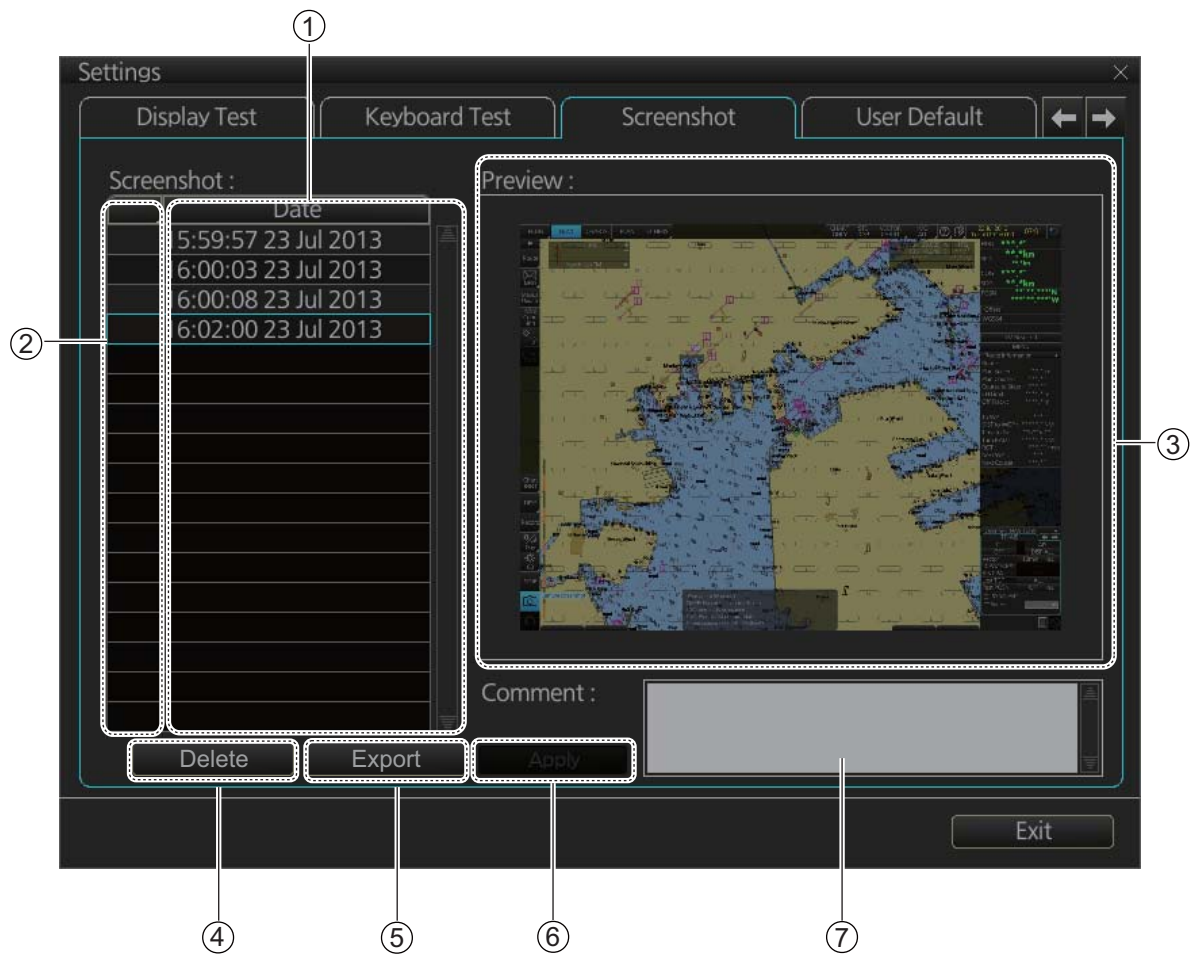


22.10 Screenshots

The [Screenshot] page handles the exporting (to a USB flash memory) and deleting of screenshots from the SSD.

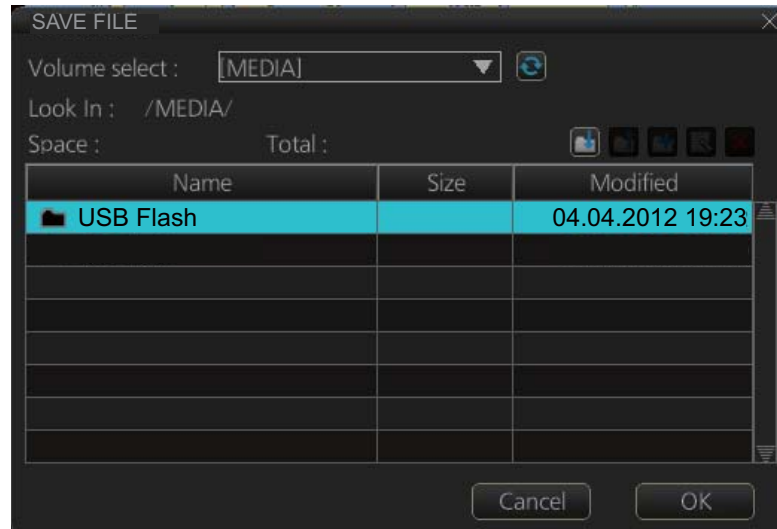


No.	Name	Description
1	List	List of screenshots taken. Screenshots are automatically assigned a file name consisting of the time and date the screenshot was taken.
2	Check boxes	Put a checkmark in the box of the screenshot to process.
3	[Preview]	Preview of the screenshot selected.
4	[Delete] button	Delete the screenshot(s) selected.
5	[Export] button	Export selected screenshot(s) to a USB flash memory.
6	[Apply] button	Save comment.
7	[Comment] box	Enter comment for screenshot. Put a check in appropriate checkbox then enter comment.

22.10.1 How to export screenshots

You can export screenshots to a USB flash memory as follows:

1. Insert a USB flash memory in the USB port on the Control Unit.
2. Open the [Screenshot] page.
3. Put a checkmark in the checkbox of the screenshot(s) to export.
4. Click the [Export] button.



5. Select the USB flash memory.
6. Click the [OK] button to export the screenshots selected.
7. If the exporting was successful, a window showing the number of files exported appears. Click the [OK] button to finish.

