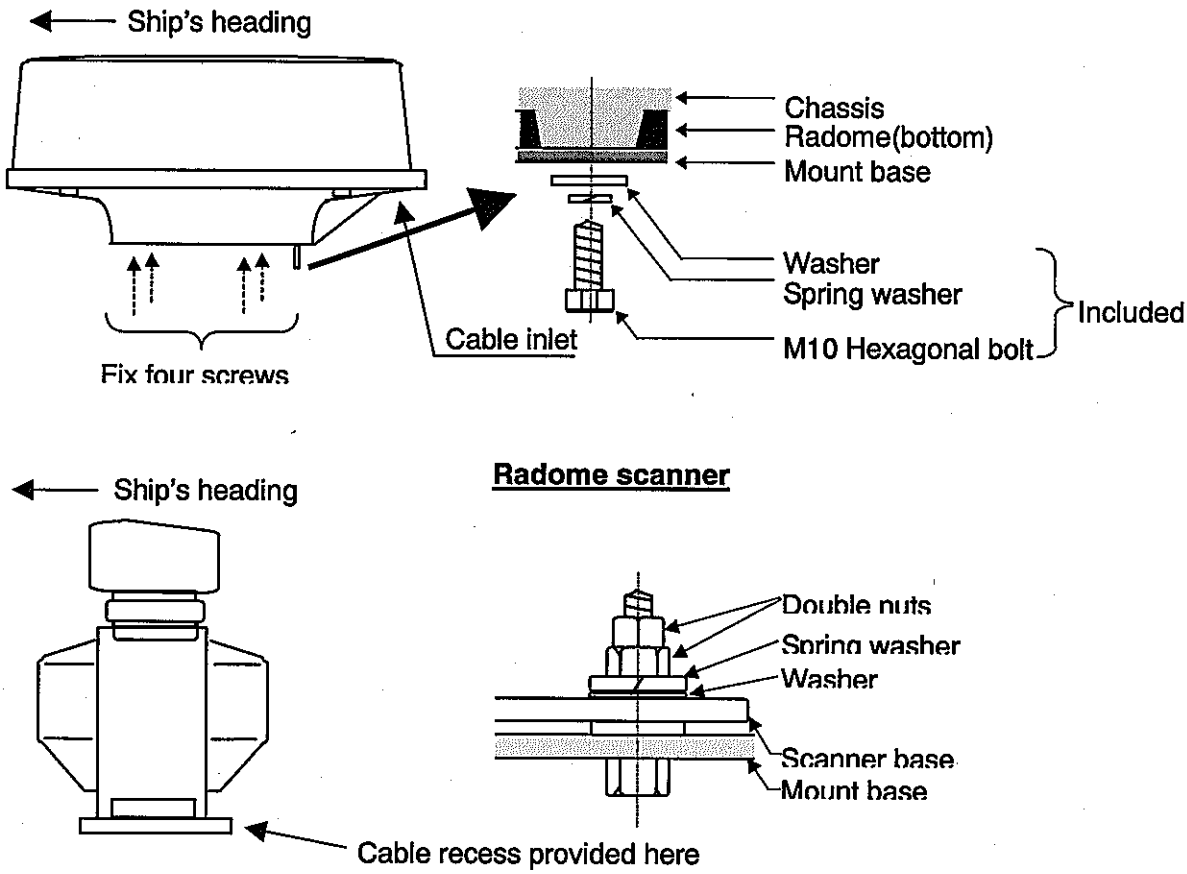


Figure 4.2 Details of the base fixing

4.6.2 Fitting the Aerial

(1) Remove the protection cap on the outlet of the rotating base.

(2) Fit the aerial on to the rotating base. Orient the aerial front face (the company logo printed on it) to the direction to which two arrow-marks on the rotating base point.

(3) Fix the aerial with four bolts attached to the aerial base.

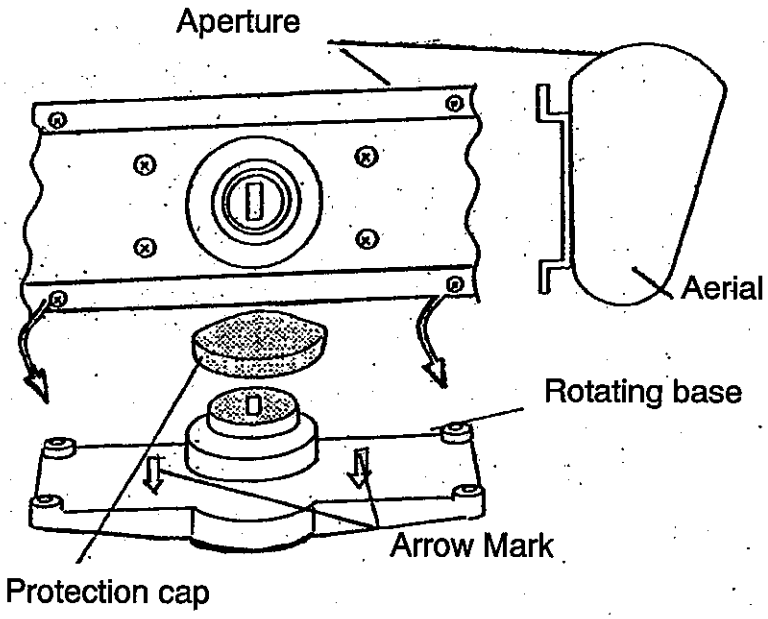


Figure 4.3 Fitting the aerial onto the rotating base

4.6.3 Connecting the cable

4.6.3.1 Connecting the cable for the Radome type scanner

1) Be sure that the power is off.

2) Remove the upper part of the radome from the scanner unit. Lift it vertically to avoid bumping it against the antenna. (There are four fixing screws.)

3) Remove the tape securing the antenna.

4) Remove the shield cover located on the backside. (There are four screws.)

5) Remove the cable clamping plate and rubber ring, pass the cable through the opening, replace the rubber ring, and clamp the cable to the scanner unit with screws on the fixing plate. Attach the 7-pin connector to X11 and 9-pin connector to X12 of the printed circuit board.

6) Replace the aluminum cover. Lay the cable shield into the channel machined into the aluminum housing. Be careful that the cable will not get caught up between the main unit and cover.

Replace the upper part of the radome being careful not to bump it against the antenna. Make sure that the cover is positioned in the correct direction as shown in Figure4.4. The upper and lower parts of the radome each have four alignment markings indicating screw positions.

Connect the cable to the plug labeled "SCANNER" on the rear panel of the display unit. Be sure to secure the rubber boot around the cable connector rim.

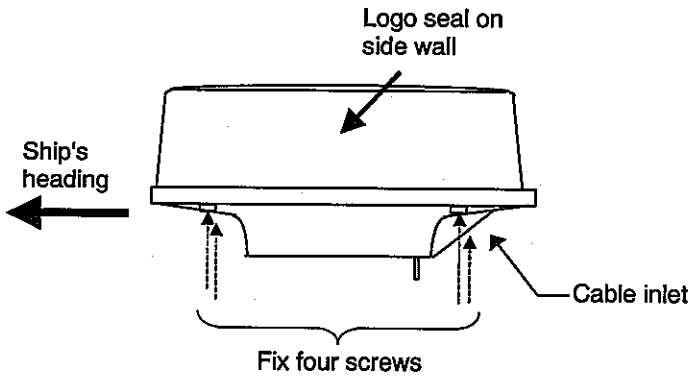


Figure 4.4 Fitting cover

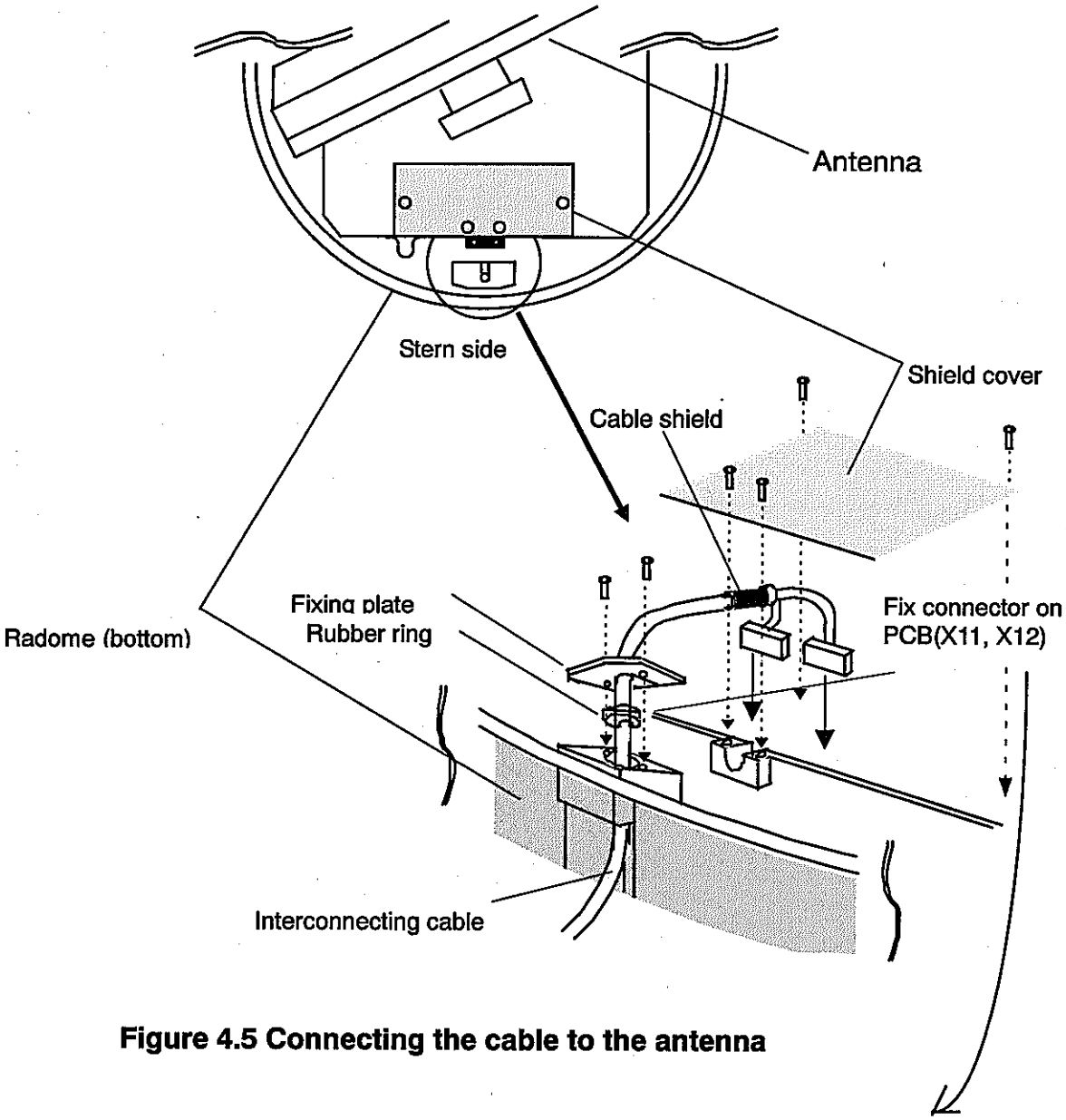
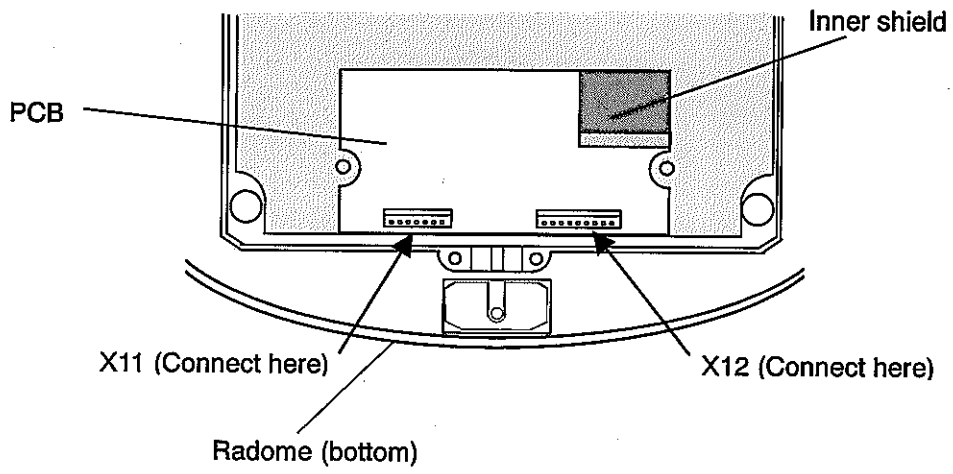


Figure 4.5 Connecting the cable to the antenna



4.6.3.2 Connecting the cable for the Open type scanner

(1) Remove the front and rear covers by loosening fixing bolts (4 bolts each).
(2) Remove the TR(transceiver) unit by removing two fixing bolts. Make sure the magnetron fitted on the transceiver does not attract any magnetizing material.
(3) Remove the rubber sealing, washer, and retainer plate from the antenna cable.
(4) Feed the cable through the access hole through to the inside of the antenna unit.
(5) Slide the rubber sealing, washer and retainer plate onto the cable.
(6) Fix the cable retainer plate over the dressed braid using three fixing bolts.
(7) Fix the antenna cable with the cable clamp.
(8) Connect the antenna cable to the Modulator PCB. (Refer to the interconnection diagram for detail)

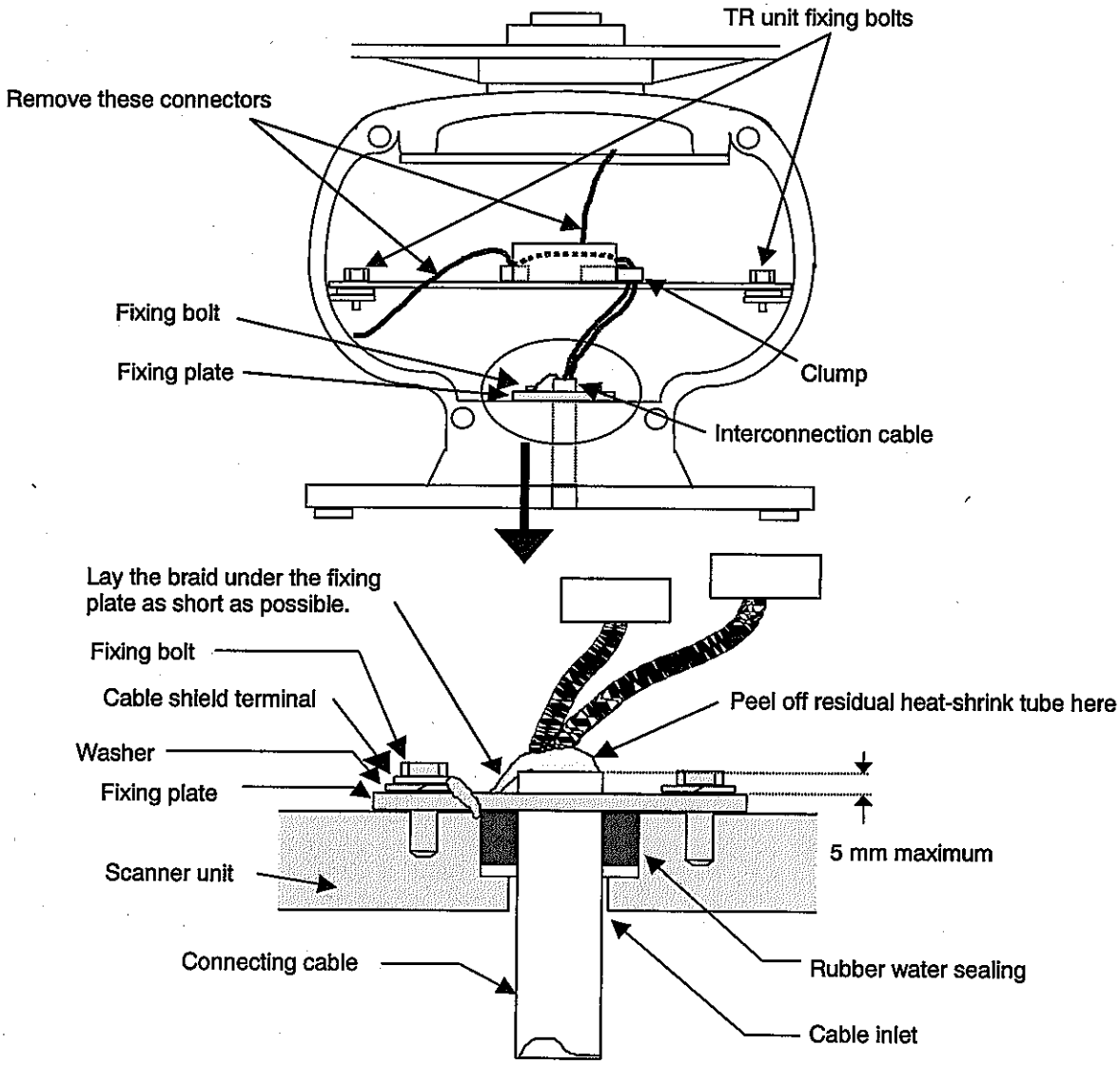


Figure 4.6 Connecting the cable to the antenna

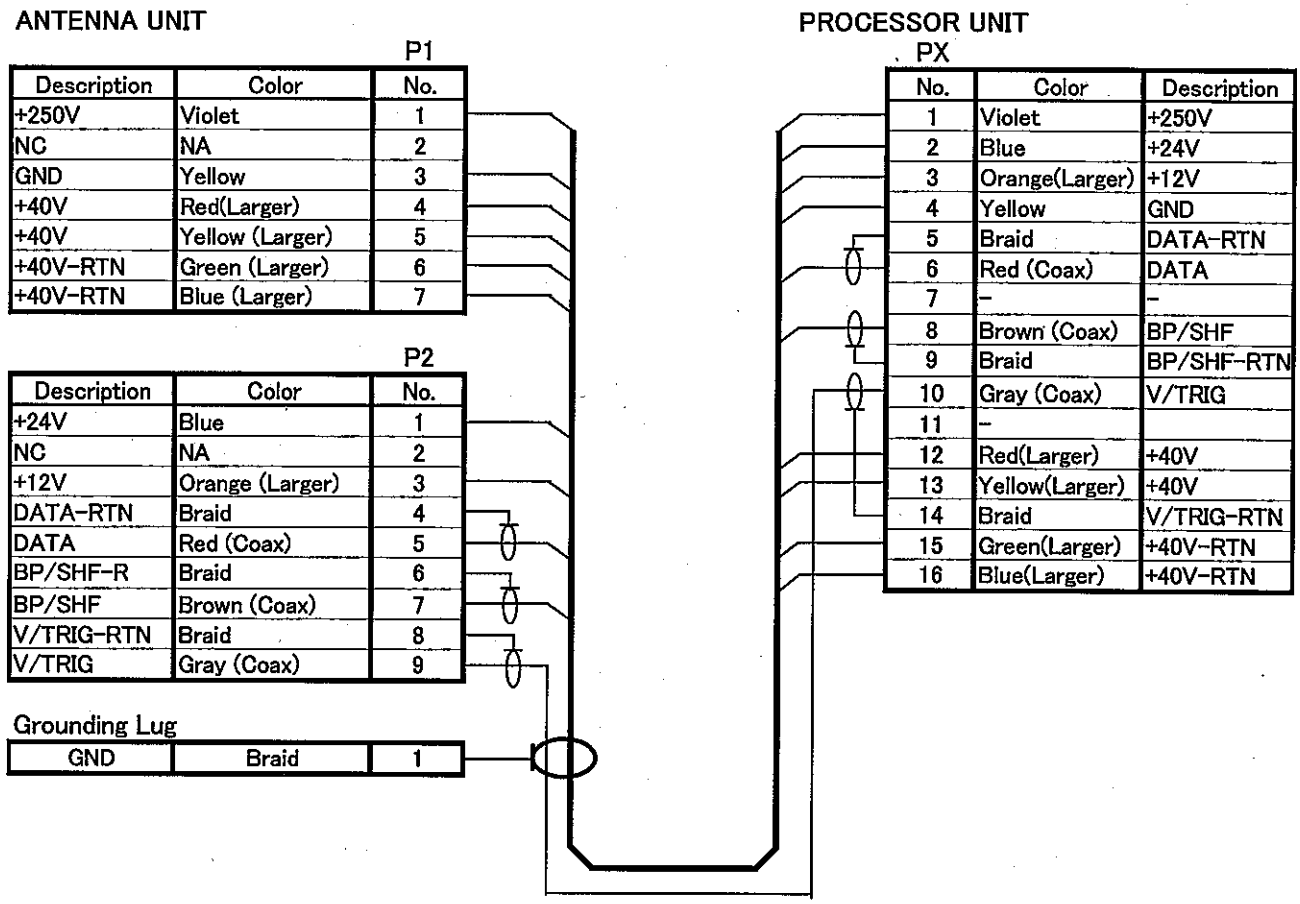


Figure 4.7 Interconnections between Antenna Unit and Display Unit

4.6.4 Installing the Processor Unit

The Processor Unit can be installed on tabletop or bulkhead. Use the following procedure for installation.

(1) Determine the location observing the precaution given in Para 4.4.2.

(2) Place the Processor Unit onto the position where the unit is installed and fix it using the truss tapping screws prepared in the installation material kit. (4 positions)

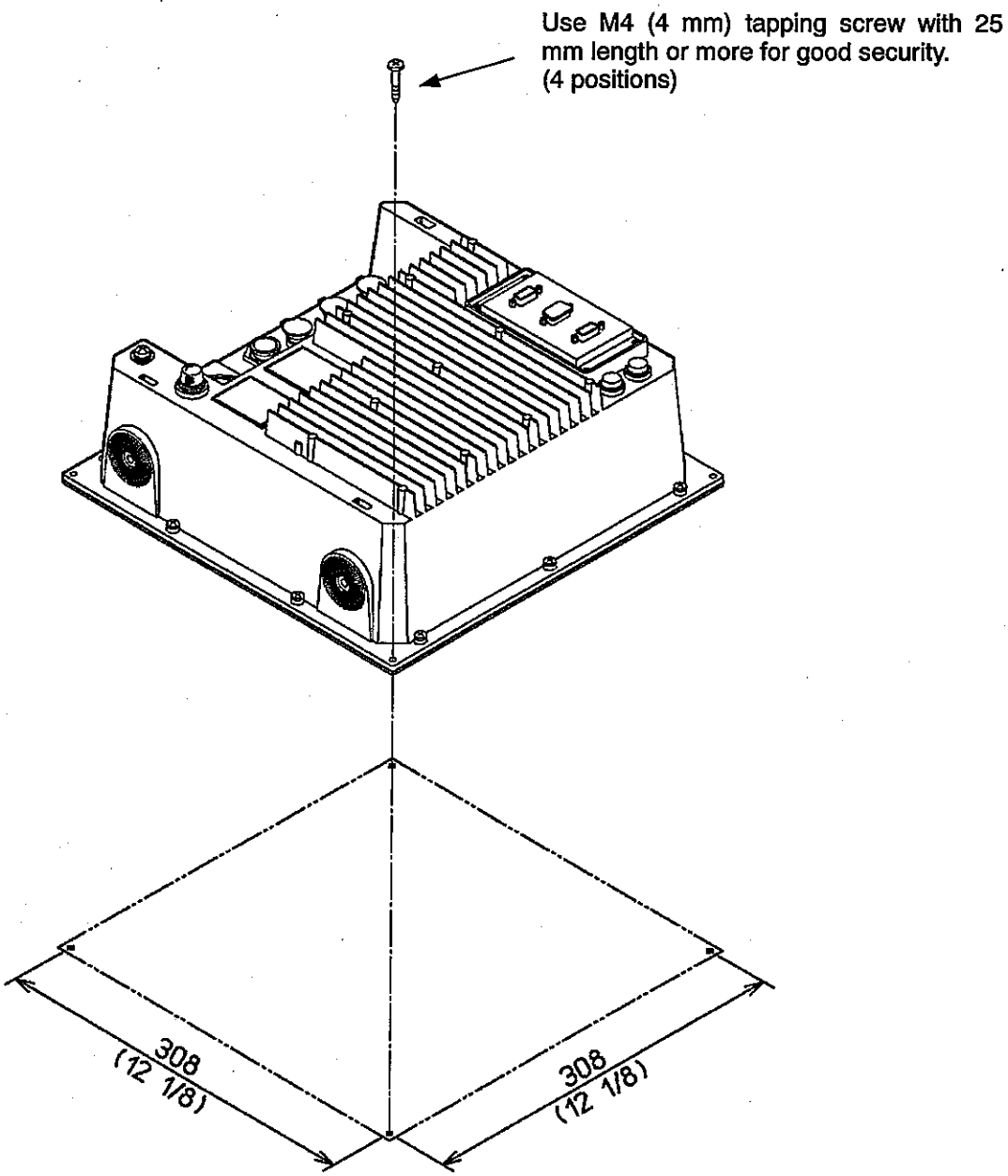


Figure 4.8 Installing the Processor Unit

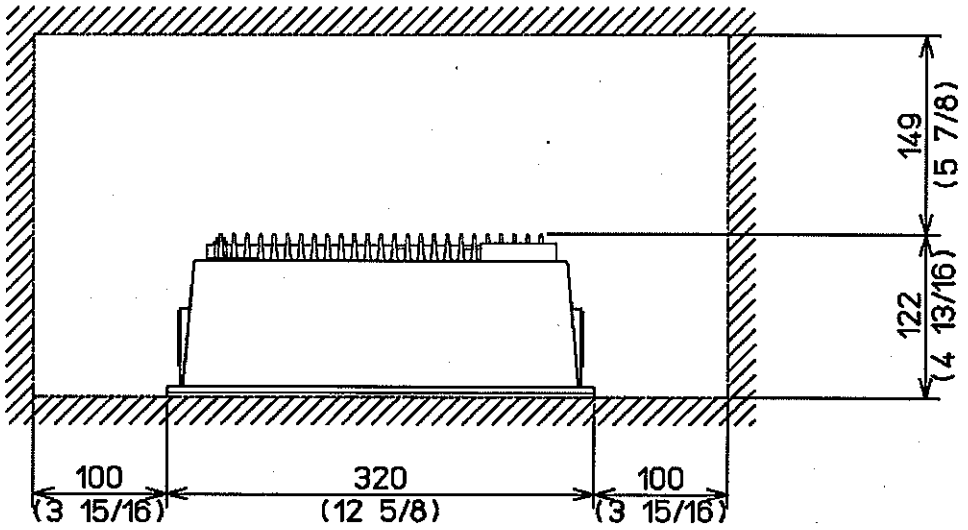


Figure 4.9 Service space required for the Processor Unit

4.6.5 Installing the Operation unit

The Operation Unit can be installed in table mount or flush mount mode.

4.6.5.1 Table mounting

(1) Remove the screw cover (4 positions) at the corner of the operation unit. To do so, insert a thin, flat screwdriver into a gap between the cover and the operation unit. Apply gentle pressure to gradually pry the cover off the unit. The screw cover comes off easily by sliding it upward.

(2) Remove the mounting bracket from the operation unit by loosening the M5 screw (4 positions).

(3) Determine the place to install the bracket and mark the point of screw. (4 positions)

(4) Put the bracket in place and fix with M5 (5 mm) tapping screw. (4 positions)

Refer to Figure 4.10 and Figure 4.11 for detail.

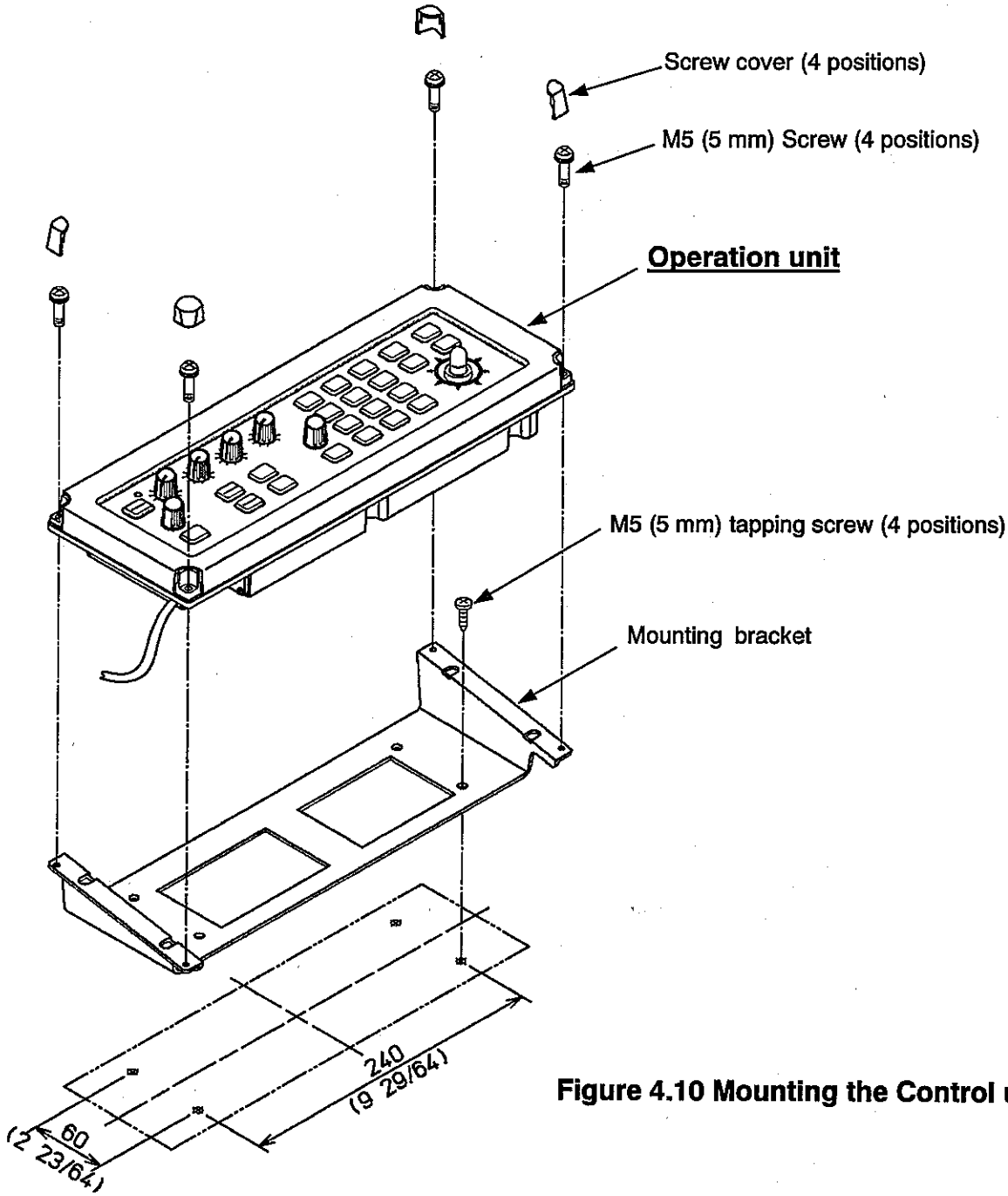


Figure 4.10 Mounting the Control unit

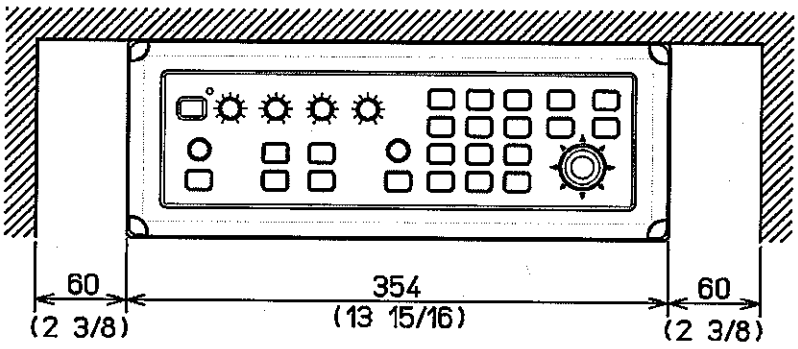


Figure 4.11 Service space required for the Operation unit

4.6.5.2 Flush mounting

Preparation:

(1) Cut aperture in surface to the dimensions shown below

(2) Mark the fixing points with a sharp-edged tool.

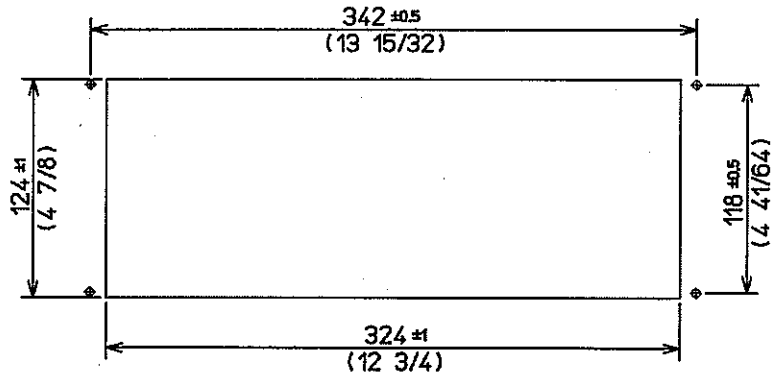


Figure 4.12 Dimensions of the Operation unit mounting aperture

Installation:

(1) Remove the mounting bracket from the Control Box.

(2) Remove a screw cover, which is fitted on each corner of the Control Box front face.

(3) Put the Control Box and connecting cable into the aperture and connect the cable to the Processor unit at the specified receptacle. (Refer to Figure 4.15)

(4) Fasten the Control Box to the panel using a 4 mm tapping-screw. (4 positions)

(5) Refit the screw covers removed in step (2).

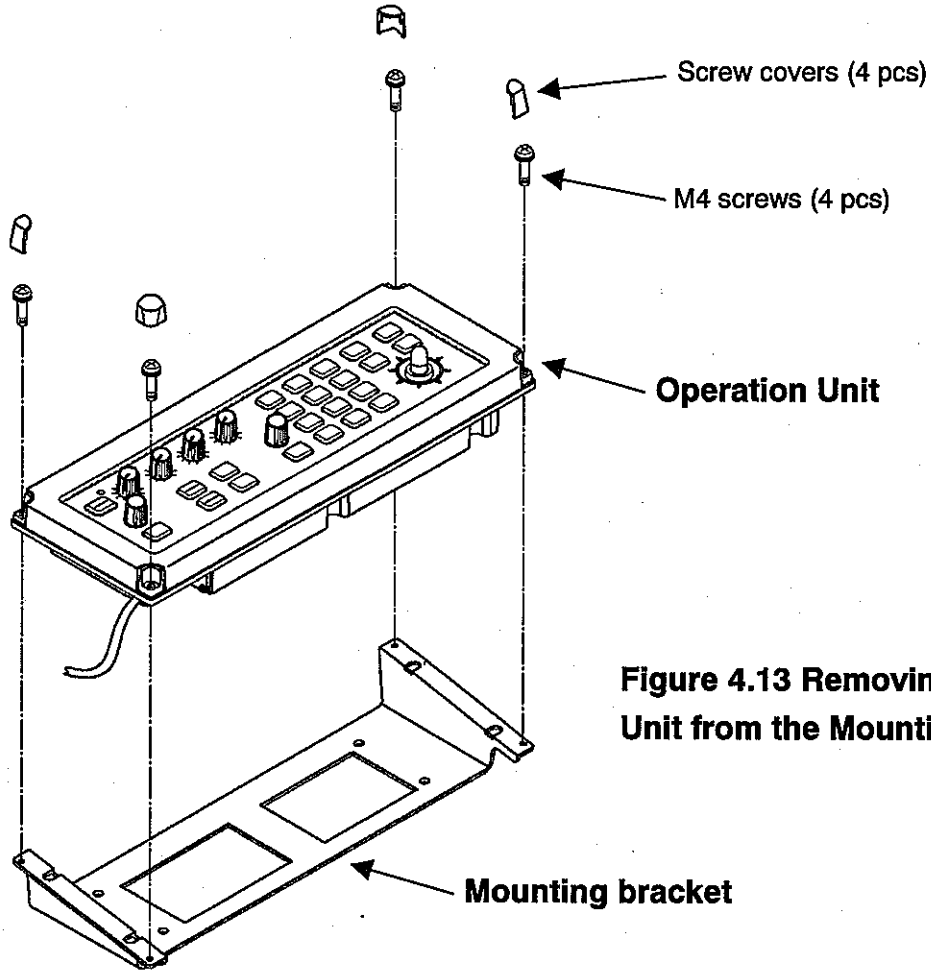


Figure 4.13 Removing the Operation Unit from the Mounting Bracket

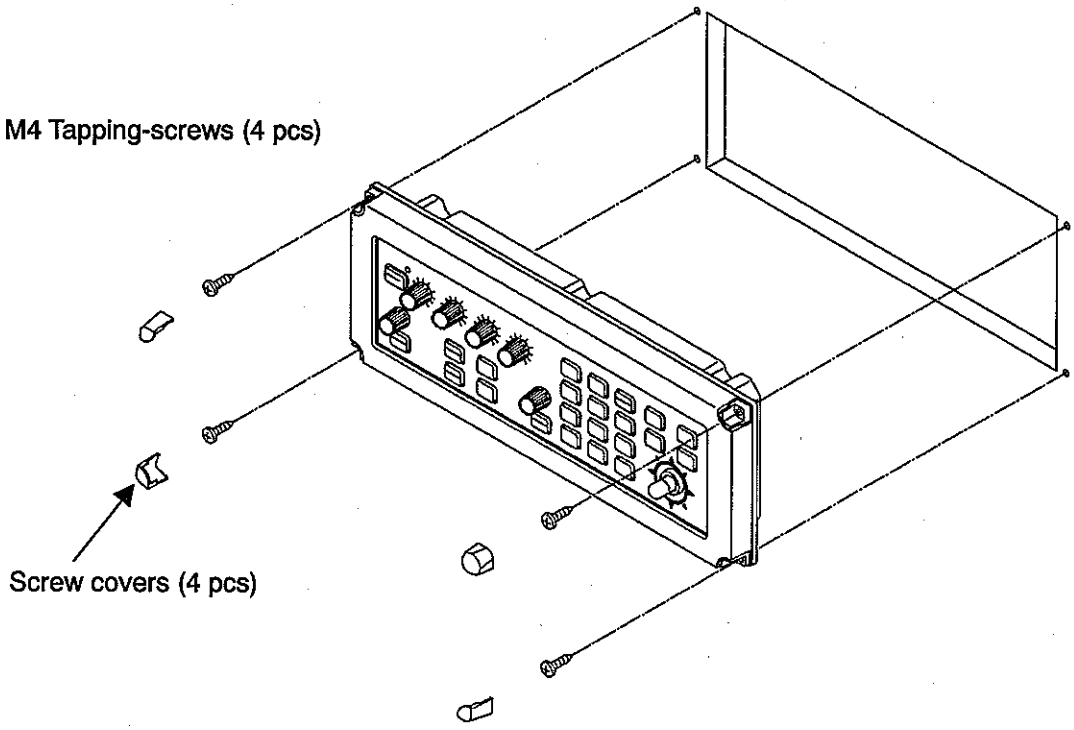


Figure 4.14 Installing the Operation Unit onto the console panel

4.6.6 Connecting the cable to the Processor Unit

Connect the antenna cable, power cable and the data cable to the designated sockets as shown in Figure 4.15.

