

APPENDIX 3 ALERT CODES, MESSAGES AND MEANINGS

Alert ID	Alert title	Priority & Category	Message and meaning
601,7	SENSOR ERROR	Warning Cat: B	Message: "AIS RECEIVE" Meaning: No AIS data received for thirty seconds.
Remedy: Press the <b>ALERT ACK</b> key. Check power and connection to AIS unit.			
602,1	SENSOR CHANGE	Caution Cat: B	Message: "POSN SOURCE CHG" Meaning: Positioning sensor input lost, automatically changed sensors.
Remedy: Press the <b>ALERT ACK</b> key. The indication is automatically removed when the signal is restored or a different sensor is selected.			
602,2	SENSOR CHANGE	Caution Cat: B	Message: "SPD SOURCE CHG" Meaning: Speed sensor input lost, automatically changed sensors.
Remedy: Press the <b>ALERT ACK</b> key. The indication is automatically removed when the signal is restored or a different sensor is selected.			
740,1	EXT RADAR ERROR	Warning Cat: B	Message: "EXT RADAR NO SIGNAL" Meaning: Externally connected radar has an error. (Only displayed when Interswitch is active.)
Remedy: Press the <b>ALERT ACK</b> key. Restore the external radar to normal operating condition.			
740,2	EXT RADAR ERROR	Caution Cat: B	Message: "EXT RADAR COM ERROR" Meaning: Communication with external radar interrupted or lost. (Only displayed when Interswitch is active.)
Remedy: Press the <b>ALERT ACK</b> key. Check connection and power to the external radar.			
790,1	ARRIVAL	Warning Cat: B	Message: "ARRIVAL" Meaning: Ship has entered the destination arrival alert zone.
Remedy: Press the <b>ALERT ACK</b> key. No other action required.			
791,1	XTE	Warning Cat: B	Message: "XTE" Meaning: Cross-track error, ship is off-course.
Remedy: Press the <b>ALERT ACK</b> key. Check course and adjust as necessary.			
794,1	HEADING SET	Warning Cat: B	Message: "HEADING SET" Meaning: AD-10 signal interrupted.
Remedy: Press the <b>ALERT ACK</b> key. Match the on-screen HDG readout with the actual gyrocompass reading if necessary.			
950,1	BAM COM ERROR	Caution Cat: B	Message: "COMMUNICATION ERROR WITH BAM" Meaning: Communication the Bridge Alert Management System interrupted.
Remedy: Press the <b>ALERT ACK</b> key. Check connection to BAM. Check power to BAM.			

ALR format alerts

Alert code	Alert title	Priority & Category	Explanation
522	TT TARGET 95%(AUTO)	Caution Cat: A	Automatically acquired target capacity has reached 95%.
Remedy: Press the <b>ALERT ACK</b> key. Remove TT symbols manually.			
523	TT TARGET FULL(AUTO)	Warning Cat: A	Automatically acquired target capacity has reached 100%.
Remedy: Press the <b>ALERT ACK</b> key. Remove TT symbols manually.			
524	TT TARGET 95% (MAN)	Caution Cat: A	Manually acquired target capacity has reached 95%.
Remedy: Press the <b>ALERT ACK</b> key. Remove TT symbols manually.			
525	TT TARGET FULL(MAN)	Warning Cat: A	Manually acquired target capacity has reached 100%.
Remedy: Press the <b>ALERT ACK</b> key. Remove TT symbols manually.			
530	AIS DISPLAY 95%	Caution Cat: A	AIS display capacity has reached 95% (285 targets).
Remedy: Press the <b>ALERT ACK</b> key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
531	AIS DISPLAY FULL	Warning Cat: A	AIS display capacity has reached 100% (300 targets).
Remedy: Press the <b>ALERT ACK</b> key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
533	AIS CAPACITY FULL	Caution Cat: A	AIS capacity has reached 100% (1000 targets).
Remedy: Press the <b>ALERT ACK</b> key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
534	AIS ACTIVATE 95%	Caution Cat: A	Active AIS target capacity has reached 95% (38 targets).
Remedy: Press the <b>ALERT ACK</b> key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
535	AIS ACTIVATE FULL	Warning Cat: A	Active AIS target capacity has reached 100% (40 targets).
Remedy: Press the <b>ALERT ACK</b> key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
526	TT COLLISION	Alarm Cat: A	TT is within CPA/TCPA threshold, danger of collision.
Remedy: Press the <b>ALERT ACK</b> key. Take evasive action if necessary. Adjust CPA/TCPA settings.			
536	AIS COLLISION	Alarm Cat: A	AIS target is within CPA/TCPA threshold, danger of collision.
Remedy: Press the <b>ALERT ACK</b> key. Take evasive action if necessary. Adjust CPA/TCPA settings.			
521	TT NEW TARGET	Warning Cat: A	A new TT target has entered the Acquisition Zone.
Remedy: Press the <b>ALERT ACK</b> key. Confirm location of new target.			
529	AIS NEW TARGET	Warning Cat: A	A new AIS target has entered the Acquisition Zone.
Remedy: Press the <b>ALERT ACK</b> key. Confirm location of new target.			
527	TT LOST	Warning Cat: A	TT target is lost.
Remedy: Press the <b>ALERT ACK</b> key. Lost target indication (blinking in red) is removed.			
528	REF TARGET LOST	Warning Cat: A	REF targets is lost.

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Alert code	Alert title	Priority & Category	Explanation
Remedy: Press the <b>ALERT ACK</b> key. Lost target indication (blinking in red) is removed.			
537	AIS LOST	Warning Cat: A	AIS target is lost.
Remedy: Press the <b>ALERT ACK</b> key. Lost target indication (blinking in red) is removed.			
720	HEADLINE	Warning Cat: B	Heading signal interrupted/lost.
Remedy: Press the <b>ALERT ACK</b> key. Restore signal or rectify reason for signal loss.			
721	AZIMUTH	Warning Cat: B	Azimuth signal is interrupted/lost.
Remedy: Press the <b>ALERT ACK</b> key. Restore signal or rectify reason for signal loss.			
722	TRIGGER	Warning Cat: B	Output trigger interrupted/lost
Remedy: Press the <b>ALERT ACK</b> key. Restore signal or rectify reason for signal loss.			
723	VIDEO	Warning Cat: B	Video signal interrupted/lost.
Remedy: Press the <b>ALERT ACK</b> key. Restore signal or rectify reason for signal loss.			
70	KEY	Warning Cat: B	Control unit signal interrupted/lost.
Remedy: Press the <b>ALERT ACK</b> key. Restore signal or rectify reason for signal loss.			
772	PM COMM ERROR	Warning Cat: B	PM communication error.
Remedy: Press the <b>ALERT ACK</b> key. Restore signal or rectify reason for signal loss.			
48	TUNE ERROR	Warning Cat: B	TUNE error due to faulty settings or malfunction.
Remedy: Press the <b>ALERT ACK</b> key. Check tuning settings and adjust as necessary.			
450	GYRO	Warning Cat: B	No heading information received from gyrocompass for five seconds.
Remedy: Press the <b>ALERT ACK</b> key. Match the on-screen indication with the actual gyrocompass. The indication "HEADING SET" appears. Press the <b>ALERT ACK</b> key to erase the indication.			
278	LOG(WT)	Warning/ Caution Cat: B	No speed data received for five seconds when [LOG(WT)] is set as speed reference.
Remedy: Press the <b>ALERT ACK</b> key. Check SDME sensor. Use a different sensor if necessary.			
284	LOG(BT)	Warning/ Caution Cat: B	No speed data received for thirty seconds when [LOG(BT)] is set as speed reference.
Remedy: Press the <b>ALERT ACK</b> key. Check SDME sensor. Use a different sensor if necessary.			
170	EPFS	Warning Cat: B	EPFS Error. No speed or position data received from EPFS device for thirty seconds.
Remedy: Press the <b>ALERT ACK</b> key. Restore the signal. This indication cannot be erased if the position signal is missing. The indication is automatically removed when the signal is restored.			
469	DATUM	Warning Cat: B	DTM sentence no received for thirty seconds or erroneous data received.
Remedy: Press the <b>ALERT ACK</b> key. Use the WGS-84 datum.			
272	UTC	Warning Cat: B	UTC error. No date or time data received for thirty seconds.
Remedy: Press the <b>ALERT ACK</b> key. Restore the signal to remove this indication.			
380	AIS RECEIVE	Warning Cat: B	No AIS data received for thirty seconds.
Remedy: Press the <b>ALERT ACK</b> key. Check power and connection to AIS unit.			