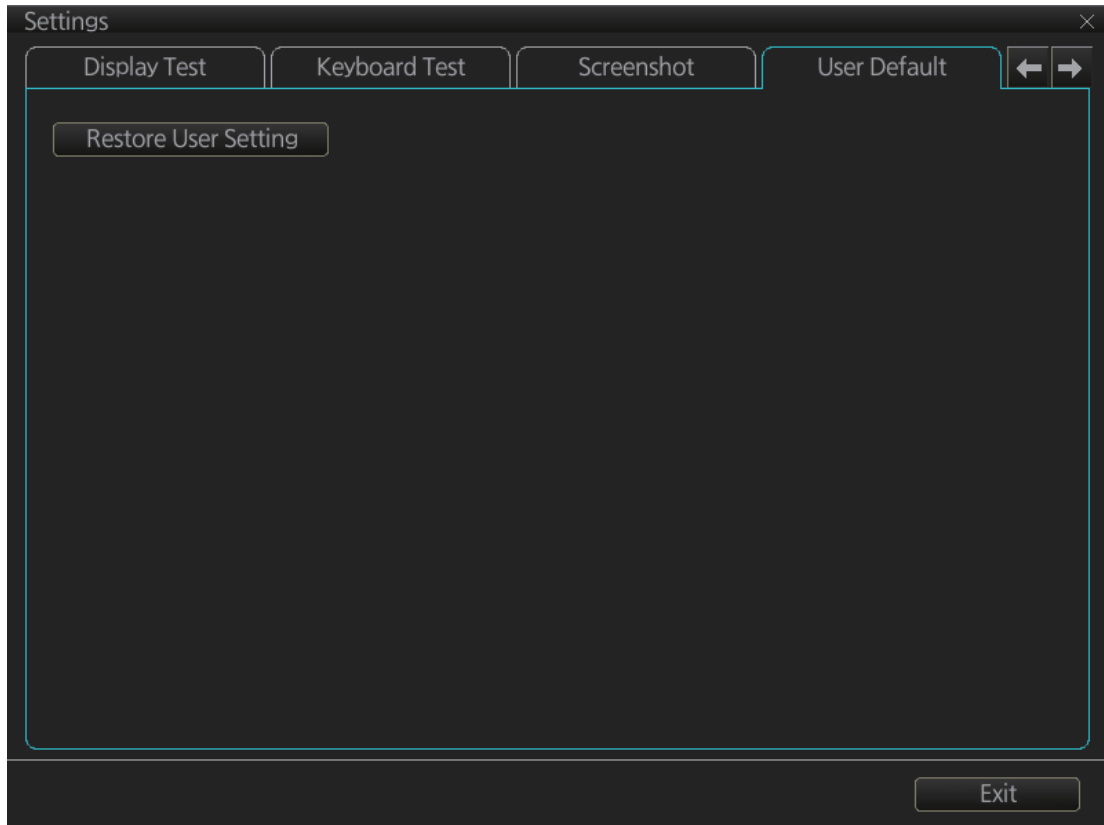
22.10.2 How to delete screenshots

1. Select the [Screenshot] page.
2. Put a checkmark in the checkbox of the screenshot(s) to delete. To select all screenshots, right-click the box to the left of the [Date] column then select [Select all]. To clear all check marks, select [Clear all].
3. Click the [Delete] button. The confirmation message "Attention: Selected files will be deleted. Do you wish to continue?" appears.
4. Click the [Yes] button to delete the screenshots selected. The message "File deletion succeeded" appears.
5. Click the [OK] button.

22.11 User Default

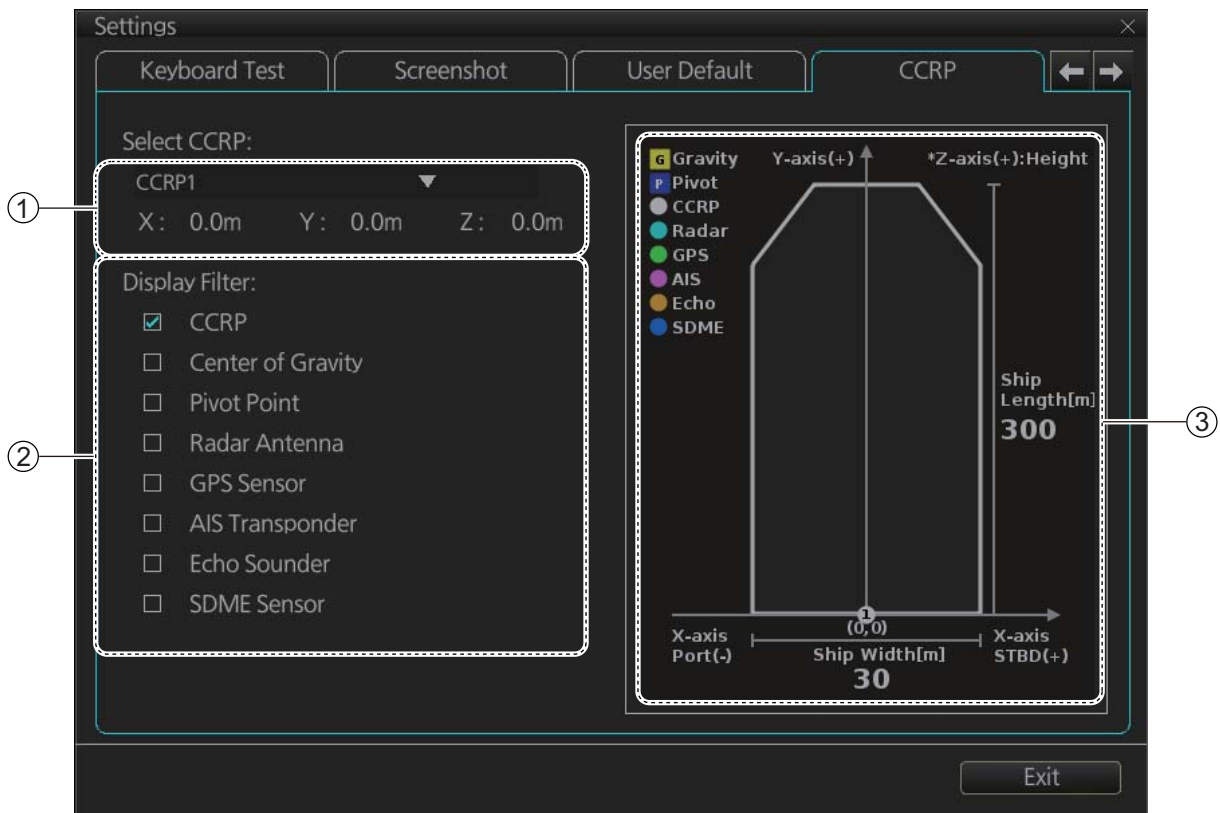
The [User Default] page restores all default settings for [Radar menu], [Chart menu], [User profile] and [Setting menu]. Click the [Restore User Setting] button. The message "All setting data will be restored to the default. Do you wish to continue?" appears. Click the [Yes] button to restore default settings and reset the power.

If you require the setting data, copy it to a USB flash memory (using the file export feature), BEFORE restoring user defaults.



22.12 CCRP

The [CCRP] page provides for selection of CCRP (Consistent Common Reference Point) and shows the location of various sensors.



No.	Name	Description
1	[CCRP]	Select the CCRP to use in the case of multiple CCRPs.
2	[Display Filter]	Check the items to show on the ship's graphic.
3	Ship's graphic	Shows the location of the sensors selected at the [Display Filter].

23. COMMON REFERENCE SYSTEM

23.1 Installation of the System

Special attention of following topics is required to maintain the "Common Reference System." The origin of the common reference system is the conning position on vessel.

- The values of the center and conning positions depend on the size and geometry of the ship.
- Offsets from the antenna position to the conning position of position sensors depend on the location of the antennas of the position sensor.
- Offsets from the antenna position to the conning position of the radars depend on the location of the radar antennas.