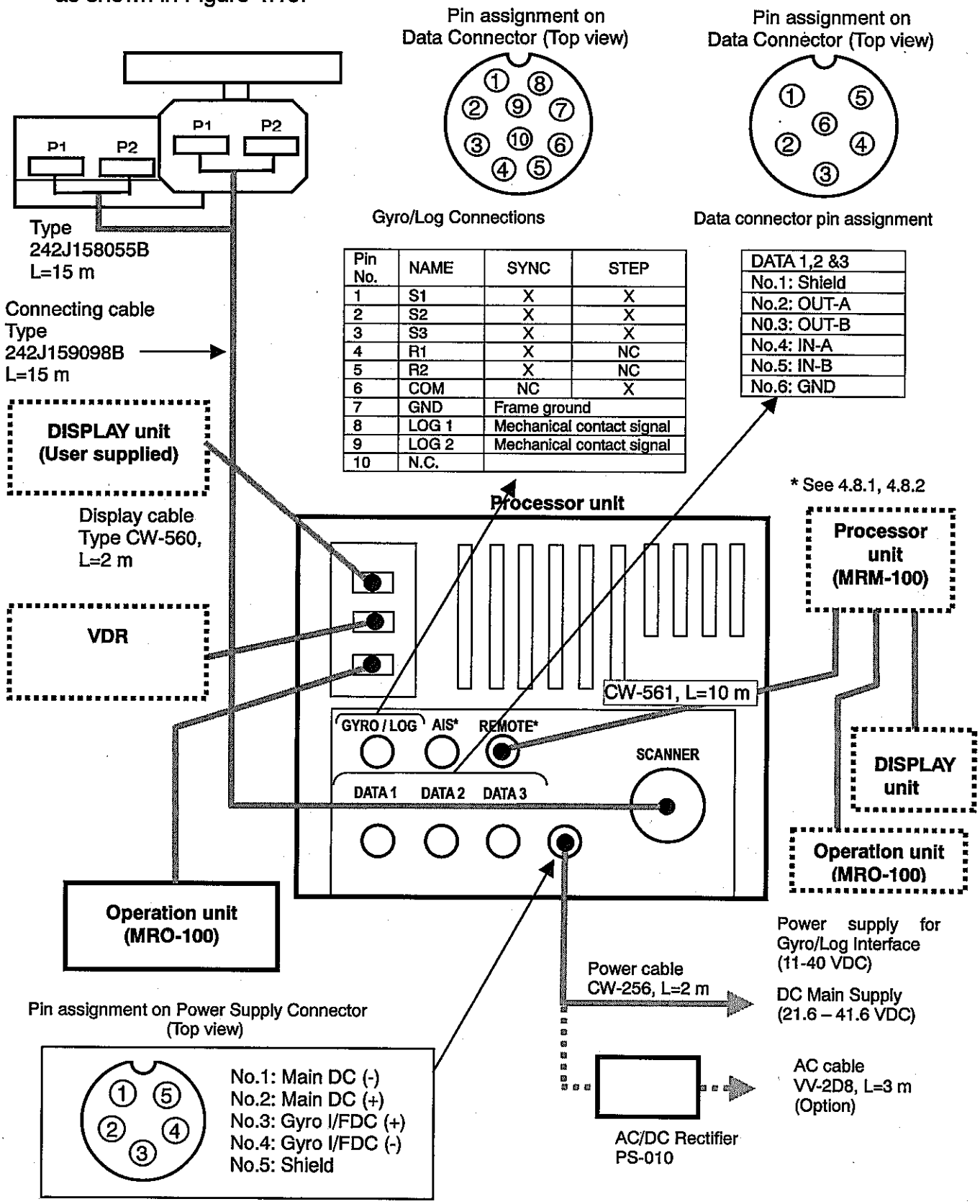


Figure 4.15 Cable connections on the Display Unit

4.6.7 Link setting for the gyrocompass

When the Gyro signal voltage is lower than 50V, change the link positions for J721 to J7125 from "2-3" to "1-2" on the Main Logic PCB (E47-700*) as shown below.

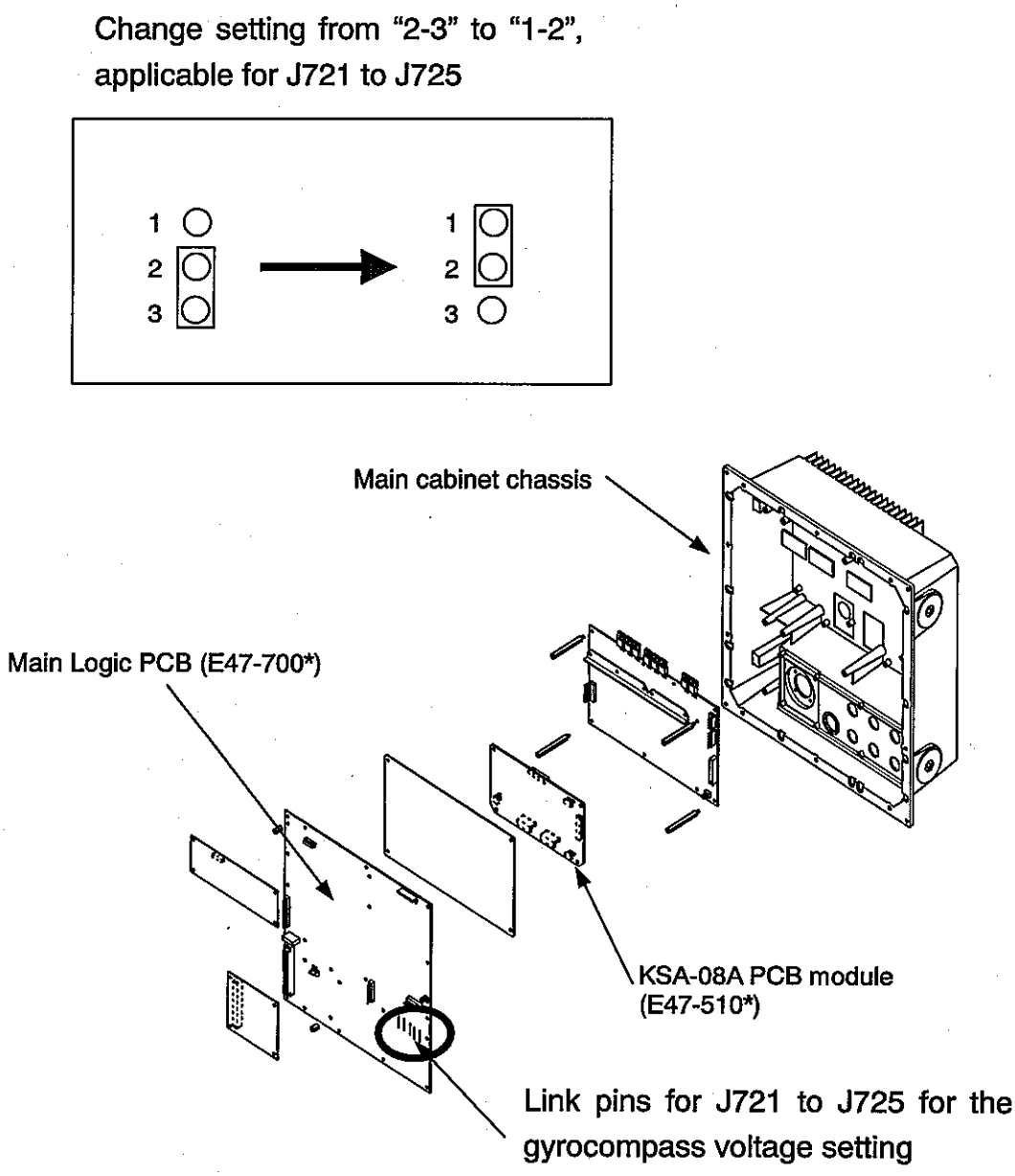


Figure 4.16 Locations of the gyrocompass links on the Main Logic PCB

4.6.8 Ferrite core assembling for Power cable

Loop the power cable around the ferrite core three turns at position of 40 cm from the connector as shown in figure 4.17.

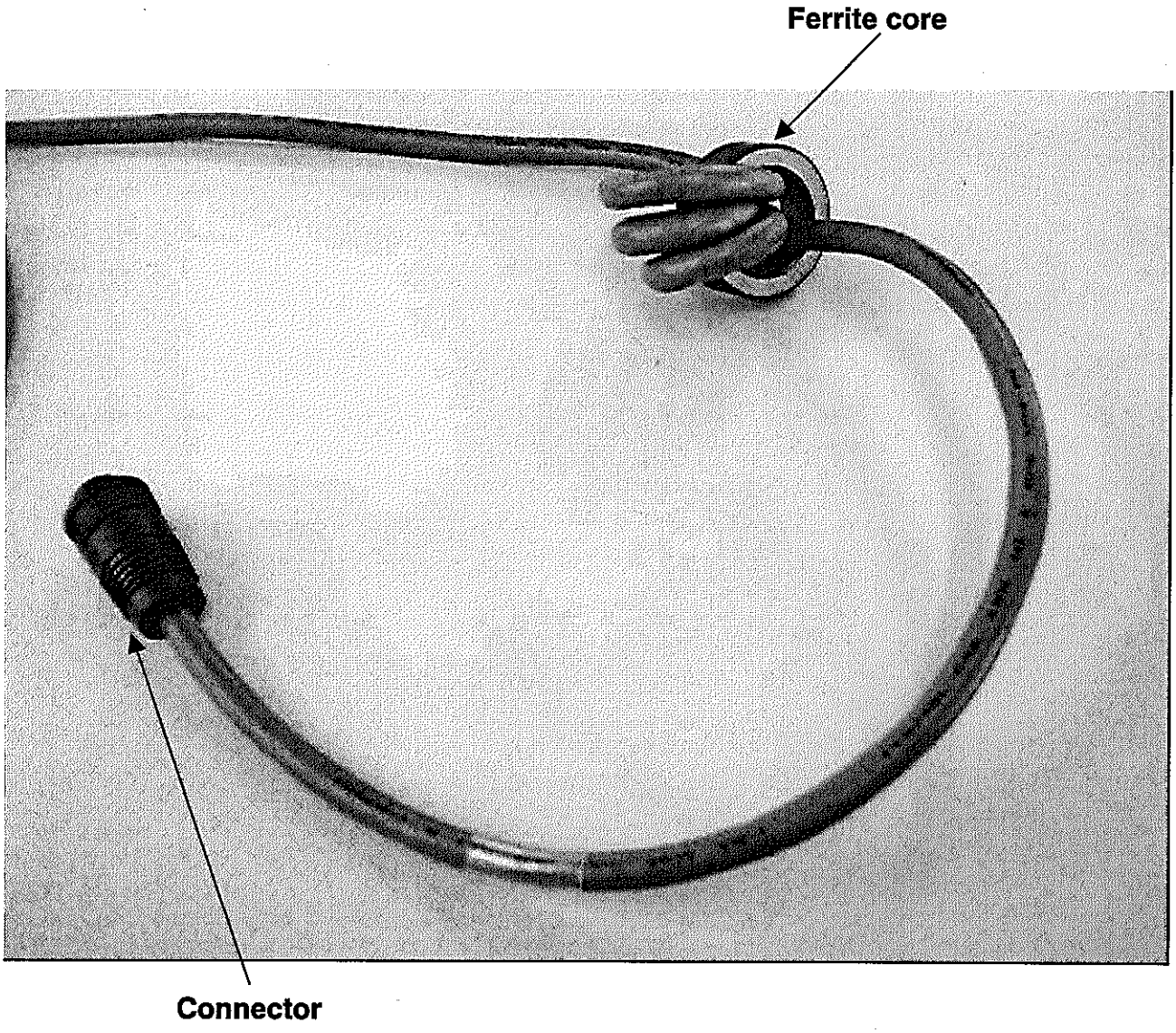


Figure 4.17 Ferrite core assembling for Power cable

4.7 Setting up after installation

A few set ups are required after installation. Before carrying out the setting up procedures, check the following items in order to make sure the equipment operates in normal manner:

(1) Check that the ship's power supply is properly rated to operate the radar system.

(2) No person is present near the platform or on the mast where the radar antenna is to be operated. Put a warning tag on the display unit that reads, **"RADAR ADJUSTMENT IN PROCESS. DO NOT TOUCH ANY CONTROLS".**

NOTE: The following setup menus are protected from ordinary key operations. To use this function, first turn off the radar set. Second, press and hold the MODE key and turn the radar on. When the standby condition is established, turn the radar on to enter the following menu functions.

NOTE: When operating the radar, the following error message happen to be indicated on the screen in case of the first power on the radar after installation, or leave the radar switched off for a long period;
"MAGNETRON HEATER CURRENT ABNORMAL", or "MAGNETRON CURRENT ABNORMAL". If the message is indicated on the screen, please ageing the magnetron first as follows.

1. Keep the radar OFF more than 20 minutes to wait the magnetron completely cold.
2. Power ON the radar. Keep the radar to stand by state for an hour.
3. Transmit the radar at 0.25NM range scale for another one hour. Do not change the range scale during the hour.
4. If above error message is indicated on the screen during this 0.25NM range operation, start again from item #1.

If the error message is indicated on the screen and stop the transmission even finish the ageing with above procedure, some problem may happen on the radar. Please contact to our local dealer.

4.7.1 Auto tune adjustment

Menu Item: ADJUST/ PRESET/ AUTO TUNE

It is necessary to adjust the AUTO TUNE for the best radar performance when installed the radar, or replaced the magnetron.

Please perform the following adjustment with entering the maintenance mode by press MODE key and power on ;

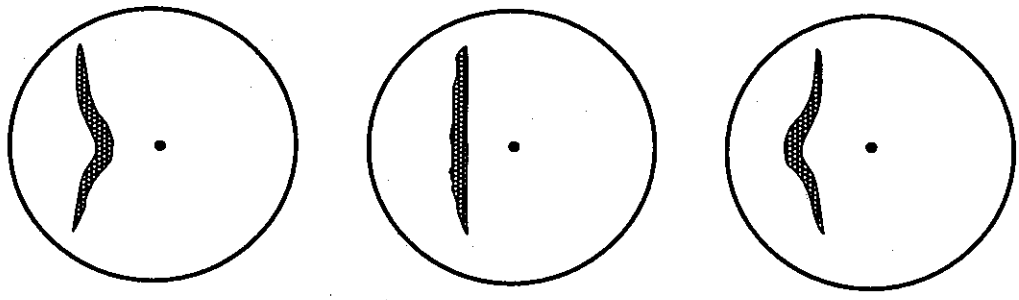
1. Set the range scale to 12NM and above to watch a land or a mountain on the screen with pressing the range[+] key.
2. Select the TUNE item from the DISP/ ECHO menu, then set it to AUTO.
3. Enter the adjustment state with selecting the AUTO TUNE from the ADJUST/ PRESET menu.
4. Change the value with control the joystick to get the maximum echo visibility on the screen.
5. Press ENT key to fix the adjustment.

4.7.2 Transmission timing

SYSTEM MENU: SYSTEM SETUP/DELAY

Adjusts the transmission delay time in order to match the timing of radar transmission and the start of the radar sweep. In practice, refer to the following figures that illustrate the result of the setting, whether it is properly adjusted or not. To effectively perform this setting, find an appropriate nearby object that is straight across from your radar. Carry out the following procedure to set up the proper transmission delay time.

(1) Highlight the DELAY item and press the ENT key to set up the selection-ready status.
(2) Press the Joystick towards the up or down until a straight video line is shown on the screen.
(3) Press the ENT key to fix the settings.



Delay time too short Delay time appropriate Delay time too much

Figure 4.18 Echo presentation depending on the transmission delay timing

4.7.3 Ship's heading set up

SYSTEM MENU: SYSTEM SETUP/HDG

Adjusts the bearing of the radar picture shown on the screen. First, take an optical bearing of a stationary target located within a viewable range using a standard magnetic compass on the ship. Then measure the target bearing on the radar. If the deviation is found more than +/- 1 degree on the screen, carry out the following procedure for correction.

(1) Move the Joystick up or down to highlight the HDG sign and press the ENT key.
(2) Press the Joystick up or down to change the bearing, in order to set the radar echo bearing to coincide with the compass bearing.
(4) Press the ENT key to fix the bearing.

4.7.4 Resetting Manual GAIN/STC(Height)/Manual STC

Gain and Sea settings have been properly set at the factory, however, when a need is arisen to change these settings use the following procedures. Resetting must be carried out in the following order.

1. Manual GAIN setting
2. STC (Height) setting
3. Manual STC setting

When completed, be sure to record respective setting values in the GAIN/SEA/HEIGHT sheet prepared in this paragraph.

4.7.4.1 Manual GAIN setting

(1) Press and hold the MODE key and turn the power on. When a beep is heard, release the key.
(2) Transmit the radar when STBY is displayed on the screen.
(3) Set the RAIN and SEA control to 0, GAIN to 8 and BRILL to 10 (Max), respectively.
(4) Confirm the following settings. If not set so.
IR level: IR2
SEA, GAIN, RAIN: MANUAL
(5) Set the range scale to maximum. (MDC-1840/41BB: 48 NM, MDC-1860BB: 64 NM, MDC-1810BB: 72 NM, MDC-1820BB: 96 NM)
(5) Select the GAIN MANUAL menu per ADJUST>PRESET>GAIN MANUAL and display the GAIN MANUAL index entry window.
(6) Move the Joystick up or down until a desired noise level (density of the noise speckle) is obtained and press the ENT key to fix the setting.
(7) Record the new GAIN setting value in the GAIN/SEA/HEIGHT Setting Record

sheet (GAIN/SEA/HEIGHT sheet, hereafter).

(8) Repeat the above procedure for all range scales, if required.

4.7.4.2 STC (Height) setting

The STC characteristic is more less subject to vary depending on the height of the antenna from the sea surface. Resetting the STC may be needed according to the circumstances of the respective vessels. To achieve the best result, this setting should be carried out off shore. Use the following procedure to do.

(1) Set SEA, GAIN and RAIN control to manual mode.

(2) Set GAIN to 8, SEA to 0 and RAIN to 0, respectively. Make sure that the sea clutter speckle is appropriately shown on the screen. If the speckle is too much or too short on the display, adjust the GAIN control as appropriate.

(3) Select an appropriate range scale to permit the clutter speckle is shown within the screen.

(4) Adjust the SEA control to reduce the sea clutter until some residual clutter speckle is shown.

(5) Turn the SEA control either clockwise or counterclockwise to see the effect of the STC. If the effect is uniform in both long and short ranges, the STC Height selection is considered appropriate. In such a case when the short range sea return is suppressed earlier that that of the long range or vice versa, use the following procedure to correct.

(6) Go SYSTEM>SYSTEM SETUP>HEIGHT and display the HEIGHT index entry window.

(7) Adjust the SEA control to see the tendency of the control. If the short-range clutter return is suppressed in advance to the long range one, reduce the HEIGHT value by pressing the Joystick downwards, and vice versa.

(8) Adjust the SEA control to confirm the effect. If the result is not satisfactory, repeat the above procedure.

(9) Press the ENT key to fix the setting.

(10) The HEIGHT index is irrelevant to the range. If this setting cannot be performed offshore, the HEIGHT index should be selected with reference to the actual antenna height from the sea surface. Use the following criteria as reference.

Antenna height	Recommended HEIGHT index
3 m	8
5 m	5
10 m	2

4.7.4.3 Manual STC setting

This setting allows the maximum STC range to be effective up to 6 NM. Use the following procedure to set up.

(1) Set radar controls as follows:
Range scale: 12 NM, RAIN/SEA: 0, GAIN: 8, BRILL: 10 (Max)
(2) Activate VRM 1 per: DISP>MARK>VRM 1>ON and press the ENT key.
(3) Set VRM 1 to 6.0 NM.
(4) Turn off IR 2 per: DISP>ECHO>IR>OFF and press the ENT key .
(5) Set SEA, GAIN and RAIN to MANUAL mode.
(6) Set SEA to 10 notch (Maximum).
(7) Go ADJUST>PRESET>SEA MANUAL and display the numeral entry window.
(8) Press the Joystick up or down to allow the background noise speckle is reduced to about 6 NM. Press the ENT key to fix the setting. Record the value.
(9) Repeat the above procedure to the rest of the range scales using the same value.
(10) Change range scale from one to the other with the SEA control set to maximum. If the STC effect is not uniform on some ranges, reset the setting repeating the above procedure.
(11) Reset IR2 to be activated.

GAIN/SEA/HEIGHT Setting Record sheet

Range scale	Pulse length	GAIN setting		SEA	
		Initial	New	Initial	New
96NM(72or64NM)	LP				
48NM	LP				
24NM	LP				
12NM	LP				
12NM	M2				
6NM	M2				
6NM	M1				
3NM	M2				
3NM	M1				
1.5NM	M1				
1.5NM	SP				
0.75NM	M1				
0.75NM	SP				
0.5NM	SP				
0.25NM	SP				
0.125NM	SP				

STC HEIGHT : Initial setting:_____ New setting:_____

4.8 Setting up option

4.8.1 AIS Interface(Option)

DISP MENU: NAV/AIS

Activate AIS function from DISP/NAV/AIS menu.

Automatic Identification System(AIS) will automatically display ships symbol and data around your ship. The range of the data display ships can be set from RADAR/AIS menu.

Pin assignment on
Data Connector (Top view)

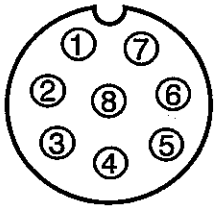


Figure 4.19 AIS connector

Pin No.	NAME
1	Shield
2	IN-B
3	IN-A
4	OUT-B
5	OUT-A
6	GND
7	AIS ALARM+
8	AIS ALARM-

4.8.2 Remote Display operation

The Processor Unit type MRM-100 can be used as a remote display. To use the display in this configuration, use the following procedure.

4.8.2.1 Connecting the Remote Display

Connect the Master display (MRM-100) and a Remote display (MRM-100) with the connecting cable CW-561 (10m) as shown in Figure 4.15.

4.8.2.2 Required set up

Set the RADAR STATUS SELECT MENU setting to INDEPENDENCE/SLAVE, the display unit will operate with the radar signal supplied from the external radar unit. Please read "6.9 Operating the Interswitch" on this manual, too.

> ⚠ **CAUTION:**
> Do not connect the Antenna unit to the remote display. If do so, the remote display may malfunction.

4.8.2.3 Possible operation on Remote Display

The remote display is configured to be slave to the master display in terms of transmission control, transmit and standby. Except this function, the remote display has all controls that the master does, such as, gain, STC, FTC, range scale change,

off-centering, changing mode of operation, VRM, EBL, fixed rings, etc.
In the following circumstances, the display presentation becomes abnormal but is not fault.

(1) When the transmission is turned off, the slave screen is displayed with plural coaxial video caused by non-updated video data.

(2) When the master display is set to short range and the remote display to long range, the remote screen will be shown with coaxial radar picture caused by higher transmission rate video being supplied from the master display.

(1) On the contrary, when the master display is set to long range and remote display to short range, the remote display screen will be shown with stretched video towards range. In a particular case, the radar video display will be shown halfway due to slower transmission rate.

NOTE: *To utilize the nav data, true bearing mode, true motion mode and EPA/ATA functions in remote display, relevant sensor units such as, gyro compass, speed log and GPS receiver must be connected.*

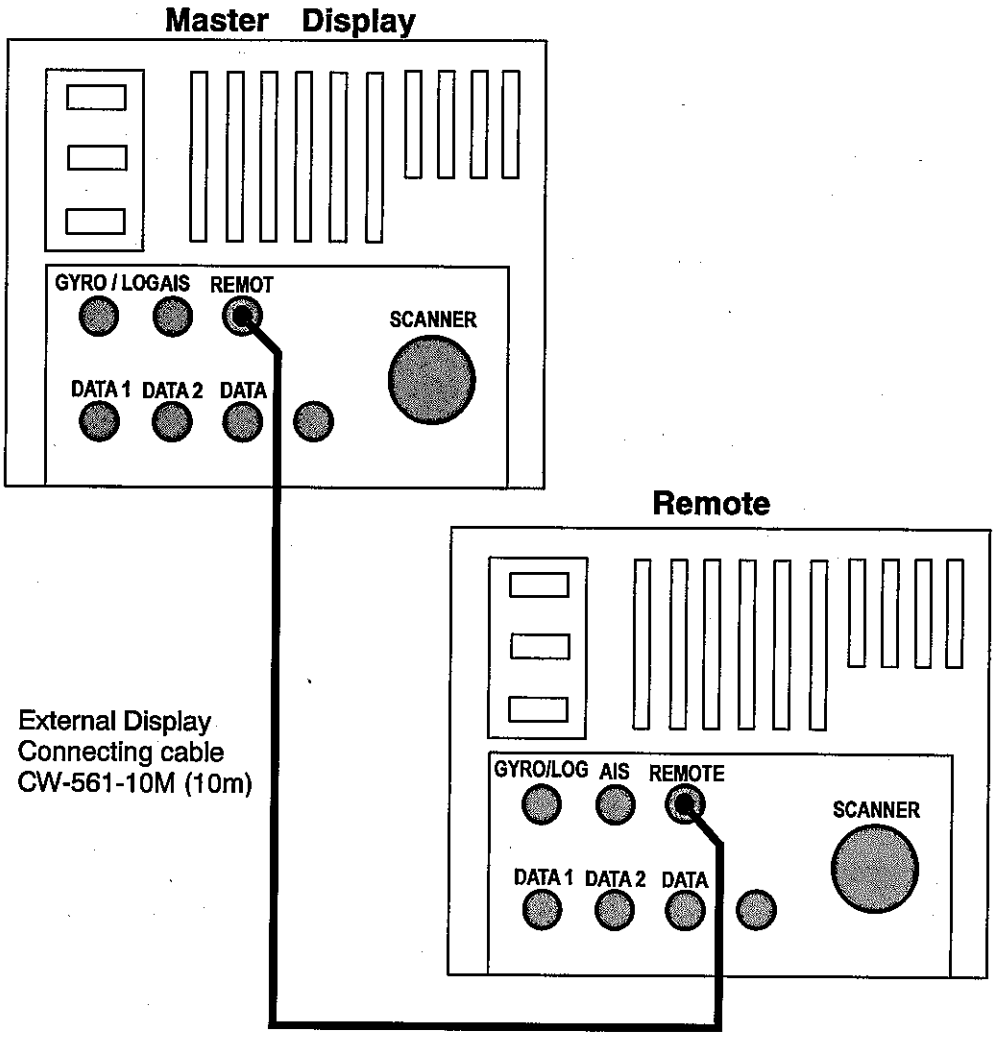
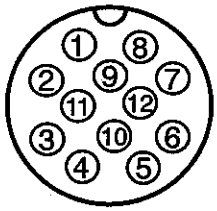


Figure 4.20 Remote display connection

Pin assignment on
REMOTEConnector
(Top view)



Pin No.	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(Not used)

Figure 4.21 Remote connector

APPENDIX 1

Installation of the ATA module, MRE-300

The ATA module MRE-300 is installed inside the display unit. Use the following the instructions for installation.

(1) Locate the position of the four fixing studs on the Main Logic PCB (E47-700*) prepared for the ATA module. (Refer to the figure below)

(2) Put the ATA module (MRE-300) on the studs and press the module gently downwards in order that the connector installed on the module properly plugs into the receptacle J705 on the Main Logic PCB.

(3) Fix the module using the four 3 mm fixing screws, prepared in the ATA module kit.

Installation of the AIS module, AIS-100

The AIS module (AIS-100) is installed inside the display unit. Use the following instructions for installation.

(1) Locate the position of the four fixing studs on the Main Logic PCB (E47-700*) prepared for the AIS module. (Refer to the figure below)

(2) Put the AIS module (AIS-100) on the studs and press the module gently downwards in order that the connector installed on the module properly plugs into the receptacle J716 on the Main Logic PCB.

(3) Fix the module using the four 3 mm fixing screws, prepared in the AIS-100 kit.

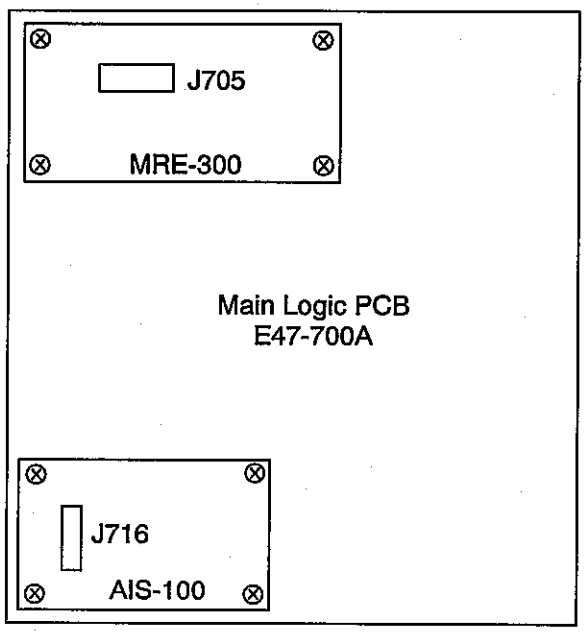


Figure A.1 Position of the ATA and AIS modules to be installed

AIS connector pinouts and cable color coding designaltion:

Cable type name	Port name	Pin number	Signal name	Color code
CW-387-5M	AIS	1	Shield	Braid
		2	IN-B	Red dot/Orange
		3	IN-A	Black dot/Orange
		4	OUT-B	Red dot/White
		5	OUT-A	Black dot/White
		6	GND	Black dot/Grey
		7	AIS ALARM+	Red dot/Pink
		8	AIS ALARM-	Black dot/Pink

About AIS malfunction alarm

If the AIS transponder gets failed in operation, the AIS ABNORMAL status is supplied from the transponder to the display causing the error message to appear on the screen.

NOTE: *In case no alarm signal lines are available in the AIS transponder, link the AIS ALARM+ (Red dot/Pink wire) and AIS ALARM- (Black dot/Pink) signal lines at the cable end at the transponder side. This processing is necessary to prevent the AIS alarm message from being shown mistakenly on the display.*

Installation of the Gyro Interface module, KSA-08A

The Gyro Interface module (KSA-08A) is installed inside the processor unit. Use the following instructions for installation.

(1) Dismount the Main Logic PCB E47-700* disconnecting cables connected to the PCB.

(2) Unscrew the four 3 mm fixing screws on the corner of the Power PCB E47-600*. The four screws will be used for fixing the Gyro Interface chassis.

(3) Locate the position of the four fixing studs at the corner on the Power PCB prepared for the KSA-08A module. (Refer to the figure A.2)

(4) Put and fix the KSA-08A module chassis with E47-510A PCB on the studs using the four 3 mm fixing screws and connect cables to connector J708 on the backside of the Main Logic PCB. (Refer to the figure A.2)

(5) Fix the Main Logic PCB E47-700* at the position again.

(6) Reconnect the cables to the connectors J707 and J718 on the topside of the Main Logic PCB. (Refer to the figure A.2)

(3) Reconnect all cables to the Main Logic PCB.

Cable connecting list

No.	KSA-08A (E47-510A)	Main Logic PCB (E47-700*)
1	J512	J708
2	J515	J707
3	J517/518	J718

GYRO connector pinouts and cable color coding designaltion:

Cable type name	Port name	Pin No.	Signal name	Color code
CW-388-5M	GYRO	1	S1	Red dot/Orange
		2	S2	Black dot/Orange
		3	S3	Red dot/Grey
		4	R1	Red dot/White
		5	R2	Black dot/White
		6	COM	Red dot/Yellow
		7	GND	Shield
		8	LOG1	Red dot/Pink
		9	LOG2	Black dot/Pink
		10	NC	

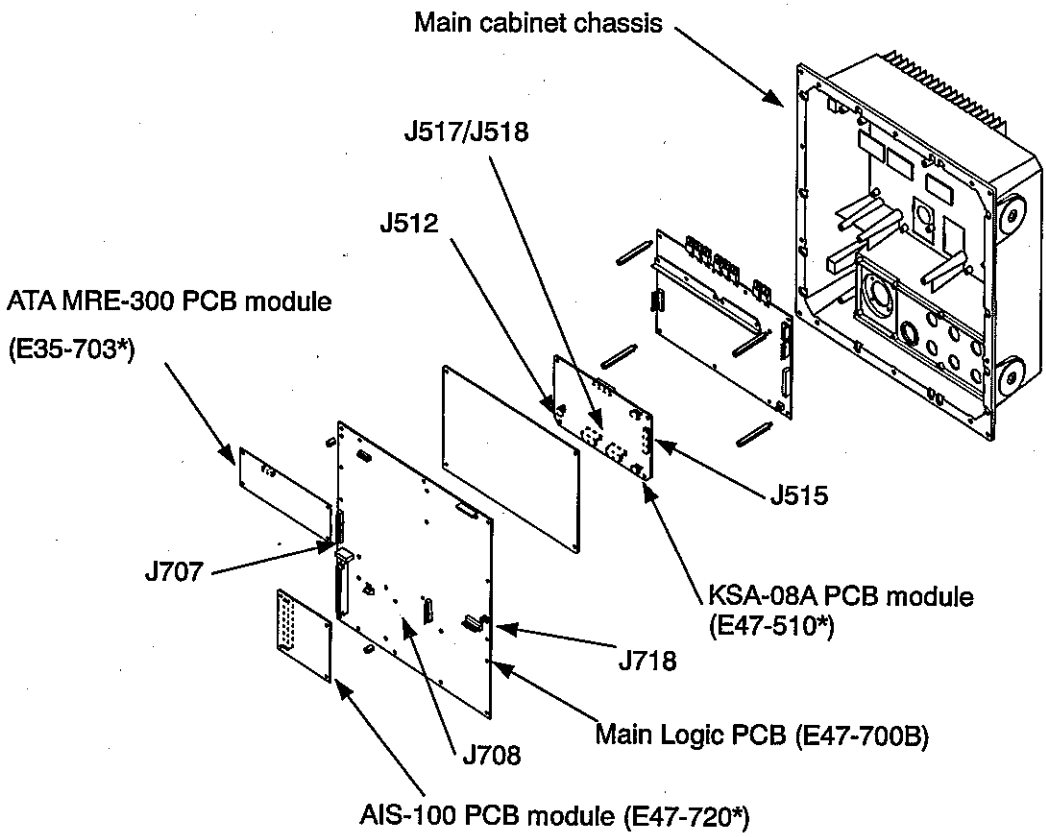


Figure A.2 Fitting ATA, AIS and Gyro Interface modules into Main Logic PCB

APPENDIX 2

Optional cables pinouts and cable color-coding designation

DATA connector pinouts and cable color coding designaltion:

Cable type name	Port name	Pin No.	Signal name	Color code
CW-376-5M	DATA	1	Shield	Shield, Blue
		2	OUT-A	White
		3	OUT-B	Red
		4	IN-A	Orange
		5	IN-B	Black
		6	GND	Green

REMOTE connector pinouts and cable color coding designaltion:

Cable type name	Port name	Pin No.	Signal name	Color code
CW-561-10M	REMOTE	1	VIDEO OUT	Coax. Black 1D(*)/White
		2	TRIG OUT	Coax. Black 2D(*)/White
		3	GND	Coax. Shield
		4	AZIP OUT	White
		5	AHF OUT	Yellow
		6	GND	Coax. Shiled
		7	VIDEO IN	Coax. Black 3D(*)/White
		8	TRIG IN	Coax. Black 4D(*)/White
		9	GND	Shield
		10	AZIP IN	Green
		11	SHF IN	Blue
		12	+12V DC	NC

NOTE for (*):

1D – 4D: This notation indicates the number of dots printed on the cable jacket.

APPENDIX 3

Recommended TFT Display

Manufacturer		Jakob Hatterland Display AS (Norway)		
Type name		JH17T01MMDA2	JH18T01MMDA2	JH19T01MMDA2
Screen size (inch)		17.4	18.1	19.0
Number of dots		1280 x 1024	1280 x 1024	1280 x 1024
Dot pitch (mm)		0.27 x 0.27	0.2805 x 0.2805	0.294 x 0.294
Effective diameter (mm)		259.2	269.28	282.24
Contrast ratio		400:1	300:1	500:1
Light intensity (cd/m^2)		220 max.	200 (typ)	250 (typ)
Viewable angle (deg)		+/-80	+/-85	+/-85
Input signal		Analog RGB	Analog RGB	Analog RGB
Power supply		24 VDC	24 VDC	24 VDC
Appliable technical std.				
	IEC 60945 Ed.3	Yes	Yes	Yes
	IEC 60936-1	No	No	No

Manufacturer		InnoScan Industrial Computer A/S (Denmark)	AYDIN Displays Inc. (USA)	CONRAC GmbH (Germany)
Type name		MON1900M	4218R3C-341-51L	6017SD
Screen size (inch)		19.0	18.1	17
Number of dots		1280 x 1024	1280 x 1024	1280 x 1024
Dot pitch (mm)		0.28 x 0.28	0.28 x 0.28	0.264 x 0.264
Effective diameter (mm)		268.8	268.8	253.44
Contrast ratio		Not specified	Not specified	500:1
Light intensity (cd/m^2)		250 (typ)	200 (typ)	200 (typ)
Viewable angle (deg)		+/-80	+/-85	+/-85
Input signal		Analog RGB	Analog RGB	Analog RGB
Power supply		10-36 VDC (option)	21-32 VDC	24 VDC
Appliable technical std.				
	IEC 60945 Ed.3	Yes	Yes	Yes
	IEC 60936-1	Yes (BSH)	No	Yes

Manufacturer		CONRAC GmbH (Germany)	KENT MODULAR ELECTRONICS LTD (UK)	
Type name		6019SD	29LR183D45UN	29LR193D35MP
Screen size (inch)		19.0	18.1	19.0
Number of dots		1280 x 1024	1280 x 1024	1280 x 1024
Dot pitch (mm)		0.294 x 0.294	0.2805 x 0.2805	0.294 x 0.294
Effective diameter (mm)		282.44	269.28	282.24
Contrast ratio		500:1	350:1	500:1
Light intensity (cd/m^2)		200 (typical)	200 (typical)	250 (typical)
Viewable angle (deg)		+/-85	+/-85	+/-85
Input signal		Analog RGB	Analog RGB	Analog RGB
Power supply		24 VDC	15 – 30 VDC	15 – 30 VDC
Appliable technical std.				
	IEC 60945 Ed.3	Yes	Yes	Yes
	IEC 60936-1	Yes	No	No

Chapter 5

Basic Operation

Contents

Chapter 5 Basic Operation

5.1 Introduction

In this chapter, all necessary operating instructions are given from getting started to turning off the system. The following panel layout illustration will give you an idea what sort of key switches and controls are available as well as their brief functional descriptions.

5.2 Control Panel Layout

The following illustration shows the layout of the control panel. All controls and key switches are grouped for respective functions.

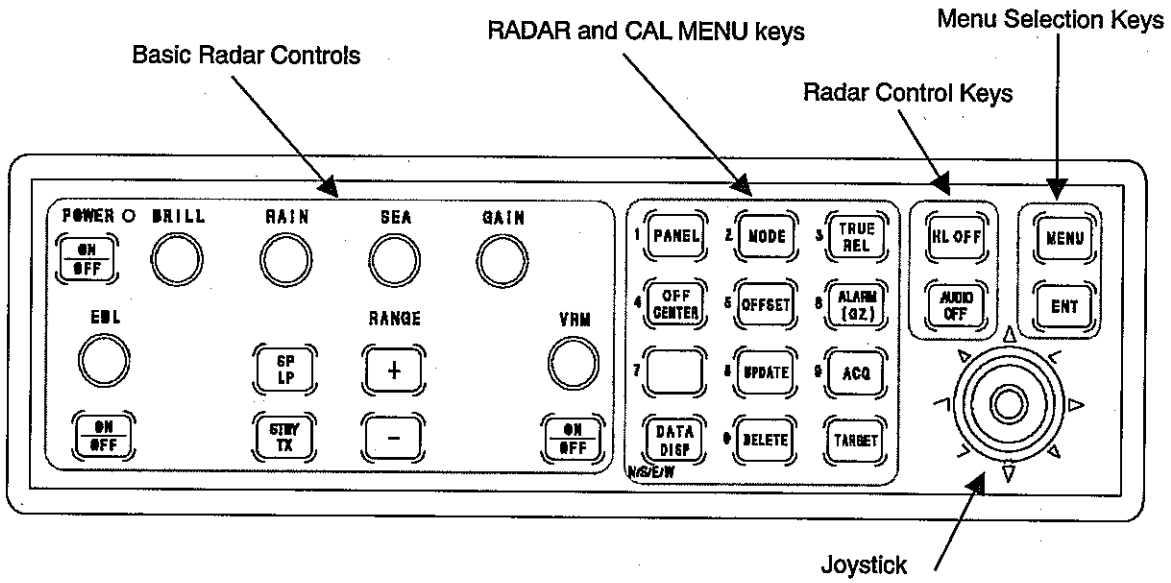


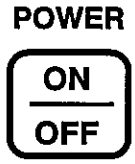
Figure 5.1 Control panel layout

5.3 Operating Controls

All necessary radar controls and functional settings can be made on the display control panel. For fundamental radar operations, such as turning on and off the radar, transmit, range change, gain control, anti-clutter rain and sea controls, the respective dedicated controls and key switches are provided, which are grouped on the left side of the control panel. For setting up various functions and ATA operations, relevant key switches and the Joystick are provided on the right side of the control panel.