APPENDIX 3 ALERT CODES, MESSAGES AND MEANINGS

Alert code	Alert title	Priority & Category	Explanation
472	POSN SOURCE CHANGE	Caution Cat: B	Message: "POSN SOURCE CHG" Meaning: Positioning sensor input lost, automatically changed sensors.
Remedy: Press the <b>ALERT ACK</b> key. The indication is automatically removed when the signal is restored or a different sensor is selected.			
476	SPD SOURCE CHANGE	Caution Cat: B	Message: "SPD SOURCE CHG" Meaning: Speed sensor input lost, automatically changed sensors.
Remedy: Press the <b>ALERT ACK</b> key. The indication is automatically removed when the signal is restored or a different sensor is selected.			
485	DEPTH	Warning Cat: B	Depth is below set threshold.
Remedy: Press the <b>ALERT ACK</b> key. Confirm depth. Adjust [DEPTH] settings as required.			
495	ANCHOR WATCH	Warning Cat: B	Ship position outside set anchor watch zone.
Remedy: Press the <b>ALERT ACK</b> key. Confirm Own Ship location and adjust as necessary.			
541	TRANSMIT ERROR	Caution Cat: B	Unable to transmit AIS binary message.
Remedy: Press the <b>ALERT ACK</b> key. Check power to AIS unit.			
542	AIS TRANSMITTING	Caution Cat: B	Transmitting AIS message.
Remedy: Press the <b>ALERT ACK</b> key. No other action required.			
560	ASSOCIATION	Caution Cat: B	One or more sets of associated targets is displayed.
Remedy: Press the <b>ALERT ACK</b> key. Set [ASSOCIATION] to [OFF].			
740	EXT RADAR NO SIGNAL	Warning Cat: B	Externally connected radar has an error. (Only displayed when Interswitch is active.)
Remedy: Press the <b>ALERT ACK</b> key. Restore the external radar to normal operating condition.			
750	EXT RADAR COM ERROR	Caution Cat: B	Communication with external radar interrupted or lost. (Only displayed when Interswitch is active.)
Remedy: Press the <b>ALERT ACK</b> key. Check connection and power to the external radar.			
790	ARRIVAL	Warning Cat: B	Ship has entered the destination arrival alert zone.
Remedy: Press the <b>ALERT ACK</b> key. No other action required.			
791	XTE	Warning Cat: B	Cross-track error, ship is off-course.
Remedy: Press the <b>ALERT ACK</b> key. Check course and adjust as necessary.			
794	HEADING SET	Warning Cat: B	AD-10 signal interrupted.
Remedy: Press the <b>ALERT ACK</b> key. Match the on-screen HDG readout with the actual gyrocompass reading if necessary.			
950	BAM COM ERROR	Caution Cat: B	Communication the Bridge Alert Management System interrupted.
Remedy: Press the <b>ALERT ACK</b> key. Check connection to BAM. Check power to BAM.			

# APPENDIX 4 DATA COLOR AND MEANING

Validity and integrity of input data (mode indicator)

Data color	HDG	L/L * <sup>1</sup>	SPD	COG/SOG
Normal color (normal data)	THS-A,E  HDT	GNS-A, D * <sup>2</sup> , F, P, R and (NAV status: S) GGA-1, 2 * <sup>2</sup> , 3, 4, 5 GLL-A, D and (status: A) RMC-A, D, F, P, R and (status: A) and (NAV status: S)	VBW-A VHW	VTG-A, D, P RMC-A, D, F, P, R and (status: A) and (NAV status: S).
Yellow-or- ange color (invalid data)		GNS-E, M, S GGA-6, 7, 8 GLL-E, M, S and (status: A) RMC-E, M, S and (Status: A)		VTG-E, M, S RMC-E, M, S, and (sta- tus: A)
Yellow color (low integrity)		GNS-A, D* <sup>2</sup> , F, P, R, and (NAV status: C, U, V) RMC-A, D, F, P, R and (status: A) and (NAV status: C, U, V)		RMC-A, D, F, P, R and (status: A) and (NAV status: C, U, V)
***.*	THS-M, N, S	GNS-N, (NAV status: N) GGA-0 RMC-N, (status: V), (NAV status: N) GLL-N, (status: V)	VBW-V	VTG-N RMC-N (sta- tus: V)

\*<sup>1</sup>: Low or doubtful integrity can occur when the GBS sentence gives a RAIM error rate of 10 m or higher. In this case, the ship's latitude and longitude indications are displayed in yellow.

\*<sup>2</sup>: "Age of differential GPS data" in GGA and GNS sentences is ten seconds or higher. In this case, ship's latitude and longitude are displayed in yellow.

# APPENDIX 5 ABBREVIATIONS

A:

Abbreviation	Word	Abbreviation	Word
ACK	Acknowledge	ACQ	Acquire
Act	Activate	ACE	Automatic Clutter Elimination
ANT	Antenna	AIS	Automatic Identification System
AP	Autopilot	ATON	Aids to Navigation
AUTO	Automatic	A/C RAIN	Anti Clutter RAIN
A/C SEA	Anti Clutter Sea	AID	Aid
ALF	ALF sentence	ALR	Alarm
AMB	Amber	AMS	Alert Management System
APR	April	ARC	Arc
AUG	August		

B:

Abbreviation	Word	Abbreviation	Word
BLU	Blue	BCR	Bow Crossing Range
BCT	Bow Crossing Time	BRG	Bearing
BRILL	Brilliance	BT	Bottom Tracking

C:

Abbreviation	Word	Abbreviation	Word
CALC	Calculated	CALIB	Calibrate
Ch	Channel	CHG	Change
CCRP	Consistent Common Reference Point	CCRS	Consistent Common Reference System
CPA	Closest Point of Approach	CONT	Continue
CDROM	Compact Disc Read Only Memory	CORR	Corrected/Correction
CPU	Central Processing Unit	CRS	Course
CTW	Course Through the Water	COG	Course Over Ground
CU	Course Up	CURS	Cursor
CYA	Cyan		

D:

Abbreviation	Word	Abbreviation	Word
DTM	Datum	DEC	December
deg	degree(s)	DEST	Destination
DGPS	Differential GPS	Diff	Differential
DIST	Distance	DISP	Display
DIST	Distance	DR	Dead Reckoning
DISP	Display		

APPENDIX 5 ABBREVIATIONS

E:

Abbreviation	Word	Abbreviation	Word
E	East	EAV	Echo Average
EBL	Electronic Bearing Line	ECDIS	Electronic Chart Display and Information System
ENC	Electronic Navigational Chart	EP	Estimated Position
EQUIP	Equipment	ERR	Error
ES	Echo Stretch	ES	Echo Stretch
ETD	Estimated Time of Departure	EXT	External

F:

Abbreviation	Word	Abbreviation	Word
FEB	February	FILT	Filter/Filtered
FUNC	Function		

G:

Abbreviation	Word	Abbreviation	Word
GAP	Gap	GC	Great Circle
GND	Ground	GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System	GRAD	Gradation
GRN	Green	GRY	Gray
GT	Gross Tonnage		

H:

Abbreviation	Word	Abbreviation	Word
HD	Heading	HDG	Heading
HL	Heading Line	HSC	High Speed Craft

I:

Abbreviation	Word	Abbreviation	Word
IBS	Integrated Bridge System	ID	Identification
IMO	International Maritime Organization	INFO	Information
INS	Integrated Navigation System	IP ADDRESS	Internet Protocol Address
IR	Interference Rejection		

J:

Abbreviation	Word	Abbreviation	Word
JAN	January	JUN	June
JUL	July		

L:

Abbreviation	Word	Abbreviation	Word
L	Long pulse	LAT	Latitude
LAN	Local Area Network	LCD	Liquid Crystal Display
LIM	Limit	L/L	Latitude/Longitude
LOG	Log	LON	Longitude
LOP	Line Of Position		

M:

Abbreviation	Word	Abbreviation	Word
MAG	Magnetic	MAG	Magenta
MAN	Manual	MAR	March
MAX	Maximum	MAY	May
MBS	Main Bang Suppression	M-CYA	Multi Cyan
MFDF	Medium Frequency Direction Finder	MENU	Menu
M-GRN	Multi Green	MIC	Monolithic Integrated Circuit
MID	Middle	M1	Medium pulse 1
M2	Medium pulse 2	M3	Medium pulse 3
MOB	Man Over Board	MON	Monday
Msgs	Messages	MSC	Maritime Safety Committee

N:

Abbreviation	Word	Abbreviation	Word
N	North	NAV	Navigation
NLT	Not Less Than	NMT	Not More Than
NOV	November	NR	Noise Rejector

O:

Abbreviation	Word	Abbreviation	Word
OS	Own Ship	OCT	October

P:

Abbreviation	Word	Abbreviation	Word
PAST POSN	Past Positions	PC	Personal computer
PI	Parallel Index Line	PM	Performance Monitor
PNK	Pink	POSN	Position
PPI	Plan Position Indicator		

R:

Abbreviation	Word	Abbreviation	Word
RACON	Radar beacon	RAD	Radius
RAM	Random Access Memory	RAIN	Anti Clutter Rain
RD	Read	RED	Red
REF	Reference/Echo Reference	R, REL	Relative
REJ	Rejection	RENC	Regional ENC Co-ordinating Centre
RFC board	RF control board	RL	Rhumb Line
RM	Relative motion	RNG	Range
ROM	Read Only Memory	ROT	Rate Of Turn
RTE	Route	RTGT	Reference Target
RX	Receive		



APPENDIX 5 ABBREVIATIONS

S:

Abbreviation	Word	Abbreviation	Word
S	South	S1	Short pulse1
S2	Short pulse2	S57	IHO Special Publication 57
SAR	Search and Rescue	SART	Search and Rescue Transponder
SB	Transversal Speed	SD	Secure Digital
SEA	Anti Clutter Sea	sel	Select
SENC	System ENC	SEP	September
SIO	Serial input output	SOLAS	Safety of Life at Sea
SOG	Speed Over Ground	SPU	Signal Processing Unit board
SPD	Speed	STAB	Stabilized
STBD	Starboard	STBY	Standby
STC	Sensitivity time control	Std	Standard
STW	Speed Through Water	SW	Switch
Symb	Symbol(s)	SYM	Symbol

T:

Abbreviation	Word	Abbreviation	Word
T	True	TAG	Tag
TCPA	Time to CPA	TGT	Target
TM	True Motion	TPL	Transferred Line Of Position
True-G	True ground stabilized	True-S	True sea stabilized
TT	Target Tracking/Tracked Target	TTG	Time To Go
TX	Transmit		

U:

Abbreviation	Word	Abbreviation	Word
UNCAL	Uncalibrated	UTC	Coordinated Universal Time

V:

Abbreviation	Word	Abbreviation	Word
VECT	Vector	VRM	Variable Range Marker

W:

Abbreviation	Word	Abbreviation	Word
W	West	WAT	Water
WGS	World Geodetic System	WHT	White
W/O	Without	WOP	Wheel Over Point
WP	Waypoint	WPT	Waypoint
WR	Write	WT	Water Tracking
WTC	Water Tracking Current		

X:

Abbreviation	Word
XTE	Cross track error

Y:

Abbreviation	Word
YEL	Yellow

Units of measurement

<b>Abbreviation</b>	<b>Word</b>	<b>Abbreviation</b>	<b>Word</b>
deg	Degree(s)	ft	Foot/feet
H	Hour(s)	km	Kilometer(s)
KM	Kilometer(s)	kn	Knot(s)
KYD	Kiloyard(s)	min	Minute(s)
m	Meter(s)	MHz	Megahertz
NM	Nautical miles	sec	Second(s)
SM	Statute mile(s)	°	Degree(s)

























# APPENDIX 6 SYMBOLS

The pages following list the symbols which can be displayed on your radar. For non-IMO type radars, some symbol colors can be changed (see "How to select the mark color (for non-IMO types only)" on page 1-56).

## General radar symbols

<b>Symbol</b>	<b>Name</b>
(on power switch)	Power symbol
	Own ship marker
	Origin marks
	Fixed range rings
	Variable Range Markers (from left, VRM1, VRM2)
	Electronic Bearing Lines (from left EBL1, EBL2)
	OS mark
+	Cursor
	Heading line
-----	North Marker
-----	Stern Marker
	Barge icon
	Drop mark

Radar map symbols (All radar types)




























<u>Symbol</u>	<u>Name</u>
	Mark
	Danger Highlight
	Buoy
	Buoy
	Buoy
	Buoy
	Buoy
	Danger Highlight
	Mark
	Mark
	Mark
	Mark
	Mark
	Mark
	Mark
	Nav Line (map)
	Coastline
	Contour
	Prohibited Area
 (cable)	Danger Highlight
 (w/line)	Buoy
 (w/line)	Mark
 (w/line)	Mark
 (w/line)	Mark

Radar map symbols (IMO type)

<u>Symbol</u>	<u>Name</u>	<u>Symbol</u>	<u>Name</u>
Red	Buoy	Orange	Mark
Green	Buoy	Orange	Mark
Red	Buoy	Orange	Mark
Green	Buoy	Purple	Navline (map)
Red	Buoy	White	Coastline
Green	Buoy	Gray	Contour Line
Red	Buoy	Purple	Danger Highlight
Green	Buoy	Purple (cable)	Danger Highlight
Purple	Danger Highlight	Orange	Mark
Purple	Danger Highlight	Orange	Mark

TT/AIS symbols

<b>TT symbols</b>	
<u>Symbol</u>	<u>Name</u>
	Acquired targets (from left: initial acquisition, one minute after acquisition, steady tracking, lost target, target selected for data readout)
	TT symbols (User may change TT symbols)
	Acquisition zone
S	Performance test
<b>AIS symbols</b>	
<u>Symbol</u>	<u>Name</u>
	AIS symbols (from left: activated target, ROT higher than preset ROT, dangerous target, lost target, target selected for data display, sleeping target, CPA/TCPA lost target)
	Other AIS symbols (from left, AIS SART (ACTIVE), AIS SART (TEST), AIS Base station, AIS search and rescue (SAR) Aircraft, AIS Search and Rescue (SAR) Vessel.)
	AIS message received