23.2 Accuracy of the System

Accuracy depends on the following conditions:

- Gyro error referenced to chart orientation
- Accuracy of EPFS
- Accuracy of radar performance and display (see the specifications at the back of this manual).
- Accuracy of setting of CCRP (see section 2.33)

The following items must be properly adjusted to meet the above conditions:

- Timing (Tx timing of radar echo). The procedure for adjustment is shown in "Timing Adjust" in the Installation Manual.
- Heading (Adjustment of radar echo heading). The procedure for adjustment is shown in "Heading Alignment" in the Installation Manual.
- Radar ANT position (Center of radar image is the radar antenna position). Radar antenna position is input in the [Common Installation Setting] menu.
- Conning position:
 - The chart radar uses position data fed from a GPS navigator to calculate the latitude and longitude position of the conning position.
 - GPS antenna position and conning position are entered in the [Common Installation Setting] menu to calculate offset.
 - The latitude and longitude position displayed at the top-right position on the screen is the latitude and longitude position of the conning position.
 - The chart datum used by the chart radar is recorded in geodetic datum WGS-84; therefore, the geodetic datum setting on the GPS navigator must be WGS-84.
- Gyro data:
 - Serial format gyro data is fed directly from a gyrocompass, thus adjustment of the heading indication on the chart radar is not necessary.

23. COMMON REFERENCE SYSTEM

- If synchro or stepper gyro data is fed to the chart radar, the heading indication on the chart radar must be adjusted to match that of the gyro. For the adjustment procedure, see section 1.15.
- Speed data:
 - Speed may be input from SDME or GPS.
 - SDME may be single-axis water speed or dual-axis ground speed.
 - GPS may be used to input COG/SOG.
 - Ground speed may also be taken from TT reference target.
 - Speed is entered from the [Setting] menu. For details, see section 1.14.

24. MAINTENANCE AND TROUBLESHOOTING

Periodic checks and maintenance are important for proper operation of any electronic system. This chapter contains maintenance and troubleshooting instructions to be followed to obtain optimum performance and the longest possible life of the equipment. Before attempting any maintenance or troubleshooting procedure please review the safety information below. If you cannot restore normal operation after following the troubleshooting procedures, do not attempt to check inside any unit; there are no user-serviceable parts inside. Refer any repair work to a qualified technician.

	WARNING
	Do not open the equipment. Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.
	Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced. Prevent the potential risk of being struck by the rotating antenna.
	A transmitting radar antenna emits electromagnetic waves, which can be harmful, particularly the eyes.
	Wear a safety belt and hard hat when working on the antenna unit. Serious injury or death can result if someone falls from the radar antenna mast.

NOTICE
Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment. Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

24.1 Maintenance

Regular maintenance is essential to good performance. A regular maintenance program should be established and should at least include the items shown in the table below.

Maintenance schedule

Interval	Check point	Check and measures	Remarks
When needed	FURUNO-supplied monitor unit and Processor Unit	Dust or dirt may be removed from a cabinet with a soft cloth. Water-diluted mild detergent may be used if desired. DO NOT use chemical cleaners to clean the display unit; they may remove paint and markings. To clean the LCD, wipe the LCD carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove dirt or salt deposits, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt or salt. Change paper frequently so the salt or dirt will not scratch the LCD. Do not use solvents such as thinner, acetone or benzene for cleaning. Also, do not use a degreaser or an antifog solution, as they can strip the coating from the LCD.	Do not use chemical-based cleaners for cleaning. They can remove paint and markings.
	Filter inside Processor Unit	Have a technician clean the filter if it is dusty. See section 24.4.	
5 years	Antenna Unit	If the grease dries out the V ring may break, allowing water to leak inside the antenna unit.	Have a qualified technician apply the grease oil to the antenna rotary.

Interval	Check point	Check and measures	Remarks
3 to 6 months	Cabling	Check that all cabling is firmly connected and is not damaged.	
	Exposed bolts and nuts of antenna unit	Exposed bolts and nuts are subject to corrosion. Further, they may loosen by vibration.	Check that bolts and nuts are not corroded and are securely fastened. If corroded, clean and coat with anticorrosive sealant.
	Radiator	Dust, dirt and salt deposits on the radiator cause signal attenuation, resulting in loss of sensitivity. Wipe radiator with a freshwater-moistened cloth.	The radiator is made of fiberglass reinforced plastic. Therefore, do not use gasoline, benzene and the like to clean the radiator. If the radiator is iced, use a wooden or plastic headed hammer to remove the ice. DO NOT use a steel hammer.
	Terminals, connectors	Check that all terminals and connectors on circuit boards are securely fastened.	Have a qualified technician check terminals and connectors.
6 months to 1 year	Screws on terminal boards in Processor Units	Check that all screws are tightly fastened.	Have a qualified technician check screws.

24.2 How to Replace the Fuses

The fuse in the Power Supply Unit, Processor Unit, monitor unit and sensor adapter protects those units from overvoltage (overcurrent) and internal fault. If a unit cannot be turned on, check if its fuse has blown. If the fuse has blown, find out the cause before replacing the fuse. If the fuse blows again after replacement, contact your dealer for advice.

WARNING

Use the proper fuse.

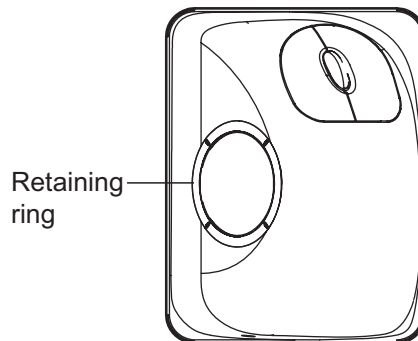
Use of a wrong fuse can damage the equipment or cause fire.

Unit	Power supply	Type	Code no.
Power Supply Unit PSU-014	100-230 VAC	F1: FGBO 250V 7A PBF	000-178-084-10
Power Supply Unit PSU-015	100-230 VAC	F1: FGBO 250V 3A PBF F2: FGBO 250V 7A PBF	000-155-841-10 000-178-084-10
Power Supply Unit PSU-016	100-230 VAC	F1: FGBO 250V 5A PBF	000-155-840-10
Power Supply Unit PSU-018	100-230 VAC	F1: FGBO 250V 3A PBF F2: FGBO 250V 7A PBF	000-155-841-10 000-178-084-10
Monitor Unit MU-190	100-230 VAC	FGBO 250V 1A PBF	000-155-828-10
Monitor Unit MU-231	100-230 VAC	FGBO 250V 1.5A PBF	000-155-833-10
Processor Unit EC-3000	100-115 VAC	FGMB 125V 10A PBF	000-157-470-10
	220-230 VAC	FGMB 250V 5A PBF	000-157-570-10
Sensor Adapter MC-3000S	24 VDC	FGMB 125V 3A PBF	000-157-481-10

24.3 Trackball Maintenance

If the cursor moves abnormally, dust or dirt may be on the trackball. Clean the trackball as shown below.