SWITCHES AND CONTROLS

POWER switch

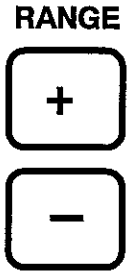


The POWER key switch turns on and off the mains supply to the radar system.

STBY/TX switch

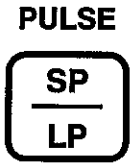
When the system goes into standby mode after 3 minutes preheating period, the STBY/TX key switch functions as a transmission switch. To temporarily stop the transmission, press the STBY/TX key again. The system returns to standby mode.

RANGE +/- switches



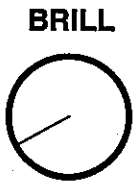
The RANGE key changes the range scale. A press of the + key or – key increases or decreases the range scale, respectively.

SP/LP switch



The SP/LP key is used to change the transmission pulse length to either long or short. Default is a standard pulse length. Subsequent pressing of the key toggles the pulse length between standard and long pulses.

BRILL control



The BRILL control is used to set the brilliance of the display tube. Turning the control CW increases the picture brilliance and CCW decreases the brilliance.

GAIN control

The GAIN control is used to vary the receiver gain. Turning the GAIN control CW increases the receiver gain, and CCW decreases the gain. Select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU, the automatic gain control will come into effect. The GAIN MANUAL sign will change to GAIN AUTO on the screen. In this mode, no manual control is available.

SEA control

The SEA control is used to reduce the clutter echo returned from the sea surface. Turning the control CW reduces the clutter and its effect becomes the largest at a full CW position and minimum at a full CCW position. Select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU, Harbor STC and the Automatic STC functions will come into effect. The HARBOR STC that provides a preset Anti-clutter sea effect, optimized for narrow areas. The AUTO1 and AUTO2 STC provides a hands-free Anti-clutter sea effect. The mode will display as AUTO1, AUTO2, HARBOR and SEA MANUAL in sequence. In the HARBOR and Auto Anti-clutter Sea modes, the manual control is disabled.

RAIN control

The RAIN control is used to reduce the clutter echo from rain or snow. Turning the control CW reduces the clutter echo with maximum effect at a full CW position and minimum at a full CCW position. Select AUTO1 or AUTO2 by ADJUST/ADJUST MENU, the automatic anti-rain clutter control will come into effect. The RAIN MANUAL sign will change from RAIN to RAIN AUTO on the screen. In this mode, the manual control is disabled.

EBL ON/OFF key

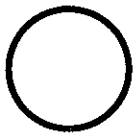
The EBL SEL key is used to switch EBL control at every press of the key. When the second EBL and Parallel Index Line (PI) feature are selected, this key is used to select these markers in the following cyclic order.

- First press: First EBL
- Second press: Second EBL
- Third press: Parallel Cursor
- Subsequent press of the key repeats the above steps.

To select the second EBL, press MENU key and select 2nd EBL item from the DISP/MARK menu. Then press ENT key and select ON. To erase the second EBL, select OFF from the menu. To select the Parallel Index line, select PI from the same menu and select ON.

EBL control

EBL



The EBL control is a rotary type control used to move the EBL position and parallel Index line.

VRM SEL key

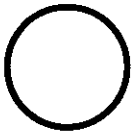
The VRM SEL key is used to switch VRM control at every press of the key. When the second VRM and Parallel Index Line (PI) feature are ON, this key is used to select these markers in the following cyclic order.

- First press: 1st VRM
- Second press: 2nd VRM
- Third press: Parallel Cursor
- Subsequent press of the key repeats the above steps.

To select the second VRM, press MENU key and select 2nd VRM from the DISP/MARK menu. Then press ENT key and select ON.
To erase the second VRM, select OFF from the menu.
To select the Parallel Index line, select PI from the same menu and select ON.

VRM control

VRM



The VRM control is a rotary type used to move the VRM position.

PANEL key

The PANEL key is used to change the brilliance of the panel illumination. Every press of the key will increase or decrease the brilliance in sequential order. The illumination level will be set to an appropriate level when the radar is first turned on.

OFFCENTER key

The OFFCENTER key is used to offset the picture to an assigned point determined by the cross cursor. First, move the cross cursor with Joystick to the point where the picture is to be offset. Second, press the OFF CENTER key. A further press of the key will reset the picture to the screen center.

DATA DISP .key

The DATA DISP key is used to show navigational information on the upper right of the screen. Every press of the key displays the following information in sequence.

First press:	Own ship's course and speed data
Second press:	Own ship's position obtained from LORAN Receiver.
Third press:	Own ship's position obtained from (D) GPS in lat/long coordinate.
Fourth press:	Own ship's position and the distance/bearing to a waypoint en route.

⚠ **Caution:** The navigation data shown in this step is directly received from external navigator equipment. Note that the COG (Course Over Ground) and the SOG (Speed Over Ground) data supplied from the navigator device may slightly differ from what is shown in the top right corner of the screen as own ship's bearing and speed data.

MODE key

The MODE key is used to change the picture mode. Every press of the key will change the mode in the following sequence.

First press:	H UP RM (Head Up, Relative Motion)
Second press:	N UP RM (North Up, Relative Motion)
Third press:	C UP RM (Course Up, Relative Motion)
Fourth press:	N UP TM (North Up, True Motion)

Further press of the key returns the picture mode to the H UP RM mode.

OFFSET key

The OFFSET key is used to set the EBL 1 and VRM 1 off-centered on the screen. Every press of the key toggles the EBL 1 and VRM 1 off-centered and centered.

UPDATE key

The UPDATE key is used in the EPA function, in conjunction with the TARGET key and Joystick, to correct a plotted target position. For detail, refer to Para 6.1.16.1 "Correcting the latest plotting position".

DELETE key

The DELETE key is used in the EPA/ATA function, in conjunction with the TARGET key, to cancel a plotted target. For detail, refer to Para 6.1.16 Operation of EPA or Para 6.1.17 Using ATA.

ACQ key

The ACQ key is used in the EPA/ATA function, in conjunction with the TARGET key, to acquire a target for tracking. For detail, refer to Para. 6.1.16 Operation of EPA or Para. 6.1.17 Using ATA.

TARGET key

The TARGET key is used in the EPA/ATA function, to assign the target number to acquire, delete or display the ATA/EPA information of each tracked target. For detail, refer to Para 6.1.16 Operation of EPA or Para 6.1.17 Using ATA.

TRUE/REL key

The TRUE/REL key is used to change EPA or ATA target vectors to Relative or True.

ALARM (GZ) key

The ALARM key is used to turn on and off the Guard Zone Alarm.

HL OFF Key

The HL OFF key is used to momentarily remove the Heading Line from the screen. When the key is pressed and held, the Heading Line will be removed and, when released it appears again.

AUDIO OFF

The AUDIO OFF key is used to temporarily turn off the audio alarm. A press of the key will silence the alarm.

MENU key

The MENU key is used to display the MENU on the screen. Every press of the key will change the contents of the menu as follows:

First press: RADAR MENU. This menu contains all the preset items for radar functions, sensor data display and EPA/ATA operational settings.

Second press: CAL MENU. This menu contains all technical settings for the radar operation and Performance Monitor.

ENT key

The ENT key is used to activate and fix the selected menu items by the joystick.

5.4 Getting Started

(1) Press the POWER ON/OFF key switch. The red LED lamp lights accordingly and a 3-minute timer starts to count down. At the same time, the following information will be shown on the screen.

- Application software name
- Range scale
- Range ring interval

(2) When the countdown timer finishes, the STANDBY sign will appear on the screen.

(3) Press the STBY/TX key to transmit. The radar starts transmission and the radar video, alphanumeric and graphic information will be shown on the screen at a preset brilliance level. Refer to Figure 5.2 for possible screen presentation.

5.5 Basic Radar Operations

Basic radar controls can be set up using dedicated keys and controls on the control panel. These include:

- Range scale selection
- Pulse selection
- Gain control
- Anti-clutter SEA
- Anti-clutter RAIN
- Bearing measurement with EBL and two EBLs
- Range measurement with VRM and two VRMs
- Picture off-centering
- Selection of presentation mode
- Guard Zone Alarm
- Control panel brilliance

All available screen presentations are shown in Figure 5.2 and respective meanings are given under the illustration.

5.5.1 Range scale selection

A press of the RANGE + or RANGE – key will increase or decrease the range scale by step.

5.5.2 Transmission Pulse selection

Press the SP/LP key if required, to change the pulse length according to your requirement. The pulse change function is available on specific range scales, ranging from 3/4 NM to 12 NM. Available pulse lengths vs range scales are shown in Table 5.1 "Range vs Transmission Pulse Length".

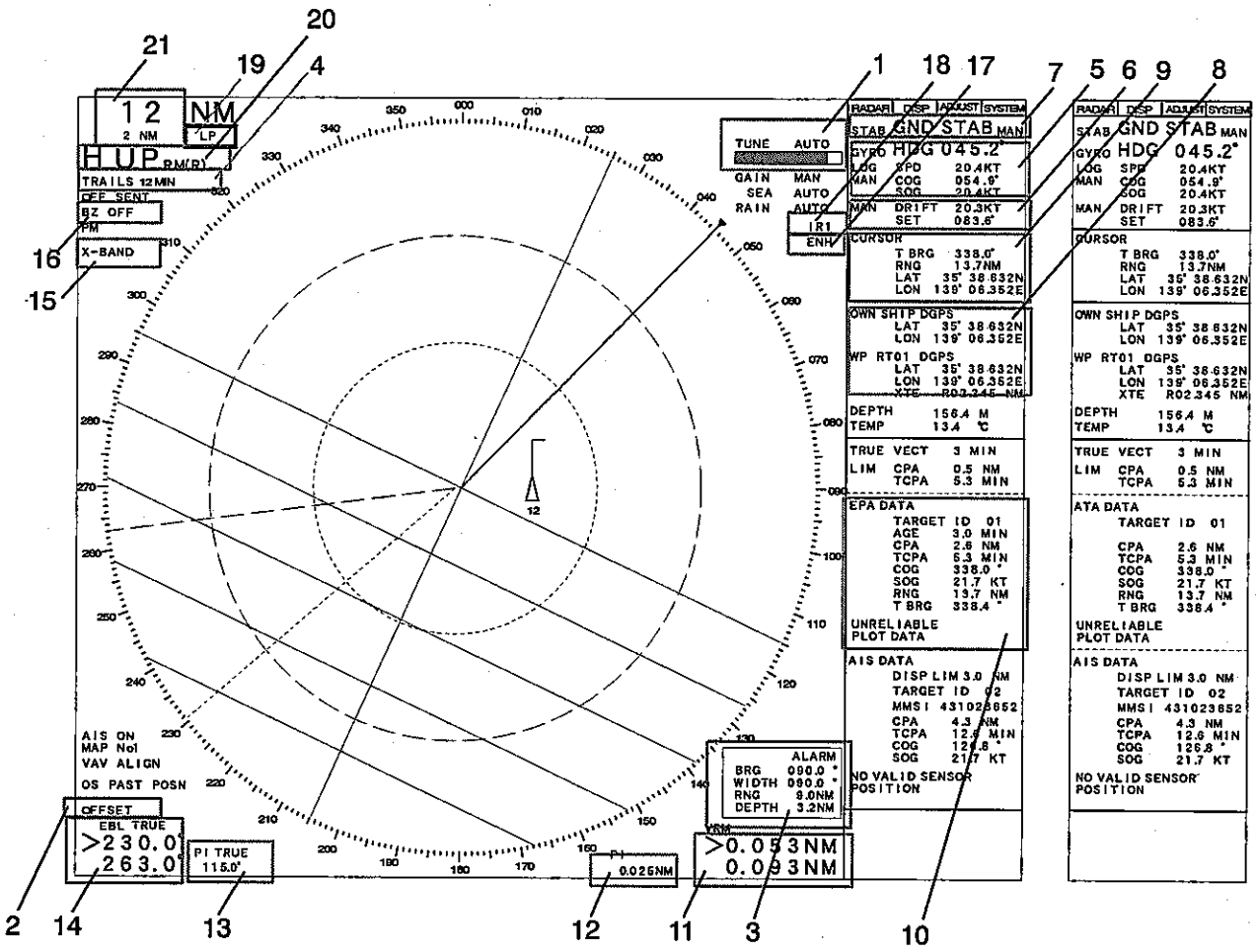


Figure 5.2 MDC-1800B series On-screen information

No.	Descriptions
1	Tuning bar graph & tuning mode display
2	Screen & EBL/VRM offsets display
3	Guard zone position (Range/Bearing)
4	Trail length in time
5	Bearing/Speed Data & signal source names
6	Tidal data & track mode
7	Own ship's data & sensor name
8	Ship's and Waypoint position data with position sensor name
9	Cross cursor position data (lat/long or Range/Bearing)
10	EPA (ATA) data

No.	Descriptions
11	VRM (No.1/No.2) distance data
12	Parallel Index Line interval
13	Parallel Index Line bearing
14	EBL (No.1/No.2) bearing data
15	TX Frequency Band display
16	Electronic Buzzer status
17	Picture Enhancement status (ON)
18	Interference Rejection status
19	TX Pulse length status
20	Picture mode status
21	Range scale and Rings interval display

Table 5.1 Range vs Transmission Pulse Length(PL)

RANGE(NM)	Pulse code	Pulse Length (4kW)	Pulse Length (6/12kW)	Pulse Length (25kW)
0.125	SP	0.08 us	0.08 us	0.08 us
0.25	SP	0.08 us	0.08 us	0.08 us
0.5	SP	0.08 us	0.08 us	0.08 us
0.75	SP	0.08 us	0.08 us	0.08 us
	M1P	0.25 us	0.25 us	0.3 us
1.5	SP	0.08 us	0.08 us	0.08 us
	M1P	0.25 us	0.25 us	0.3 us
3	M1P	0.25 us	0.25 us	0.3 us
	M2P	0.8 us	0.5 us	0.6 us
6	M1P	0.25 us	0.25 us	0.3 us
	M2P	0.8 us	0.5 us	0.6 us
12	M2P	0.25 us	0.5 us	0.6 us
	LP	0.8 us	1.0 us	1.2 us
24	LP	0.8 us	1.0 us	1.2 us
48(4KW)	LP	0.8 us	1.0 us	1.2 us
64 (6KW)	LP	-	1.0 us	1.2 us
72 (12KW)	LP	-	1.0 us	1.2 us
96 (25KW)	LP	-	-	1.2 us

5.5.3 Gain control

The GAIN control is used to change the receiver gain. The gain control can be switched to manual or auto mode by ADJUST/ADJUST MENU. When the equipment is turned on at first, the gain control will be defaulted to manual mode.

Set the gain control as appropriate to your operational needs. As a standard setting, turn the GAIN control clockwise to 3/4 of the full excursion. This provides slight noise speckles on the mid ranges and adequate speckles on the long ranges.

To set the auto gain mode, select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU. The receiver gain will be automatically set and the manual gain control will accordingly become inactive.

5.5.4 Anti-clutter SEA control

The Anti-clutter SEA control is used to reduce the clutter echo appearing around the center of the screen, which is caused by the echo return from the sea surface. The effect of the control is highest at the center of the screen and reduces with distance.

The Anti-clutter SEA control is effective up to approximately 6 NM, which can be switched to either manual or auto mode by ADJUST/ADJUST MENU. When first turned on, the anti-clutter sea control is defaulted to manual mode. To set the auto Anti-clutter mode, select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU. The receiver gain will be automatically set and the manual SEA clutter control will accordingly become inactive. The HARBOR STC provides a preset Anti-clutter sea effect, optimized for narrow areas. The AUTO1 and AUTO2 STC provides a hands-free Anti-clutter sea effect. The mode will display as AUTO1, AUTO2, HARBOR, and MANUAL. In HARBOR and Auto Anti-clutter Sea modes, the manual control is set ineffective.

5.5.5 Anti-clutter RAIN control

The RAIN control is used to reduce the clutter echo appearing on the screen caused by the rain or snow. The effect of the anti-clutter rain control increases as you turn the control clockwise and is the greatest at a fully clockwise position. The anti-clutter RAIN control can be switched to either a manual or auto mode by ADJUST/ADJUST MENU.

When first turned on, the anti-clutter RAIN function is defaulted to manual mode. To set the auto RAIN-clutter control, select AUTO1 or AUTO2 by ADJUST/ADJUST MENU. The clutter echo from rain or snow will be reduced automatically and the manual rain clutter control will become inactive.

5.5.6 Bearing measurement using a single EBL

(1) Activate the 1st EBL from the DISP/MARK menu with select ON. The EBL will be displayed in a dashed line with the bearing display in the bottom left of the screen. An arrow mark will be shown on the front of the digital display to indicate the EBL is active.
(2) Select the bearing mode if necessary, either RELATIVE or TRUE by DISP/[BRG TRUE/REL] MENU.
(3) Rotate the EBL control to measure the bearing of a target. To measure a single target, always set the EBL on the center of the target. To measure the bearing of the edge of a landmass, move EBL towards the inside of the landmass by half of the aerial horizontal beam width.
(4) To erase the EBL, select OFF from the DISP/MARK/1st EBL menu item.

5.5.7 Bearing measurement using two EBLs

(1) Activate the 2nd EBL from the DISP/MARK menu with select ON. The 2nd EBL will be shown with the 1st EBL in a dotted line with the bearing display underneath the

1st EBL bearing display. An arrow mark will be shown on the front of the digital display to indicate the selected EBL is active.

(2) Use the same step as step (2) and (3) in the 1st EBL operation.

(3) To switch the active EBL to another, press the EBL SEL key.

(4) To erase the second EBL, select OFF from the DISP/MARK/2nd EBL menu item.

5.5.8 Range measurement using Range Rings

Display the RANGE RINGS on the screen from the DISP/MARK menu with select ON. The range ring's interval is indicated on the top left corner of the screen under the range indication. Approximate target range can be estimate with range rings.

5.5.9 Range measurement using VRM

(1) Activate the 1st VRM from the DISP/MARK menu with select ON to show VRM on the screen. The VRM will be shown in a dashed line with the distance displayed in the bottom right of the screen. An arrow mark will be shown in front of the digital display indicating that VRM is active.

(2) Rotate the VRM control to measure the distance to a target. Always place the VRM on the right front of the target.

(3) To erase the VRM, select OFF from the DISP/MARK/1st VRM menu item.

5.5.10 Range measurement with two VRMs

(1) Activate the 2nd VRM from the DISP/MARK menu with select ON. The 2nd VRM will be shown with 1st VRM, in a dotted line with the distance displayed shown underneath the 1st VRM display. An arrow mark will be shown on the front of the digital display to indicate which VRM is active to control.

(2) Rotate the VRM control to measure the distance to a target. Always place the VRM on the right front of the target.

(3) To switch the active VRM to another, press the VRM SEL key.

(4) To erase the second VRM, select OFF from the DISP/MARK/2nd VRM menu item.

5.5.11 Measuring the distance and bearing between any two points by offset 1st EBL / 1st VRM

(1) Activate the 1st EBL and 1st VRM from the DISP/MARK menu with select ON to display 1st EBL and 1st VRM.

(2) Place the cross cursor on the first target.

(3) Press the OFFSET key. The origin of 1st EBL / 1st VRM is now set on the first target.

(4) Move 1st EBL to fall in the center of the second target.

(5) Move 1st VRM to touch the right front of the second target. The distance between the two targets will be shown on the bottom right center of the screen.

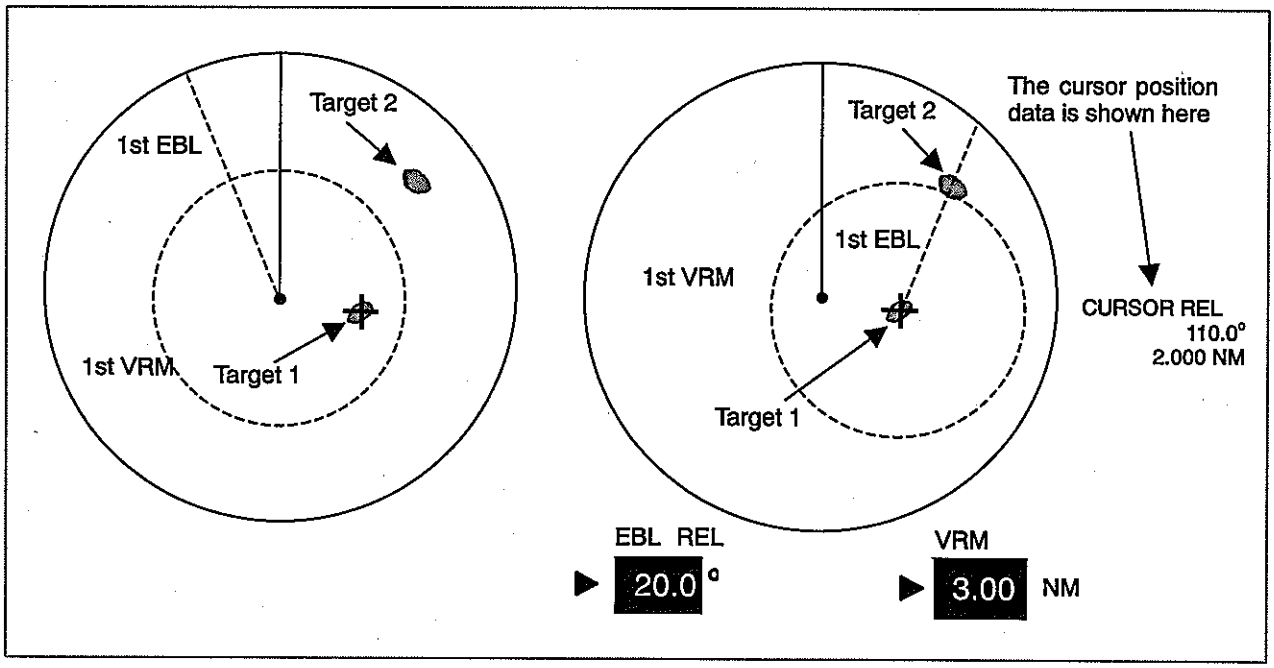


Figure 5.3 Measuring the distance between two points

5.5.12 Picture off-centering

The radar picture can be offset to any position within 2/3 of the screen radius. Use the following procedure.

(1) Move the cross cursor to a desired point to be offset.
(2) Press the OFF CENTER key. The entire radar picture will be moved to the specified point.
(3) A further press of the key will reset the picture to the center position.

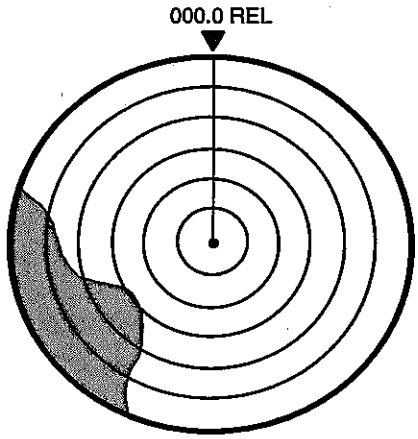
5.5.13 Selection of presentation mode

The following four kinds of presentation modes are available.

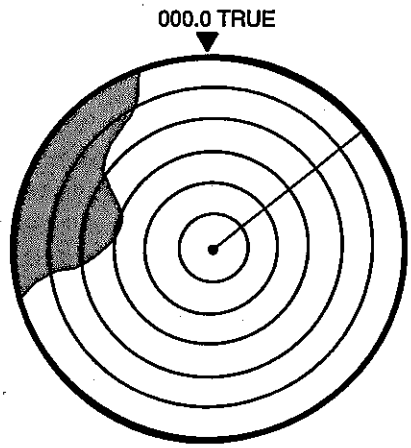
(1) Head Up, Relative Motion
(2) North Up, Relative Motion (Note: Bearing information must be provided)
(3) Course Up, Relative Motion (Note: Bearing information must be provided)
(4) True Motion (Note: The bearing and speed information must be provided)

To select the presentation mode, press the MODE key. Every press of the key will change the presentation mode in the above sequence.

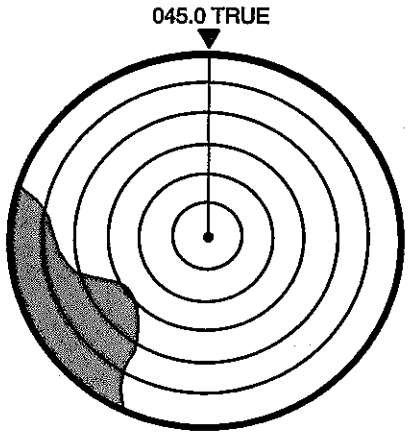
Head Up, Relative Motion (H UP RM)
Ship's position and heading line are always fixed to the screen center and 0 degree of the bearing scale, respectively. Bearings of the objects displayed on the screen are relative to ship's heading. When own ship changes her course, all displayed objects will move in azimuth, accordingly. (Bearing Un-stabilized)



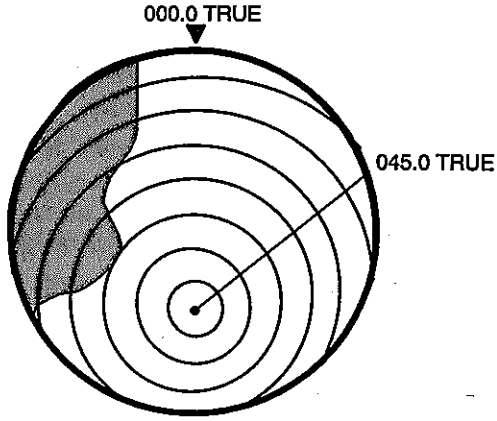
North Up, Relative Motion (N UP RM)
Own ship's position is fixed to the center of the screen, meanwhile, the azimuth bearing scale is stabilized in which true north refers to the cursor scale of 000.0 degree. When own ship changes her course, all displayed objects will stay stationary in azimuth, accordingly. (Bearing stabilized) To allow the bearing to be stabilized, the true bearing data must be provided from a bearing sensor such as a gyrocompass.



Course Up, Relative Motion (C UP RM)
The picture mode is the same as the North Up, Relative Motion mode except, the ship's intended course pointed by the ship's heading line is brought to top of the display.



True Motion (N UP TM)
Own ship and each target moves with its true motion on the radar screen. When own ship reaches 2/3 of the screen radius, it is reset backwards to a specified point to repeat the display. To achieve the True Motion display, a bearing sensor and a speed sensor must be connected to the radar system to provide true bearing and true speed information.



5.5.14 Setting the Guard Zone

The Guard Zone Alarm warns the operator a target has entered the preset alarm zone. When the target stays in the zone for more than 8 seconds, the ALARM sign will flicker and an audio alarm sounds. Press the AUDIO OFF key to silence the alarm.

To set up the position of the Guard Zone.

(1) Press the ALARM (GZ) key. This allows the EBL and VRM controls to be used for moving the Alarm Zone in azimuth and range, respectively.

(2) Move the EBL control to set the position of the Guard Zone in azimuth. The center bearing of the Guard Zone will be displayed in the lower right corner of the screen.

(3) Move the VRM control to set the position of the Guard Zone in range. The distance of the outer edge of the Guard Zone will be displayed in the same place as the bearing display. The minimum distance is limited to 0.6 NM.

To set up the depth and width of the Guard Zone

(Reference drawing: Figure 5.4 The outline of the Guard Zone Alarm)

(4) Press the EBL SEL key and rotate the EBL control to set up the width of the alarm zone. An arrow mark will be shown on the front of the WIDTH to indicate width is active to control. A further press of the key will return to control the Guard Zone in azimuth.

(5) Press and hold the VRM SEL key and rotate the VRM control to set up the depth of the alarm zone. An arrow mark will be shown on the front of the DEPTH to indicate depth is active to control. A further press of the key will return to control the Guard Zone in range. The minimum distance of the inner zone to own ship is limited to 0.5 NM.

(6) Press the ENT key to fix the settings. The Guard Zone will be shown on the screen.

CAUTION: In the following case, the alarm function will become inoperative. The ALARM range and bearing displays accordingly flicker to notify that the function is inoperative.

(1) When the alarm zone is set in the vicinity of the screen center.

(2) When the alarm zone is set beyond the viewable screen area caused by improper range scale setting such as, the range scale is too short, off-centering is too much, etc.

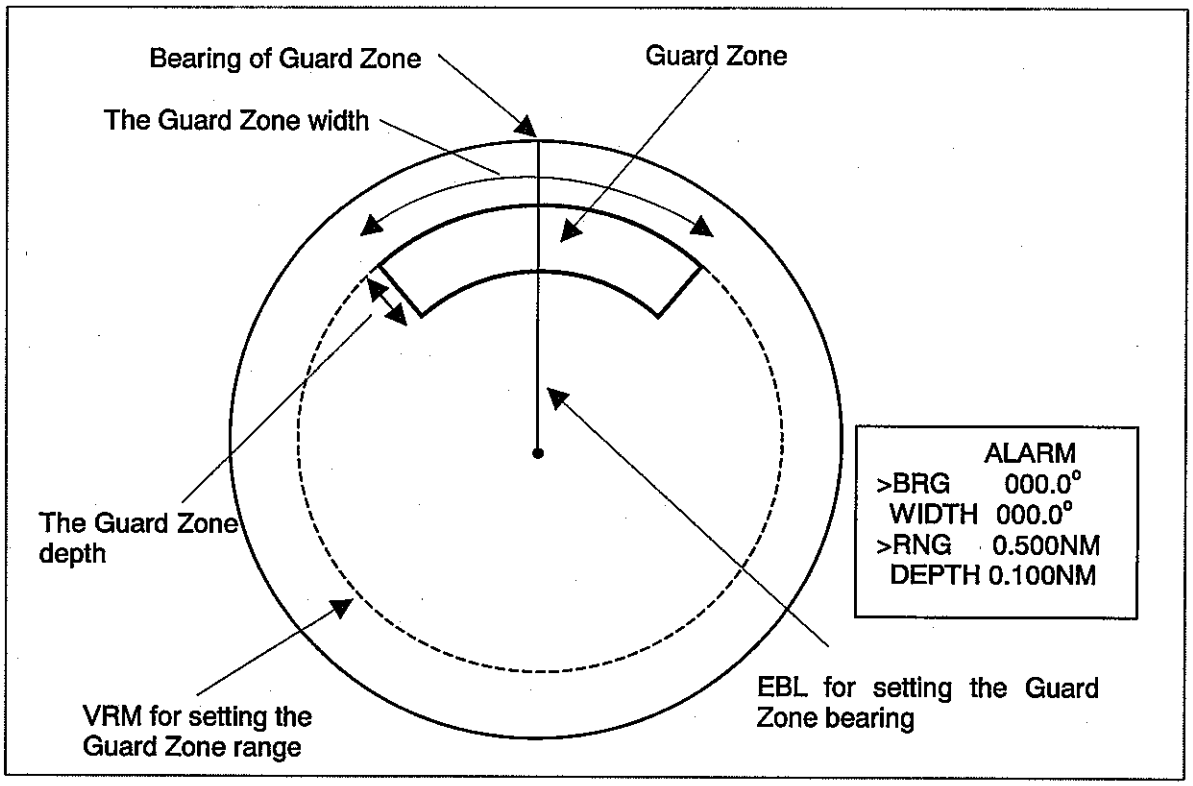


Figure 5.4 The outline of the Guard Zone Alarm

5.5.15 Control panel brilliance

The control panel illumination is set by default. To change the brilliance, use either the following procedure.

(1) Keep pressing the PANEL key to change the panel illumination in 10 cyclic steps, starting from OFF, increasing, decreasing and finally to OFF again.

5.5.16 Displaying the navigational data

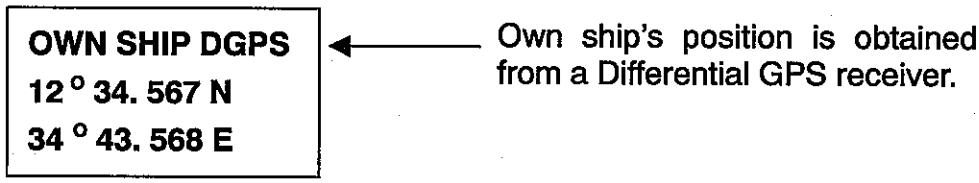
Navigational data such as own ship's position, waypoint position and the distance and bearing to a waypoint can be shown on the screen. Press the DATA DISP key to display this data on the screen.

NOTE:
1. A navigator unit must be connected to the display unit.
2. The serial data format must be selected. Refer to Para 6.3 "SYSTEM: I/O SETUP MENU" for detail.

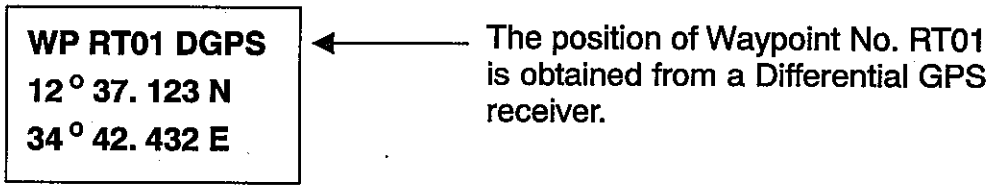
Each press of the DATA DISP key changes the contents of the navigation display in the following sequence.

OFF: The navigation display is turned off.
OWN SHIP (COG/SOG): Own ship's bearing and speed.
OWN SHIP (TD): Own ship's position in the LOP (Lane of Position) coordinate.
OWN SHIP (L/L): Own ship's position is expressed in latitude and longitude.
OWN SHIP (L/L) / WP (Bearing/Distance): Own ship's position in latitude/longitude and waypoint position in bearing and distance.
OWN SHIP (L/L) / WP (L/L): Own ship's position and waypoint position in latitude/longitude grid.

OWN SHIP'S POSITION DISPLAY



WAYPOINT POSITION DISPLAY



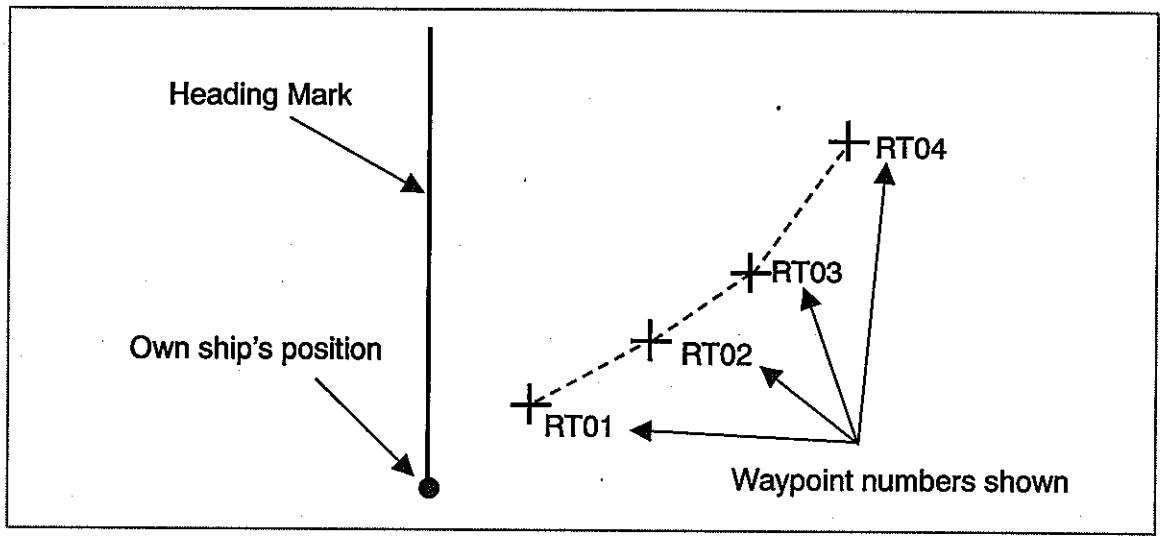


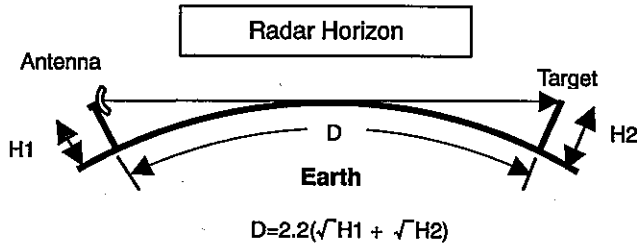
Figure 5.5 The waypoint number display on the screen

APPENDIX 1: Interpretation of Radar Images

Factors that affect the radar detection range

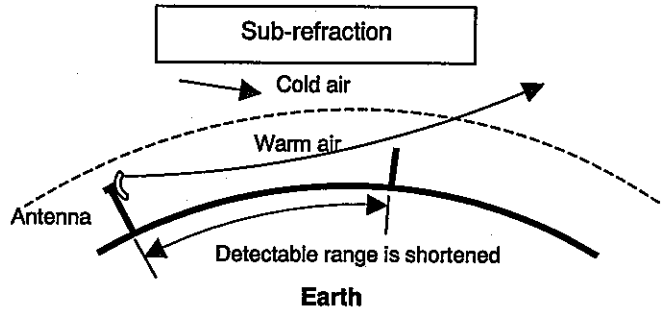
Radar Horizon

The radar uses microwave energy that travels in a straight line like light. Light is reflected towards the surface of the earth due to the temperature, humidity, and the atmospheric pressure changes in the air. This causes the visual range to extend beyond the physical horizon. This is called the optical horizon. Microwave has the same effect and this is called the radar horizon. Meanwhile, its wavelength is longer than that of light. The radar visual range is therefore longer than light by approximately 6%.



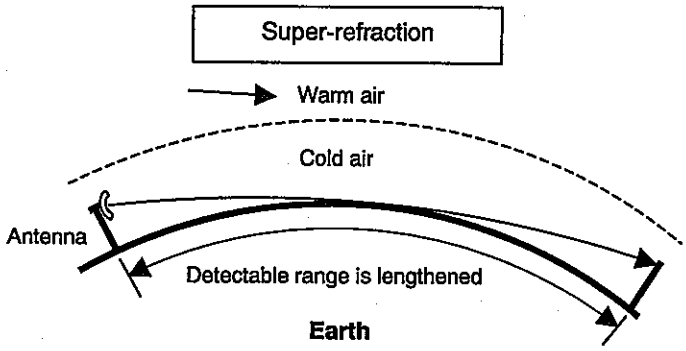
Sub-refraction

When cold air flows over a warm surface, the microwave is bent upwards as shown in the figure. This phenomenon is called sub-refraction. As a result, the detectable range may be reduced. This situation is likely to occur in the Polar Regions, or in warm current waters where cold air from the Polar Regions flow over the sea surface.



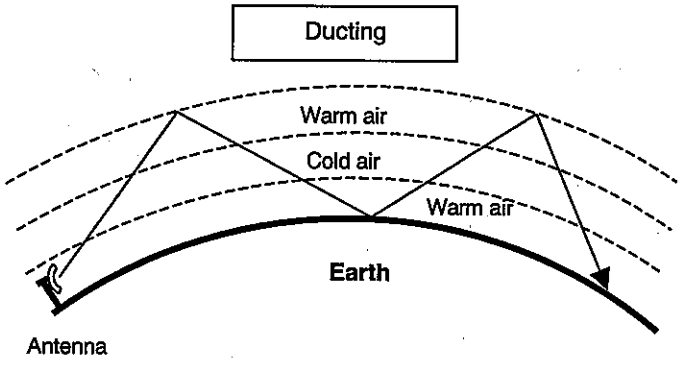
Super-refraction

When the air being warmed up in an inland area flows over the cold sea, the microwave is bent downwards. In this case, a detectable radar range may increase. This situation may occur produced in warm coastal regions, and it becomes noticeable as the temperature difference becomes larger.



Ducting

When two or more layers of different temperature come into contact with one another, the radar wave may be reflected from the boundary surface where different refraction indices exist. As a result, the microwave propagates along the curvature of the earth while being reflected on the wave passage situated between the interface and the surface of the earth. This passage is called "Duct", and an abnormal propagation of the radio wave caused by the duct is called "Ducting". If the air layers with mutually different temperature or atmospheric pressures are alternately present along the different altitudes, radar may be able to detect a target far beyond its maximum detectable range.