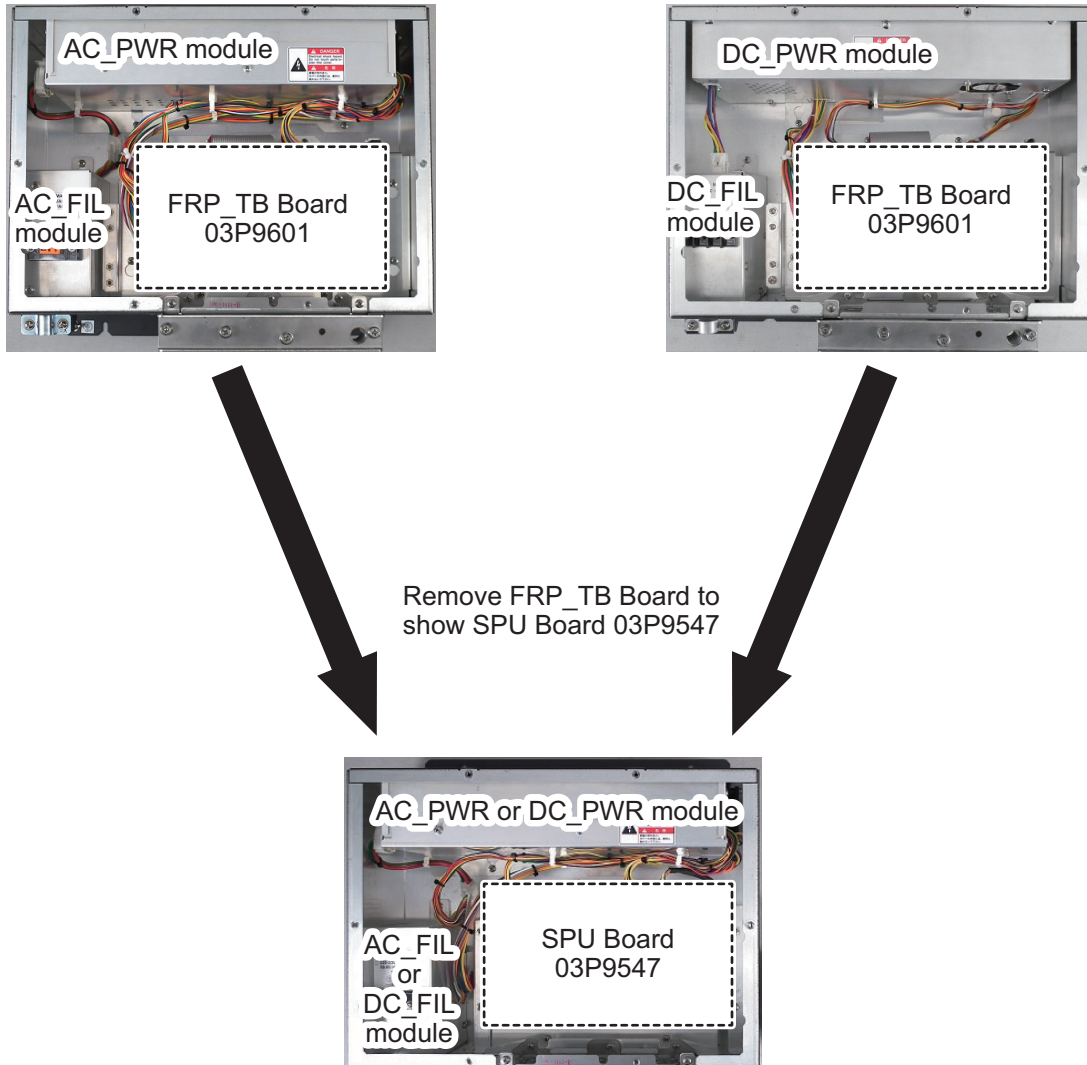
AIS Physical AtoN Symbol	AIS Virtual AtoN Symbol	Meaning
		Basic shape
		RACON
		Emergency wreck mark
		North cardinal mark
		East cardinal mark
		South cardinal mark
		West cardinal mark
		Port hand mark
		Starboard hand mark
		Isolated danger
		Safe water
		Special mark
<b>Off Pos</b> 		Off position (Displayed with yellow line and yellow text)
<b>Unlit</b> 		Light fail or at reduced range (Displayed with yellow text)
<b>Racon err</b> 		RACON error (Displayed with yellow text)
	<b>Missing</b> 	Missing (Displayed with yellow dashed line and yellow text)

# APPENDIX 7 PARTS LOCATION

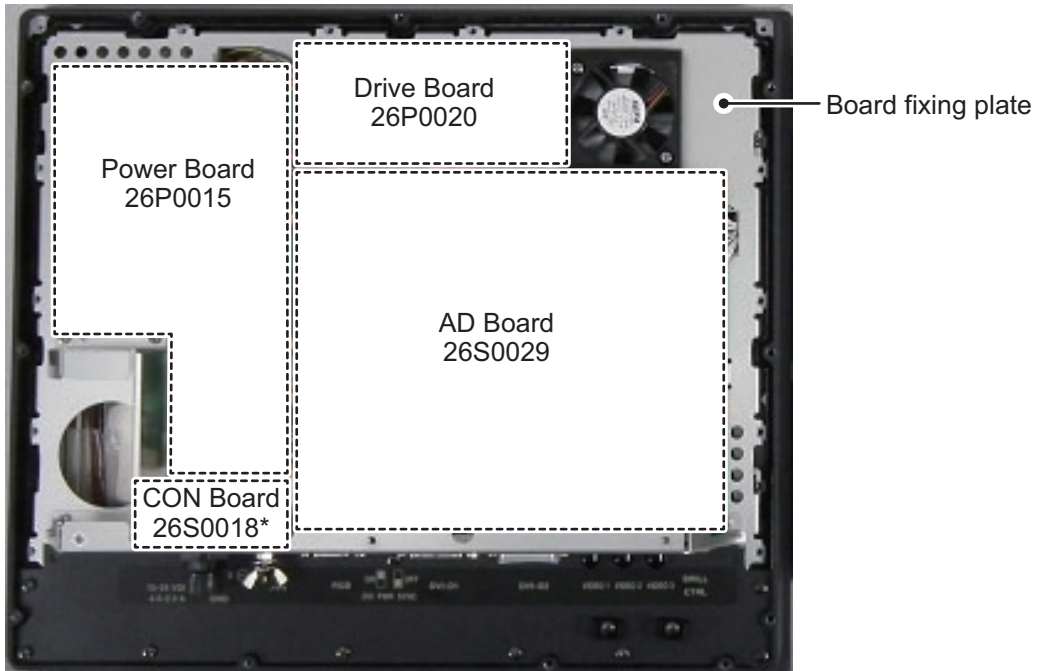
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This section shows the location of PC boards inside the equipment which can be replaced. For information on parts, or to replace a part, consult your local FURUNO dealer.