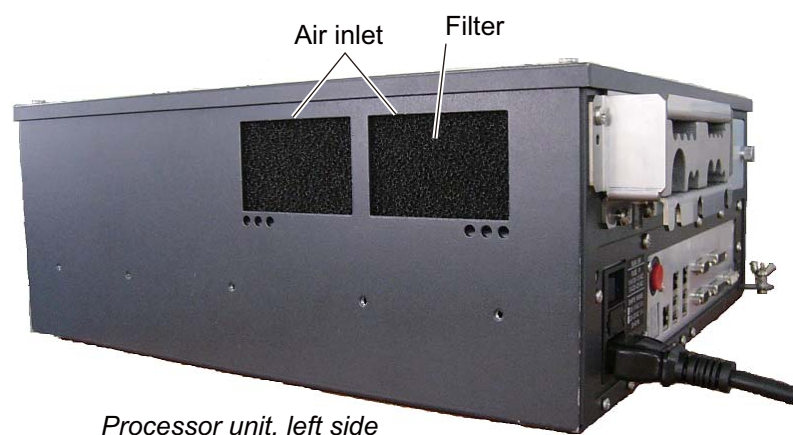
1. Turn the retaining ring on the trackball module counterclockwise 45° to unlock it.



2. Remove the retaining ring and ball.
3. Clean the ball with a soft, lint-free cloth. Blow carefully into the ball-cage to dislodge dust and lint.
4. Look for a build-up of dirt on the metal rollers. If dirty, clean the rollers using a cotton swab moistened lightly with isopropyl-rubbing alcohol.
5. Make sure that fluff from the swab is not left on the rollers.
6. Re-set the ball and retaining ring. Be sure the retaining ring is not inserted reversely.

24.4 How to Clean the Filter in the Processor Unit

Have a qualified technician clean the air inlet filter in the Processor Unit when it becomes dusty. Remove the filter and clean it with water and a mild detergent. Rinse the filter, allow it filter to dry then return it to the Processor Unit.



Processor unit, left side

Note 1: Be sure the air inlet is not blocked. A blocked inlet can cause the temperature to rise inside the cabinet, which can lead to malfunction.

Note 2: The right side of the Processor Unit has an exhaust vent. Remove dust from the vent as necessary.

24.5 Troubleshooting

The troubleshooting table below provides common faults and the remedy with which to restore normal operation.

Radar troubleshooting

If...	then...	Remedy
the radar echoes disappear and the alert 727 "Radar Sensor COM Error" appears	check the connection between the EC-3000 and radar sensor.	Reconnect the cable (if loosened) then restart the equipment.
the alert 750 "EXT Radar COM Error" appears	- check the connection between the EC-3000 of this equipment and the EC-3000 in the LAN line. - check the connection between the EC-3000 and radar sensor in the LAN line.	Reconnect the cable (if loosened) then restart the equipment.
the equipment cannot be turned on	- power connector may have loosened. - ship's mains is off. - fuse has blown.	- Check connector. - Check ship's mains. - Replace fuse.
the equipment can be turned on but nothing appears on the display	- brilliance is too low. - the ambient temperature is less than 0°C (32°F).	- Adjust brilliance. - The heater is warming the EC-3000. The display appears in approx. 10 minutes.
key doesn't beep when operated	key beep is turned off.	Turn on key beep from the menu.
picture not updated or picture freezes.	If the picture freezes, the buzzer sounds and the Status LED blinks in red.	Restart the equipment.
picture does not change even though range is changed.	suspect faulty the RANGE key or video freeze.	Hit the RANGE key several times. If nothing happens, restart the equipment.
only two index lines are displayed	check index line distance setting.	Refer to section 2.23.2 for how to adjust index line distance.
range rings are not displayed	range rings are hid.	Turn on the range rings.
tracked target is not tracked correctly	sea clutter etc. are masking tracked target.	Adjust A/C SEA and A/C RAIN to suppress sea and rain clutters.
sensitivity is poor	suspect second-trace echo or soiled radiator.	Reject second-trace echo; clean radiator.

Chart troubleshooting

If...	then...	Remedy
the message "No connection to dongle" appears	dongle is not connected to USB port.	Connect dongle.
the message "There is no dongle or an error has occurred in the dongle. The system will automatically shut down." appears	- dongle is not connected. - data in the dongle is corrupted.	- Connect dongle. - Contact FURUNO for assistance.
monitored route is not displayed	- route has not been selected. - monitor route has not been selected to be visible above the chart.	- Select route to monitor. - Open the [Route] page of the [Symbol Display] menu and check the monitored route parts to show.
planned route is not displayed	- route has not been selected. - planned route has not been selected to be visible above the chart.	- Select route as "planned". - Open [Route] page of [Symbol Display] menu and check the planned route parts to show.
route monitoring is stopped	Alert 691: RM Stop - Exceed Max XTE. Own ship is too far away from the route. Alert 692: RM Stop - No Valid Sensor Data. Chart radar internal error. Alert 693: RM Stop - Other Causes. Required data (position, SOG/COG) not found.	- Steer the ship back to the route then restart route monitoring. - Request service. - Check sensor connections.
symbol of user chart cannot be erased	two or more symbols may be superimposed on each other.	Do the delete action several times.
position cannot be found	- position sensor(s) is not selected on the [POSN] page. - position sensor is turned off. - sensor cable has loosened.	- Check position sensor selections. - Turn on position sensor. - Check cable.
S57 chart cannot be displayed	- No ENC chart for area. - Dongle not connected.	- Open S57 chart from [Manage Charts] dialog box - Connect dongle.
past track is not displayed	past track is not selected to be visible.	Open [Tracking] page of [Symbol Display] menu and select [Own Ship Past Tracks] to [Primary] or [Secondary] as appropriate.
monitored user chart is not displayed on chart display	user chart is not selected to be visible.	Open [Mariner] page of [Symbol Display] menu and select parts to show.
user chart is not displayed on radar display	user chart is not selected in Voyage navigation mode.	Select user chart in Voyage navigation mode.
the message "Nearing memory usage limit. Click the Restart button to restart the system to prevent trouble." appears	the memory usage limit for software is close to capacity. Performance may be affected.	If you need to save your work, click the [Later] button then restart the equipment. If you don't need to save your work, click the [Restart] button.

If...	then...	Remedy
the message "Memory usage limit reached. Click the Restart button to restart the system to prevent trouble." appears	the memory usage limit for software is reached. Performance may be affected.	Click the [Restart] button to reset the power. No other operations are available than restart.
both the operating mode buttons [RADAR] and [CHART for RADAR] are yellow	the memory usage limit for software is close to capacity. Performance may be affected.	Stop all operations and restart the equipment.

24.6 Consumable Parts

The table below lists the consumable parts in the antenna unit, Monitor Units, Processor Unit and Sensor Adapters. Replace the parts before their expected expirations.