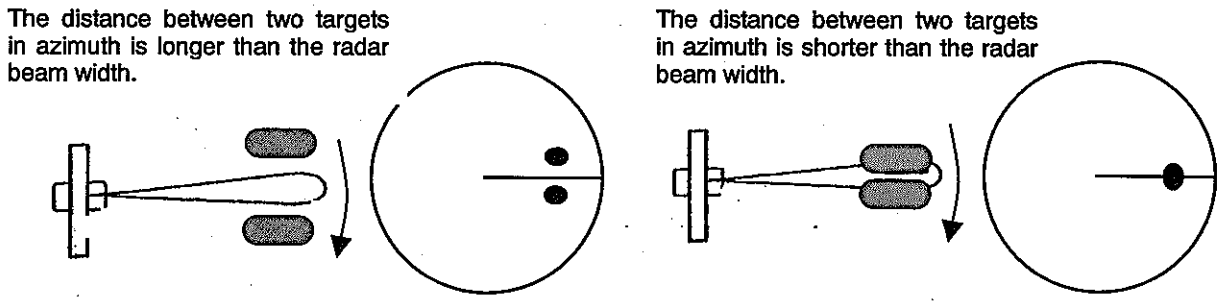


Picture resolution

The picture resolution depends on the bearing and range discriminations that are solely determined by the antenna horizontal beam width and the transmission pulse length. These factors are defined in the following explanations and illustrations.

(1) Bearing discrimination

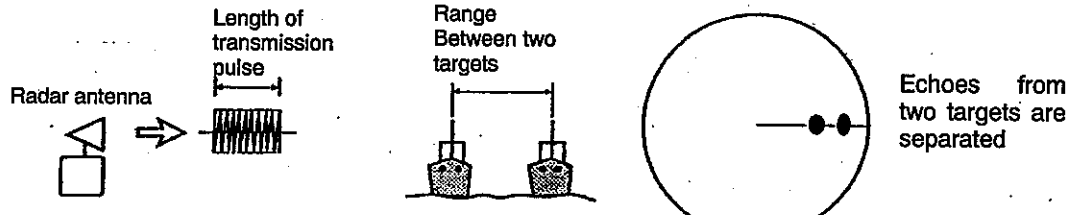
The bearing discrimination is defined as the minimum bearing where two targets of the same distance are displayed as two independent images on the screen. The bearing discrimination is determined by the aerial horizontal beam width.



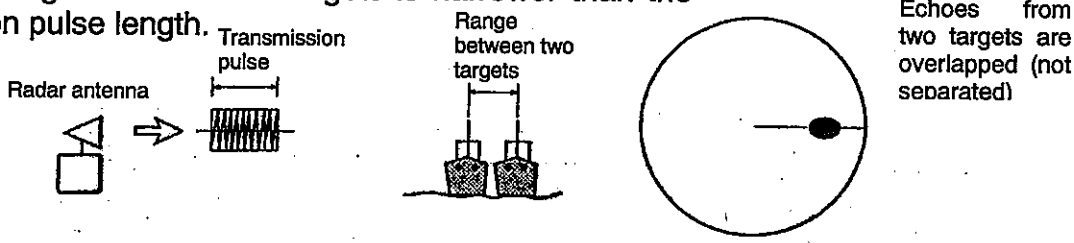
(2) Range discrimination

The range discrimination is defined as the minimum distance where two different targets situated in line on the same bearing are shown separated. The range discrimination is dependent on the transmission pulse length.

When the range between two targets is wider than the transmission pulse length.

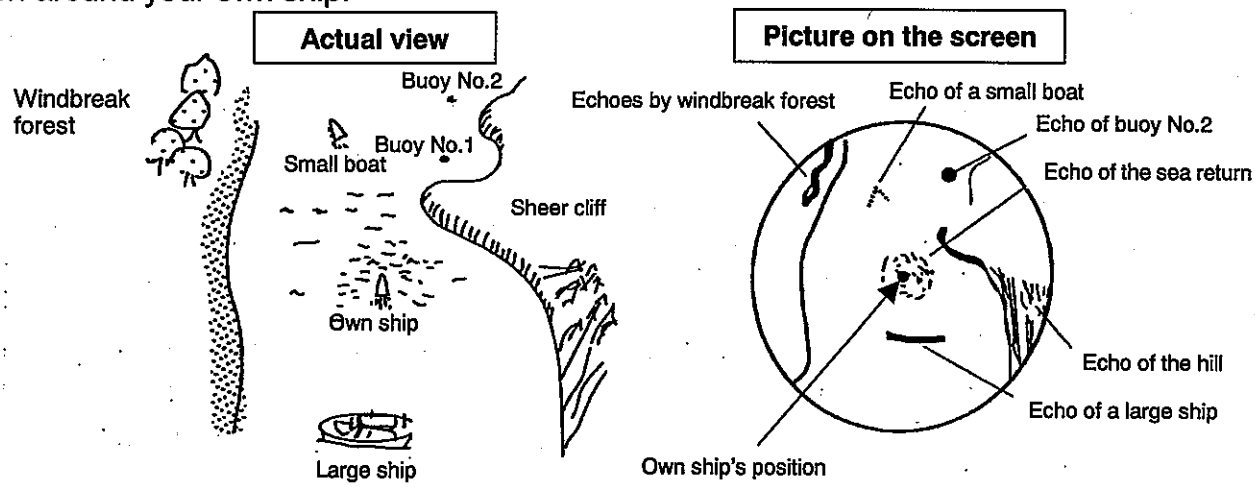


When the range between two targets is narrower than the transmission pulse length.



Reading the radar images

The following pictures illustrate how the radar picture is constituted from an actual situation around your own ship.

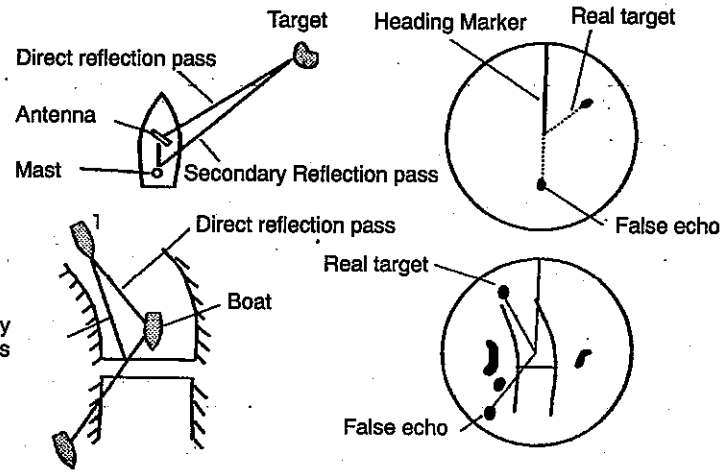


- The buoy No.1 is not detected because the cape blocks it.
- The echo of the large boat is painted similar to its actual profile because of short distance.
- The echo of a small boat is shown as a spot because it has a small echoing area.
- The hill located on the starboard (in the bearings of 90 deg to 130 deg) has a deep forest zone, and its echoing area is large. It is represented as wide spreading echoes on the screen.
- Since the sand beach on the port side is deep, but is not topographic. The echoes are shown weak.
- The windbreak forest produces strong echoes, and it is shown as massive echoes in high contrast.
- The echoes reflected from the sea surface change from time to time, depending on the wind speed and direction. These echoes are shown as a group of spots.

False echoes

The operator should be fully aware of various false echoes caused by the radar performance, terrain and structures on the land, as mentioned below.

(1) False echo caused by secondary reflection

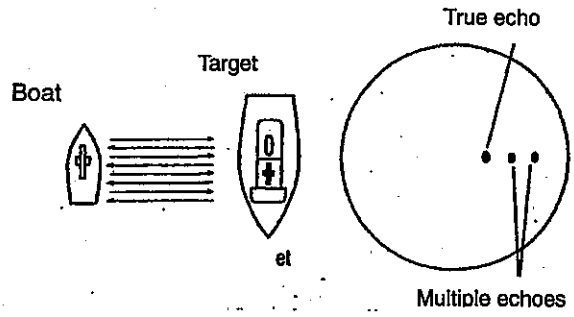


An example of false echo caused by the radar beam reflected by an aft mast.

An example of a temporarily produced false echo caused by the radar beam reflected by a large bridge.

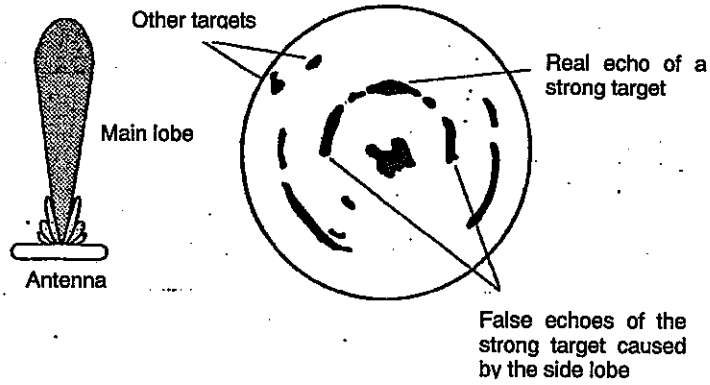
(2) False echo caused by multiple echoes

When a boat passes near a large boat, radio waves are repeatedly reflected between own boat and the boat nearby, causing several echoes at regular intervals to appear in the same bearing (Multiple reflections). These false echoes produced by multiple reflections are called multiple echoes. In this case, the real target is the closest one. The multiple echoes soon disappear when your boat moves from the boat that caused the multiple reflections or, the boat has changed her course. For this reason, the true image can easily be identified.



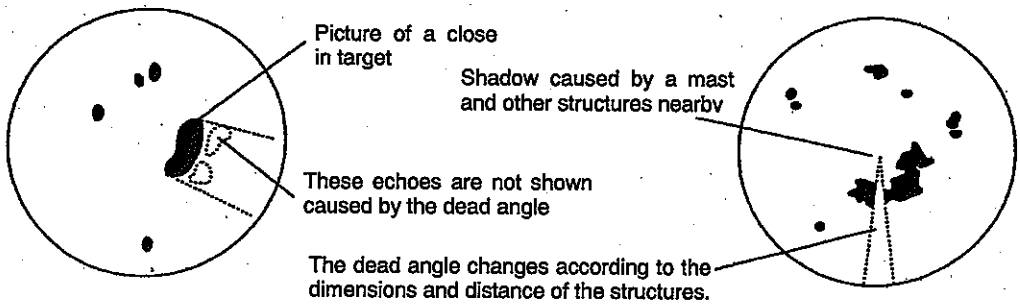
(3) False echo caused by the side lobes

The radio beam emitted from a radar antenna contains some residual smaller beams on both sides of the main beam. These components are called the side lobes. A closely located target with high reflectivity can be displayed as an arc caused by the side lobes. To reduce these false echoes, reduce the gain slightly or apply A/C sea control.

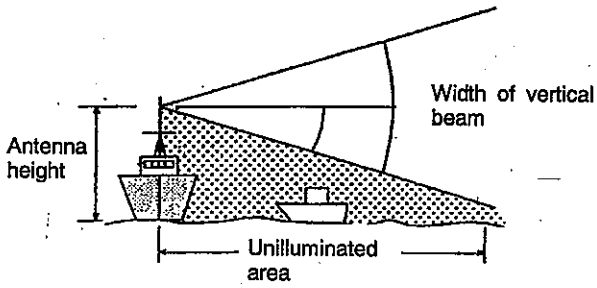


(4) Shadow and dead angle

If the funnel, mast or other structures are located near a radar antenna, the radar beam will be blocked, causing a shadow area where no object will be detected by the radar. The angle of the shadow is called the dead angle. To avoid the shadow, the radar antenna position should be changed to a better place to minimize this effect. If this is not possible, the operator should be aware this dead angle exists while operating the radar.



Height of antenna affects the short range target detection. If the antenna is mounted too high, the radar beam may skip the target, causing no echo detection. The vertical beam width of the radar antenna also affects the close range detection.



APPENDIX 2: Receiving the Radar Beacons and SART

The X-band radar system is required to be capable of receiving signals emitted from a Radar Beacon and a SART (Search and Rescue Transponder). To receive those signals by the radar system, use the following procedures.

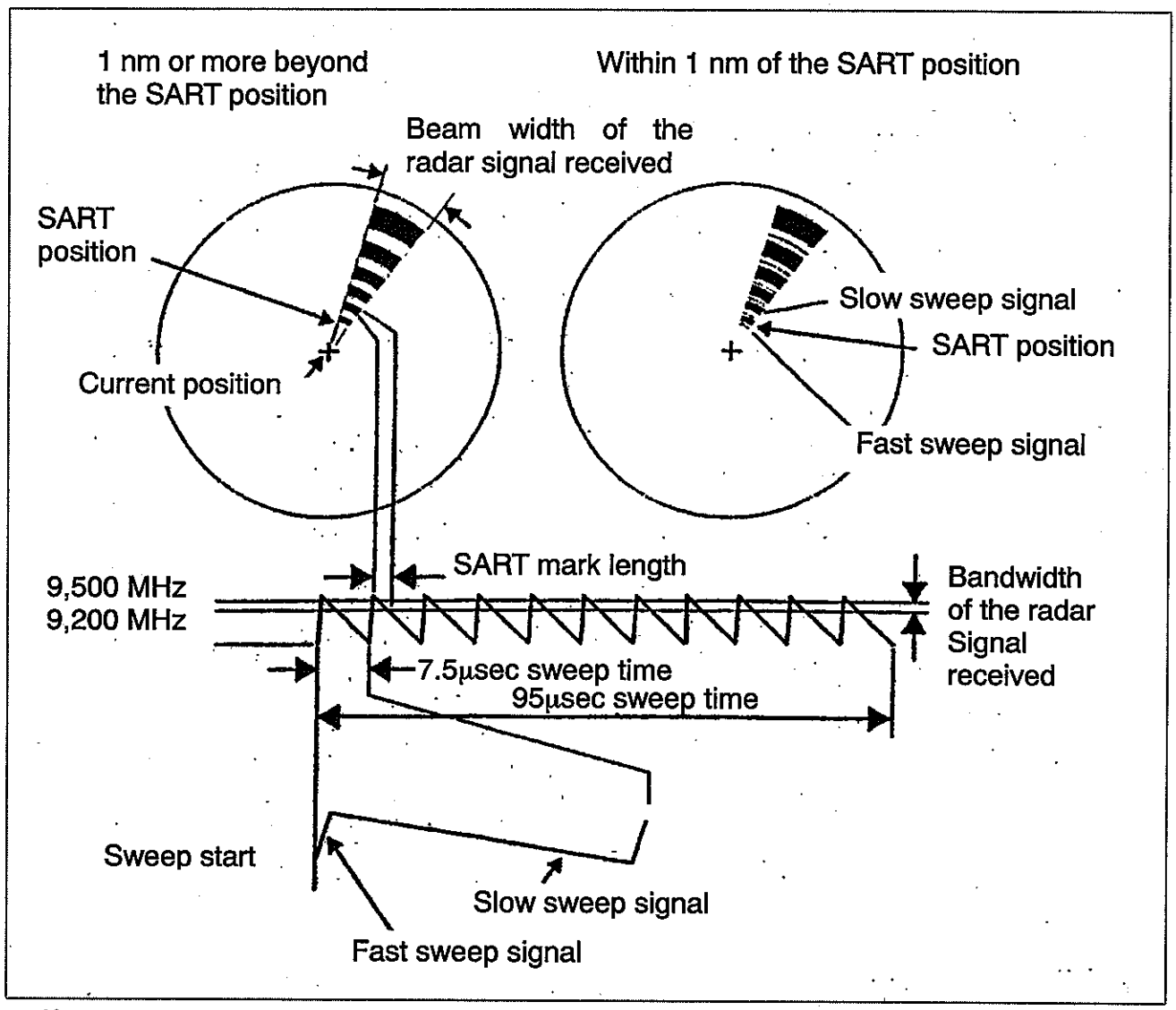
(1) Set the range scale to 6 or 12 NM.
(2) Turn off the Interference Rejection function from DISP/ECHO/IR menu item. Refer to Para. 6.1.2 "IR (Interference Rejection).
(3) In case the radar picture is obscured with too many echo signals, detune the receiver a little for better observation.
(4) When your vessel approaches the transmitting Radar Beacon or the SART, the echoes will become blurred in an arc. For better observation of those signals, adjust the Gain, Anti-clutter Sea and RAIN controls, as appropriate.

About SART

According to the GMDSS (Global Maritime Distress and Safety Systems) requirement, the IMO/SOLAS class ships must be equipped with a SART. When a ship is in distress, a signal will be automatically emitted from the SART so that other ships and/or aircrafts can identify its location. When your ship carrying the X-band radar comes within 8 miles of a ship in distress, the SART picks up the radar signal and responds to it. The signal consists of 12 sweeps and is emitted in the frequency range of 9.2 GHz through to 9.5 GHz. The SART has two sweep times that switch from slow sweep (7.5 us) to fast sweep (0.4 us) and vice versa, according to the distance. When the radar receives this signal, a line of 12 dots, which is equally spaced at about 0.64 NM, appears on the screen. The nearest blip of the SART indicates the location of the ship in distress. When your vessel comes within 1 NM to the SART, a fast sweep signal is displayed on the radar and a thin line connects the 12 blips.

Actual location of the ship carrying the SART

If your vessel is located at 1 NM or more away from the SART, the position at which the first echo is displayed is 0.64 NM behind the actual SART position when the 12 SART echoes are identified. If your vessel comes within 1 NM from the SART, the fast sweep signal is indicated. The position of this echo is displayed 150 meter beyond the actual SART position.



The SART signal presentation and its signal timing

Chapter 6

Using The Menu

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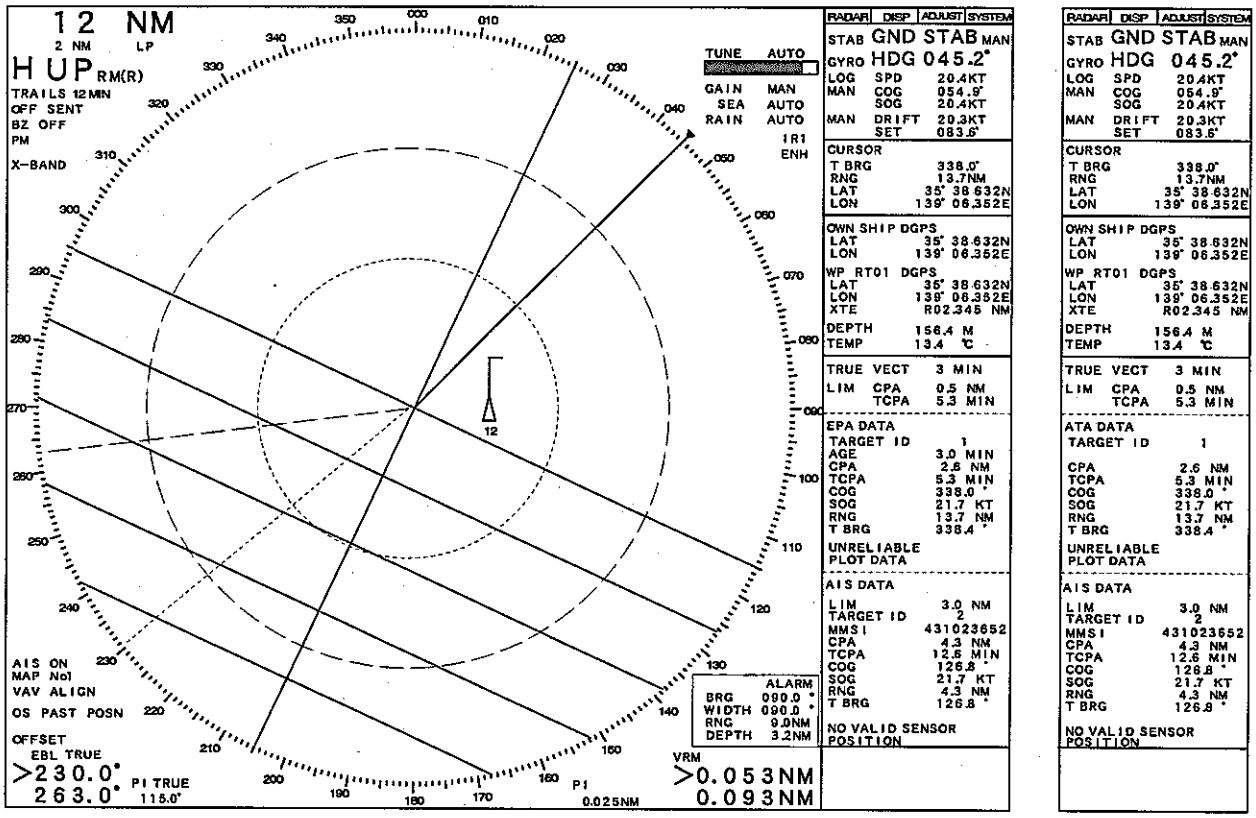


[Common key operation]

All menu-driven functions can be selected by the same key sequence. In the menu, there are four main menus available such as RADAR, DISP (Display), ADJUST, and SYSTEM.

The RADAR menu provides operational sub menus, used in setting up parameters for picture stabilizing mode and EPA/ATA functions.

The DISP menu provides sub menus that set on-screen marks, cursor, echo trails, plotting mode selection, etc. all used for screen display.

The ADJUST menu is protected from ordinary operations. This menu provides operational sub menus for adjustments and presets for the screen display, including video contrast controls for radar, markers, alpha-numeric characters, presetting manual/auto tuning functions, manual/auto GAIN, SEA, RAIN functions, etc.

The SYSTEM menu is also protected. The menu provides technical sub menus used for setting up various technical parameters of the radar system during installation or post repair adjustments.

To select the menu items, use the following procedures.

(1) Press the MENU key and use the Joystick to select an item. The selected item is

highlighted. Subsequent pressing of the MENU key brings back to the normal operation.

1) Press the MENU key.
2) Highlight a desired menu by pressing the Joystick.
3) Highlight a desired sub menu or item by pressing the Joystick up or down.
4) Press the ENT key to activate the selection sequence or select the sub menu.
5) Press the Joystick up or down to select a status or parameter of the item selected. When the parameters are identified with numbers (1:PANEL, 2:MODE, 3:TRUE/REL, etc.) the numerical keypad can also be used for the selection.
6) Press the ENT key to fix the selection. The highlighted part is removed and its function becomes effective.
7) Press the Joystick up or down to select the item.
8) Press the ENT key to activate the selection sequence.
9) Press the Joystick up or down to select a status or parameter of the item selected. When the parameter is numerical, the numerical keypad can be used for the selection.
10) Press the ENT key to fix the selection.

NOTE: *When you have finished setting the relevant menu functions, exit the menu by pressing the MENU key to make sure the settings become active.*

6.1 RADAR Menu

The RADAR menu includes the setting and display items used for the ordinary radar operations.

6.1.1 Picture Stabilization

Indication	Meaning	Selection
SEA STAB/GND STAB	Stabilizing mode indication	SEA GND (Note)

NOTE 1: *The under lined is a default value.*
NOTE 2: *To change the selection, go to DISP=>SEA STAB/GND STAB.*

SEA (Sea Stabilized mode): The radar picture is stabilized with respect to the water with signals supplied from a bearing sensor and a water speed sensor. The current direction (Set) and speed (Drift) are combined in the motion of targets on the screen.
GND (Ground Stabilized mode): The radar picture is stabilized with respect to the ground with the signals supplied from a bearing sensor and a speed sensor (either a

water speed sensor or a ground speed sensor). When a water speed sensor is used, a tidal effect causes the deviation in picture stabilization. In such a case, the Set and Drift correction must be made by manual means or NMEA signal. Refer to Para 6.4.1.3 and 6.4.1.4 for details.

6.1.2 Ship's Heading

GYRO HDG

Indication	Meaning	Selection
GYRO HDG	Gyro heading indication	None

NOTE: *This item is for display only.*

6.1.3 Ship's Speed

Indication	Meaning	Selection
LOG/DOLOG SPD	Ship's Speed indication	LOG or DOLOG

LOG: Magnetic Log or Mechanical Log.

DOLOG: Doppler Log.

NOTE: *This item is for display only. To change the selection, go to SYSTEM => I/O SETUP => SEA STAB SPD or GND STAB SPD.*

Indication	Meaning	Selection
MAN SPD	Manual Speed	0 to 99.9 (KT)

NOTE: *To set the speed, go to SYSTEM => IO SETUP => SEA STAB SPD.*

Indication	Meaning	Selection
MAN COG	Course Over Ground indication	N.A.
SOG	Speed Over Ground indication	N.A.

NOTE: *This item is for display only.*

6.1.4 Set and Drift

When the GND STAB (Ground Stabilized) mode is selected via SYSTEM/IO SETUP/GND STAB SPD, the Set and Drift data is displayed.

Indication	Meaning	Selection
MAN SET	Direction of the current	0 to 359.9 (Deg.)
DRIFT	Speed of the current	0 to 99.9 (KT)

To set or change setting, go to SYSTEM/IO SETUP/GND STAB SPD.

6.1.5 Cursor Position

Indication		Meaning
CURSOR T BRG		Cursor True or Relative(R) Bearing indication
	RNG	Cursor Range
	LAT	Cursor Latitude
	LON	Cursor Longitude

NOTE: *To use this function the heading and latitude/longitude data must be supplied from the gyro/log interface unit KSA-08A and a GPS or Loran-C navigator unit.*

⚠ CAUTION:

- *When no bearing data is entered from the gyrocompass, the latitude and longitude display will turn to "XXX.XX.XXX".*
- *The position data may deviate when a navigator unit is used in latitude above 70 degrees.*
- *To use the EPA and ATA functions, the bearing and speed information must be supplied from external bearing and speed sensors.*

[Data Indication]

OWN SHIP DGPS		Own Ship Information (Input Device Name) (Select with DATA DISP key)
	LAT	Latitude/**COG/LOP1**
	LON	Longitude/**SOG/LOP2**
WP RT01 DGPS		Waypoint Information/Route Name/Input Device
	LAT	Latitude/Bearing
	LON	Longitude/Range
	XTE	Cross Track Error
DEPTH K (W)		Depth

NOTE: K means the depth from the Keel, W means the depth from Water surface.

WATER TEMP Water Temperature

6.1.6 Vector Time

The vector indication mode can be set with the TRUE/REL key. A vector time can be set from the following menu.

Indication	Meaning	Selection
TRUE (REL) VECT	Vector Indication Time	OFF, 30SEC, 1MIN, 3MIN, 6MIN, 12MIN, 30MIN, 60MIN

6.1.7 CPA Alarm Limit

This function is used to set up the warning limit at which the CPA and TCPA alarms are activated. Use the following procedure to set up.

(1) Highlight the item and press the ENT key.

(2) Move the Joystick up or down to select the value and press the ENT key.

(3) Setting ranges for CPA and TCPA are as follows:

ATA CPA: 0.00 NM to 19.9 NM.
ATA TCPA: 1 Minute to 63 min.
AIS LIM CPA: 0 NM to 19.9 NM
AIS TCPA: 1 to 63 min.

Indication	Meaning	Selection
LIM CPA	Limit for CPA (NM)	0 to 19.9 (NM)
TCPA	Limit for Time to CPA (Min.)	1 to 63 (Min.)

6.1.8 Data indication

The following data are shown in the data window.

EPA/ATA DATA	Plot Mode (Select with DISP/NAV/PLOT MODE menu. ATA: option)
TARGET ID	ID for Operating Target
AGE	EPA Life
CPA	Closest Point of Approach
TCPA	Time to CPA
CSE/COG	Course/Course Over Ground
STW/SOG	Speed Through Water/Speed Over Ground
RNG	Range
T BRG	True Bearing

AIS DATA	(ON/OFF with DISP/NAV/AIS menu)
LIM	Indicating Range ---------- 1.0 to 20.0 (NM) AIS data will be displayed inside the range of LIM setting.
TARGET ID	Target ID for Data Indication -------- 1 to 64 Set the ship's ID to data display.

MMSI	Ship's ID
CPA	Closest Point of Approach
TCPA	Time to CPA
CSE/COG	Course/Course Over Ground
STW/SOG	Speed Through Water/Speed Over Ground
RNG	Range
T BRG	True Bearing

6.2 DISP Menu

The DISP menu has three sub menus; MARK, ECHO, and NAV. Each menu has the following sub menus.

6.2.1 MARK

The MARK menu has various markers such as VRM (Variable Range Marker), EBL (Electronic Bearing Line), Stern Marker and Cursor L/L (Position Cursor) that can be turned on or off. This menu also has the bearing mode control that affects the bearing indication of the EBL and vectors.

6.2.1.1 VRMs and EBLs

VRM 1 and 2, EBL 1 and 2, and PI (Parallel Index Line) can be set with the menu.

1st VRM	Variable Range Marker No.1	OFF, ON
2nd VRM	Variable Range Marker No.2	OFF, ON
1st EBL	Electronic Bearing Line No.1	OFF, ON
2nd EBL	Electronic Bearing Line No.2	OFF, ON
PI	Parallel Index Line Cursor	OFF, ON

NOTE: *The underlined items are default values.*

To change the bearing and interval of the parallel index line, use the following procedure:

1) Set the screen to normal display mode.
2) Keep pressing the EBL SEL key until the wedge symbol points to the letters PI, shown in the left bottom of the screen. In the same manner, press the VRM SEL key until the wedge symbol points to the letters PI in the right bottom of the screen.
3) Rotate the EBL control to move the PI in azimuth and the VRM control to change the interval of the index lines.

6.2.1.2 VRM Unit

Indication	Meaning	Selection
VRM UNIT	Unit for VRM	NM, KM, SM

6.2.1.3 RANGE RINGS

Indication	Meaning	Selection
RANGE RINGS	Range Rings	OFF, ON

6.2.1.4 BRG TRUE/REL (Bearing True or Relative)

Indication	Meaning	Selection
BRG TRUE/REL	Bearing Mode	REL, TRUE (True or Relative)

6.2.1.5 STERN MKR (Stern Marker)

Indication	Meaning	Selection
STERN MKR	Stern Marker	OFF, ON

6.2.1.6 CURSOR L/L (Cursor Position Indication)

Indication	Meaning	Selection
CURSOR L/L	Cursor Position (Latitude/Longitude)	OFF, ON

6.2.2 ECHO (Echo Menu)

The ECHO menu has various functions associated with radar echo presentations and signal processing as described below.

6.2.2.1 TRAILS (Echo Trail Setting)

Indication	Meaning	Selection
TRAILS	Radar Echo Trails	OFF, EVERY, 15SEC, 30SEC, 1MIN, 3MIN, 6MIN, 12MIN

OFF: The TRAILS function is turned off.

EVERY scan: All ship's echoes are plotted on every picture scan.

15SEC, 30SEC, 1MIN, 3MIN, 6MIN and12MIN: All ships' tracks are plotted every specified time, 15 sec, 30 sec, 1 min, 3 min, 6 min or 12 min.

6.2.2.2 IR (Interference Rejection)

Indication	Meaning	Selection
IR	Interference Rejection	OFF, 1, 2, 3, 4

OFF: The IR function is turned off.

1, 2, 3 and 4: The effect of interference rejection increases as the number increases.

6.2.2.3 ENH (Echo Enhancement)

Indication	Meaning	Selection
ENH	Radar Echo Enhance	OFF, ON

When the ENH is set to ON, the target echo, which signal level exceeds a predetermined level, are stretched towards range for better recognition.

6.2.2.4 TUNE (Receiver Tuning Mode)

Indication	Meaning	Selection
TUNE	Tuning Mode	AUTO, MANUAL

6.2.2.5 MAN TUNE (Manual Tuning Set)

Indication	Meaning	Selection
MAN TUNE	Manual Tuning	0 to 99

This function becomes effective when the manual-tuning mode is selected.

6.2.2.6 DAY/NIGHT (Day or Night Screen)

The screen color can be changed according to the lighting conditions as required.

Indication	Meaning	Selection
DAY/NIGHT	Day/Night screen color	NIGHT, DAY

NIGHT: Echoes in green with red characters and black background.

DAY: Echoes in yellow with white characters and dark blue background.

6.2.2.7 RADAR VIDEO (Radar picture color)

The radar picture can be changed to your requirements as follows:

Indication	Meaning	Selection
MONO	Mono color picture	Picture color changes automatically to yellow in DAY mode and green in NIGHT mode.
YELLOW	Yellow picture color	Fixed to yellow irrelevant to DAY or NIGHT.
GREEN	Green picture color	Fixed to green irrelevant to DAY or NIGHT.

6.2.3 NAV (NAV Menu)

The NAV menu includes various navigational items such as the screen stabilization, potting function setting, AIS data indication, etc.

6.2.3.1 STAB (Screen stabilizing Mode)

Indication	Meaning	Selection
STAB	Stabilizing Mode	SEA, GND

6.2.3.2 PLOT MODE (Plotting Mode)

Indication	Meaning	Selection
PLOT MODE	Plot Mode	EPA, ATA

In this radar series, the Electronic Plotting Aid (EPA) function is installed as standard, while the Automatic Tracking Aid (ATA) unit is an optional item. To use the ATA function, the ATA module (PCB based) must be installed inside the processor unit.

> ⚠ **CAUTION:** *To use the EPA and ATA functions, the bearing and speed information must be applied from an external bearing/speed sensor.*

6.2.3.3 TARGET ALL CLEAR (Plotting Target All Clear)

Using this function, all target plots can be cleared. To do so, highlight the "TARGET ALL CLEAR" sign and press the ENT key.

Indication	Meaning	Selection
TARGET ALL CLR	All plotted targets cleared	None

6.2.3.4 ID DISP (ID Number Display)

When this item is set to ON, the target number is indicated beside the target symbol mark.

Indication	Meaning	Selection
ID DISP	Target ID Display	OFF, ON

6.2.3.5 OUTLINE DISP (Outline Data Display)

When this item is set to ON, the course and speed data for 10 targets are indicated at the data display area.

Indication	Meaning	Selection
OUTLINE DISP	10 Target Data Display	OFF, ON

6.2.3.6 AIS (Automatic Identification Systems) Data Display

This function is available on option basis. For operating details, refer to Para. 6.8 "Operating the AIS."

6.2.3.7 Navigation Display, Map function

Indication	Meaning	Selection

NAV ALIGN MODE	Navigation Display Align Mode	OFF, MANUAL, SERIAL
MAP	Map Display	OFF, ON
MAP DATUM	Map Display Datum	NONE, WGS84, WGS72, SGS85, PE90
GPS DATUM REFERENCE LOCAL	**GPS Datum**	See NOTE

NOTE: *The GPS DATUM (REFERENCE or LOCAL) is shown only when SERIAL is selected as NAV ALIGN MODE.*

6.2.3.8 TM RESET (True Motion Center Reset)

When this function is activated, the picture center position is reset to the position designated by the SYSTEM/SYS SETUP/TM RESET menu.

Indication	Meaning	Selection
TM RESET	True Motion Center Reset	No choice

6.2.3.9 PAST CRS (Own Ship's Past Course)

When this function is selected, the course own ship has traveled past is displayed in a line form plotted at a predetermined interval.

Indication	Meaning	Selection
PAST CRS	Own Ship's Past Course	OFF, EVERY, 15SEC, 30SEC, 1MIN, 3MIN, 6MIN, 12MIN

6.3 ADJUST MENU

The ADJUST menu has two sub menus; ADJUST and PRESET.
Details of each sub menu are as follows:

6.3.1 ADJUST

6.3.1.1 Screen Contrast Settings

Indication	Meaning	Selection
VIDEO CONTR	Radar Video Contrast	0 to 99

Changes the brilliance of the radar echo presentation.

Indication	Meaning	Selection
MARKER CONTR	Marker Contrast	0 to 99

Changes the brilliance of various markers, Parallel Cursor, Heading Line, Alarm Zone, and Cross Cursor.

Indication	Meaning	Selection
PLOT CONTR	Plot Contrast	0 to 99

Changes the brilliance of plotting symbols and ID number used for the EPA and ATA functions.

Indication	Meaning	Selection
DATA CONTR	Data Contrast	0 to 99

Changes the brilliance of texts and graphics outside the PPI screen.

6.3.1.2 Navigation Position Alignment

This function is used to move a user defined Navigation Line(s) or map to a desired position on the screen. To do so, perform the following procedure.

(1) Set the NAV ALIGN MODE to MANUAL in the DISP/NAV menu. Highlight the prompt NAV ALIGN d-LAT or d-LON.
(2) Press the ENT key to set the NAV ALIGN.
(3) Press the Joystick up or down to set the align value and press the ENT key.

Indication		Meaning	Selection
NAV ALIGN	**d-LAT**	Manual Navigation Alignment	-1.000 to 1.000
	d-LON		-1.000 to 1.000

6.3.1.3 RADAR SENSITIVITY (Selecting Auto/Man Receiver Functions)

Indication	Meaning	Selection
AUTO SELECT	Auto Function Select	AUTO1, AUTO2, HARBOR

NOTE:

The AUTO function provides automated Gain, STC and FTC functions without the need of operator's control, giving an optimized radar picture while it is activated.

The **AUTO 1** is suited for coastal navigation. In this mode the picture is optimized for short and mid ranges with reduced noise and weather clutters.

The **AUTO 2** is used for open sea navigation. In this mode the sea and weather clutters are effectively reduced while the long-range performance is maintained.

The **HARBOR** mode is used for the navigation in a confined area such as a harbor, inland waterway, canal, etc. where hard and tall objects give strong radar reflections causing the picture to be saturated. Using this mode the Gain, STC and FTC are effectively introduced to minimize such strong echoes while the picture definition is maintained.

Indication	Meaning	Selection
MANUAL SELECT		
GAIN	Auto/Manual Gain	AUTO, MANUAL
SEA	Auto/Manual STC	AUTO, MANUAL
RAIN	Auto/Manual FTC	AUTO, MANUAL

6.3.2 PRESET

This menu is protected from ordinary operations. To use this function, first turn off the radar set. Second, press and hold the MODE key and turn the equipment on. When the standby condition is established, turn the radar on. This allows you to enter the PRESET menu and select the following menu functions.

6.3.2.1 AUTO TUNE (Auto Tune Preset)

Indication	Meaning	Selection
AUTO TUNE	Auto Tune Preset	0 to 99

This function is used to correct the deviated automatic tuning function. Use the following procedure to do:

(1) Prior to presetting the AUTO TUNE, open the DISP/ECHO menu and set TUNE to AUTO.
(2) Highlight AUTO TUNE in the ADJUST/PRESET menu, and press the ENT key.
(3) Press the Joystick either up or down until the radar picture becomes the largest.
(4) Press the ENT key to fix the setting.

6.3.2.2 TUNE METER (Tuning Meter Center Preset)

Indication	Meaning	Selection
TUNE METER	Tuning Meter Center Preset	0 to 99

To make tuning meter preset, carry out the following procedure.

(1) Open the DISP/ECHO menu and set TUNE to MANUAL and press the Joystick up or down to obtain the largest radar video presentation.
(2) Press the ENT key to fix the setting.
(3) Highlight MANUAL TUNE in the ADJUST/PRESET menu and press the ENY key.
(4) Perform the manual tuning by pressing the Joystick up or down to let the tuning meter bar graph becomes the longest.
(5) Press the ENT key to fix the setting.

6.3.2.3 GAIN AUTO/MANUAL (Gain Preset)

Indication	Meaning	Selection
GAIN AUTO/MANUAL	Gain preset	1 to 30

GAIN AUTO: This function is used to preset the reference receiver gain in AUTO mode. Once set, the receiver gain will be automatically controlled to a preset level, providing a constant optimized receiver gain even if the amount of video presentation and climatic condition change. Select a desired level by the Joystick and press the ENT key to fix the entry.

GAIN MANUAL: This function is used to preset the reference receiver gain in MANUAL mode. Once set, the receiver gain will be controlled with reference to the preset level. Select a desired level by the Joystick and press the ENT key to fix the entry.

6.3.2.4 SEA AUTO/MANUAL/HARBOR (STC Preset)

Indication	Meaning	Selection
SEA AUTO/MANUAL	STC Preset	1 to 16

SEA AUTO: This function is used to preset the effect of AUTO STC (Anti-Sea Clutter). Once set, the sea clutter echo will be reduced to a predetermined level, providing constant effect of Anti-Sea Clutter even if the sea state varies. Select a desired level with the Joystick and press the ENT key to fix the entry.