## Processor unit RPU-024 (AC and DC type)

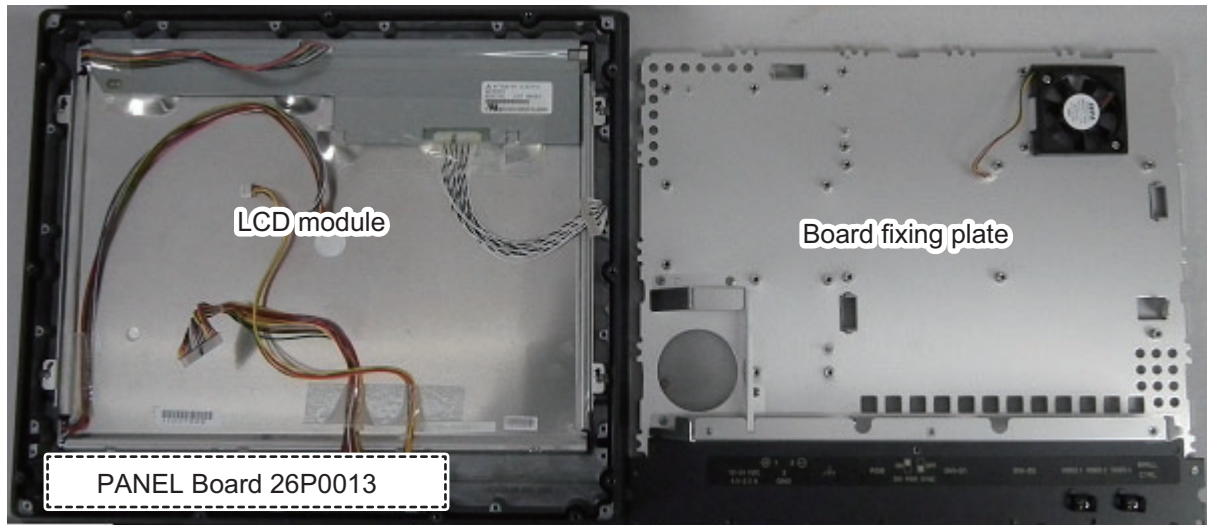


Marine display MU-150HD



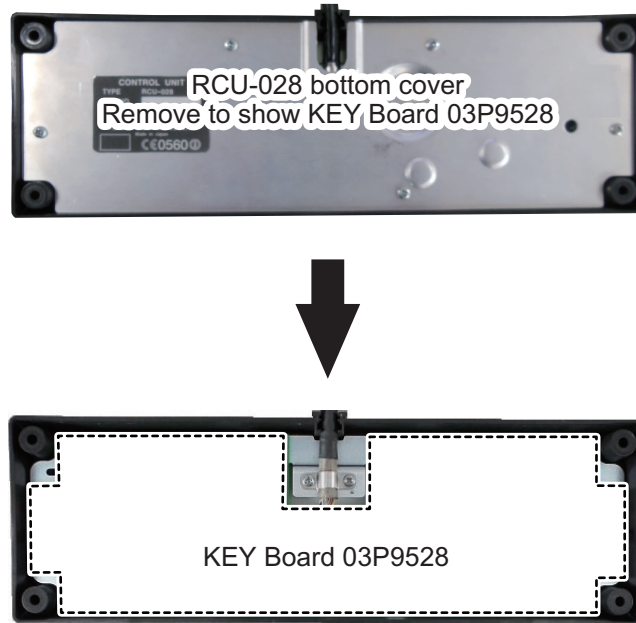
\*: CON Board 26S0018 is located under the overhang on the board fixing plate.

Remove Power Board 26P0015, Drive Board 26P0020, AD Board 26S0029, CON Board 26S0018 and the Board fixing plate to show the LCD module and PANEL Board 26P0013.



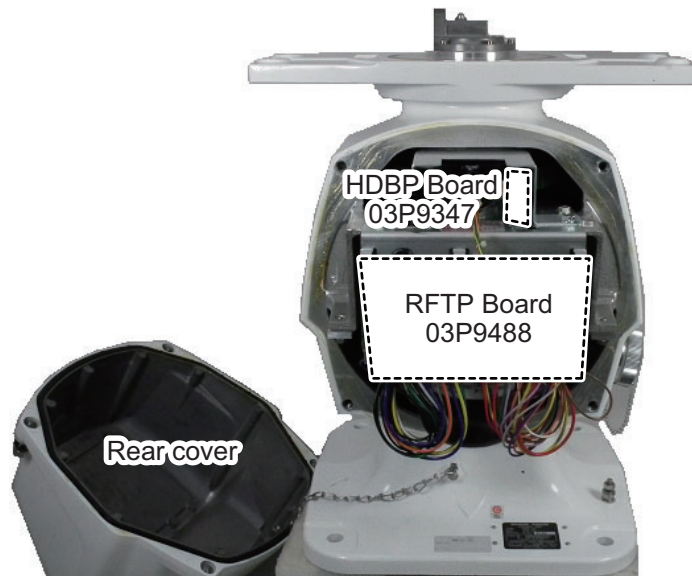


Control Unit RCU-028



Transceiver Unit RTR-100/101 Rear view

**Note:** The board location for both the RTR-101 and RTR-100 are the same. The image below shows the RTR-101.

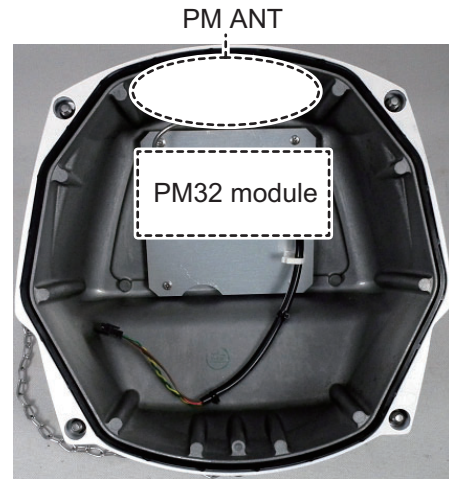


Transceiver Unit RTR-100/101 Front view

**Note:** The board location for both the RTR-101 and RTR-100 are the same. The image below shows the RTR-101.

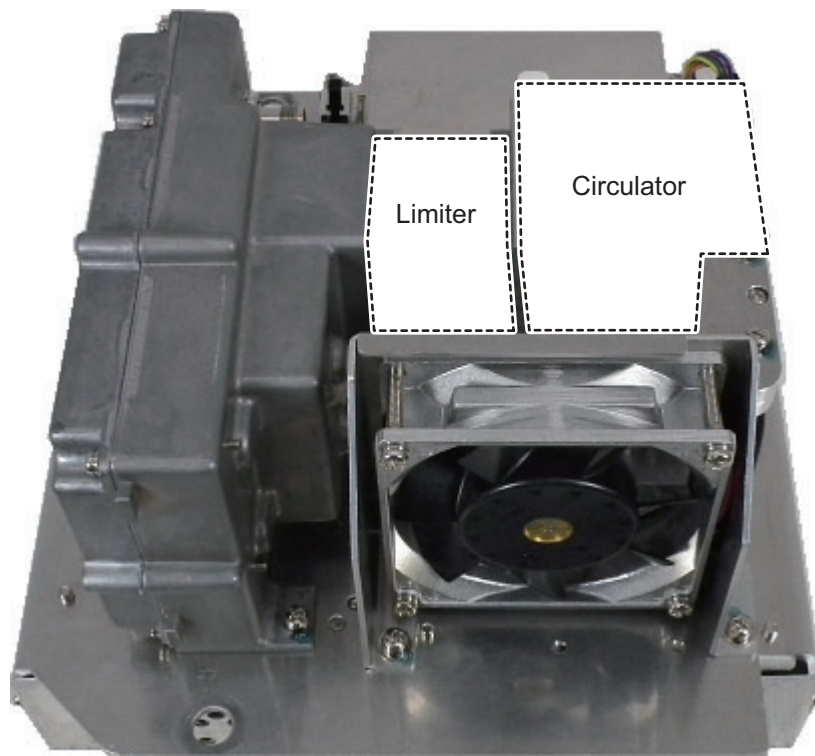


Rear view with cover and transceiver module RTR-101 removed.