Consumable parts

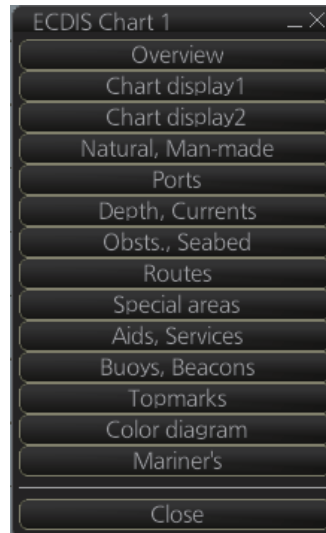
Part	Type	Lifetime	Remarks
Antenna Unit			
Magnetron	FNE1201	5,000 hours	Check number of hours used at TX time. Reset time then adjust the PM gain after replacement (see section 2.32).
	MG5436	5,000 hours	
	MG5223F	7,000 hours	
Motor	VGLC22-15N400L4 (S)	10,000 hours	
	VGLC18-10N200L4 (X)	10,000 hours	
Monitor Unit			
BEZEL (19) & LCD ASSEMBLY	MU-190	50,000 hours	
BEZEL (23) & LCD ASSEMBLY	MU-231	50,000 hours	
Processor Unit EC-3000			
CPU Fan	109R0612G429	8.5 years	
Power Fan	109P0612H761	8.5 years	
Chassis Fan	109P0612H761	8.5 years	
Sensor Adapter MC-3000S			
MC-CS Board	24P0114	8.5 years	
Sensor Adapter MC-3010A			
MC-ANLG Board	24P0115	7.0 years	

The expected lifetimes are typical values. Actual lifetime depends on usage and ambient temperature.

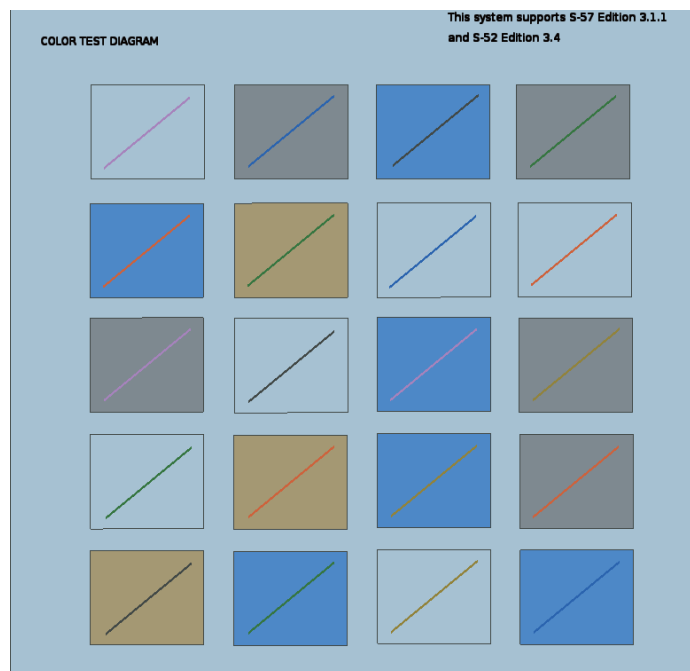
24.7 Color Differentiation Test for S57 Charts

The color differentiation checks if the chart radar monitor can distinguish between the various color-coded areas, lines and symbols.

1. Click the [Chart INFO] and [Chart 1] buttons on the InstantAccess bar to show the [ECDIS Chart 1] menu.



2. Click [Color diagram] to show the color test diagram.



If the colors are correct, the diagonal line will be distinguishable from its surroundings, at any brilliance setting.

24.8 Fallback Arrangements

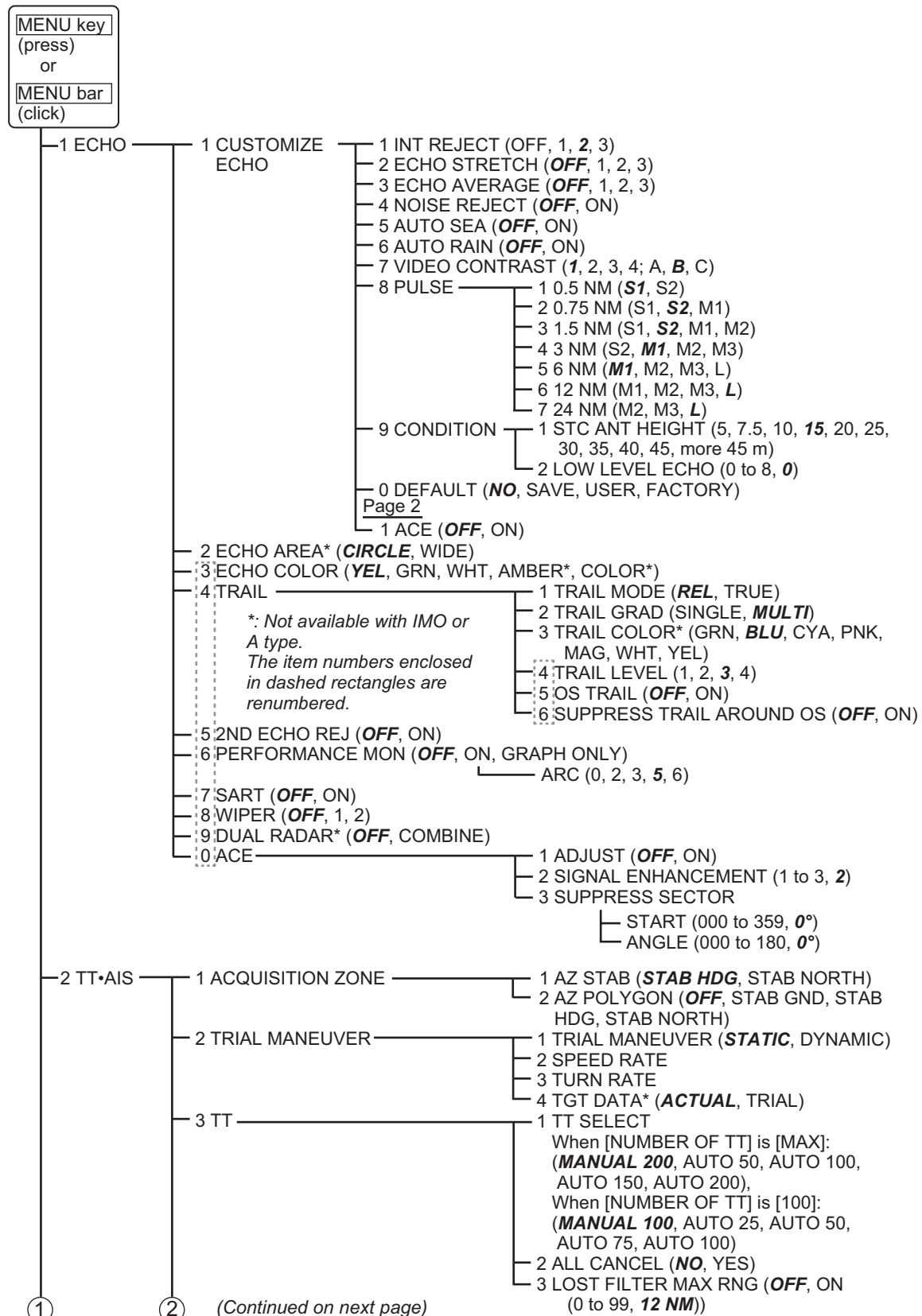
If the top priority sensor (e.g. GPS1) can not be used, this equipment automatically uses the second priority sensor (e.g. GPS2) when the multiple sensors (e.g. GPS1 and GPS2) are installed. When all sensors can not be used, each function is limited as follows:

Sensor	Operation of this equipment
Heading sensor	- The HDG indication reads "****. *°". - The orientation mode is automatically set for head-up. - TT, AIS, radar map, chart and echo averaging (EAV) are disabled.
Speed sensor	<u>When LOG(WT) is selected:</u> - The sensor used is automatically switched in the following priority order: GPS(BT) > LOG(BT). - The SPD indication reads "****. * kn" when both GPS(BT) and LOG(BT) can not be used.
	<u>When LOG(BT) is selected:</u> - The sensor used is automatically switched in the following priority order: GPS(BT) > LOG(WT). - The SPD indication reads "****. * kn" when both GPS(BT) and LOG(WT) can not be used.
	<u>When GPS(BT) is selected:</u> - The sensor used is automatically switched in the following priority order: LOG(BT) > LOG(WT). - The SPD indication reads "****. * kn" when both LOG(BT) and LOG(WT) can not be used.
COG/SOG sensor	- When the GPS sensor can not be used, the values of COG and SOG are calculated from HDG and LOG(BT). - Additionally when the heading sensor can not be used, the values of SOG is calculated from LOG(BT). The COG indication reads "****. *°".
Position sensor	- The POSN indication reads all asterisks. - AIS, radar map and chart are disabled.

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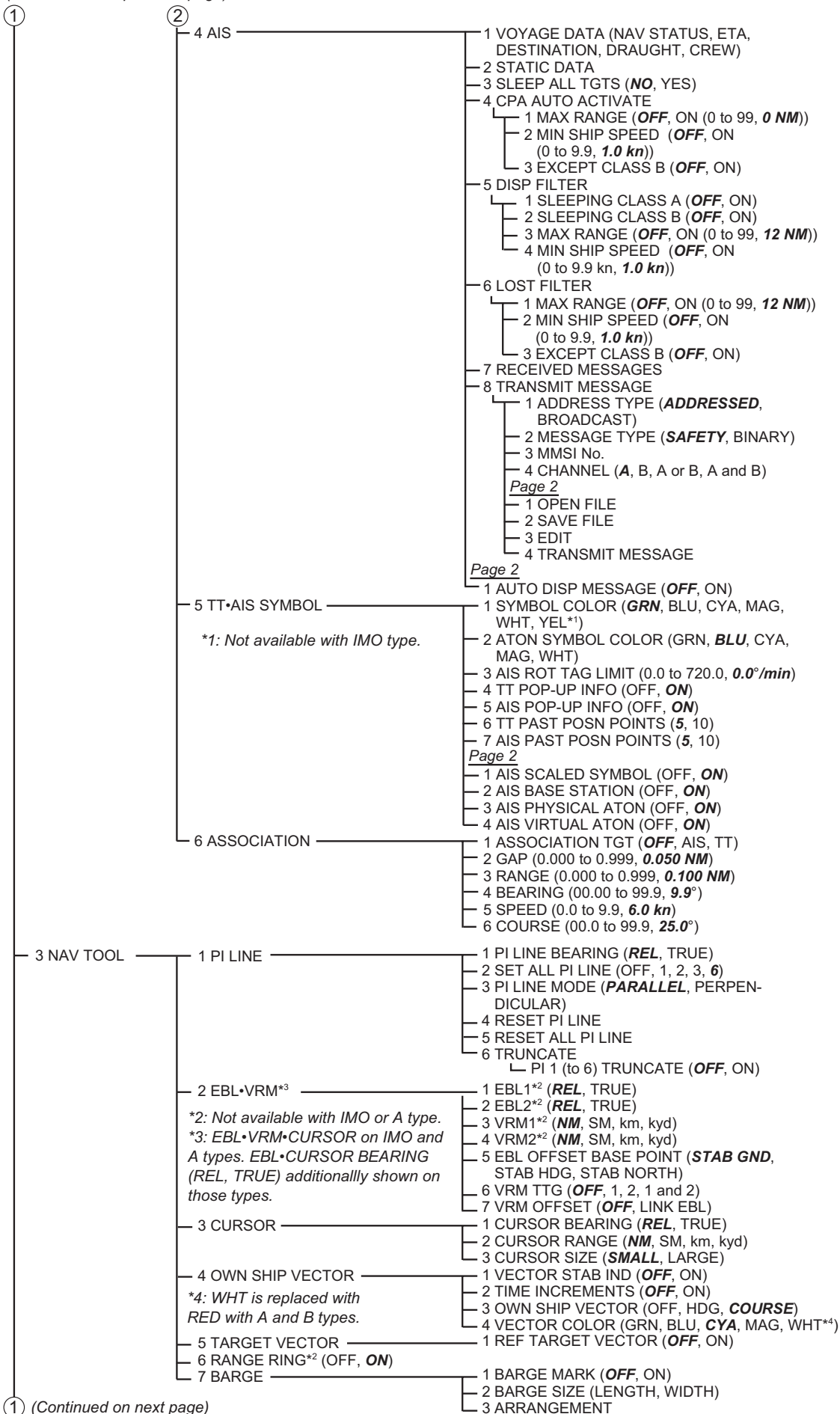
APPENDIX 1 MENU TREE