SEA MANUAL: This function is used to preset the Anti- Sea Clutter effect in manual mode. Before setting up the level, turn the SEA control to an appropriate position at which the Anti- Sea Clutter needs to be preset. Select a desired level by the Joystick and press the ENT key to fix the entry.

HARBOR: This function is used to preset the Anti-Sea Clutter effect used in a confined area such as a harbor, waterway, etc. Run your radar in a harbor for instance, and select the most suited level with the Joystick and press the ENT key.

6.3.2.5 RAIN AUTO/MANUAL (FTC Preset)

Indication	Meaning	Selection
RAIN AUTO/MANUAL	FTC Preset	1 to 16

RAIN AUTO: This function is used to preset the effect of AUTO RAIN. Once set, the clutter echo caused by the rain or snow will be reduced to a predetermined level, providing the constant Anti-Rain Clutter effect even if the weather conditions vary.

Select a desired level by the Joystick and press the ENT key to fix the entry.

RAIN MANUAL: This function is used to preset the reference receiver Anti-Clutter Rain in MANUAL mode. Once set, the Anti-Clutter Rain will be controlled with reference to the preset level. Select a desired level by the Joystick and press the ENT key to fix the entry.

6.3.2.6 MBS (Main Bang Suppression)

Indication	Meaning	Selection
MBS	Main Bang Suppression	0 to 99

This function is used to minimize the center sun shown on the radar screen caused by the split of the transmitting energy generated by the magnetron (transmitting tube).

6.3.2.7 TARGET LEVEL (Target Detection Level)

Indication	Meaning	Selection
TARGET LEVEL	Target Detection Level	1 to 8

This function is used to set the signal level to be supplied to the ATA system. Use the following procedure to select a signal level.

(1) Highlight the TARGET LEVEL. The signal level increases in ascending order.

(2) Press the ENT key to set the ready to select status.

Press the Joystick up or down to select an appropriate level and press the ENT key to set up the level.

6.4 SYSTEM MENU

The SYSTEM menu has I/O SETUP, SYS SETUP, and BITE functions. Details of each function is as follows:

6.4.1 I/O SETUP

This function is used to select the data source supplied from a speed sensor and a bearing sensor.

> **NOTE:** *This menu is protected from ordinary operations. To use this function, turn off the radar first. Press and hold the MODE key and turn the radar on again. When the standby condition is established, turn the radar on to enter the following menu functions.*

6.4.1.1 HDG INPUT (Heading Input)

Indication	Meaning	Selection
HDG INPUT	Heading Input	GYRO, HDT

GYRO: The compass data is taken from a gyrocompass via the gyro interface unit KSA-08A. Use the GYRO SET to set up the bearing.

HDT: The true bearing data will be automatically set in the incoming data sentence.

6.4.1.2 GYRO SET (Gyro Initial Setting)

Indication	Meaning	Selection
GYRO SET	Gyro Initial Setting	0.0 to 359.9

NOTE: *The GYRO HDG bearing data becomes "XXX.X" and the buzzer sounds in the following circumstances:*
1. When no gyro signal is input.
2. When no power is applied to KSA-08A. Check the power supply line to KSA-08A for power failure, disconnection, etc.
3. When initial setting of the gyro bearing is not completed.
In case at least one condition has been met, the bearing stabilized picture in relative or true motion mode such as N UP RM (North Up Relative Motion), C UP (Course Up Relative Motion) or N UP TM (North Up True Motion) will be reset to H UP RM (Head Up Relative Motion) mode.

6.4.1.3 SEA STAB SPD (Water Speed Input)

This function is used to select the signal source of the water speed input. The available selections include; MAN (Manual setting), PULSE (Pulse signal supplied from a speed log) and the NMEA sentences (VHW and VBW).

Indication	Meaning	Selection
SEA STAB SPD	Water Speed Input	MAN, PULSE, VHW, VBW

NOTE for NMEA sentences, VHW and VBW:

When the VHW sentence is selected, the Doppler Log or a speed log (Magnetic or Mechanical) can be selected according to the talker device name included in the sentence. When the VBW sentence is selected, only the Doppler LOG is selected.
The relation of the sentences and available device names is shown in the following table.

Table 6.1 Available NMEA sentences and talker devices

Sentence	Talker identifier	On-screen display	Device name
VHW	VD	DO LOG/WT-Speed	Doppler LOG
	VM	LOG	Speed LOG, magnetic
	VW	LOG	Speed LOG, mechanical
VBW	VD	DO LOG/BT-Speed	Doppler LOG

6.4.1.4 GND STAB SPD (Ground Stabilized Speed)

This function is used to select the signal source of the ground speed and set/drift inputs. The available selections include; MAN (Manual setting), PULSE (Pulse signal supplied from a speed log) and the NMEA sentences.

Indication	Meaning	Selection
GND STAB SPD	Speed stabilized over ground	See the following table.
SET / DRIFT	Set: The direction towards which current flows. Drift: The speed of a current	See the following table.

Table 6.2 Combinations of GND STAB SPD and SET/DRIFT

GND STAB SPD	SET/DRIFT	Notes
MAN	MAN	
PULSE	MAN	
VHW	MAN	
VHW	VDR	
VBW	Not need	Set/Drift data included in the sentence only if VBW delivers GND based data
VTG	Not need	Course and speed measured over ground

NOTE for NMEA sentences, VHW, VBW, VTG and VDR:

When the VHW sentence is selected, the Doppler Log or a speed log (Magnetic or Mechanical) can be selected according to the talker device name included in the sentence.

When the VBW sentence is selected, only the Doppler LOG is selected.

When the VDR sentence is selected, only the Doppler LOG is selected.

When the VTG sentence is selected, the Doppler LOG or the GPS receiver is selected.

Table 6.3 The relation of the sentences and available device names

Sentence	Talker identifier available	On-screen display	Device name
VHW	VD	DO LOG/WT-Speed	Doppler LOG
	VM	LOG	Speed LOG, magnetic
	VW	LOG	Speed LOG, mechanical
VBW	VD	DO LOG/BT-Speed	Doppler LOG
VDR	VD	DO LOG	Doppler LOG
VTG	GP	GP	GPS receiver
	VD	DO LOG	Doppler LOG

6.4.1.5 LOG PULSE (Log Pulse Rate)

This menu is used to set up the incoming log pulse ratio, which is fed to the Gyro Interface unit, type KSA-08A built into the processor unit.
The following pulse ratios can be selected: 100, 200, 400 and 500 pulses/nm.

Indication	Meaning	Selection
LOG PULSE	Log pulse count for 1 NM	100, 200, 400, 500

6.4.1.6 GYRO (Gyro Gear Ratio)

This menu is used to set up the gyro gear ratio used, which is fed to the Gyro Interface unit, type KSA-08A. The following pulse ratios can be selected: 36X, 90X, 180X and 360X.

Indication	Meaning	Selection
GYRO	Gear Ratio for Gyro repeater	36, 90, 180, 360

6.4.1.7 Serial Input Format

This menu is used to select the type of incoming serial signal sent from external equipment for each data input connector from DATA1 to DATA3. The following signal formats can be selected:

SERIAL IEC61162-1, NMEA-0183,NMEA-0182,KODEN-717

6.4.1.8 SERIAL TRANSMIT (Serial Output Interval)

This menu is used to select the interval of transmission of outgoing signals.

Indication	Meaning	Selection
SERIAL TRANSMIT	Serial Output Interval	0.1 to 9.9 SEC

6.4.2 SYSTEM SETUP

This menu is used to select various functional parameters, which are specific to respective users and their operating conventions.

> **NOTE:** *This menu is protected from ordinary operations. To use this function, turn off the radar se first. Press and hold the MODE key and turn the equipment on. When the standby condition is established, turn the radar on to enter the following menu functions.*

6.4.2.1 RANGE DISP (Range Scale Display)

This function is used to select the range scale notation system; decimal or fraction.

Example: DECIMAL: 0.125, 0.25... FRACTION: 1/8, 1/4....

Indication	Meaning	Selection
RANGE DISP	Range Display Mode	DECIMAL, FRACTION

6.4.2.2 BUZZER

This function is used to turn on or off the electronic buzzer.

Indication	Meaning	Selection
BUZZER	Alarm Buzzer	OFF, ON

> **NOTE:** *To momentary silence the audio alarm, press the AUDIO OFF key.*

6.4.2.3 LANGUAGE

This function is used to change the Indication Language.

Indication	Meaning	Selection
LANGUAGE	Indication Language	ENG, JPN

6.4.2.4 DELAY (Transmission Timing Adjustment)

This function is used to adjust the transmission delay time in order to coincide the radar transmission timing with the start of the radar sweep. In practice, the Figure 4.7 in Chapter 4 illustrates the result of the setting, whether it is properly adjusted or not. To effectively perform this setting, find an appropriate object that is straight across from your radar.

Indication	Meaning	Selection
DELAY	Radar Echo Timing	0 to 99

Carry out the following procedure to set up the proper transmission delay time.

(1) Highlight DELAY and press the ENT key to set up the selection ready status.
(2) Press the Joystick up or the down until a straight picture is shown on the screen.
(3) Press the ENT key to exit.

6.4.2.5 HDG (Ship's Heading/Picture Bearing Adjustment)

This function is used to correct the ship's heading bearing to allow the entire radar picture to be set to correct bearings.

Indication	Meaning	Selection
HDG	Radar Echo Bearing Set	0.0 to 359.9

Use the following procedure for correction.

First, take an optical bearing of a stationary target located within viewable range using a standard magnetic compass. Second, measure the target bearing on the radar. If the deviation is found more than +/- 1 degree on the screen, carry out the following procedure for correction.

(1) Highlight HDG and press the ENT key.
(2) Press the Joystick up or down to change the bearing, in order to set the radar echo bearing to coincide with the compass bearing within a specified accuracy.
(3) Press the ENT key to fix the bearing.

6.4.2.6 HEIGHT (STC Law Selection)

This function is used to set the most suited Anti-Clutter Sea control law that corresponds to the height of a radar antenna from the sea level. The variable range of the figure is 1 to 9, which does not represent an actual height but an index of the law. Select the most suited figure while the radar is operated.

Indication	Meaning	Selection
HEIGHT	Antenna Height (STC curve)	1 to 9

6.4.2.7 TM RESET (True Motion Reset Position)

This function is used to set the resetting point of the radar picture in the True Motion mode when the center of a radar picture reaches the predetermined boundary of the screen.

Indication	Meaning	Selection
TM RESET	True Motion Reset Position	OPPOSITE, CENTER COURSE

There are two resetting modes available as, CENTER and OPPOSITE.

CENTER: The picture is brought back to the center of the radar screen.

OPPOSITE: The picture is brought back in parallel to the course taken to a point on the circle of 66 % of the screen radius.

COURSE: The picture is brought back in parallel to the course taken to a point on the circle of 66 % of the screen radius with keep wide area at heading. Refer to Figure 6.1 for detail.

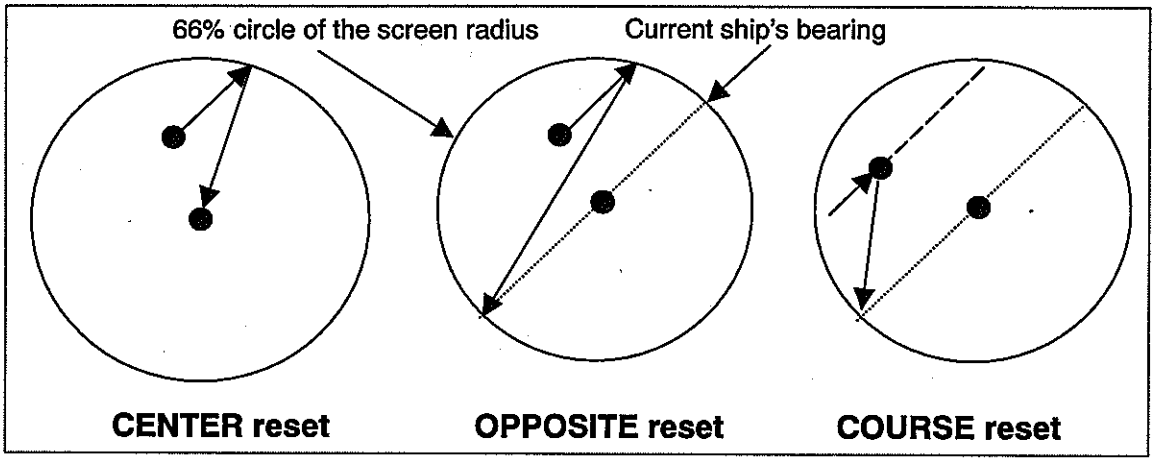


Figure 6.1 Resetting point in the True Motion mode

6.4.2.8 KEY SOUND (Key Click Sound)

This menu is used to turn on or off the key click.

Indication	Meaning	Selection
KEY SOUND	Key Click Sound	OFF, ON

6.4.2.9 BUZZER FREQ (Buzzer Sound Frequency)

This menu is used to set up the audio frequency of a key click. The frequency can be selected among the frequencies ranging from 100 Hz to 9999 Hz.

Indication	Meaning	Selection
BUZZER FREQ	Buzzer Sound Frequency[Hz]	100 to 9999

6.4.2.10 ALARM MODE (Alarm Zone Set Mode)

This menu is used to set up the alarm zone shape.

Indication	Meaning	Selection
ALARM MODE	Alarm Zone Set Mode	VARIABLE, FIXED

Selectable alarm zones are as follows:

VARIABLE: The alarm zone shape can be changed from a full circle to any form of semi-circles. The depth and angle of the alarm zone can be set using the EBL and VRM.

FIXED: The alarm zone can be selected from three different shapes, the 90 degree, 180 degree and full circle.

6.4.2.11 TRAIL MODE (Echo Trail Mode)

This menu is used to select the type of trail presentations.

Indication	Meaning	Selection
TRAIL MODE	Echo Trail Mode	PAINT, PLOT

PAINT: The ship's trail is displayed for the time specified by the operator. Once selected, the trail is displayed every picture scan for a specified time. After fully displayed within the time, the entire trail length is first shortened to 2/3 of a total length and then it continues to stretch to its full length. The PAINT is a default setting.
PLOT: The trail is plotted every specified time, leaving the ship's trail in a dot form.

6.4.2.12 OFF CENTER (Off-center Mode)

This menu is used to select the point of offset to which the center of the radar picture is shifted.

Indication	Meaning	Selection
OFF CENTER	Off-Center Mode	CURSOR, OPPOSITE

The available off center modes are as follows:

CURSOR: An entire radar screen can be shifted to any point within 66% of the screen radius.
OPPOSITE: An entire radar screen can be shifted downwards by 66% of the screen radius.

6.4.2.13 GYRO/LOG (Own ship's information)

This menu is used to select the usage of GYRO/LOG.

Indication	Meaning	Selection
GYRO/LOG	Own ship's information	OFF, ON

The own ship's information selections are as follows:
OFF: No ship's information such as Heading, Water speed, Ground Speed are used.
ON: The radar system will use the Heading, Water-Speed, and Ground-Speed.

Note1: It is necessary to use the Heading information for ATA operation.
Note2: It is necessary to use the Heading, Water-Speed, and Ground-Speed with navigation equipment for AIS operation. No manual-speed, no manual Set-Drift can be used for AIS operation.

6.4.3 BITE (Built In Test Equipment)

NOTE: *This menu is protected from ordinary operations. To use this function, turn off the radar first. Press and hold the MODE key and turn the radar on. When the standby condition is established, turn the radar on to enter the following menu functions.*

6.4.3.1 ALARM TEST (Alarm System Test)

This function is used to verify that the alarm function is in normal order.

Indication	Meaning	Selection
ALARM TEST	Alarm System Test	OFF, ON

Carry out the following operation to perform this function.

(1) Highlight the words ALARM TEST.
(2) Press the ENT key to set the selection ready status.
(3) Press the joystick down to select the ON sign.
(4) Press the ENT key to fix the selection. The alarm test will start.
(5) In approximately 10 seconds, various alarm messages will be shown and an audio alarm will be activated. (NOTE: NO audio alarm sounds if the BUZZER OFF status is activated)
(6) To cancel the ALARM TEST function, set the ALARM TEST to OFF, or set the radar to standby mode once, and then transmit again.

6.4.3.2 ATA TEST (ATA Tracking Test Mode)

This function is used to test the ATA function.

Indication	Meaning	Selection
ATA TEST	ATA Tracking Test Mode	OFF, ON

When the ATA Test mode is selected, the following test conditions and display will be available on the screen.

(1) Range scale: 6 NM
(2) Ship's heading: 90 degrees
(3) Test target speed: 12 knots
(4) Test target bearing: 90 degrees
(5) A small letter "x" will be shown near the test target as an identifier and a large letter "X" at the bottom of the screen, showing that the display is in the TEST mode.

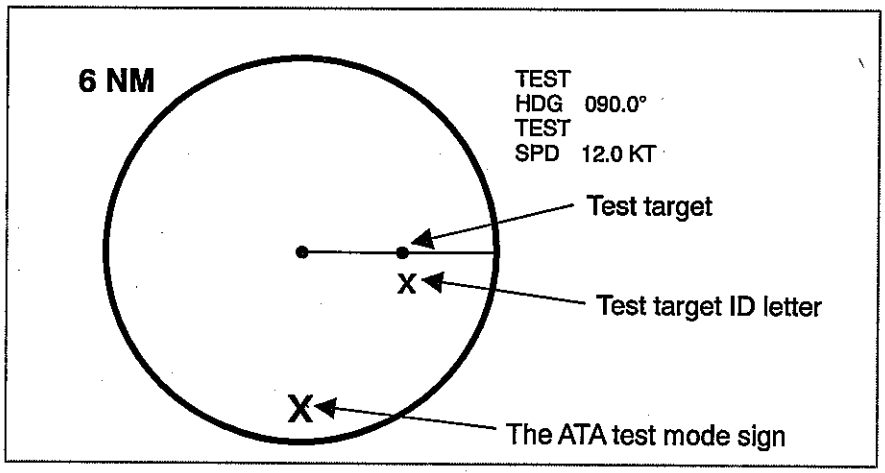


Figure 6.2 The ATA test mode display

(6) To perform the ATA test function, use the SYSTEM/BITE/ATA TEST menu.

6.4.3.3 Hour Meter

The following maintenance test items will be shown:

Items shown	Meaning	Indication
TOTAL HOUR	Operation Hours Indicator	XX HOURS
TX HOUR	Transmit Hours Indicator	XX HOURS

6.5 MAINTENANCE MENU

This menu is protected from ordinary operation. To activate this function, press and hold the Mode Key and turn the unit on.

6.5.1 ANTENNA

The following maintenance test items will be shown:

Items shown	Meaning	Normal indication (range)
TUNE LEV.	Tuning Level Indicator	10 to 20
TUNE VOL.	Tuning Voltage Level Monitor	50 to 240
250V(HT)	250V monitor	100 to 180
MAG. CUR.	Magnetron Current Monitor	5 to 240
P.M. RX	Performance Monitor Receiver Level	10 to 240
P.M. TX	Performance Monitor Transmitter Level	10 to 240
TYPE	Antenna Type	1
MODE	Scanner Unit ID2	ID No. (See NOTE)
250V(HT)	250V monitor	200 to 300
40V	40V monitor	30 to 50

NOTE: *ID number varies according to the transmission power level as follows:*
7: 6 kW, 0: 12 kW, 5: 25 kW

6.5.2 OPTION

Indication	Meaning	Selection
ALARM	ALARM Mode	IN, OUT
TM SYNC	True Motion Position sync.	OFF, ON
HL BLINK	Heading Line Blink	OFF, ON
H SYNC	Ex. Monitor Horizontal Position	20 to 120
I.S. HDG	Ex. Radar Image Bearing Offset	-179.9 to 180.0

I.S. GYRO	Ex. Heading Offset for $RAHDT	-179.9 to 180.0
RANGE UNIT	Range Indication Unit	NM, km, sm
MOTOR SPEED	Antenna Rotation Speed	LOW, HIGH
TIME	Time Zone correction	OFF, ON
TIME ZONE	Correction Hours	-12 to 13
SECTOR	Sector Blanking	OFF, ON
START	Blanking Start Bearing	-179.9 to 180.0
END	Blanking End Bearing	-179.9 to 180.0

6.6 Operation of the EPA

The EPA (Electronic Plotting Aid) provides the information for collision avoidance by manually plotting the first and second positions of each target. These include:
CPA (Closest Point of Approach), TCPA (Time to Closest Point of Approach), Ship's speed, Ship's course and Ship's vector

6.6.1 Using the EPA

Perform the following procedure to use the EPA function:

(1) Move the Joystick to move the cross cursor to a target for plotting.
(2) Press thè ACQ key to acquire the target. The assigned target is braced with a dashed acquire mark with the figure 1 shown nearby.
(3) After 30 seconds or more since the target has been acquired, plot the target again as a second plot by placing the cross cursor on it and pressing the ACQ key. A vector will be developed and the relevant data will be shown on the right side of the screen. (Refer to Figure 6.2)
(4) Press the DELETE key to cancel the target tracking. The symbol of the target and data will be cleared.

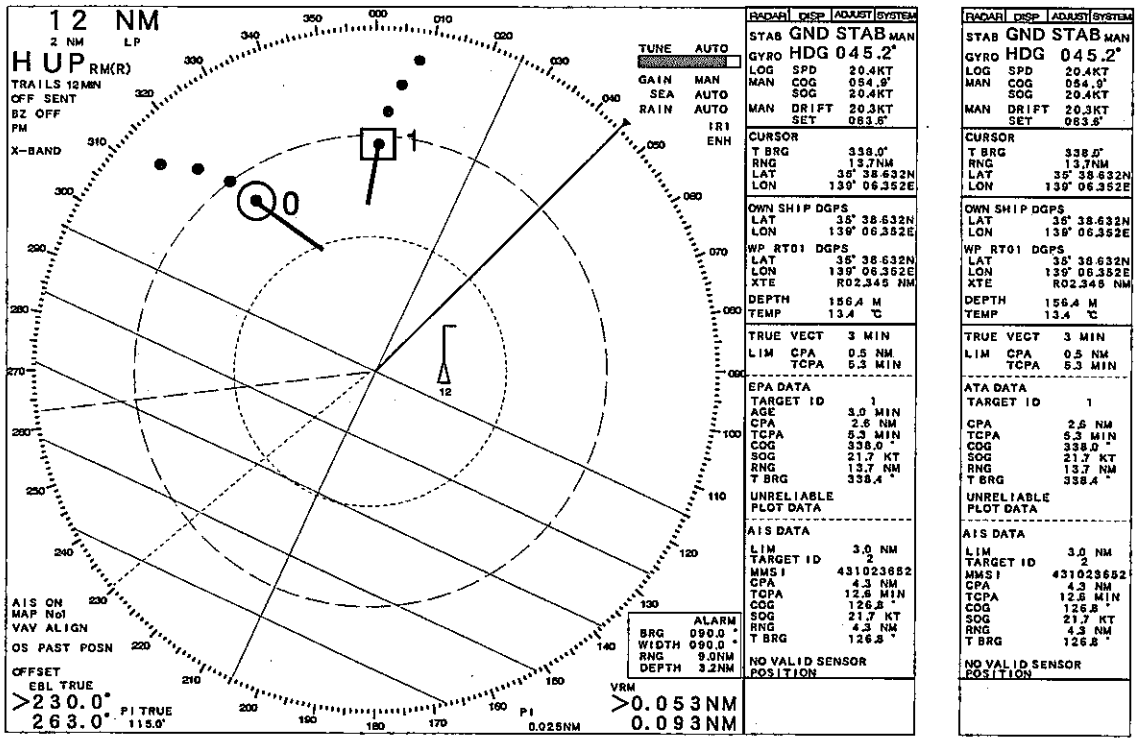


Figure 6.3 The EPA data shown on the screen

6.6.2 CPA and TCPA

The definition of CPA and TCPA is shown in the Figure 6.3.

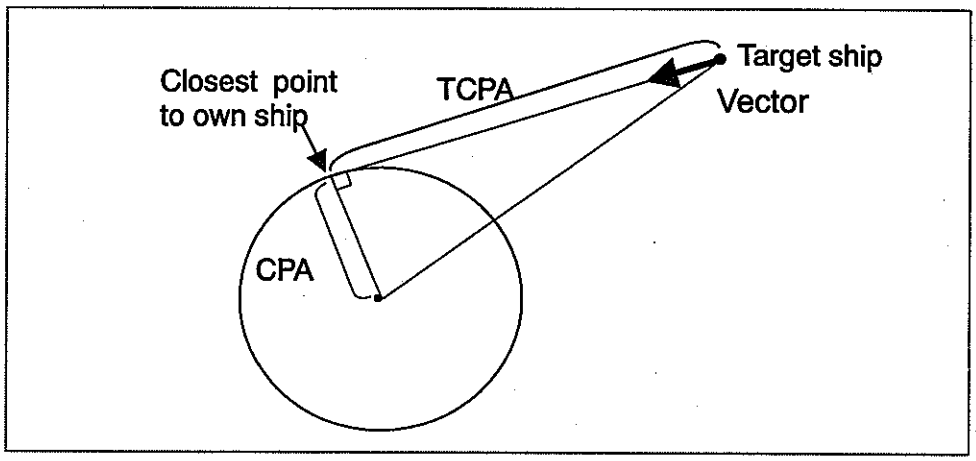


Figure 6.4 Definition of CPA and TCPA

6.6.3 EPA plotting on the screen

The EPA data is displayed for 10 minutes on the screen. Up to 5 plots are available. When the 6th plot is entered, plot 1 will be deleted automatically.

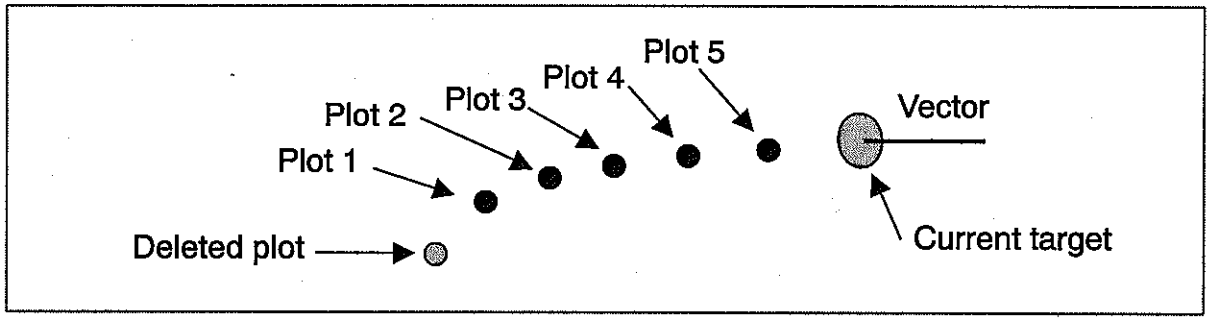


Figure 6.5 Plotting sequence

6.6.4 Alarm display

When 10 minutes has elapsed since a target has been plotted on the screen, the system judges that the reliability of the plot data is lost, and accordingly turns the audio alarm on together with the screen message "UNRELIABLE PLOT DATA" and the blinking symbol ◈ shown. Responding to the audible alarm and the screen message, you must update the plot. If you leave the plotted data without updating for 15 minutes, all symbols and the data currently plotted on the screen will be automatically deleted.

6.6.5 Explanation of the EPA terms

TARGET ID:
The target ID number can be tagged on each displayed target from 1 to 10.

AGE:
The time elapsed from when a target is plotted. The unit is in minute(s).

CPA (Closest Point of Approach):
The closest distance of a plotted target to own ship. The unit is in nautical mile(s).

TCPA (Time to CPA):
The time required for a target reaching CPA.

CRS/COG (Course/Course Over Ground):
The course of a target plotted is shown. The course can be switched to true or relative by pressing the TRUE/REL key.

STW/SOG (Speed):
The true speed of a plotted target, can be switched to true or relative by pressing the TRUE/REL key.

VECT (Vector):
The vector time of a plotted target.

BRG (Bearing):
The bearing of a target, plotted in true or relative mode. The bearing display is referenced to own ship.

DIST (Distance):
The distance of a target plotted from own ship.

UNRELIABLE PLOT DATA:
A warning that means the assigned target plot is old and not reliable, suggesting you to update the plotting. When this display is shown, an audio alarm is activated. If you leave the plot not updated for 15 minutes after the last update, all symbols and data currently plotted will be deleted.

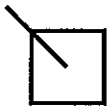
LIMIT CPA TCPA
This is a warning limit of CPA and TCPA. If the CPA and TCPA figures exceed the set up limit the assigned warning symbols flash and the audio alarm sounds. Set the warning limit with the RADAR/LIM CPA or TCPA menu.

6.6.6 VECT TIME (Selecting the Vector Time)
This function is used to set up the length of a vector that predicts the position of a target after preset time. Set with the RADAR/TRUE (REL) VECT menu.

6.6.7 EPA symbols
Acquisition symbols
The symbol for the plotted target changes as follows according to the plotting status:

This symbol appears when a target is plotted for the first time.

This symbol appears when a target is plotted for more than two points. A vector develops and the target data can be displayed when its target number is assigned (highlighted).



This symbol appears when a target is plotted for more than two points with its target number assigned. The target data is shown in the right side of the screen.

Warning symbols

The following symbols are used in the EPA functions to notify the operator of a high-risk target or invalid plotting. These symbols will blink when they are shown.

This is a CPA alarm symbol that appears when a plotted target is predicted to infringe a predetermined CPA and/or TCPA range. The symbol blinks at an interval of 0.5 seconds. The data can be displayed by assigning the target number.

This is a CPA alarm symbol that appears when the relevant target number is assigned. The rest of the features are the same as above.

This is an Unreliable Plot symbol that appears when a target is not plotted over 10 minutes. The on-screen error message "UNRELIABLE PLOT DATA" will also appear on the screen. In approximately 15 minutes from when the symbol is shown and no further plotting is made, the symbol mark and audio-visual alarm will be turned off automatically.

6.6.8 WARNING LIMIT (Setting the Warning Limit of CPA and TCPA)

This function is used to set up the limit at which the warning alarm for CPA and TCPA is activated. Use the RADAR/LIM CPA and LIM TCPA menu. Setting ranges for CPA and TCPA are as follows:

CPA: 0.00 NM to 19.9 NM.
TCPA: 1 Minute to 63 Minutes

6.6.9 TARGET ALL CLEAR (Clearing all target plots)

Use the DISP/NAV/TARGET ALL CLR menu.

6.6.10 ID DISP (Displaying Target ID Number)

Using this function, the target ID number can be tagged on each displayed target. Use the DISP/NAV/ID DISP menu.

6.6.11 Correcting the latest plotting position

In case you find a wrong plotting and need to correct it, carry out the following steps:

(1) Move the Joystick to move the cross cursor on to the new plot point.
(2) Press the UPDATE key. Wrong plot will be corrected as shown below.

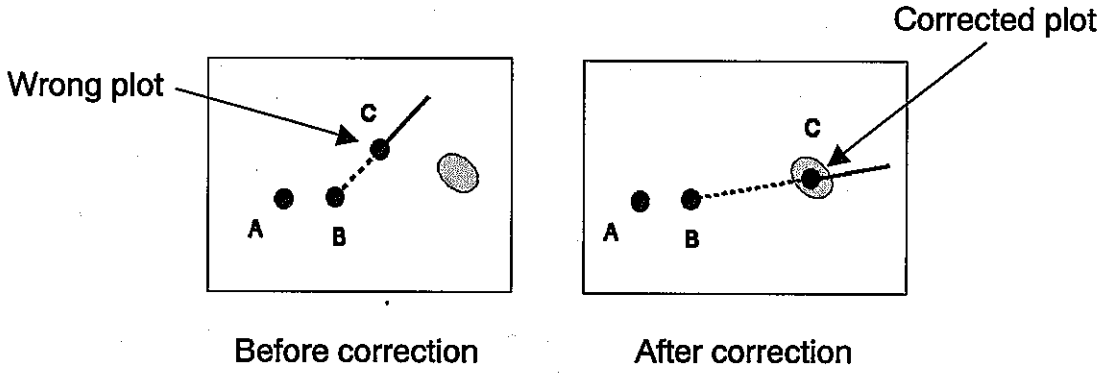


Figure 6.6 Correcting the plotting position

6.7 Operating the ATA (Option)

6.7.1 Using the ATA

The ATA (Automatic Tracking Aid) unit is an optional PC Board that can be installed into the processor unit. Using this function, up to ten targets can be manually acquired and tracked automatically. All tracked target data is the same type as the EPA data, and is shown on the right of the screen.

All operating procedures are also the same as that of the EPA function with one exception i.e. no second plotting is needed in the ATA system.

Note: If the ATA system gets malfunctioned, the plotting system will switch to EPA mode automatically.

6.7.2 Outline of the ATA system

To use the ATA function the MRE-300 ATA module must be installed. (Refer to APPENDIX 1 in Chapter 4 for installation instruction) To run the ATA function, the bearing signal and the speed signal must be supplied to the Processor unit.

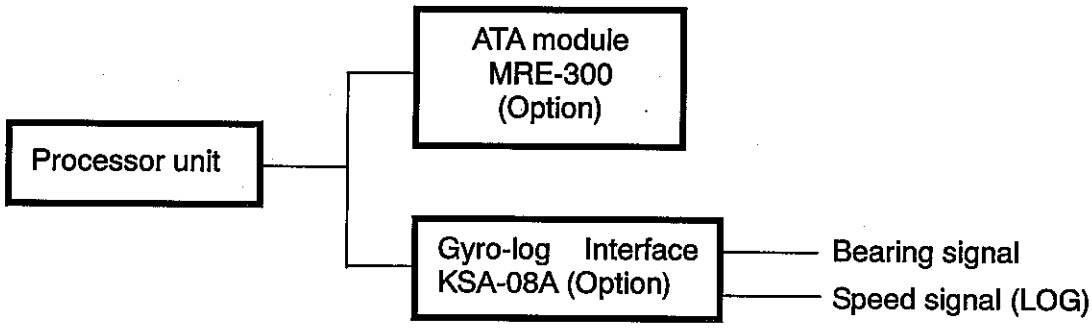


Figure 6.7 Configuration of ATA

⚠ **WARNING:** *The accuracy of the auto tracking function provided by the ATA could be affected by the following factors:*

(1) Sea clutter and weather clutter such as rain and snow may degrade the ATA tracking capability. These clutter components should be appropriately reduced.

(2) Poor receiver sensitivity may also degrade the tracking capability.

(3) Faulty azimuth synchronization could be the cause of erratic vectors.

(4) Degraded bearing and speed data fed from external sensor devices also cause erratic vectors.

If any of the errors stated above are detected, the following data provided by the ATA will be erratic.

(1) The CPA and TCPA value.

(2) The target ship's course and speed.

(3) The target ship's bearing and distance.

6.7.3 ATA functions

The ATA system provides the following functions and display on the screen.

(1) Symbols:
- Acquisition symbols
- Warning symbols

(2) Target acquisition

(3) Target data display

(4) Changing the vector length

(5) Cancellation of an acquisition and tracking of target

(6) Warning limit setting

(7) Clearing all plotted targets

(8) Target number display

(9) Selecting the TRUE or RELATIVE tracking

6.7.4 Operating procedures

Perform the following procedure to use the ATA function:

(1) Move the Joystick to let the cross cursor fall on a target.

(2) Press the ACQ key to acquire the target. At the same time, the assigned target will be braced with a dashed acquire mark with an ID number shown nearby.

(3) To acquire a next target, press the TARGET key to set the next target ID.

(4) Repeat step (1) and (2) for other targets up to ID number 9.

(5) Press the DELETE key to cancel the target tracking. The symbol of the target and

data will be cleared.

NOTE: The target detection echo level can be set with the menu "ADJUST/PRESET/TARGET LEVEL".

6.7.5 ATA symbols

Acquisition symbols

The symbol mark for the plotted target changes as follows according to the plotting status:

This symbol appears when a target is acquired for the first time.

This symbol appears when the target tracking becomes stable. A vector develops and the target data can be displayed when its target number is assigned (highlighted).

This symbol appears when a target tracking becomes stable with its target number assigned. The target data is shown in the right side of the screen.

Warning symbols

The following symbols are used in the EPA functions to notify the operator of a high-risk target or invalid plotting. These symbols will blink when they are shown.

This is a CPA alarm symbol that appears when a displayed target is predicted to infringe a predetermined CPA and/or TCPA range. It blinks at an interval of 0.5 seconds. The data can be displayed by assigning the target number.

This is a CPA alarm symbol that appears when the relevant target number is assigned. The rest of the features are the same as above.

This symbol appears with audio alarm when the target is lost during tracking. The on-screen error message "UNRELIABLE PLOT DATA" will also appear on the screen. The symbol mark and audio-visual alarm will be turned off automatically 15 seconds after first appearance of the symbol.

This symbol appears when the target enters the Guard Zone. The symbol is shown overlaid on the target and is automatically deleted as the target leaves the zone.

6.7.6 Setting the Guard Zone

The Guard Zone Alarm warns the operator an entry of a target to a preset alarm zone. When the target enters the zone, a flashing equilateral triangle with its apex down is shown to mark the target. (Refer to Figure 6.7) At the same time, the GZ sign flickers and an audio alarm sounds. To stop the audio alarm, press the AUDIO OFF key.

6.7.6.1 To set up the position of the Guard Zone

(1) Press the ALARM (GZ) key. This allows the EBL and VRM controls to be used for moving the Alarm Zone in azimuth and range, respectively.

(2) Move the EBL control to set the position of the Guard Zone in azimuth. The center bearing of the Guard Zone will be displayed in the lower right corner of the screen.

(3) Move the VRM control to set the position of the Guard Zone in range. The distance of the outer edge of the Guard Zone will be displayed in the same place as the bearing display.

6.7.6.2 To set up the depth and width of the Guard Zone

(Reference drawing: Figure 6.7 The outline of the Guard Zone Alarm)

(4) Press the EBL SEL key and rotate the EBL control to set up the width of the alarm zone. An arrow mark will be shown on the front of the WIDTH to indicate width is active to control. A further press of the key will return to control the Guard Zone in azimuth.

(5) Press and hold the VRM SEL key and rotate the VRM control to set up the depth of the alarm zone. An arrow mark will be shown on the front of the DEPTH to indicate depth is active to control. A further press of the key will return to control the Guard Zone in range.

(6) Press the ENT key to fix the settings. The Guard Zone will be shown on the screen.

> ⚠ **Caution:** *In the following circumstances, the alarm function will become inoperative. The ALARM range and bearing displays accordingly flicker to notify that the function is inoperative.*
>
> *(1) When the alarm zone is set lower than 0.5 NM.*
>
> *(2) When the alarm zone is set beyond the viewable screen area caused by an improper range scale setting such as, the range scale is too short, off-centering is too much, etc.*

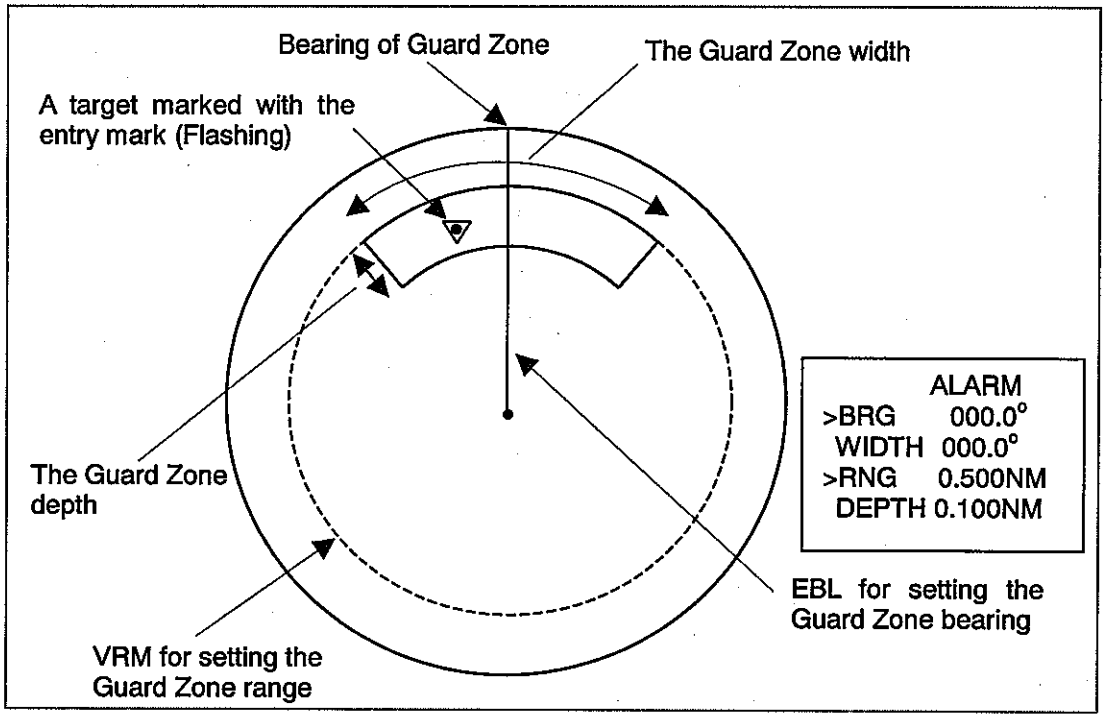


Figure 6.8 The outline of the Guard Zone Alarm

6.8 Operating the AIS (Option)

NOTE: To use this function, the optional AIS interface module (PCB based) must be installed inside the processor unit and connected to an external AIS transponder. The installation of the module must be performed by an authorized service personnel. Reference description: APPENDIX 1 Installation of AIS module, AIS-100, Chapter 4 Installation.