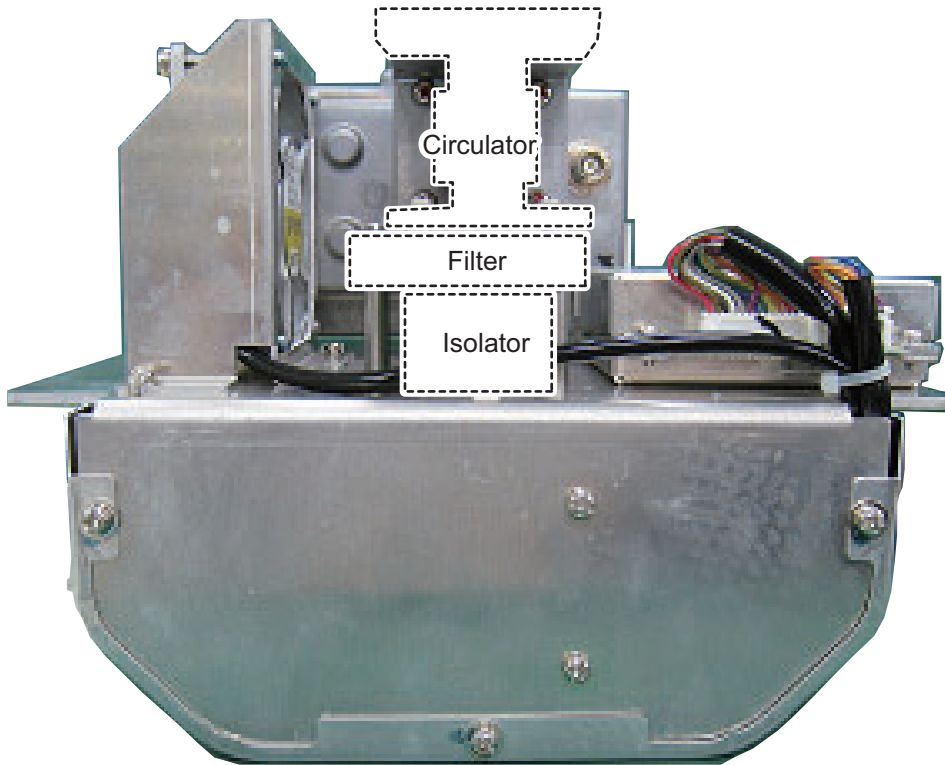


Rear cover inner with PM32 module showing.

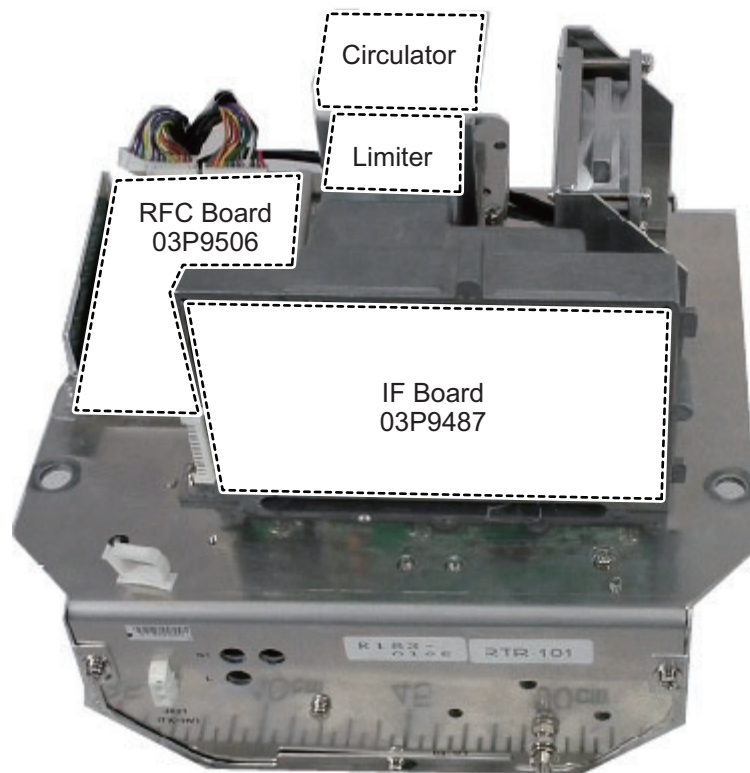
Transceiver module RTR-100/101 right-side view



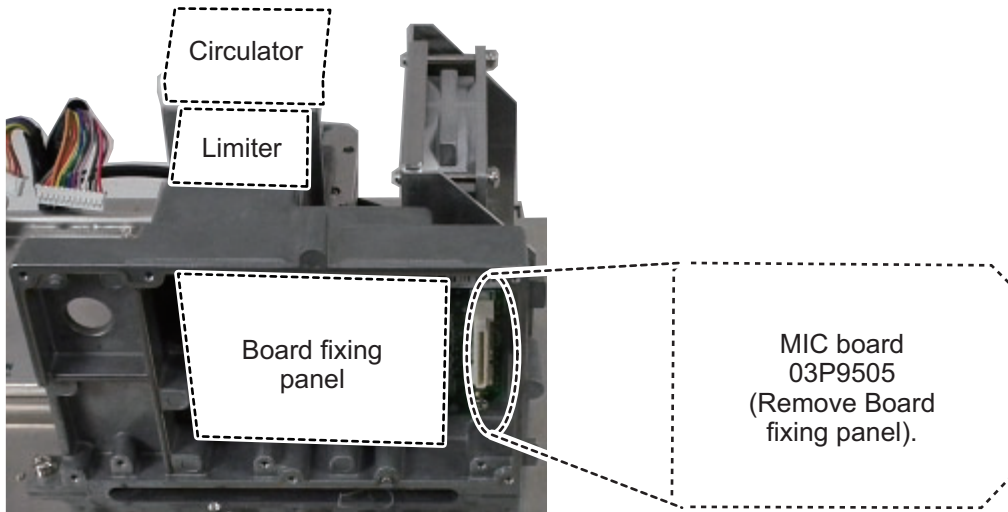
Transceiver module RTR-100/100 rear view



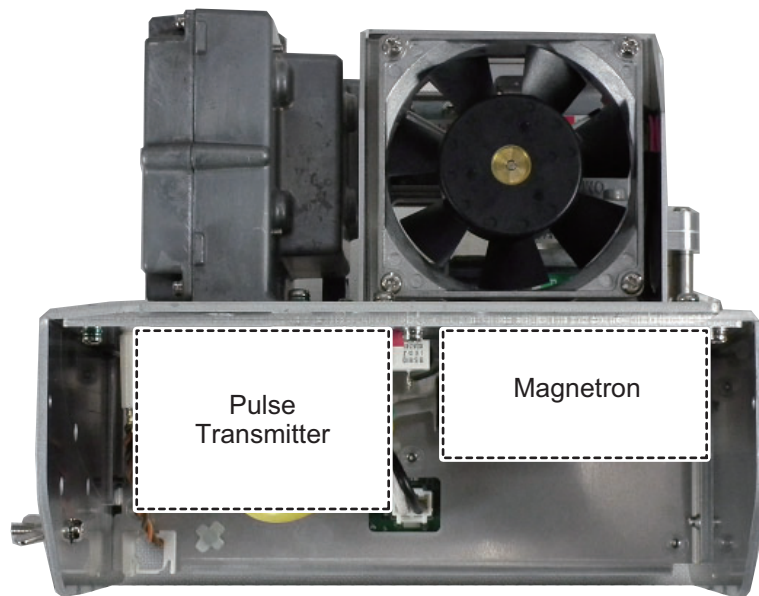
Transceiver module RTR-100/101 front view



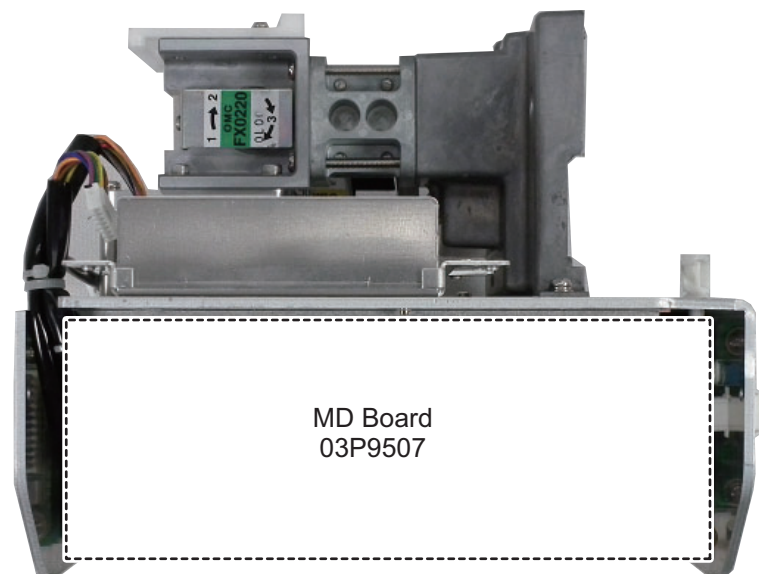
Remove IF Board 03P9487 to show MIC board 03P9505 (covered by board fixing panel).