Radar menu



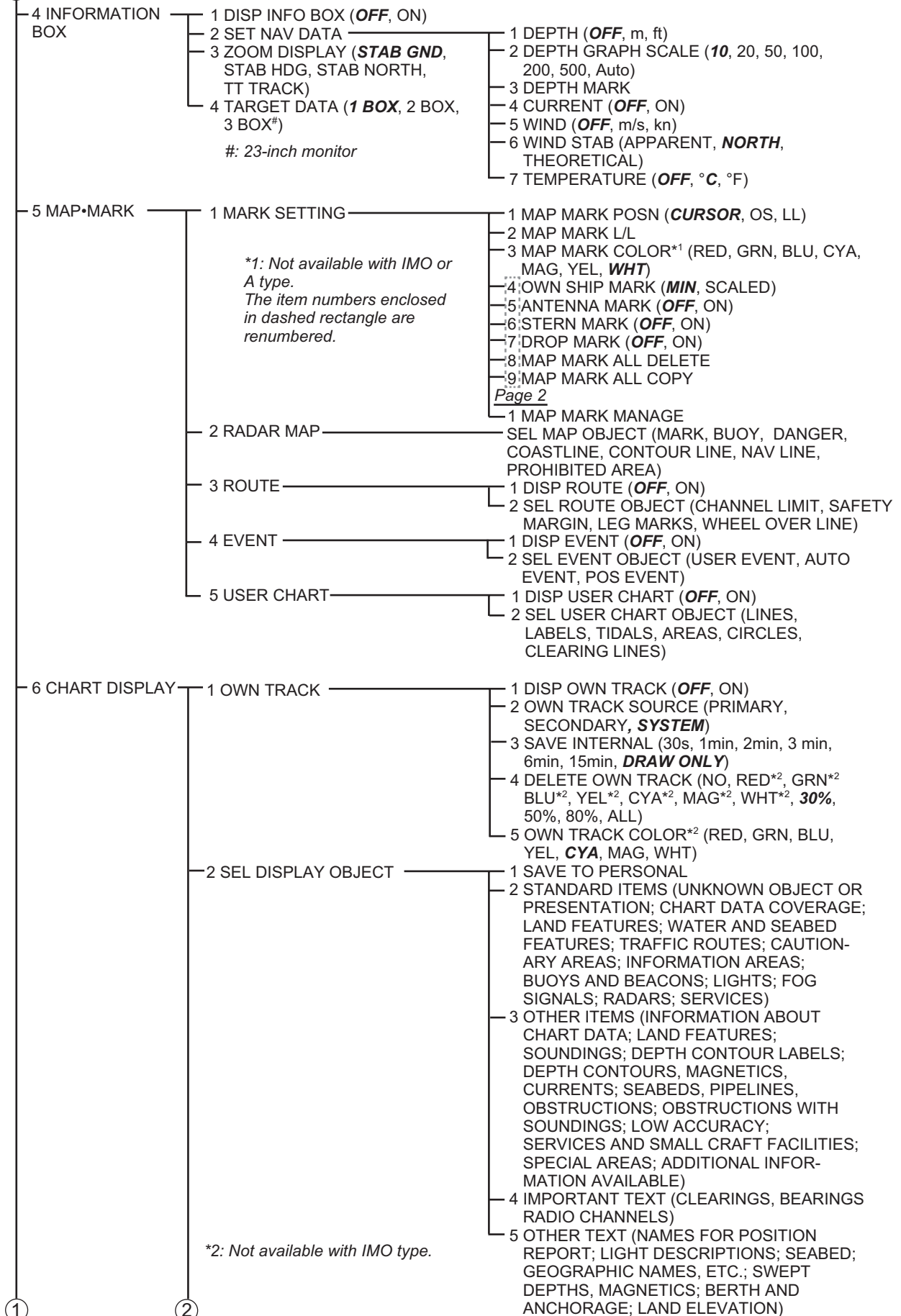
APPENDIX 1 MENU TREE

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APPENDIX 1 MENU TREE

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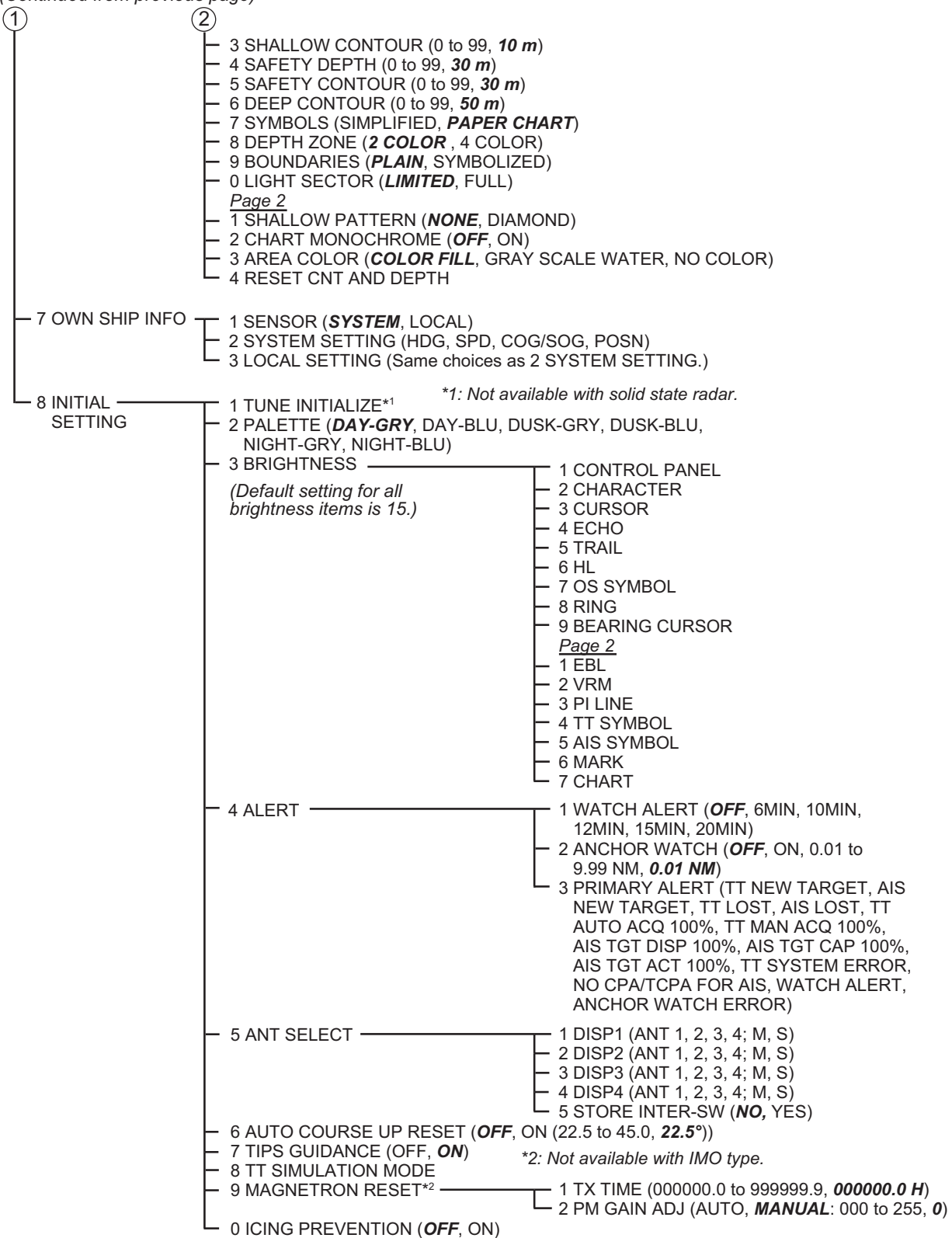
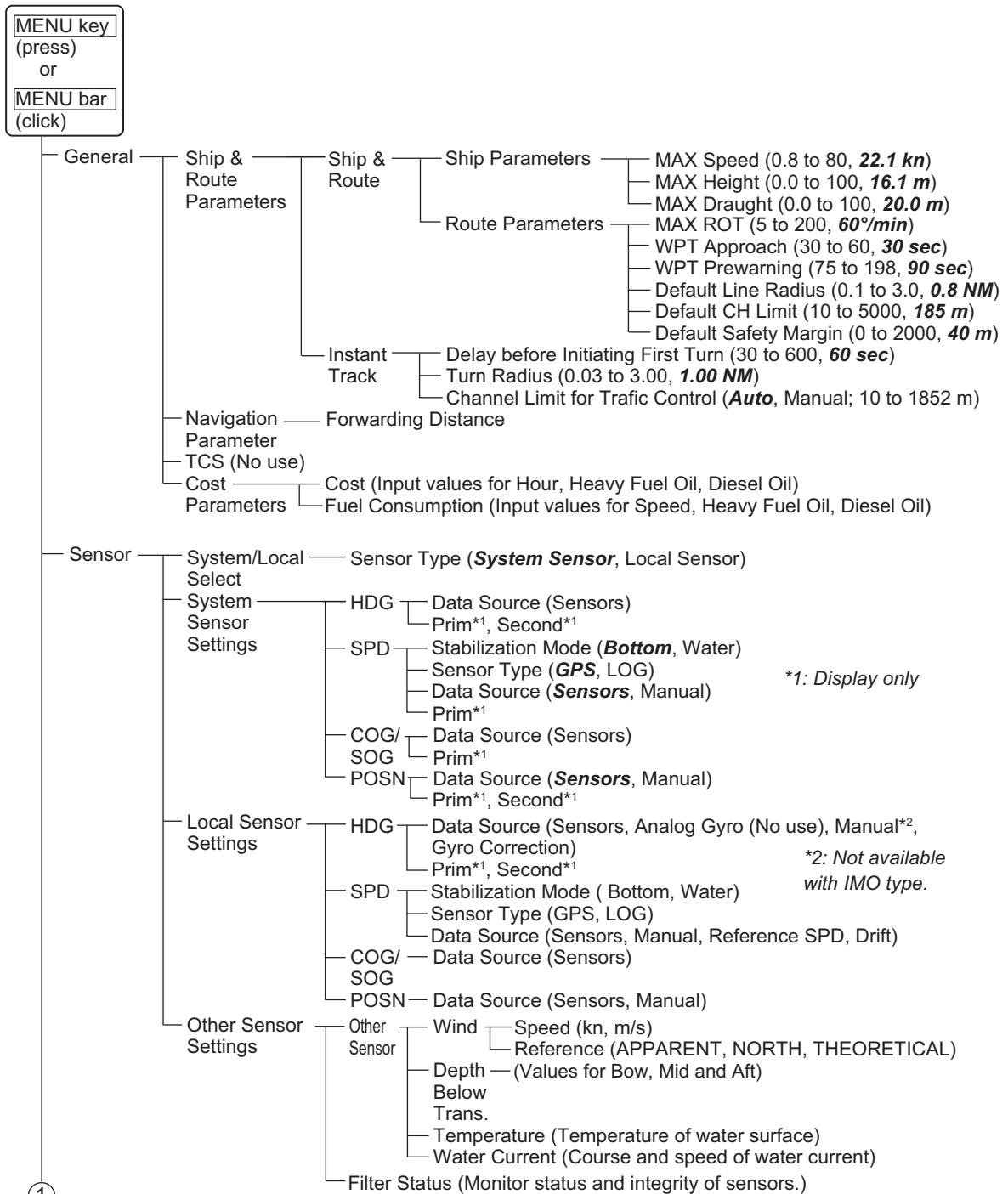