6.8.1 Outline of the AIS

The AIS interface module receives the other ship's information sent from an external AIS transponder and displays the AIS symbols and data. (NOTE: The AIS transponder transmits own ship's information at certain interval and also receives the navigational information broadcast from ships located within the AIS reception coverage.

6.8.2 Setting the AIS to work

(1) In the DISP menu select AIS and select ON.

Indication	Meaning	Selection
AIS	AIS data display	OFF, SYMBOL OFF, ON

(2) Select and set LIM (AIS range) In the RADAR menu. The AIS sleeping target symbols will be displayed on the screen within the LIM range. The LIM range can be set up to 20NM as maximum range.
(3) The AIS symbols are displayed on the target echoes or separated on reported position. The AIS interface can handle up to 64 targets for AIS processing. The exceeding the limit numbers of target cause the alarm message "Number of targets have exceeded the limit" shown on the screen.
(4) To prevent potential dangerous targets from being unprocessed, always keep the LIM range to allow a total number of AIS targets to be within 64.
(5) To view the AIS data of a specific target, set the cursor with the joystick on to the sleeping target symbol and press ENT key to change it to an activated target symbol. Then, set the target ID number in the RADAR menu to an associated TARGET ID shown on the screen.

6.8.3 AIS data display

TARGET ID	Target ID for Data Indication
MMSI	An acronym of "Maritime Mobile Service Identity", which means the identification number of each ship that carries the AIS transponder. The number is assigned by the IMO.
CPA	Closest Point of Approach
TCPA	Time to CPA
CSE/COG	Course/Course Over Ground
STW/SOG	Speed through Water/Speed Over Ground
RNG	Range
T BRG	True Bearing

The TARGET ID is applied from 1 to 64 automatically. When a target has moved out of LIM range or been lost, the ID number being used will be applied to other newly selected target automatically.

In case of uncertainty of CPA/TCPA calculation (e.g. AIS SOG/COG not available) the AIS data field is marked with xxx.x.

In case of own ship data missing (e.g. VTG, VBW) the AIS data field is left blank and an alarm "NO OWN DATA" is generated.

⚠ **WARNING:** *The accuracy of the data provided by the AIS could be affected by the following factors:*

Degraded bearing and speed data fed from external sensor devices cause erratic vectors. If any error data fed from external sensor devices are detected, the following data provided by the AIS display will be also erratic.

(1) The CPA and TCPA value and Alarm.

(2) The target ship's course and speed.

(3) *The target ship's bearing and distance.*

6.8.4 AIS target symbols

According to the AIS operational status, the following target symbols are used.

Activated Target

A target, which the AIS user has activated is termed "Activated Target" and is supplied with an ID number (1 to 64). The vector time and mode are determined with the settings being made for the radar plotting function.

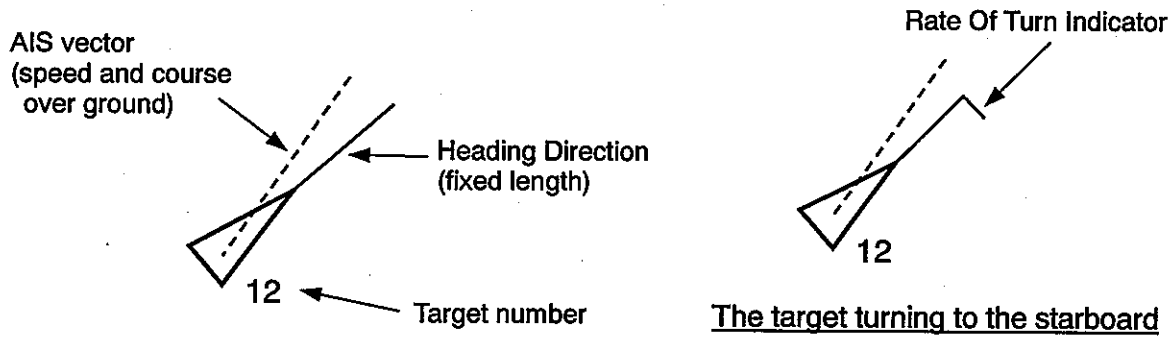


Figure 6.9 Activated Target Symbol

Sleeping Target

A target, which is not activated by the AIS user is termed "Sleeping Target." The target has no ID, vectors or ROT information, only showing the presence of a vessel with AIS equipped.

Figure 6.10 Sleeping Target Symbol

Selected Target

A target selected by the AIS user is termed "Selected Target". Once selected, a dashed square is drawn around the target and AIS data (MMSI, CPA, TCPA, COG,

SOG, RNG and BRG) will be displayed in the AIS data window.

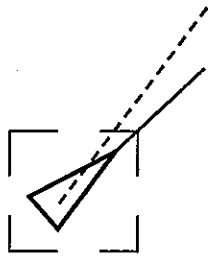


Figure 6.11 Selected Target Symbol

Dangerous Target

If predicted CPA and TCPA values of a Target are smaller than the one being set up, the AIS target symbol will turn to a flashing bold symbol as shown below.
If the target is a "Sleeping Target", it will be an "Activated Target" automatically.

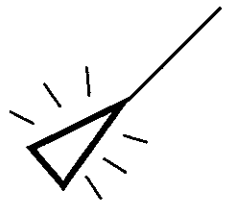


Figure 6.12 Alarm Target Symbol

Lost Target

A target that strays out of tracking is termed "Lost Target." The lost symbol is displayed flashing with a line drawn across. When an activated target changes to a lost target, the buzzer sounds. When a sleeping target changes to a lost target, the buzzer does not sound and the symbol will disappear automatically approx. 1 minute later.

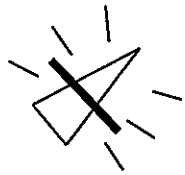


Figure 6.13 Lost Target Symbol

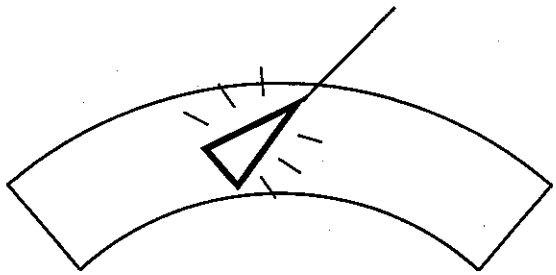
NOTE:

The radar vector (generated by EPA or ATA) and the AIS vector may differ in terms of the vector length and its direction. This is not a fault. The radar vector is developed based on the past target positions stored either by manual plotting (EPA) or automatic tracking (ATA). Meanwhile, the AIS vector is generated from the navigation data sent from the AIS transponder. The radar vectors take a certain time until they are fully displayed, while the AIS vector is displayed as soon as the AIS data is received from

the AIS transponder and own GPS/SHIP information.

Guard Zone

When the Guard Zone is set, an AIS target located in the Zone cause a AIS Guard Zone Alarm. The AIS symbol is displayed flashing and "Guard Zone Alarm" will be indicated in the AIS window..

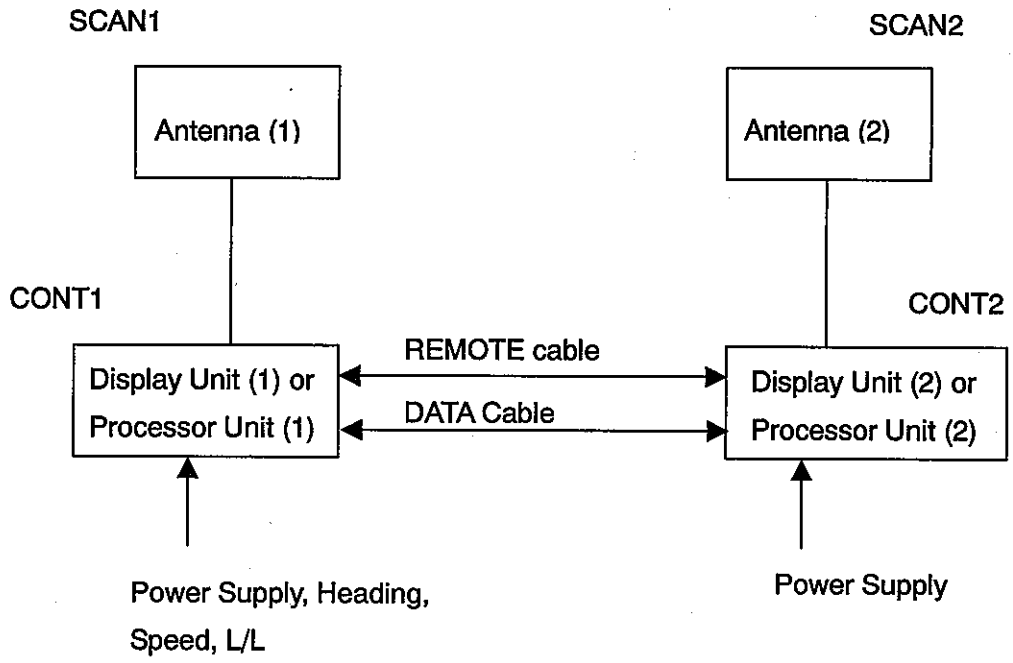


6.9 Operating the Interswitch

6.9.1 Outline of Interswitch

Two radar systems can be used for an independent system, cross over switched system, master-slave system, or dual control system with the Interswitch function. The interswicth function is useful when a transceiver unit, an antenna, or a display unit is out of order. The non-faulty unit can be used for the radar system instead of the faulty unit with the interswicth function.

6.9.1.1 System Diagram



6.9.2 System Setting Modes

6.9.2.1 NORMAL

This is the mode to use two radars as independent radars. The CONT1 controls the SCAN1 in the system diagram shown above, and the CONT2 controls the SCAN2 independently. Two radars will operate as independent two radars without any effects each other.

6.9.2.2 CROSS

This is the mode with exchanging two scanner units, and operating two independent radars. The CONT1 controls the SCAN2 in the system diagram shown above, and the CONT2 controls the SCAN1 independently. Two radars will operate as scanner exchanged independent two radars without any effects each other.

6.9.2.3 MASTER-SLAVE

On this mode, one radar system operates normally and another display unit operates as a monitor.

6.9.2.3-1. CONT1: MASTER(Radar), CONT2: SLAVE(Monitor)

The CONT1 controls the SCAN1 in the system diagram. The radar with CONT1 and SCAN1 will operate a independent radar system. The CONT2 will receive and indicate the radar image with SCAN1 radar signals. But the CONT2 could control nothing of the SCAN1. The SCAN2 is idling on this mode.

The range scale can be changed at the CONT2 freely but without SCAN1 controls such as transmit pulse width, repetition, receiver band width. When indicate the short range radar image at the CONT2 with long pulse transmitting on the SCAN1, there may be a strange radar image on the screen. But this is not a problem of the system. On the contrary, short pulse on the SCAN1, long range on the CONT2, there may be a strange radar image on the screen. of CONT2 but this is not a problem also. Please use the display ranges at the CONT2 within indicating normal radar image.

You can use functions without scanner control freely such as EBL, VRM, Gain, STC control on the CONT2.

6.9.2.3-2. CONT1: SLAVE(Monitor), CONT2: MASTER(Radar)

The CONT2 controls the SCAN2 in the system diagram. The radar with CONT2 and SCAN2 will operate a independent radar system. The CONT1 will receive and indicate the radar image with SCAN2 radar signals. The other functions and cautions are the same.

The SCAN1 is idling on this mode.

6.9.2.4 DUAL

This is the mode that two display units will control one scanner unit.
One of the scanner units and two display will be used on this mode.
Both of the display unit can control the scanner unit such as pulse width, receiver band width. These control information transferred between two display units each other. When change the display range on the one display unit such as to 6NM, the range of the another display unit will be changed to the same range as 6NM automatically.

You can use radar functions freely on both display units such as EBL, VRM, Gain, STC control independently.

6.9.3 Operation

1. Press MENU key several times on the standby state. The Interswitch setting screen shown below will be displayed on the screen. The part indicated as ▒ is the item for setting.
2. Move the ▒ part with the joystick to the item for setting, then press ENT key.
The ▒ part will blink and shows ready to set.
3. Change the setting with the joystick and press ENT key.

"OTHER" items shows the status of the other radar unit through communication line.

RADAR STATUS SELECT MENU

	OWN	OTHER
MODE	INDEPENDENCE ▒	INDEPENDENCE
TYPE	MASTER	MASTER
STATUS	STANDBY	STANDBY
ANTENNA	PORT	STBD

6.9.3.1 MODE

Set the radar control mode on this item.
(1) INDEPENDENCE
The display unit controls the scanner unit that is actually connected to the display unit. No operation effects to the other radar system.
(2) CROSS
The display unit controls the scanner unit that is connected to the other display unit. No operations effect to the other radar system.

(3) DUAL

Two display units control the scanner unit that is selected with MASTER radar on the TYPE item. Operations for the scanner unit will effect to the other display unit automatically.

6.9.3.2 TYPE

Set the operation type on this item.

(1) MASTER

The display unit can control a scanner unit. When the MODE is set as DUAL, the scanner unit of this radar system will be used for the radar system.

(2) SLAVE

The display unit will operate as monitor. An external radar signals will be used for the radar image indication.

6.9.3.3 STATUS

This item will indicate for each radar status such as STANDBY, TX(Transmit), and WAIT.

(1) STANDBY

The radar is at stand by state.

(2) TX

The radar in transmitting.

(3) WAIT

The radar is waiting for magnetron preheating.

6.9.3.4 ANTENNA

This item will indicate for each radar antenna position on the screen such as PORT, STBD(STarBoarD), and so on. Set the antenna position on this item.

6.9.3.5 Examples for Setting

1. Settings for normal two radars

1st radar	display unit = CONT1,	scanner unit = SCAN1
2nd radar	display unit = CONT2,	scanner unit = SCAN2

The indication and settings at CONT1

	OWN	OTHER
MODE	INDEPENDENCE	INDEPENDENCE
TYPE	MASTER	MASTER
STATUS	STANDBY	STANDBY

The indication and settings at CONT2

	OWN	OTHER
MODE	INDEPENDENCE	INDEPENDENCE
TYPE	MASTER	MASTER
STATUS	STANDBY	STANDBY

2. Settings for cross controlled two radars

1st radar	display unit = CONT1,	scanner unit = SCAN2
2nd radar	display unit = CONT2,	scanner unit = SCAN1

The indication and settings at CONT1

	OWN	OTHER
MODE	CROSS	CROSS
TYPE	MASTER	MASTER
STATUS	STANDBY	STANDBY

The indication and settings at CONT2

	OWN	OTHER
MODE	CROSS	CROSS
TYPE	MASTER	MASTER
STATUS	STANDBY	STANDBY

3. Settings for master-slave with CONT1/SCAN1 as MASTER

1st radar	display unit = CONT1,	scanner unit = SCAN1
2nd radar(monitor)	display unit = CONT2,	scanner unit = ---

The indication and settings at CONT1

	OWN	OTHER
MODE	INDEPENDENCE	INDEPENDENCE
TYPE	MASTER	SLAVE
STATUS	STANDBY	STANDBY

The indication and settings at CONT2

	OWN	OTHER
MODE	INDEPENDENCE	INDEPENDENCE
TYPE	SLAVE	MASTER
STATUS	STANDBY	STANDBY

4. Settings for dual control radar system with using SCAN1

1st radar	display unit = CONT1,	scanner unit = SCAN1
2nd radar	display unit = CONT2,	scanner unit = SCAN1

The indication and settings at CONT1

	OWN	OTHER
MODE	DUAL	DUAL
TYPE	MASTER	SLAVE
STATUS	STANDBY	STANDBY

The indication and settings at CONT2

	OWN	OTHER
MODE	DUAL	DUAL
TYPE	SLAVE	MASTER
STATUS	STANDBY	STANDBY

6.9.4 Data output function

When using Interswitch function, one radar navigation information will be transferred to the another radar system with NMEA0183 format. It is not necessary to connect navigation information for both of the radar systems. The information is transferred through DATA1 connector together with Interswitch control messages. The talker device names of the output messages are "RA" as a radar.

1. Heading information
Formatter: HDT
Output time period: 0.1 second

2. Speed information
Formatter: VHW
Output time period: 0.1 second

3. Speed and Course over ground information
Formatter: VTG
Output time period: set with SYSTEM / I/O SETUP / SERIAL TRANSMIT menu

4. Latitude and Longitude of the ship information
Formatter: GLL
Output time period: set with SYSTEM / I/O SETUP / SERIAL TRANSMIT menu

Note: To prevent multiple data input, no data will be output when the talker device is "RA".

6.9.5 Installation

It is necessary to connect two cables between two radars for Interswitch operation.

1. REMOTE cable

The radar signals should be cross connected between two radars for Interswitch operation. The radar video, trigger, SHF, and azimuth signals are connected each other with the REMOTE cable.

2. DATA cable

The Interswitch control is carried out with the data communication. The data input and output should be cross connected between two radars, too. The connection should be made with DATA1 connector only.

6.9.6 Adjustment

The radar image distance adjustment is necessary for Interswitch operation. Please adjust the radar image distance with stand alone(independence) mode, and also CROSS or SLAVE mode. Change the Interswitch operation mode to CROSS or SLAVE, then adjust the distance from "SYSTEM / SYSTEM SETUP / DELAY" menu.

If necessary, adjust STC characteristics with "SYSTEM / SYSTEM SETUP / HEIGHT" menu with CROSS or SLAVE mode, too.

6.9.7 Option

6.9.7.1 radar image bearing offset

The radar image bearing can be added an offset from the menu. If two radar displays do not installed as parallel, such as a dual bridge ferry, set an 180 degree offset for SLAVE or DUAL operation. Set the offset angle at "I.S.HDG" from "MAINTE/OPTION" menu next to the "SYSTEM". The "MAINTE/OPTION" menu can be used with enter the maintenance mode. The maintenance mode can be entered by pressing "MODE" key when power on.

6.9.7.2 heading information offset

When both select the NMEA-0183 serial data type, and no heading information is connected for the SLAVE processor/display unit, the transmitted data "$RAHDT" from the MASTER unit can be used for heading information.
The "$RAHDT" heading information can be added an offset from the menu. If two radar displays do not installed as parallel, such as a dual bridge ferry, set a 180 degree offset for SLAVE or DUAL operation. Set the offset angle at "I.S.GYRO" from "MAINTE/OPTION" menu next to the "SYSTEM" same as above.
This offset is effective for the "$RAHDT" format data **only**.

6.9.8 Cable Connection

Cable connection for REMOTE cable

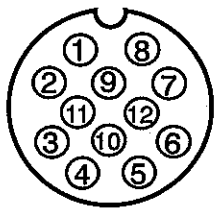
Radar No.1

pin No.	Name
1	Video Out
2	Trigger Out
3	Gnd
4	Azimuth Out
5	SHF Out
6	Gnd
7	Video Input
8	Trigger Input
9	Gnd
10	Azimuth Input
11	SHF Input
12	+12Vdc

Connection

Radar No.2

pin No.	Name
1	Video Out
2	Trigger Out
3	Gnd
4	Azimuth Out
5	SHF Out
6	Gnd
7	Video Input
8	Trigger Input
9	Gnd
10	Azimuth Input
11	SHF Input
12	+12Vdc



Coaxial

REMOTE connector
Pin assignment (Top View)

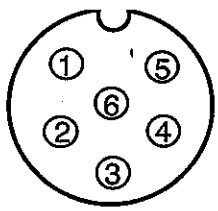
Cable connection for DATA cable

Radar No.1

DATA 1	
pin No.	Name
1	Shield
2	OUT-A
3	OUT-B
4	IN-A
5	IN-B
6	Gnd

Radar No.2

DATA 1	
pin No.	Name
1	Shield
2	OUT-A
3	OUT-B
4	IN-A
5	IN-B
6	Gnd



DATA connector pin assignment
(Top View)

Chapter 7

Graphic Displays

Contents

Chapter 7 Graphic Displays

The MDC-1800BB series has a graphic mode in addition to the normal radar display to assist in navigation. The available graphics are NAVLINE (Navigation Line), MAP (Map) and 10 kinds of marks. The map is constituted by a set of Coastlines.

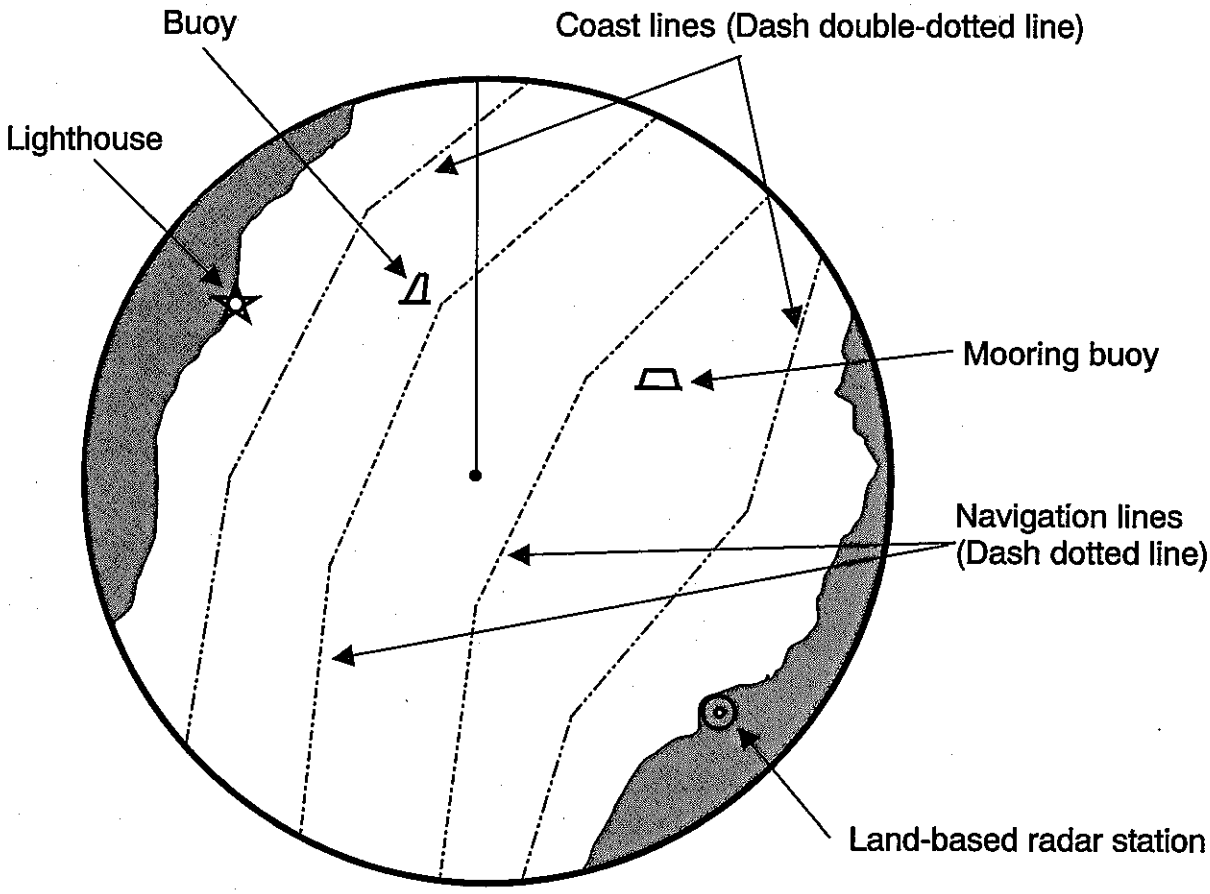


Figure 7.1 An example of the graphic display

Specifying nodes on each graphic in the latitude and longitude creates both navigations lines and coastlines.

7.1 Entering the Graphic Mode

Put the radar to standby mode and press the MENU key. Pressing the MENU key toggles the graphic mode of display in the following order.

First press: DISPLAY ITEM SELECT MENU
Second press: NAVLINE DATA INPUT MENU
Third press: COASTLINE DATA INPUT MENU
Fourth press: MARK INPUT MENU

NOTE: To use the graphic function, you need to enter the position data from external Electronic Position Fix System (EPFS).

7.2 Selecting the Graphic Display / DISPLAY ITEM SELECT MENU

This menu shows the status of the current settings on all available graphic display items.

Table 7.1 DISPLAY ITEM SELECT MENU

DISPLAY ITEM	NAVLINE NUMBER	0	OFF
		1	OFF
		2	OFF
		3	OFF
		4	OFF
		5	OFF
		6	OFF
		7	OFF
		8	OFF
		9	OFF
	MAP NUMBER	0	OFF
		1	OFF
	COAST LINE NUMBER	0	OFF
		1	OFF
		2	OFF
		3	OFF
	MARK		OFF

7.2.1 Selecting each item

To select a graphic display, carry out the following procedures:

(1) Move the Joystick to the right highlighting the OFF sign and press the ENT key. The OFF sign will blink accordingly.

(2) Move the Joystick further to the right to show the blinking ON sign.

(3) Press the ENT key to fix the selection of the graphic display. The ON sign will become stationary and the selected graphic display will be shown overlaid with a normal radar picture.

The above procedure applies to all DISPLAY ITEMs in the table.

⚠ **WARNING:** In case no positional data is entered in the selected graphic display item, a beep sounds to alarm the operator that the item is not valid.

7.2.2 NAVLINE

- The NAVLINE is a graphic display that shows a course or course separation zone on the radar screen. Up to 10 pairs of data can be registered (Registration number: 0 to 9) For registration of NAVLINE, refer to **"7.3.1 Registering or modifying the NAVLINE data"**
- One NAVLINE consists of a pair of continuous polygonal lines.
- You can register up to 10 points on each polygonal line (Registration number: A0 to A9 and B0 to B9).
- One NAVLINE alone can be displayed on the screen.
- If your ship contacts or crosses a NAVLINE, the warning display on the screen will appear with highlighted "NAVLINE" sign, which is shown in the lower right corner of the screen.
- Before displaying the NAVLINE, you must enter the position signal from the NAVIGATOR (EPFS)

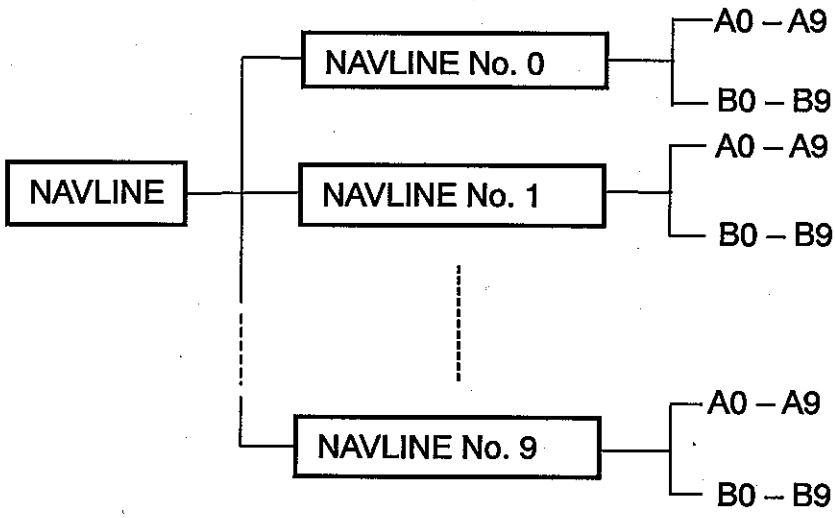


Figure 7.2 Structure of NAVLINE

7.2.3 MAP

- The MAP function is used to make artificial warning zones, warning spots or landmarks for fixed targets including coastlines, buoys, reefs, sunken ships and lighthouses on the radar screen. You can register up to 2 pairs of the maps (Registration number: 0 to 1).
- Up to 4 coastlines (Registration number: 0 to 3) and 20 marks (Registration number: 0 to 19) can be registered to a single map.
- Up to 20 points (Registration number: 0 to 19) can be registered to a single coastline. Polygonal lines connecting the registered points constitute a coastline.
- One map alone can be displayed at a time.

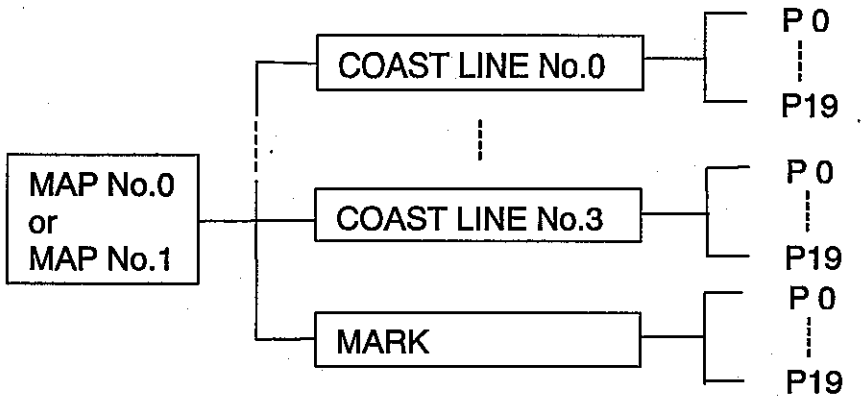


Figure 7.3 Structure of the Map

7.3 Registering or modifying the NAVLINE data / NAV LINE DATA INPUT MENU

To use this function, carry out the following procedures:

(1) Select the NAVLINE INPUT MENU. The following list will accordingly be shown on the screen.

Table 7.2 NAV LINE INPUT MENU

NAVLINE NUMBER			0	
POSITION NUMBER	LATITUDE	N / S	LONGITUDE	E / W
	12°34.567	N	123°45.678	E
A1				
A2				
A3				
A4				
A5				
A6				
A7				
A8				
A9				
B0				
B1				
B2				
B3				
B4				
B5				
B6				
B7				
B8				
B9				

(2) Move the Joystick up or down to highlight the number shown right to the words NAVELINE NUMBER and press the ENT key. The number will blink.

(3) Move the Joystick left or right to select the desired number out of 0 through to 9.

(4) Press the ENT key to fix the selection. The blinking number will become

stationary. To clear all position data, press HL OFF key at this state.

(5) Move the Joystick up or down to highlight an alphanumeric display (A0 – B9) under the POSITION NUMBER column. To clear the position data, press HL OFF key at this state.

(6) Press the ENT key to let the selected alphanumeric display blink.

(7) Use the N/S/E/W and numeric keys (0 - 9) to enter the latitude and longitude coordinates. If a correction is needed, move the Joystick left or right to highlight the part for correction and repeat step (7) and after.

(8) Press the ENT key to fix the entry. The blinking alphanumeric data will become stationary.

(9) To continue the registration, repeat the step (5) and after.

7.3.1 Registering or modifying the MAP data / COAST LINE INPUT MENU

(1) Select the COASTLINE input menu. The following table will be accordingly shown.

Table 7.3 COASTLINE INPUT MENU

MAP NUMBER			0	
COASTLINE NUMBER			0	
POSITION NUMBER	LATITUDE	N / S	LONGITUDE	E / W
	12°34.567	N	123°45.678	E
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

(2) Move the Joystick up or down to highlight the number shown right to the words MAP NUMBER and press the ENT key. The number will blink.

(3) Move the Joystick left or right to select the MAP NUMBER, 0 or 1.
(4) Press the ENT key to fix the selection. The blinking number will become stationary.
(5) Move the Joystick down to highlight the number shown right to the words COASTLINE NUMBER and press the ENT key.
(6) Press the Joystick left or right to select the COASTLINE NUMBER from 0 through to 3.
(7) Press the ENT key to fix the selection. The number display will become stationary. To clear all coastline data, press HL OFF key at this state.
(8) Move the Joystick up or down to highlight the number (0 - 19) under the POSITION NUMBER column and press the ENT key to fix the selection.
(9) Use the N/S/E/W and numeric keys (0 - 9) to enter the latitude and longitude coordinates. If a correction is needed, move the Joystick left or right to highlight the part for correction and enter new data.
(10) Press the ENT key to fix the entry. The blinking alphanumeric data will become stationary. To clear the position data, press HL OFF key at this state.
(11) To continue the entry of position data for other position numbers or change the data, repeat the step (8) and after.

7.3.2 Registering or modifying the MARK data / MARK INPUT MENU

(1) Select the MARK INPUT menu. The following list will be shown, accordingly.

Table 7.4 MARK INPUT MENU

MAP NUMBER				0	
POSITION NUMBER	MARK SELECT	LATITUDE	N / S	LONGITUDE	E / W
	○	12°34.567	N	123°45.678	E
1					
2					
3					
4					
5					
6					
7					
8					
9					

(2) Move the Joystick up or down to highlight the number shown right to the words MAP NUMBER and press the ENT key. The number will blink.
(3) Move the Joystick left or right to select the MAP NUMBER, 0 or 1.
(4) Press the ENT key to fix the selection. The blinking MAP number will become

stationary. To clear all mark data, press HL OFF key at this state.

(5) Move the Joystick up or down to highlight the number shown right to the words POSITION NUMBER and press the ENT key. The number will blink.

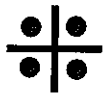
(6) Select a desired mark by pressing a numeric key (0 - 9)

(7) Use the N/S/E/W and numeric keys (0 - 9) to enter the latitude and longitude coordinates. If a correction is needed, move the Joystick left or right to highlight the part for correction and enter new data.

(8) Press the ENT key to fix the entry. The blinking alphanumeric data will become stationary. To clear the mark data, press HL OFF key at this state.

(9) To continue the entry of position data for other position numbers or change the data, repeat the step (5) and after.

Table 7.5 MARKS USED IN THE MAP

No.	Mark shape	Applicable objects
0		Light
1		Lighthouse, Aeronautical light, Light beacon, etc.
2		Buoy
3		Large mooring buoy
4		Radio and/or radar station
5		Dry rock
6		Awash rock
7		Reef, submerged rock, etc.
8		Surface object, wreck, Hazardous point, etc
9		Rush tidal current, eddy, etc.

Chapter 8

Trouble Shooting And On Board Servicing

Contents

Chapter 8 Trouble Shooting And On Board Servicing

This chapter covers simplified fault locating procedures to enable faulty areas to be identified on your vessel.

8.1 Information required for service

Please advise the following details:

(1) Name of vessel, Satcom number if available.
(2) Equipment type name
(3) Equipment serial number
(4) Software type name, shown on the standby screen and stated in this manual.
(5) Next port of call, ETA and ship's agent
(6) Faulty conditions and the result of on board check

8.2 Self diagnosis functions provided

The equipment provides on-screen alarm messages and the status indicator inside the display unit.

8.2.1 Alarm messages

The following alarm messages will be shown as a result of diagnosis by the built-in self-check function if the equipment becomes faulty. Details are as follows:

Table 8.1 Alarm messages shown on the screen

Alarm messages	Faults detected
ANTENNA ABNORMAL (NO RESPONSE)	Communication between Antenna and Display is faulty. Suspect no Antenna connection.
AZIMUTH ABNORMAL	The azimuth pulse signal is erratic in timing or frequency or no signal input to the display.
HEADING LINE ABNORMAL	The Heading Line signal is erratic or no signal input to the display.
TRIGGER ABNORMAL	Master trigger pulse is erratic in timing and level or, not present at all.
MAGNETRON CURRENT ABNORMAL	Magnetron current is not within specified range.
250V ABNORMAL	High voltage supply for Modulator Unit is not within specified range.
MAGNETRON HEATER CURRENT ABNORMAL	Magnetron heater current is not within specified range.

(Alarm messages)

Alarm messages	Faults detected
RADAR VIDEO ABNORMAL	Video signal sent from the transceiver unit is erratic or not present at all.
GYRO HDG XXX	No bearing data is applied to the display unit.
LOG SPD XXX	No bearing data is applied to the display unit

8.2.2 Status indicators

Two LEDs (Light Emitting Diodes) are provided on the Logic board fitted inside the display unit. These LEDs indicate the operational status of the software and hardware used in this system. Details of the indications are as follows:

Table 8.2 Status indications

LED No.	Usage	Operational status	LED status
DS1	Software check	Normal	ON
		Failure	OFF
DS2	Hardware check	Normal	ON
		Failure	OFF

Location of the status indicators

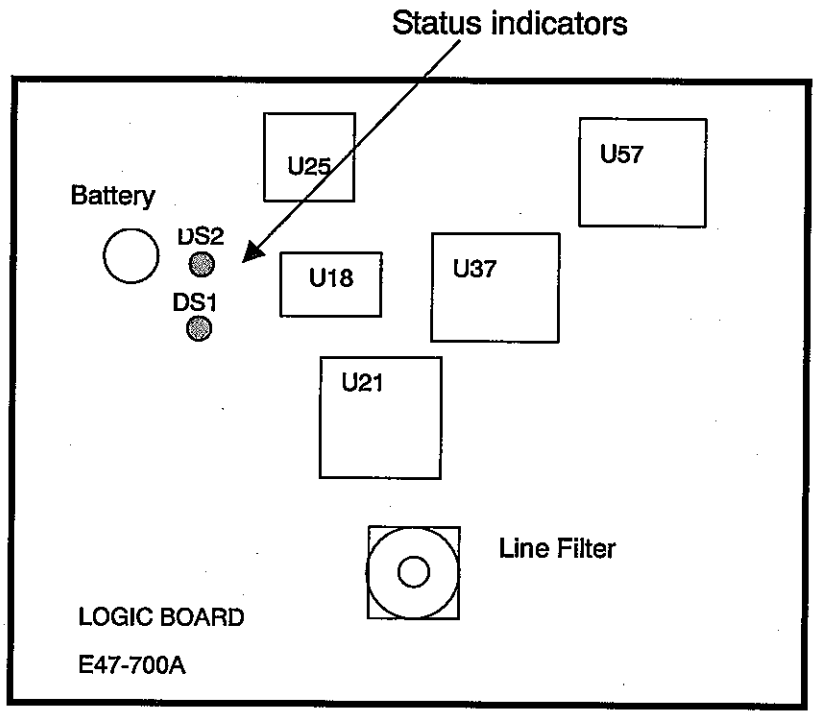


Figure 8.1 Location of status indicators

8.3 Trouble shooting

This section provides information required to fix or diagnose the faulty part in MDC-1860BB/1810BB/1820BB radar systems.

8.3.1 First-line faultfinding

Use the following tables that show brief diagnosis schedule to assist first-line servicing on board the ship.

Table 8.3 Primary faults

Description of fault	Possible cause of failure	Corrective measures
Radar does not turn on	1. Power cable is disconnected. 2. Power supply voltage is outside of the specified value. 3. Main fuse is blown.	1. Connect the power cable and secure the cable plug connection. 2. Use properly rated power supply. 3. Replace the fuse with new one.
Radar turns on but nothing displayed on the screen	1. Brilliance control is set at minimum position. 2. LCD is defective. 3. LCD driving circuits are defective.	1. Turn the brilliance control CW to set proper brilliance. 2. Call for service. 3. Call for service.