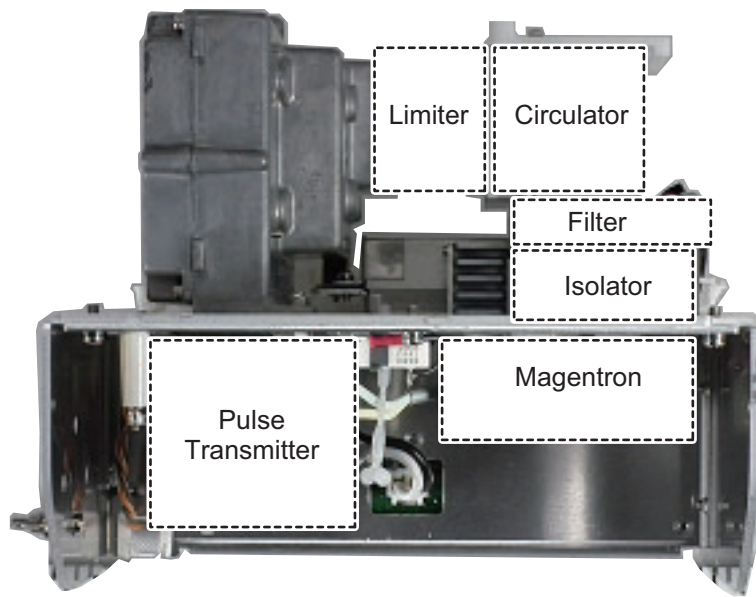
Transceiver module RTR-101 underside-front view (For FAR-1518/1528/BB)



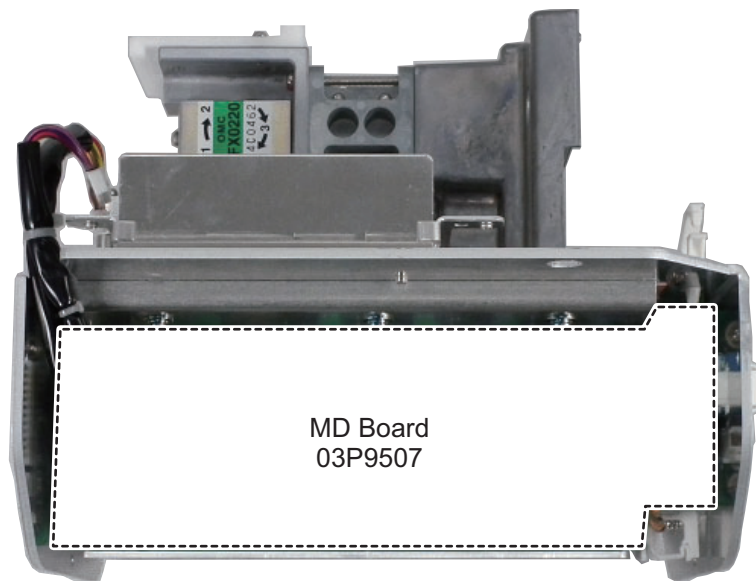
Transceiver module RTR-101 underside-rear view (For FAR-1518/1528/BB)



Transceiver module RTR-100 underside-front view



Transceiver module RTR-100 underside-rear view



**SPECIFICATIONS OF MARINE RADAR  
FAR-1513/1523 (-BB)**

**1 ANTENNA UNIT**

- 1.1 Antenna type Slotted waveguide array
- 1.2 Radiator length 4 ft (XN12A), 6 ft (XN13A)
- 1.3 Horizontal beamwidth 1.9° (XN12A), 1.35° (XN13A)
- 1.4 Vertical beamwidth 20°
- 1.5 Sidelobe attenuation  
XN12A -24 dB (within ±20° of main-lobe)  
XN13A -28 dB (within ±20° of main-lobe)
- 1.6 Polarization Horizontal
- 1.7 Rotation 24 rpm (RSB-0070), 48 rpm (RSB-0073)

**2 RF TRANSCEIVER**

- 2.1 Frequency 9410 MHz ±30 MHz, P0N
- 2.2 Output power  
FAR-1513 (-BB) 12 kW  
FAR-1523 (-BB) 25 kW
- 2.3 Minimum range 25 m
- 2.4 Range discrimination 25 m
- 2.5 Range accuracy 1 % of range in use or 10 m whichever is the greater
- 2.6 Bearing accuracy ±1°
- 2.7 Range, Pulselength and Pulse Repetition Rate

PRR (Hz approx.)	Range scale (NM)																			
	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	32	48	72	96	120	
2100	S																			
1200							M													
600*									L											

\*: 500 Hz on 96/120 NM ranges

- 2.8 IF frequency 60 MHz

**3 PROCESSOR UNIT**

3.1 Range scales and ring interval

Scale (NM)	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	32	48	72	96	120
RI (NM)	0.025	0.05	0.1	0.25	0.25	0.25	0.5	0.5	1	1	2	2	4	4	8	8	12	16	20
Number of rings	5	5	5	3	4	6	4	6	4	6	4	6	4	6	4	6	6	6	6

- 3.2 Warm-up time 3 minutes approx.
- 3.3 Presentation mode Head-up, STAB Head-up, North-up (TM/RM), Course-up, Stern-up
- 3.4 Marks Cursor, Radar ring, Heading mark, North mark, Bearing line, Vector, Map mark, Zoom, VRM, EBL, Acquisition zone
- 3.5 Target tracking (TT) Auto or manual acquisition: 50 targets in 0.2-32 NM  
Tracking: 5/10 pts on all target  
Time of vector: 0 to 60 minutes
- 3.6 AIS Display capacity: 300 targets, Tracking: 5/10 pts on all target  
Time of vector: 0 to 60 minutes
- 3.7 Echo trail True/Relative, Trail length: 0 to 30 minutes (30 s steps) or continue

- 3.8 Radar map 5,000 pts
- 3.9 Interswitch function Selected from menu

**4 MARINE DISPLAY (MU-150HD\*)**

- 4.1 Screen size 15-inch color LCD, 304 x 228 mm, 1024 x 768 dots (XGA)
- 4.2 Brightness 1,000 cd/m<sup>2</sup> typical
- 4.3 Contrast 600:1
- 4.4 View angle 160° typical
- 4.5 Radar effective diameter 205 mm

\*: The display unit for BB-type should be prepared by user.

**5 INTERFACE**

5.1 Number of ports on processor unit

- Heading 1 port: AD-10 format or IEC61162-2
- Serial IEC61162-2: 2 ports (AIS/HDG)  
IEC61162-1: 4 ports (GPS/LOG/AMS/ECDIS)
- Contact closure Alert output: 4 ch, Remote ACK input, System fail, power fail
- Remote display 2 ports (Signal: HD, BP, Trigger and Video)
- LAN Ethernet 100Base-TX: 1 port
- DVI DVI-D: 1 port for main display
- RGB 1 port for VDR or RGB monitor

5.2 Data sentences

- Input ABK, ACK, ACN, ALR, BWC, BWR, CUR, DBK, DBS, DBT, DPT, DTM, GBS, GGA, GLL, GNS, HBT, HDG, HDM, HDT, MTW, MWV, RMB, RMC, RTE, THS, VBW, VDM, VDO, VDR, VHW, VSD, VTG, VWR, VWT, WPL, ZDA
- Output ABM, ACK, ALC, ALF, ALR, ARC, BBM, EVE, HBT, OSD, RSD, TLB, TLL, TTD, TTM, VSD