Table 8.4 Possible faults

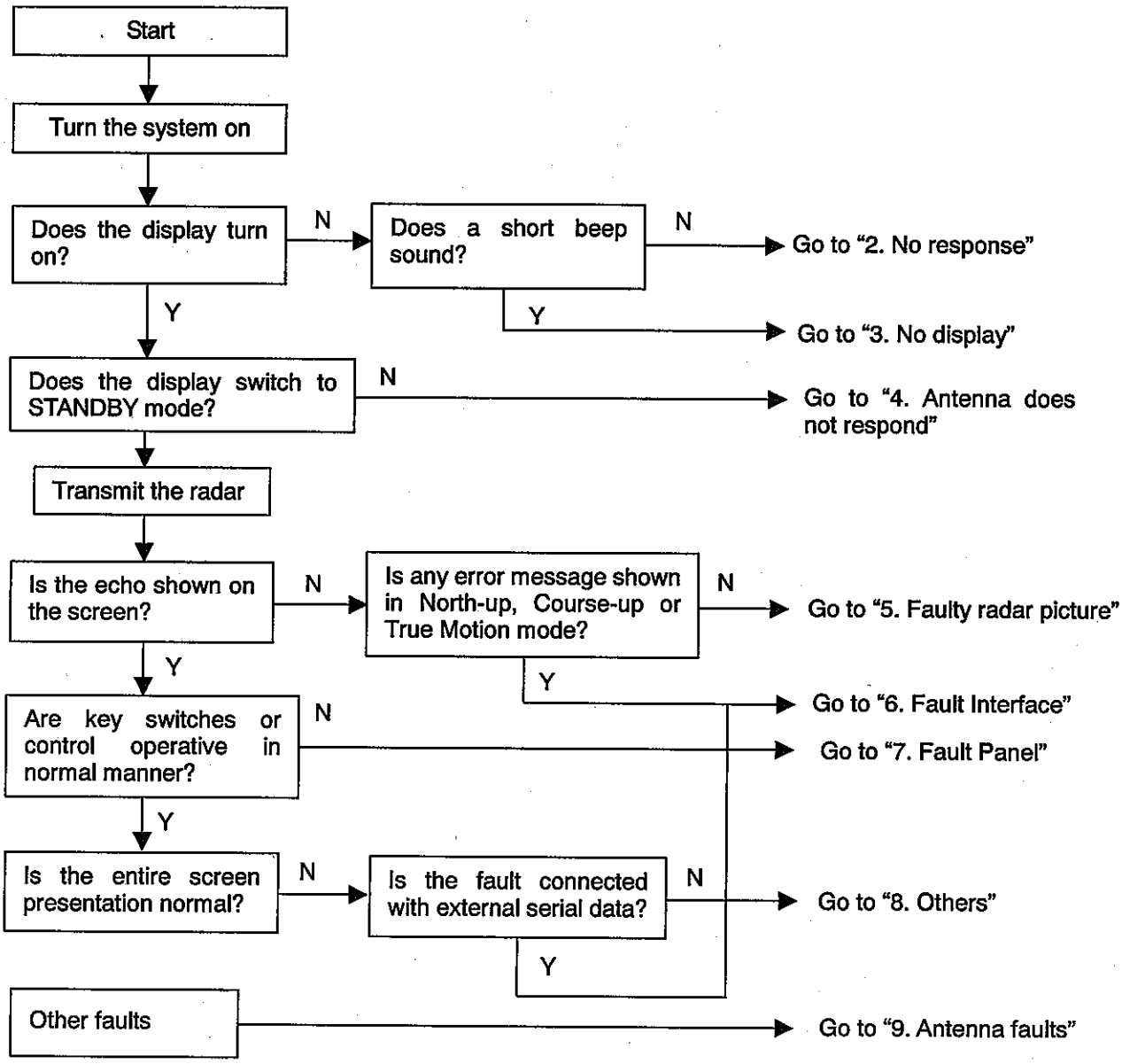
Description of faults	Possible cause of failures	Corrective measures
Screen is dark	1. Brilliance of the screen is not properly set. 2. LCD driving circuits are defective.	1. Turn the brilliance control CW to set proper brilliance. 2. Call for service.
No targets shown	1. Tuning is deviated. 2. Video contrast is poor. 3. Transceiver is defective.	1. Re-adjust tuning referring to para 6.2.14 and 6.2.15 in this manual. 2. Re-adjust contrast referring to para 6.2.1 3. Turn on Performance Monitor to isolate the faulty section. 4. Call for service.
Targets are weak	1. Tuning has drifted. 2. Magnetron or MIC is faulty.	1. Re-adjust tuning referring to para 6.2.14 and 6.2.15 in this manual. 2. Call for service.
No markers (HL, EBL, VRM, Range Rings, Parallel Index Line, Alarm Zone)	1. Marker video contrast is not properly set. 2. Logic board is defective.	1. Re-adjust Marker contrast referring to para 6.2.2. 2. Call for service.
Heading Line is missing	1. Heading Line signal is not applied to the display. 2. Heading Line signal is not generated. Fault on HL Generator PCB.	1. Check for cable connections for HL signal at antenna and display units. 2. Call for service.

Description of faults	Possible cause of failures	Corrective measures
Aerial does not rotate	1. Motor fuse is blown. 2. Turning motor is not powered. 3. Turning motor brushes are worn out.	1. Replace the motor fuse with new one. 2. Check the connections for motor power supply line. 3. Replace the motor brushes.

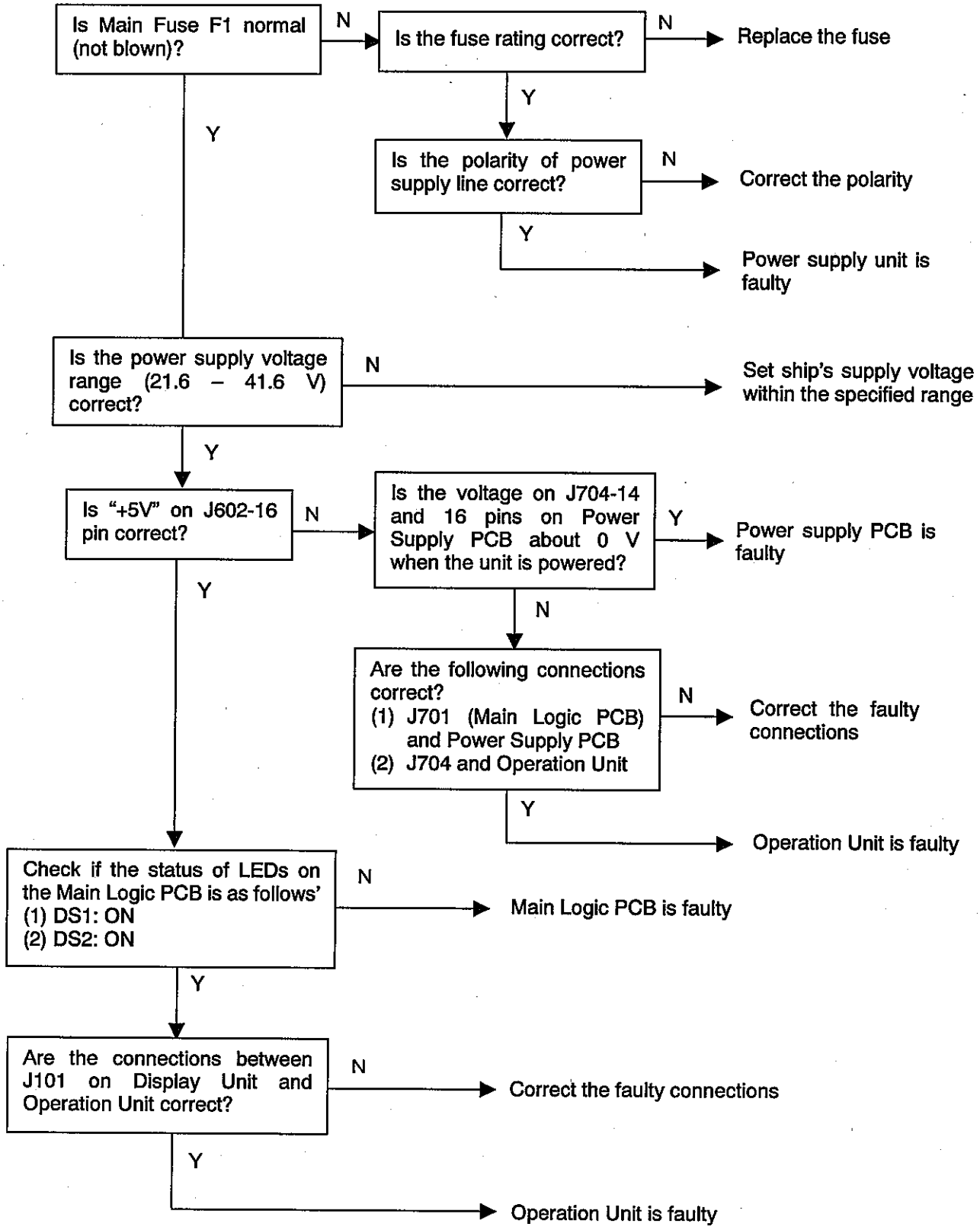
8.3.2 Faultfinding chart

The following faultfinding charts are prepared for a service engineer to allow him to diagnose and locate a faulty part on a module basis. The charts are systematically arranged from primary fault analysis to finding a path to a detailed flow chart that follows.

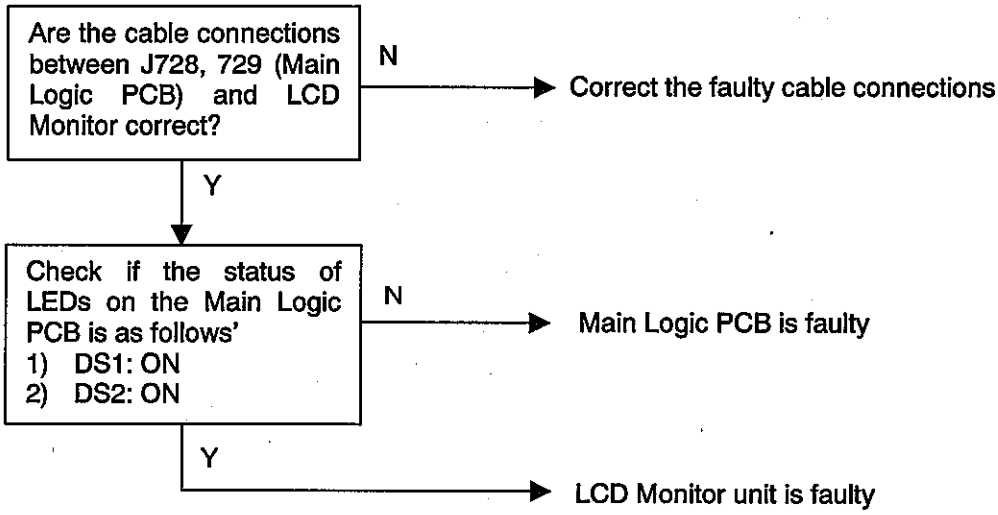
1. Fault analysis



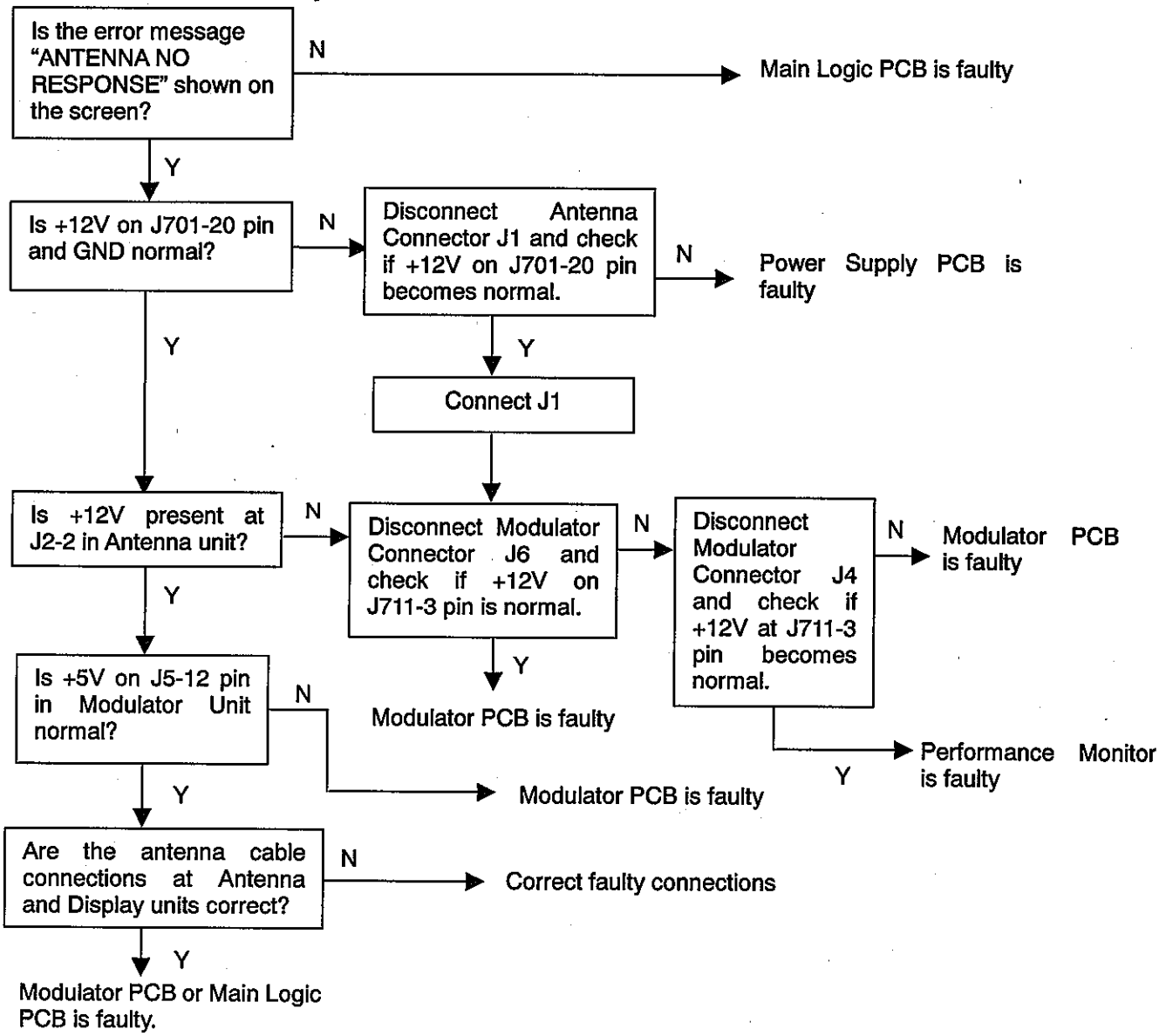
2. No response



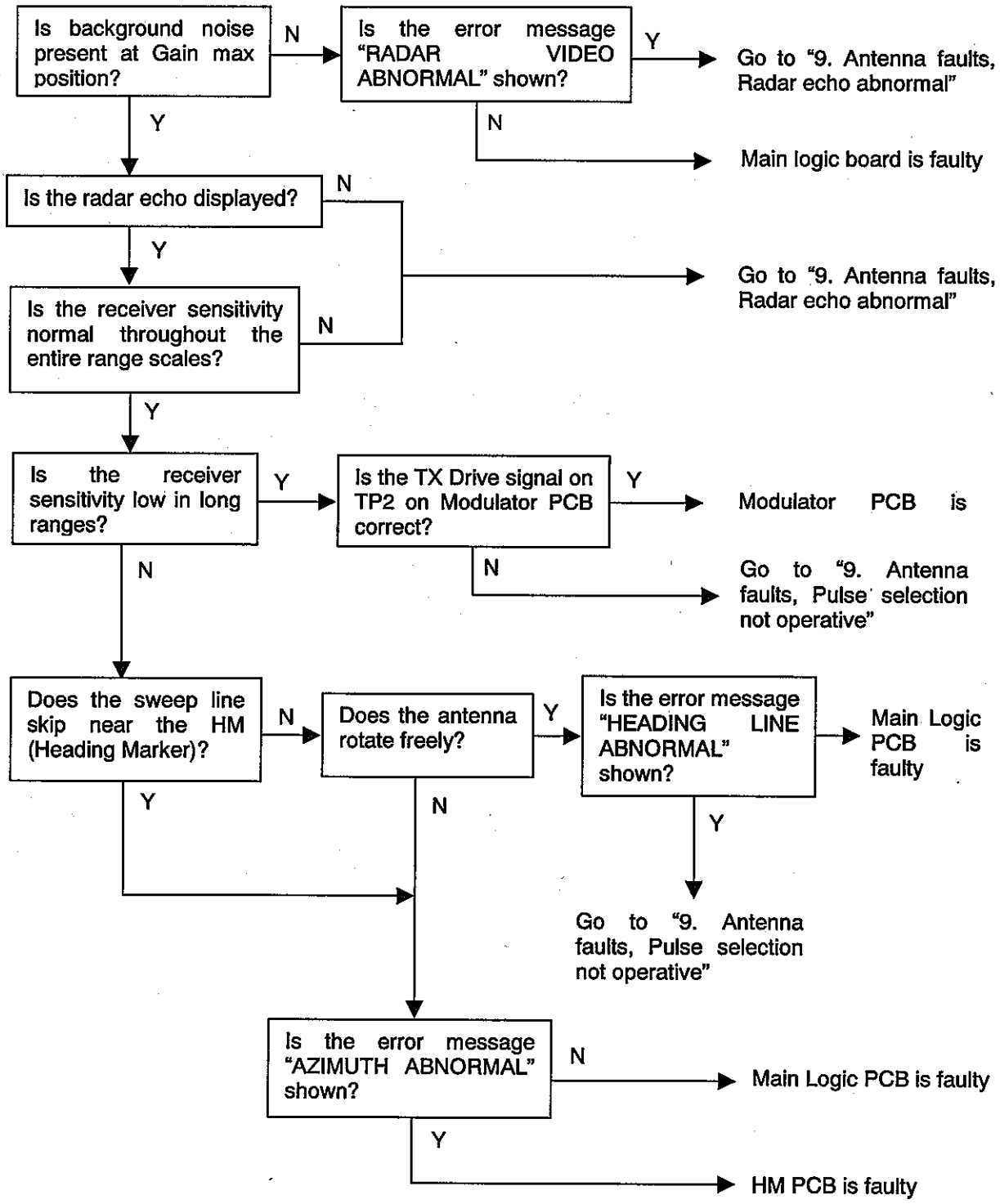
3. No display



4. Antenna does not respond

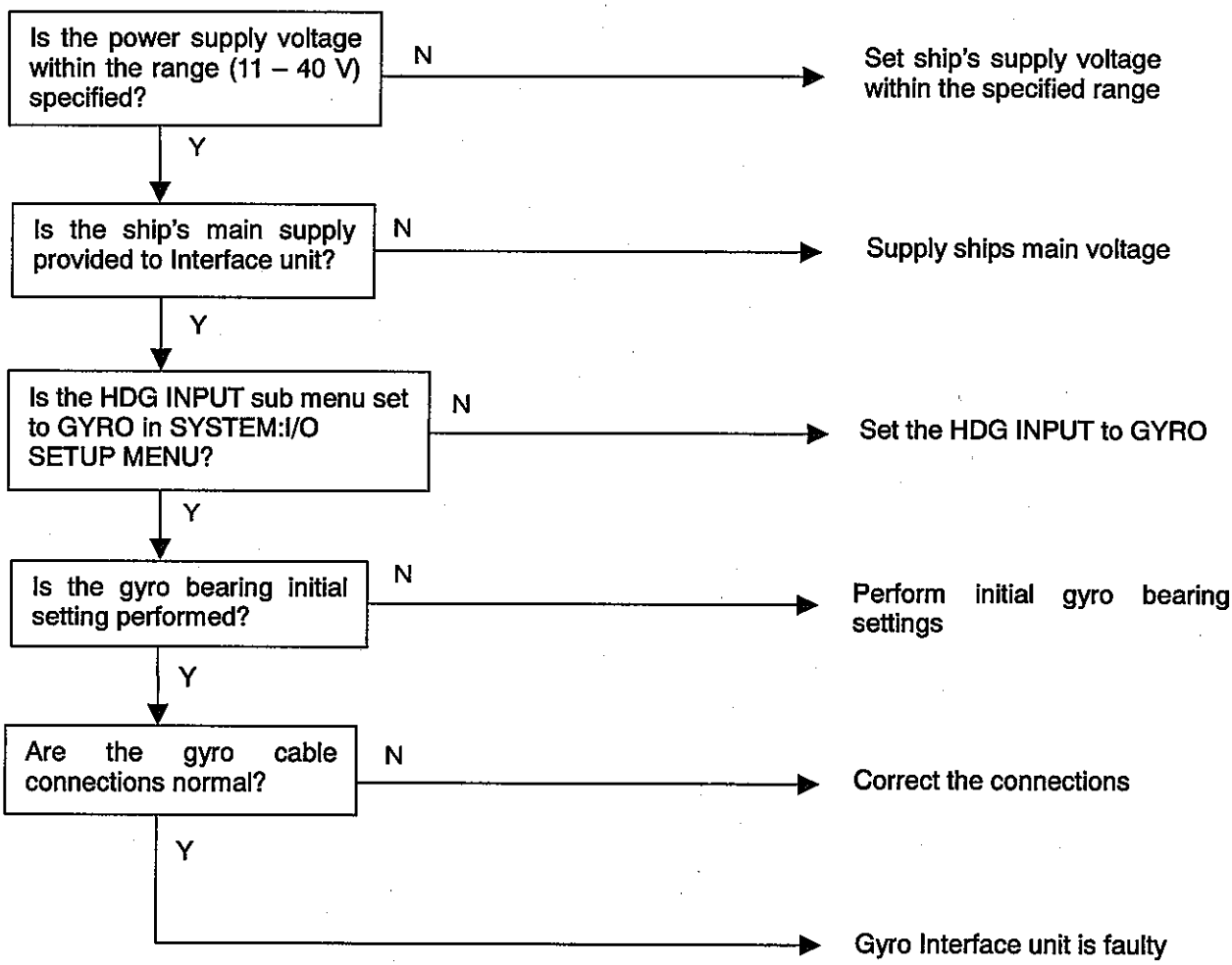


5. Faulty radar picture

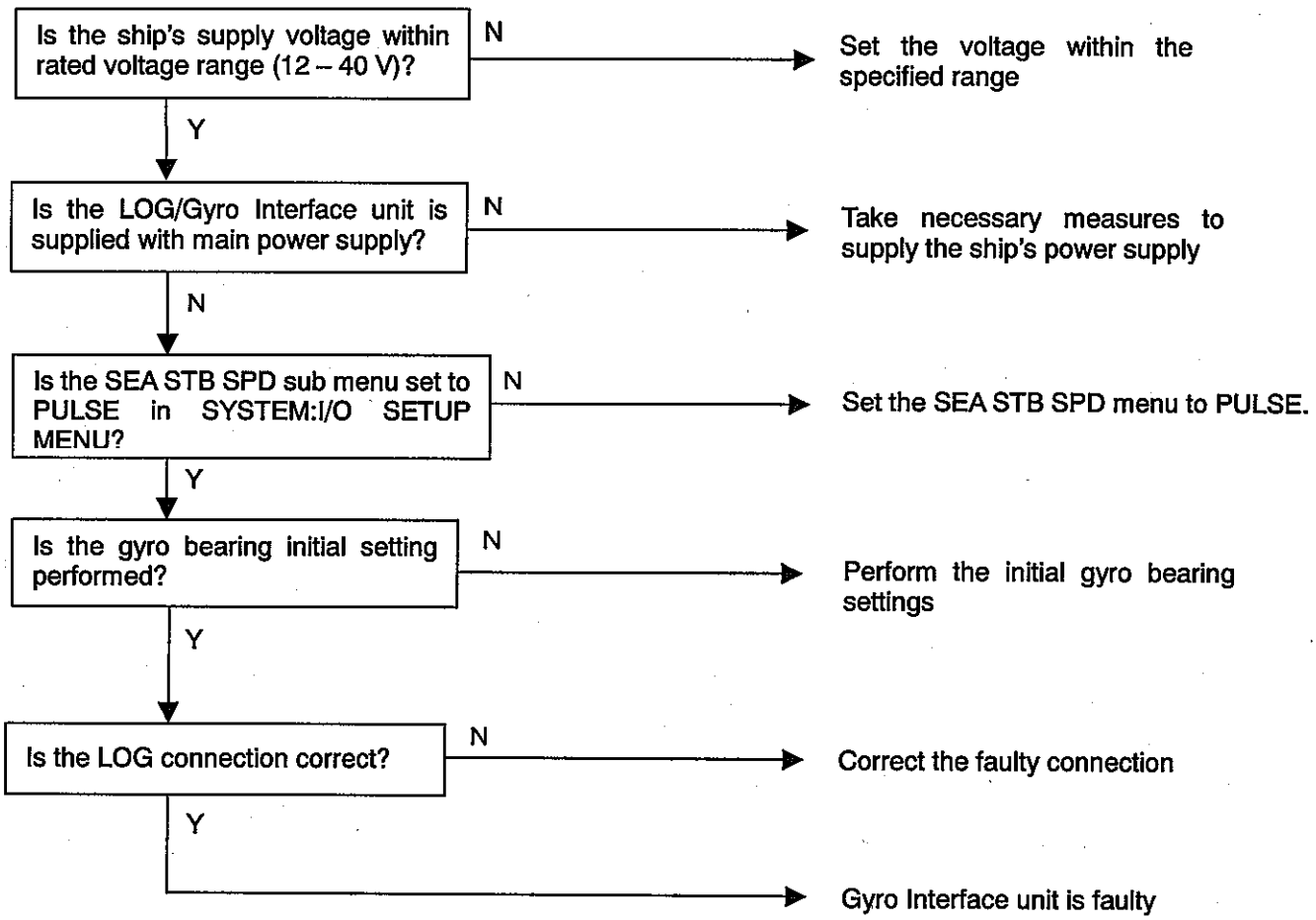


6. Interface

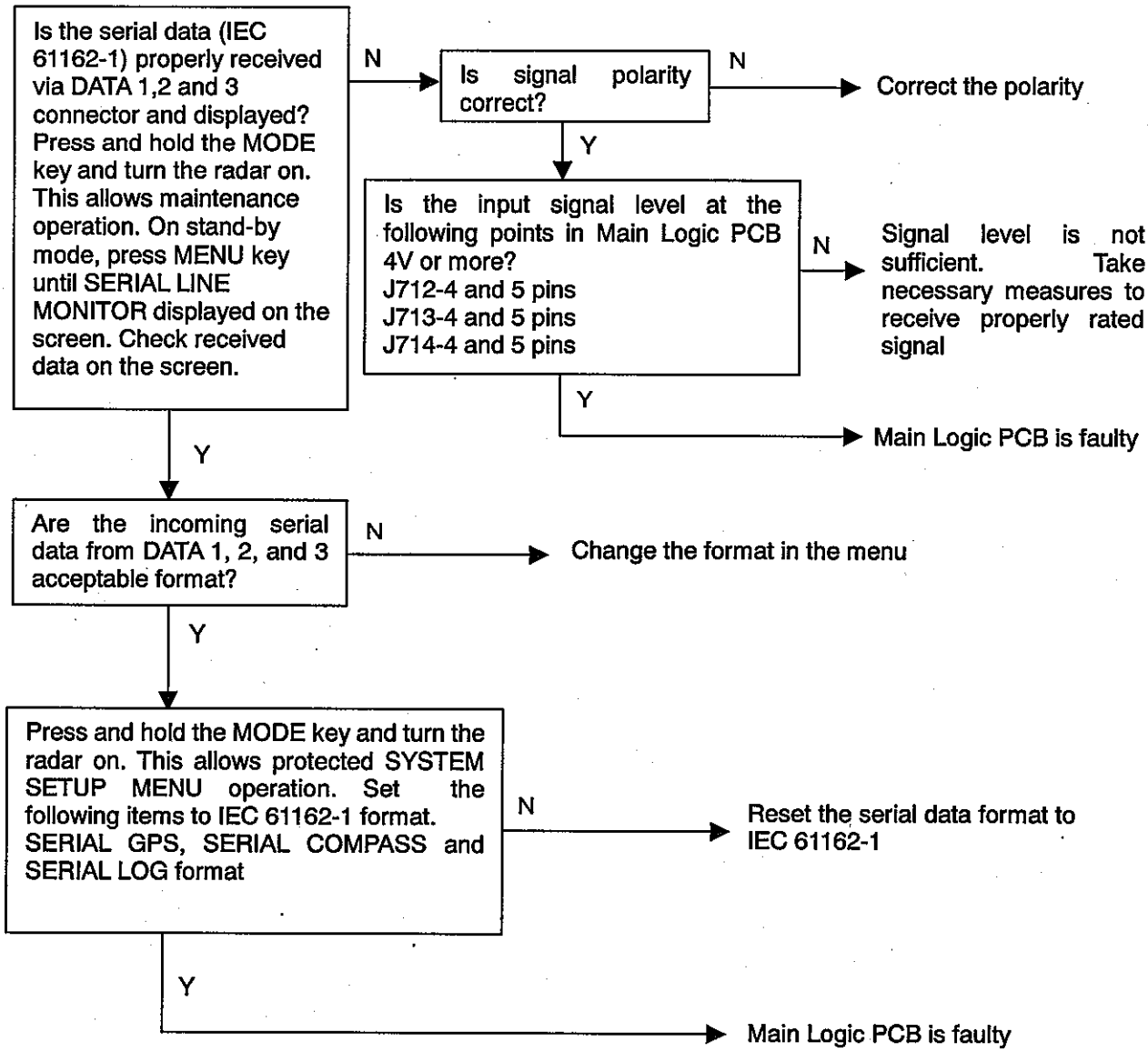
(1) Gyro Interface



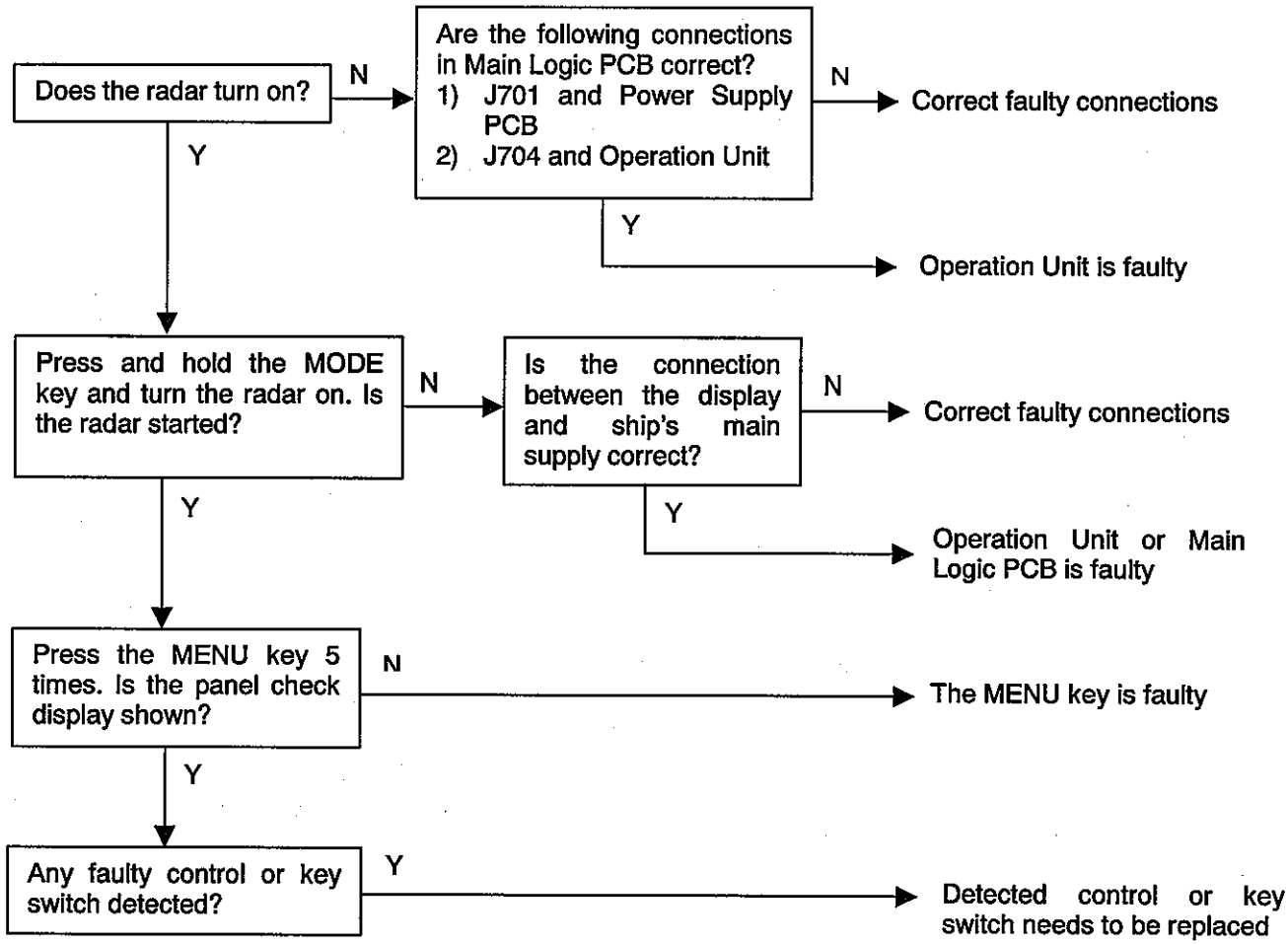
(2) LOG Interface



(3) IEC 61162-1 Interface



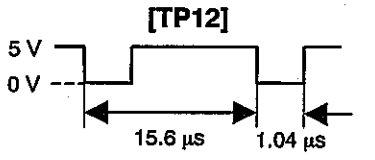
7. Operation Unit

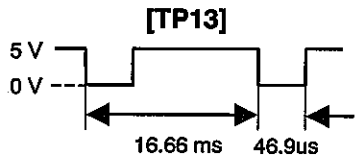


8. Others

The display synchronization is unstable.

Are the following sync signals present at TP12 and TP13 in Main Logic PCB.





N → Main Logic PCB is faulty

Y

Is the RGB signal presented at the J218 and J219 connector?

Y → LCD monitor unit is faulty

N → Main Logic PCB is faulty

Texts and graphics displays are erratic. → Main Logic PC B is faulty

9. Antenna unit

+12V line is shorted.

Disconnect P6(J6) from the Modulator PCB. Is the fault removed?

Y → IF PCB is faulty

N

Disconnect P5(J5) from the Modulator PCB. Is the fault removed?

N → Performance Monitor is faulty

Y

Disconnect P1(J1) from the Modulator PCB. Is the fault removed?

N → Internal wirings in the Antenna unit or Display unit is faulty

Y → Modulator PCB is faulty

+250 V line is shorted

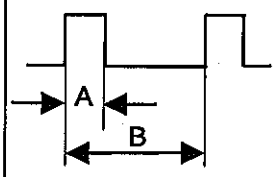
Disconnect J2 from the Modulator PCB. Is the fault removed?

N → Internal wiring in the Antenna unit or Display unit is faulty

Y → Modulator PCB is faulty

Pulse selection function is faulty

Waveform on TP2



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

Is the TX drive signal on TP2 (Modulator PCB) normal?

Y → Modulator PCB is faulty

N

Is +24V present on J1-1 pin(Modulator PCB) normal?

N → Internal wiring in the Antenna unit or Display unit is faulty

Y → Modulator PCB is faulty

Antenna does not rotate

Is the Motor Fuse F2 normal (not blown)?

N → Replace the fuse with new one.

Y

Is the fault

N

Finished

Can the antenna be rotated manually?

N → Check if the following conditions are observed:
1) The antenna gets caught with a rope.
2) Turning gear mechanism gets stuck.

Y

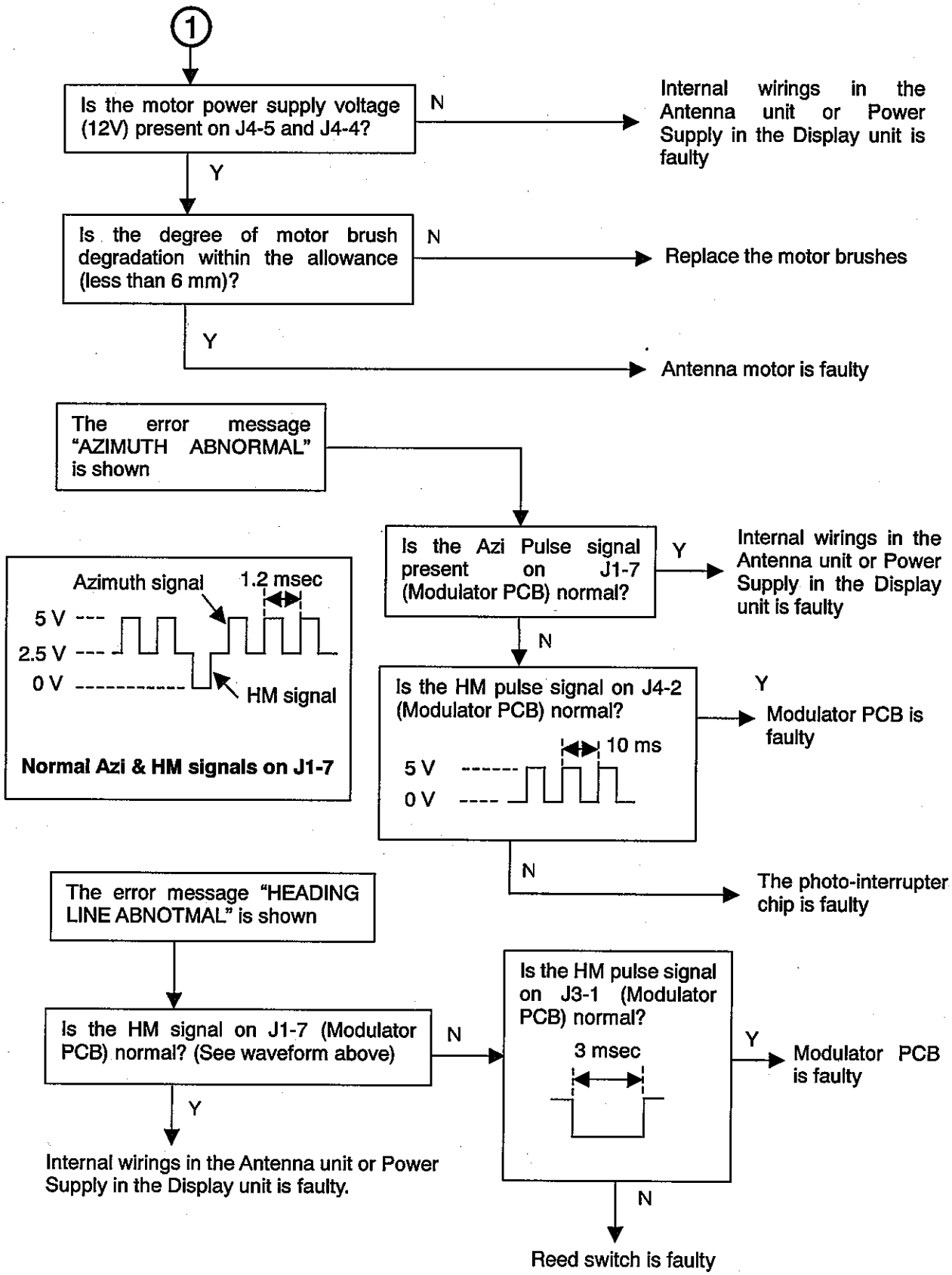
Disconnect P4(J4) from the Modulator PCB. Is the fault removed?

N → Internal wirings in the Antenna unit or Power Supply in the Display unit is faulty

Y

Motor is faulty.