**6 POWER SUPPLY**

6.1 Processor unit

- FAR-1513 (-BB) 24 VDC: 5.0 A max. (24 rpm), 5.6 A max. (48 rpm)
- FAR-1523 (-BB) 24 VDC: 6.4 A max. (24 rpm), 7.0 A max. (48 rpm)

6.2 Marine display 12-24 VDC: 4.5-2.2 A

6.3 Rectifier (RU-1746B-2, option) 100-115/220-230 VAC, 1 phase, 50/60Hz

**4 ENVIRONMENTAL CONDITIONS**

4.1 Ambient temperature

- Antenna unit -25°C to +55°C (storage: +70°C or less)
- Processor unit -15°C to +55°C
- Marine display -15°C to +55°C

4.2 Relative humidity 93% or less at +40°C

4.3 Degree of protection

- Antenna unit IP26
- Processor unit IP20 (IP22: option)
- Control unit IP22

	Marine display	IP56 (panel), IP22 (chassis)
4.4	Vibration	IEC 60945 Ed.4

## **5 UNIT COLOR**

5.1	Antenna unit	N9.5 (fixed)
5.2	Processor/control unit	N2.5 (fixed)
5.3	Marine display	N2.5 (fixed)



**SPECIFICATIONS OF MARINE RADAR  
FAR-1518/1528 (-BB)**

**1 ANTENNA UNIT**

- 1.1 Antenna type Slotted waveguide array
- 1.2 Radiator length 4 ft (XN12AF), 6.5 ft (XN20AF), 8 ft (XN24AF)
- 1.3 Horizontal beamwidth 1.9° (XN12AF), 1.23° (XN20AF), 0.95° (XN24AF)
- 1.4 Vertical beamwidth 20°
- 1.5 Sidelobe attenuation  
 XN12AF -24 dB (within ±20° of main-lobe)  
 XN20/24AF -28 dB (within ±20° of main-lobe)
- 1.6 Polarization Horizontal
- 1.7 Rotation 26 rpm (RSB-120), 48 rpm (RSB-121)

**2 RF TRANSCEIVER**

- 2.1 Frequency 9410 MHz ±30 MHz, P0N
- 2.2 Output power  
 FAR-1518 (-BB) 12 kW  
 FAR-1528 (-BB) 25 kW
- 2.3 Minimum range 25 m
- 2.4 Range discrimination 25 m
- 2.5 Range accuracy 1 % of range in use or 10 m whichever is the greater
- 2.6 Bearing accuracy ±1°
- 2.7 Range, Pulselength and Pulse Repetition Rate

PRR (Hz approx.)	Range scale (NM)											
	0.125	0.25	0.5	0.75	1.5	3	6	12	24	48	96	
3000*	S1											
2760*	S2											
1500				M1								
1000				M2								
1000						M3						
600**							L					

\*: 2200 Hz approx. with TT range on 32 NM. \*\*: 500 Hz on 96 NM range.

- 2.8 IF frequency 60 MHz

**3 PROCESSOR UNIT**

- 3.1 Range scales and ring interval

Scale (NM)	0.125	0.25	0.5	0.75	1.5	3	6	12	24	48	96
RI (NM)	0.025	0.05	0.1	0.25	0.25	0.5	1	2	4	8	16
Number of rings	5	5	5	3	6	6	6	6	6	6	6

- 3.2 Warm-up time 3 minutes approx.
- 3.3 Presentation mode Head-up, STAB Head-up, North-up (TM/RM), Course-up, Stern-up
- 3.4 Marks Cursor, Radar ring, Heading mark, North mark, Bearing line, Vector, Map mark, Zoom, VRM, EBL, Acquisition zone
- 3.5 Target tracking (TT) Auto or manual acquisition: 50 targets in 0.2-32 NM  
 Tracking: 5/10 pts on all target  
 Time of vector: 0 to 60 minutes

- 3.6 AIS Display capacity: 300 targets, Tracking: 5/10 pts on all target  
Time of vector: 0 to 60 minutes
- 3.7 Echo trail True/Relative, Trail length: 0 to 30 minutes (30 s steps) or continue
- 3.8 Radar map 5,000 pts
- 3.9 Interswitch function Selected from menu

**4 MARINE DISPLAY (MU-150HD\*)**

- 4.1 Screen size 15-inch color LCD, 304 x 228 mm, 1024 x 768 dots (XGA)
- 4.2 Brightness 1,000 cd/m<sup>2</sup> typical
- 4.3 Contrast 600:1
- 4.4 View angle 160° typical
- 4.5 Radar effective diameter 213 mm

\*: The display unit for BB-type should be prepared by user.

**5 INTERFACE**

- 5.1 Number of ports on processor unit
  - Heading 1 port: AD-10 format or IEC61162-2
  - Serial IEC61162-2: 2 ports (AIS/HDG)  
IEC61162-1: 4 ports (GPS/LOG/AMS/ECDIS)
  - Contact closure Alert output: 4 ch, Remote ACK input, System fail, power fail
  - Remote display 2 ports (Signal: HD, BP, Trigger and Video)
  - LAN Ethernet 100Base-TX: 1 port
  - DVI DVI-D: 1 port for main display
  - RGB 1 port for VDR or RGB monitor
- 5.2 Data sentences
  - Input ABK, ACK, ACN, ALR, BWC, BWR, CUR, DBK, DBS, DBT, DPT, DTM, GBS, GGA, GLL, GNS, HBT, HDG, HDM, HDT, MTW, MWV, RMB, RMC, RTE, THS, VBW, VDM, VDO, VDR, VHW, VSD, VTG, VWR, VWT, WPL, ZDA
  - Output ABM, ACK, ALC, ALF, ALR, ARC, BBM, EVE, HBT, OSD, RSD, TLB, TLL, TTD, TTM, VSD

**6 POWER SUPPLY**

- 6.1 Processor unit
  - AC type
    - FAR-1518 (-BB) 100-115/220-230 VAC: 3.0/1.4 A (26 rpm), 3.6/1.6 A (48 rpm)
    - FAR-1528 (-BB) 100-115/220-230 VAC: 3.8/1.7 A (26 rpm), 4.3/2.0 A (48 rpm)
  - DC type
    - FAR-1518 (-BB) 24 VDC: 6.7 A max. (26 rpm), 8.3 A max. (48 rpm)
    - FAR-1528 (-BB) 24 VDC: 8.3 A max. (26 rpm), 10.0 A max. (48 rpm)
- 6.2 Marine display 12-24 VDC: 4.5-2.2 A
- 6.3 Rectifier (RU-1746B-2/RU-3424, option)
  - 100-115/220-230 VAC, 1 phase, 50/60Hz
- 6.4 Transformer (RU-1803, option) 440 VAC, 1 phase, 50/60Hz

## 7 ENVIRONMENTAL CONDITIONS

7.1	Ambient temperature	
	Antenna unit	-25°C to +55°C (storage: +70°C or less)
	Processor unit	-15°C to +55°C
	Marine display	-15°C to +55°C
7.2	Relative humidity	93% or less at +40°C
7.3	Degree of protection	
	Antenna unit	IP56
	Processor unit	IP20 (IP22: option)
	Control unit	IP22
	Marine display	IP56 (panel), IP22 (chassis)
7.4	Vibration	IEC 60945 Ed.4

## 8 UNIT COLOR

8.1	Antenna unit	N9.5 (fixed)
8.2	Processor/control unit	N2.5 (fixed)
8.3	Marine display	N2.5 (fixed)

## 9 PERFORMANCE MONITOR (PM-32A)

9.1	Frequency range	9380 to 9440 MHz
9.2	Input power	+18dBm to 30dBm
9.3	Output power	-21 dBm (2 <sup>nd</sup> pulse max. output), -41 dBm (2 <sup>nd</sup> pulse min. output)
9.4	Step level	8 to 12 dB (1 <sup>st</sup> pulse to last pulse)

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