①


1
Is the motor power supply voltage (12V) present on J4-5 and J4-4?
N
Internal wirings in the Antenna unit or Power Supply in the Display unit is faulty
Y
Is the degree of motor brush degradation within the allowance (less than 6 mm)?
N
Replace the motor brushes
Y
Antenna motor is faulty
The error message "AZIMUTH ABNORMAL" is shown
Is the Azi Pulse signal present on J1-7 (Modulator PCB) normal?
Y
Internal wirings in the Antenna unit or Power Supply in the Display unit is faulty
Azimuth signal
1.2 msec
5 V
2.5 V
0 V
HM signal
Normal Azi & HM signals on J1-7
N
Is the HM pulse signal on J4-2 (Modulator PCB) normal?
Y
Modulator PCB is faulty
10 ms
5 V
0 V
N
The photo-interrupter chip is faulty
The error message "HEADING LINE ABNOTMAL" is shown
Is the HM signal on J1-7 (Modulator PCB) normal? (See waveform above)
N
Is the HM pulse signal on J3-1 (Modulator PCB) normal?
3 msec
Y
Modulator PCB is faulty
Y
Internal wirings in the Antenna unit or Power Supply in the Display unit is faulty.
N
Reed switch is faulty

No transmit

Is the Mod-HT fuse F3 normal (not blown)? N → Modulator PCB is faulty

Y

Is +250 V on J2-1 (Modulator PCB) normal? N → Check for cable connection between antenna and display

Y

Is the trigger signal on TP2 (Modulator PCB) normal? N → Modulator PCB is faulty

Y

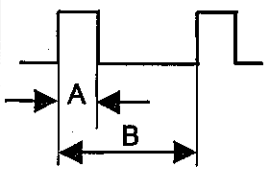
Is any buzz heard from the Pulse Transformer? N → Modulator PCB is faulty

Y

Is 6.3 V applied to the magnetron heater? N → Internal wiring in the Antenna unit or Power Supply in the Display unit is faulty.

Y → The magnetron is faulty

Waveform on TP2



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

Manual tuning is faulty

Is +24V supply on J1-1 (IF Amplifier) normal? N → Internal wiring in the Antenna unit or Power Supply in the Display unit is faulty

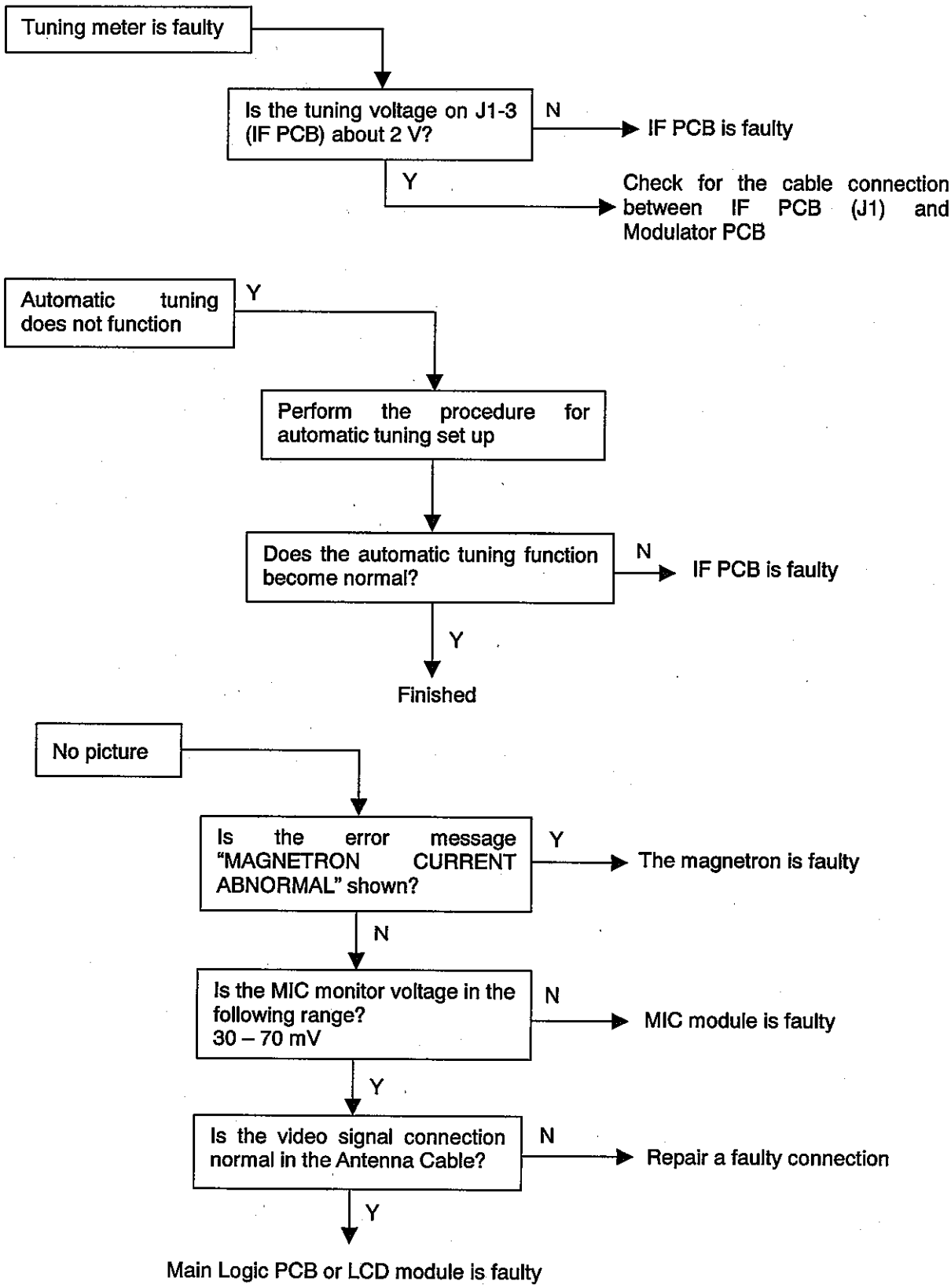
Y

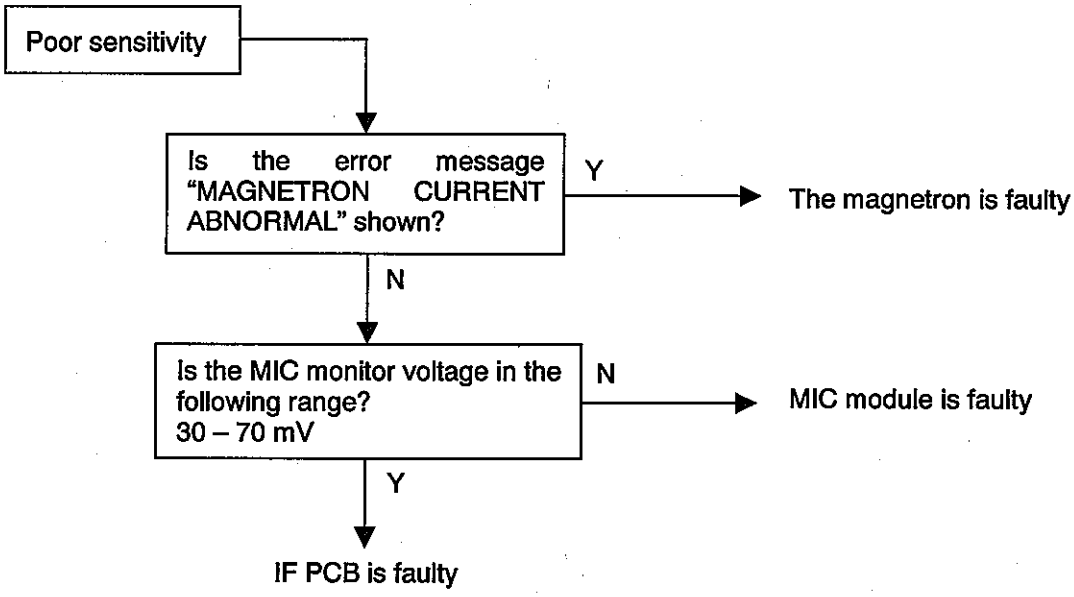
Does the voltage on J2-3 (IF PCB) vary from 6 V to 9 V? N → IF PCB is faulty

Y

Is +5 V supply on J2-2 (IF PCB) normal? N → IF PCB or LNFE module is faulty

Y → LNFE module is faulty


Tuning meter is faulty
Is the tuning voltage on J1-3 (IF PCB) about 2 V?
N
IF PCB is faulty
Y
Check for the cable connection between IF PCB (J1) and Modulator PCB
Automatic tuning does not function
Y
Perform the procedure for automatic tuning set up
Does the automatic tuning function become normal?
N
IF PCB is faulty
Y
Finished
No picture
Is the error message "MAGNETRON CURRENT ABNORMAL" shown?
Y
The magnetron is faulty
N
Is the MIC monitor voltage in the following range? 30 – 70 mV
N
MIC module is faulty
Y
Is the video signal connection normal in the Antenna Cable?
N
Repair a faulty connection
Y
Main Logic PCB or LCD module is faulty


Poor sensitivity
Is the error message "MAGNETRON CURRENT ABNORMAL" shown?
Y
The magnetron is faulty
N
Is the MIC monitor voltage in the following range?
30 – 70 mV
N
MIC module is faulty
Y
IF PCB is faulty

8.4 On board servicing

8.4.1 Replacing the fuses

There are three fuses provided on the processor unit. Details are as follows:

- Fuse type and ratings

Fuse name	Shape (Dimensions in mm)	Fuse Type	Ratings
Main fuse	Tubular type (ϕ6.3 x 32)	Normal Blow	15 A
Modulator fuse	Tubular type (ϕ5 x 20)	Normal Blow	0.3 A
Drive Motor fuse	Tubular type (ϕ5 x 20)	Normal Blow	5 A

- Location of the fuses

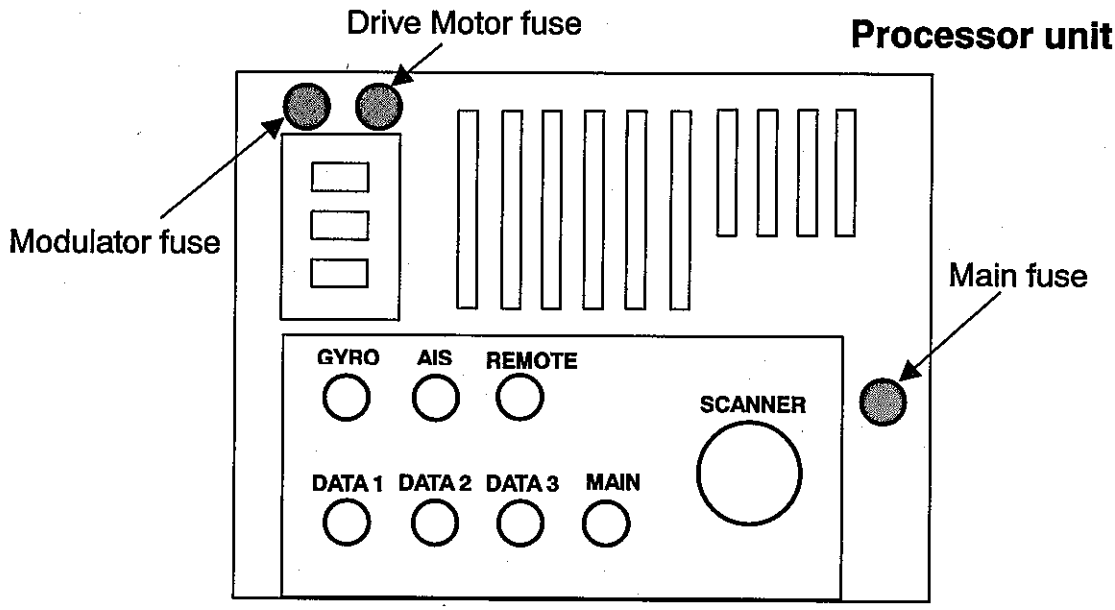


Figure 8.2 Fuses provided on the Processor

Chapter 9

Maintenance

Contents

Chapter 9 Maintenance

9.1 Periodic inspections and cleaning

Periodic inspection and cleaning is essential to allow the radar set to work in good order for a long period of time.

9.1.1 Monthly Check

(1) Check the antenna radiation surface for stains due to dirt soot. Wipe off the surface using a soft cloth soaked with fresh water or soapsuds. Also make sure the radiating surface of the aerial is free from residual paint or scratches.

> Never turn the radar on while maintenance work is in process.

(2) If the display screen is dirty, clean the screen with a cloth soaked with anti-static agent. Do not use a dry cloth as it causes static charging, which accumulates dust.

9.1.2 Yearly check

Check the motor brushes of the antenna unit every 2,000 working hours. Replace them if the brushes are less than 6 mm in length.

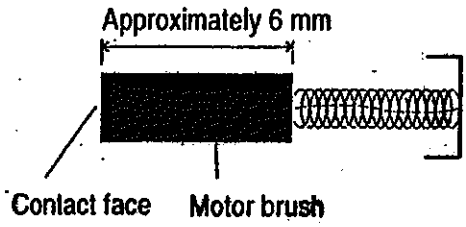


Figure 9.1 Criteria of the Motor Brush replacement

(1) Loosen the four fixing screws that fasten the front side cover and remove the cover. The antenna motor will be found in the lower part in the antenna housing.
(2) Use a flat-blade screwdriver to loosen the motor brushes as shown in Figure 9.2..
(3) Insert a screwdriver into the groove provided on top of the brush and gently turn the screwdriver counter clockwise. Make sure to remove both brushes.
(4) Install a new pair of brushes and reverse the procedure from step (3) to fix the brushes.

> **Alarm:** Make sure to turn off the equipment before attempting to reach inside of the antenna unit. Failure to do so may lead to electrical shock.

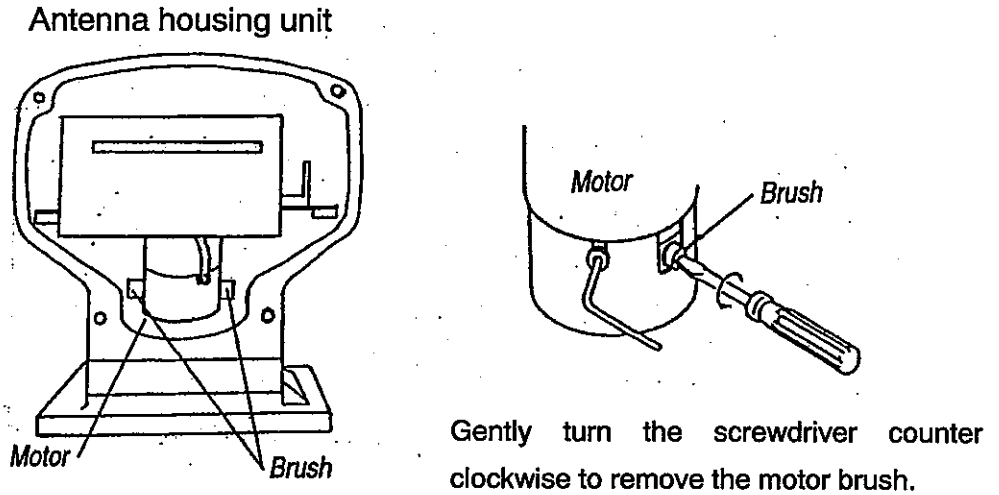


Figure 9.2 Replacing the motor brushes

Chapter 10

Technical References

Contents

Chapter 10 Technical References

10.1 Serial input data sentence detail

Sentence name: IEC61162-1 or NMEA0183 Ver 2.30

Descriptions

(1) Data priority

Data such as waypoint display, own ship's position and the speed against water are available from two different sentences in IEC61162-1. These data are prioritized as follows:

Data name	Available sentences	Priority
Waypoint	RMB and BWC	RMB>BWC
Own ship's position	GGA and GGL	GGA>GLL
Own ship's speed against water	VBW and VHW	VBW>VHW

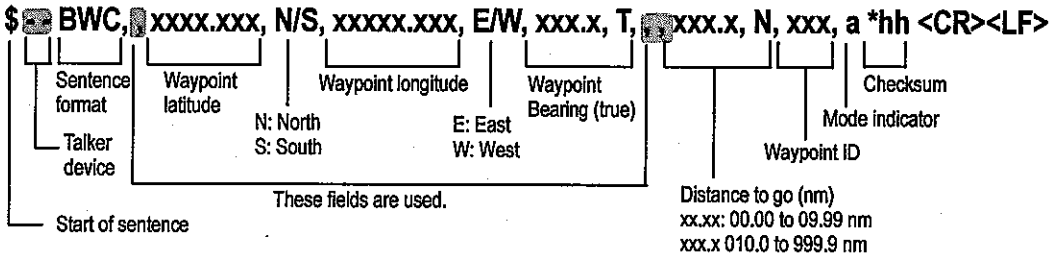
(2) Route display

In case the RMB/BWC and RTE/WPL sentences are all input, only routes are displayed while the waypoint without route is not displayed.

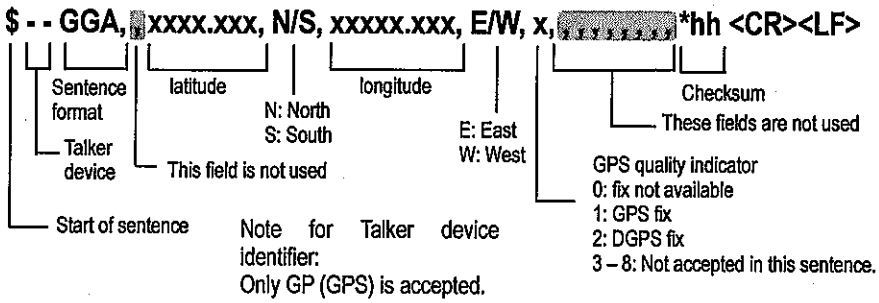
(3) Checksum

Checksum is the total of all the EX-ORed data between the $ and asterisk (*) signs.

BWC — **Bearing & Distance to Waypoint**



GGA — **Global Positioning System Fix Data**



GLC — Geographic Position, Loran C

$ -- GLC, ▒▒▒ ▒a *hh <CR><LF>

- Start of sentence: $
- Talker device: --
- Sentence format: GLC
- These fields are valid as far as the data are entered in 2 out of 5 TD fields; Otherwise the fields will be void: ▒▒▒
- This field is not used: ▒
- Mode indicator: a
- Checksum: *hh

GLL — Geographic Position, Latitude/Longitude

$ -- GGL, xxxx.xxx, N/S, xxxxx.xxx, E/W, ▒A, a *hh <CR><LF>

- Start of sentence: $
- Talker device: --
- Sentence format: GGL
- latitude: xxxx.xxx
- N: North, S: South: N/S
- longitude: xxxxx.xxx
- E: East, W: West: E/W
- This field is not used: ▒
- A: Valid
- Mode indicator: a
- Checksum: *hh

HDT — Heading, True

$ -- HDT, xxx.x, T *hh <CR><LF>

- Start of sentence: $
- Talker device: --
- Sentence format: HDT
- Heading (True): xxx.x, T
- Checksum: *hh

Note for Talker Device:
Only HE (North Seeking Gyro) and HN (Non-north Seeking Gyro) are accepted.

RMB — Recommended Minimum navigation Information

$ -- RMB, A, ▒▒ c-c, xxxx.xxx, N/S, xxxxx.xxx, E/W, xxx.x, xxx.x, ▒▒▒ a, *hh <CR><LF>

- Start of sentence: $
- Talker device: --
- Sentence format: RMB
- A: Valid: A
- These fields are not used: ▒▒
- Waypoint ID: c-c
- Waypoint latitude: xxxx.xxx
- N: North, S: South: N/S
- Waypoint longitude: xxxxx.xxx
- E: East, W: West: E/W
- Waypoint distance (nm): xxx.x
  xx.xx: 00.00 to 09.99 nm
  xxx.x 010.0 to 999.9 nm
- Waypoint Bearing (true): xxx.x
- These fields are not used: ▒▒▒
- Mode indicator: a
- Checksum: *hh

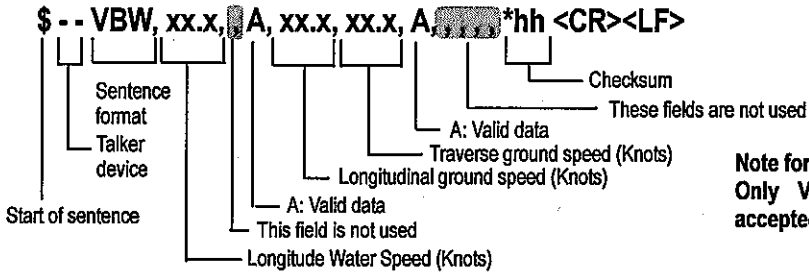
RTE — Routes

$ -- RTE, ▒x, W, ▒ c-c, c-c, c-c, c-c, c-c *hh <CR><LF>

- Start of sentence: $
- Talker device: --
- Sentence format: RTE
- This field is not used: ▒
- Message number. Only one message is selectable: x
- Message mode: W
- This field is not used: ▒
- Current waypoint: c-c
- Checksum: *hh

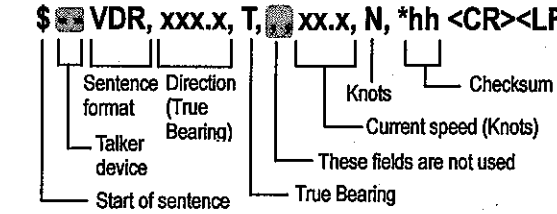
Waypoint ID:
- The first 4 digits are valid to designate Wypoint ID, which can be assigned up to 8 kinds as maximum.
- Only a working route is displayed.

VBW — Dual Ground/Water Speed



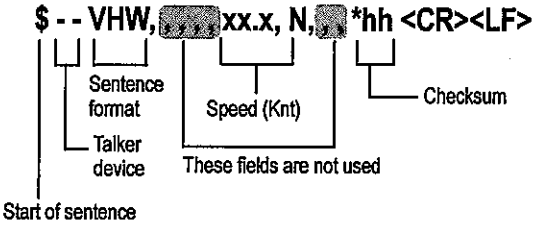
Note for Talker device identifier:
Only VD (Doppler Speed Log) is accepted.

VDR — Set and Drift



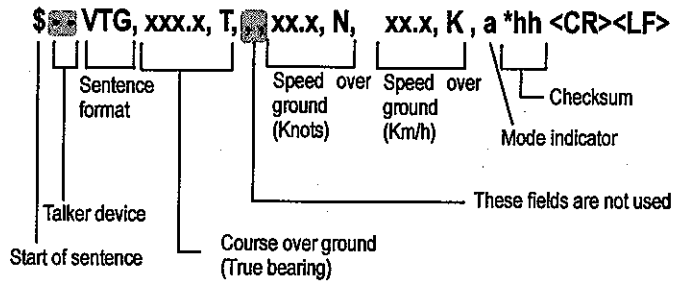
- The radar only accepts VD as a talker.

VHW — Water Speed and Heading

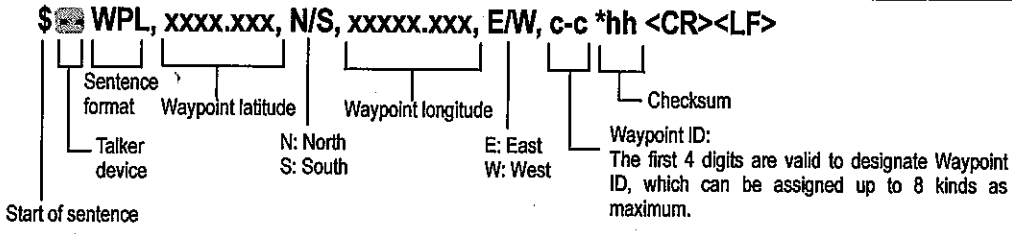


Note 1:
In case the speed data in knots is not available, then the metric speed data field will be recovered and used for alternative metric data.
Note 2:
Talker Device:Only VD (Doppler Speed Log), VM (Magnetic Water Speed Log) and VW (Mechanical Water Speed Log) are accepted.

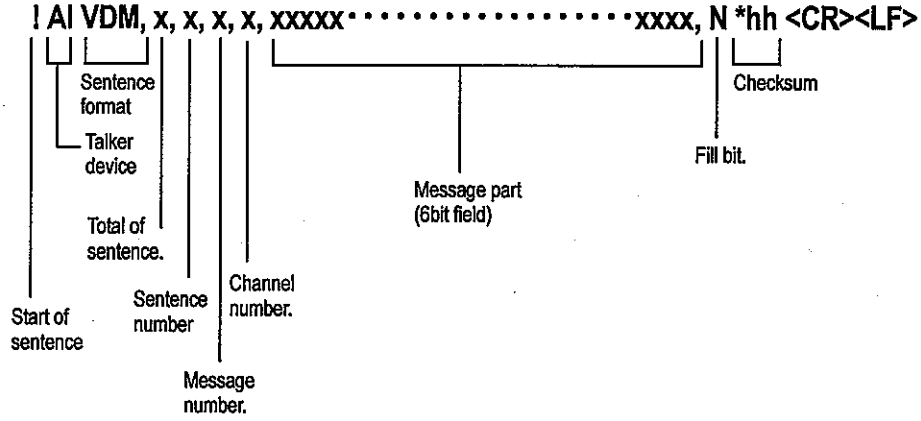
VTG — Course and Ground Speed



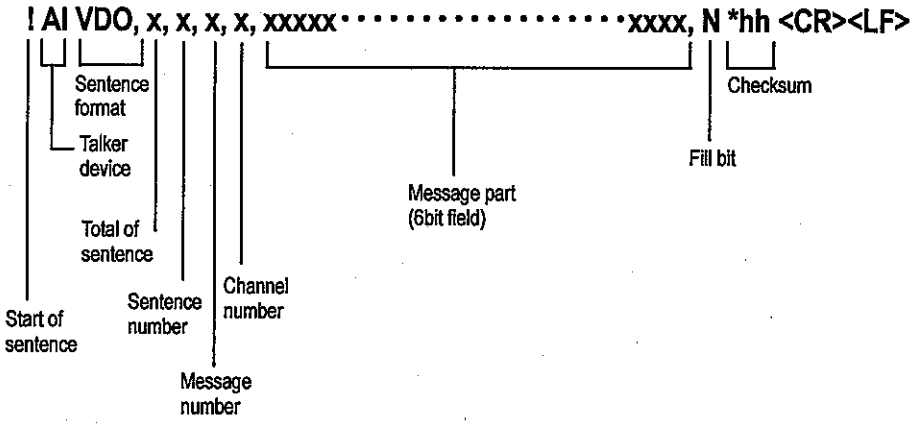
WPL — Waypoint Location



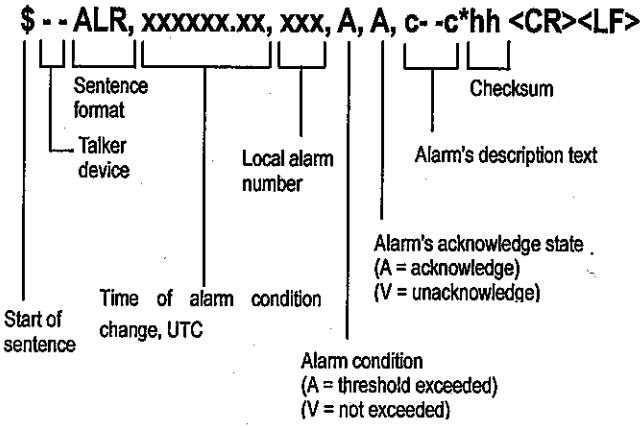
VDM — AIS Other Ship Data



VDO — AIS Own Ship Data (Not used)



ALR — Set Alarm State



Data format settings and acceptable formatter

Item	IEC-61162-1	NMEA-0183 (Ver 2.30)
Ship's Heading Information(HDG)	HDT	HDT, HDG, HDM VTG(COG), RMC(COG), RMA(COG)
Water Speed(SPD)	VHW VBW(Vertical to Water)	VHW VBW(Vertical to Water) VTG(SOG), RMC(SOG), RMA(SOG)
Speed over Ground, Drift : [VBW correction over ground]	VBW(two axis over ground)	VBW(two axis over ground)
Drift : [VDR correction over ground]	VDR(invalid magnetic bearing of Tide)	VDR(valid magnetic bearing of Tide)
COG, SOG [VTG correction over ground]	VTG(invalid magnetic bearing)	VTG, RMC, RMA
Own ship's LOP	GLC	GLC
Own ship's L/L	GNS, GGA, GLL(invalid mode indicator 3, 4, 5)	GNS, GGA, GLL(valid mode indicator 3, 4, 5), RMC, RMA
Waypoint Bearing, Distance	RMB, BWC(invalid WP magnetic bearing)	RMB, BWC
Waypoint L/L	RMB, BWC, RTE/WPL	RMB, BWC, RTE/WPL
Waypoint Cross track error	RMB, XTE	RMB, XTE
Route	RTE, WPL	RTE, WPL
Depth	DPT, DBT	DPT, DBT
Water temperature	MTW	MTW
Datum	DTM	DTM
KODEN original Data for Interswitch	PKODR	PKODR
Checksum	Essential	Option
Mode ID	Essential	Omissible
Talker Device ID	Restrictive (See next Table)	not restrictive

10.2 Tracking data output sentence detail

Sentence name: IEC61162-1

The ATA data can be output to an external unit via the data connector labeled "DATA 1,2 & 3" on the display rear panel.

TTM	Tracked Target Message

$ RA TTM, x, x.x, xxx, T, xx.x, xxx.x, T, x.x, x.x, N, xxxx, a, [redacted]M, *hh <CR><LF>

- $ — Start of sentence
- RA — Talker device
- TTM — Sentence format
- x — Target number (0 to 9)
- x.x — Target distance from own ship
- xxx — Bearing from own ship
- T — (true)
- xx.x — Target speed
- xxx.x — Target course
- T — (true)
- x.x — Distance of Closest Point of Approach
- x.x — Time to CPA (min)
- N — Speed/distance units (nm)
- xxxx — User data
- a — Target status (See Note)
- [redacted] — These fields are not used
- M — Type of acquisition
- *hh — Checksum
- <CR><LF>

Note for Target status:
L: Lost, tracked target has been lost
Q: Quary, target in process of acquisition
T: Tracking, target in process of tracking

10.3 Radar data output sentence detail

Sentence name: IEC61162-1

The Radar data can be output to an external unit via the data connector labeled "DATA 1,2 &3" on the display rear panel.

10.3.1 Own Ship Data

OSD	Own Ship Data

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

- $ RA: Start of sentence
- OSD: Sentence format
- Talker device
- xxx.x: Own ship's Heading(True)
- A: Ship's True Heading Status: A=Valid
- xxx.x: Own ship's course
- a: Course reference
- xx.x: Own ship's speed
- a: Speed reference
- x.x: Set
- x.x: Drift
- N: Speed units (K: km/h, N: Knot, S: SM/h)
- *hh: Checksum
- <CR><LF>

Note for Course/Speed reference:
B: Log
M: Manual
W: Water
R: Radar Tracking
P: Positioning System

10.3.2 Radar System Data

RSD	Radar System Data

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

- $ RA: Start of sentence
- RSD: Sentence format
- Talker device
- x.x: Origin 1 Range
- x.x: Origin 1 Bearing
- x.x: VRM 1 Range
- x.x: EBL 1 Bearing
- x.x: Origin 2 Range
- x.x: Origin 2 Bearing
- x.x: VRM 2 Range
- x.x: EBL 2 Bearing
- x.x: Cursor Range
- x.x: Cursor Bearing
- x.x: Display Range
- a: Range Unit (K/N/S)
- a: Display Mode
  C: Course Up
  H: Head Up
  N: North Up
- *hh: Checksum
- <CR><LF>

10.4 Interface requirements

10.4.1 Input requirements

Feature	Characteristics	
Power	Voltage Consumption	24/32VDC, -10%, +30% 170 W
Gyro compass	Synchro Stepper Gear ratio Serial	Voltage value: 50VAC or 100VAC+/-10%, 50/60 Hz+/-10% Gear ratio: 1:360, 1:180, 1:90 Voltage value: 21.6 to 38.5 V (See NOTE) or 63 to 77 V (Standard) 1:360, 1:180, 1:90 IEC61162-1 via opto-isolator
LOG	Mechanical input Electronic input Serial input	PRR: 100, 200, 400 pulse/nm Input type: opto-isolator (5V/5mA) Pulse width: 100 ms (min) Same as above IEC61162-1 via opto-isolator
Serial interface	Signal standard	IEC 61162-1 or NMEA0183 Ver 2.30 via opto-isolator
AIS interface	Signal standard	IEC 61162-2 via floated RS422

NOTE: *Changing Link settings are required on the Main Logic PCB for J721 to J725. Refer to Para. 4.6.6 for detail.*

10.4.2 Data input/output serial line

Port name: DATA 1,2 & 3

The connector used:

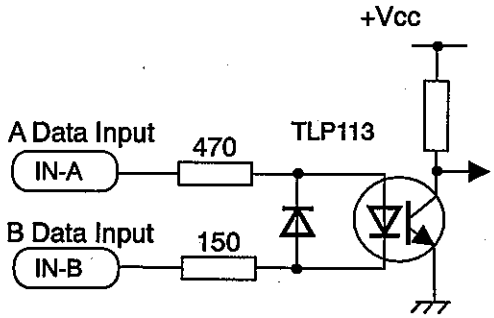
Type LTWD-06PMMP-LC

Serial Data input (listener side):

The IEC61162-1 or NMEA0183 Ver 2.30 standard signal can be received.

Input load: 470 + 150 ohms

Device: Opto-isolator
Type TLP113 (Toshiba)

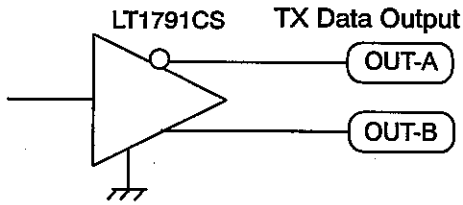


Serial data input circuit

Serial Data output (talker side):

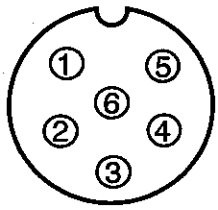
The IEC61162-1 standard signal can be transmitted.

Device: RS422 Driver IC
Type LT1791CS (Linear Technology)



Serial data output circuit

Pin assignment on
Data Connector (Top view)



Data connector pin assignment

DATA 1,2 & 3	
Pin No.	Name
1	Shield
2	OUT-A
3	OUT-B
4	IN-A
5	IN-B
6	GND

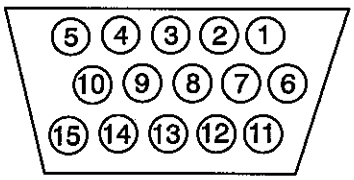
10.4.3 External monitor signal interface

Port name : VDR

The connector used : Small D-sub 15 pin

Pin assignment of the connector is as follows:

External CRT connector
(Top View)

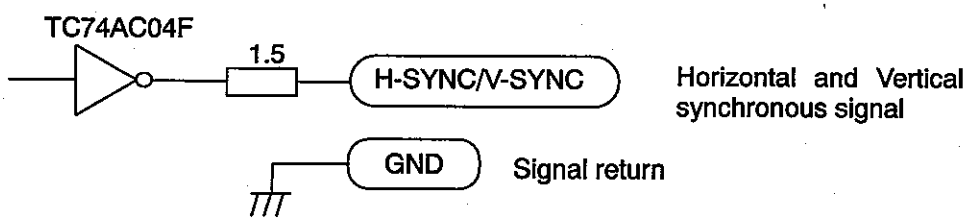


Pin No.	Signal name
1	RVD
2	GVD
3	BVD
6	R-GND
7	G-GND
8	B-GND
13	H-SYNC
14	V-SYNC
5,10	GND
4,9,11,12,15	NC

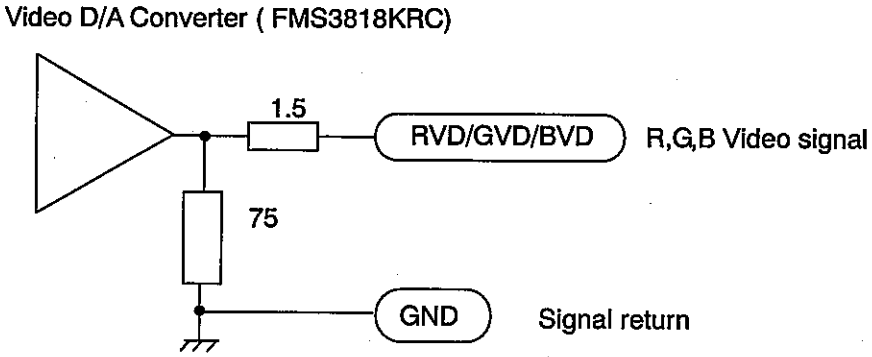
The signal specifications are as follows:

Name	Frequency	Polarity	Pulse width	Level	Impedance
Horizontal sync signal	64.0kHz	Negative	1.04 μs	TTL	200 Ω
Vertical synchronous signal	60.0Hz	Negative	46.9 us	TTL	200 Ω
R,G,B Video signal	-	Positive	-	0.7 Vp-p	75 Ω

Horizontal and Vertical synchronous signal output circuit



R,G,B Video signal output circuit



10.4.4 Data input/output serial line (AIS)

Port name: AIS

The connector used:

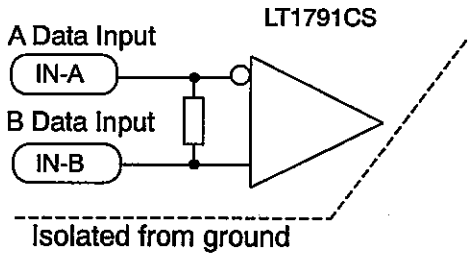
Type LTWD-08PMMP-LC

Serial Data input (listener side):

The IEC61162-1 standard signal can be received.

Input load: 94 ohms

Device: RS422 Driver/Receiver IC
Type LT1791CS (Linear Technology)

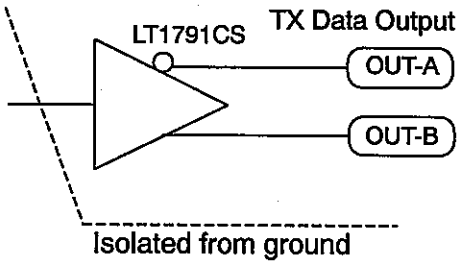


Serial data input circuit

Serial Data output (talker side):

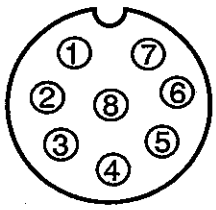
The IEC61162-1 standard signal can be transmitted.

Device: RS422 Driver/Receiver IC
Type LT1791CS (Linear Technology)



Serial data output circuit

Pin assignment on
Data Connector (Top view)



Data connector pin assignment

DATA 1,2 & 3	
Pin No.	Name
1	Shield
2	IN-B
3	IN-A
4	OUT-B
5	OUT-A
6	GND
7	ALARM+
8	ALARM-

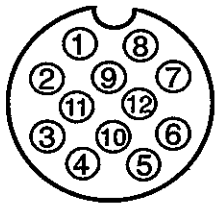
10.4.5 Radar Signal input/output

Port name: REMOTE

The connector used:

Type LTWU-12PMMP-LC

Pin assignment on Data Connector (Top view)



Data connector pin assignment

Pin No.	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

RADAR STATUS SELECT MENU

The Display Unit can be used as a radar remote display. When the RADAR STATUS SELECT MENU setting is set to INDEPENDENCE/SLAVE, the display unit operates with the radar signal supplied from the external radar unit. When the setting is set to INDEPENDENCE/SLAVE, never connect the scanner unit to the SCANNER connector. Please read "6.9 Operating the Interswitch" on this manual, too.

10.4.6 Talker identifier accepted

The MDC-1800BB series of radar accepts the following talker identifiers applied from external equipment.

Talker device	Talker identifier	Display
Decca navigator	DE	DEC
Global positioning system GPS)	GP	GPS (See NOTE)
Differential GPS receiver (DGPS)	GP	DGPS (See NOTE)
GLONASS receiver	GL	GLO
Global navigation satellite system	GN	GNSS
Integrated navigation	IN	INS
Loran C	LC	LOR
Electronic positioning system	SN	EPFS
Gyro, north seeking	HE	GYRO
Gyro, non-north seeking	HN	GYRO
Compass, magnetic	HC	MAG
Doppler, other/general	VD	DOLOG
Speed LOG, water magnetic	VM	LOG
Speed LOG, water, mechanical	VW	LOG
Other device		display talker identifier

NOTE

The on-screen device name, GPS or DGPS, is selected according to the GPS quality indicator in the GGA sentence. (Refer to Para 10.1 "Serial input data sentence detail")

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