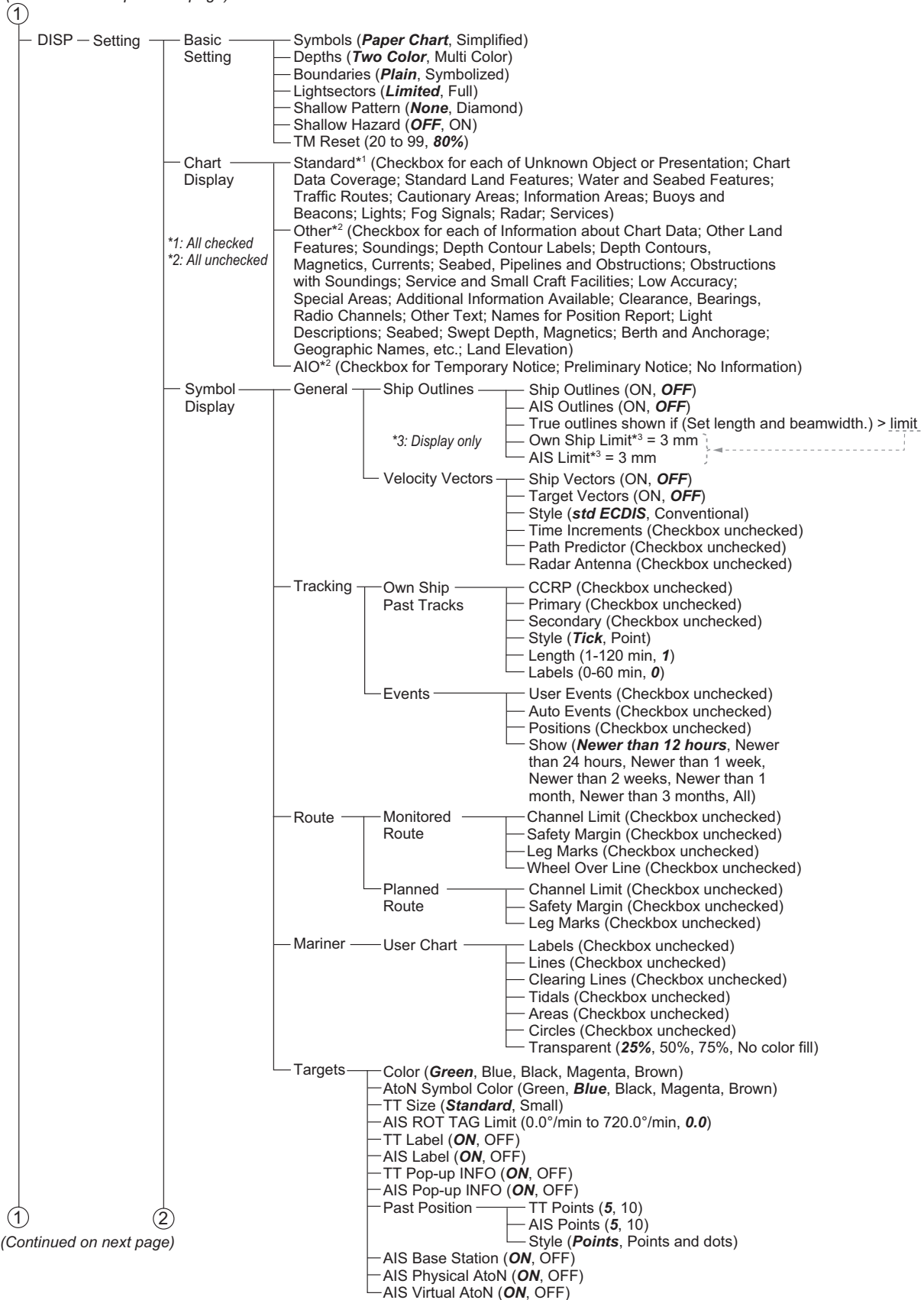
Chart menu

①

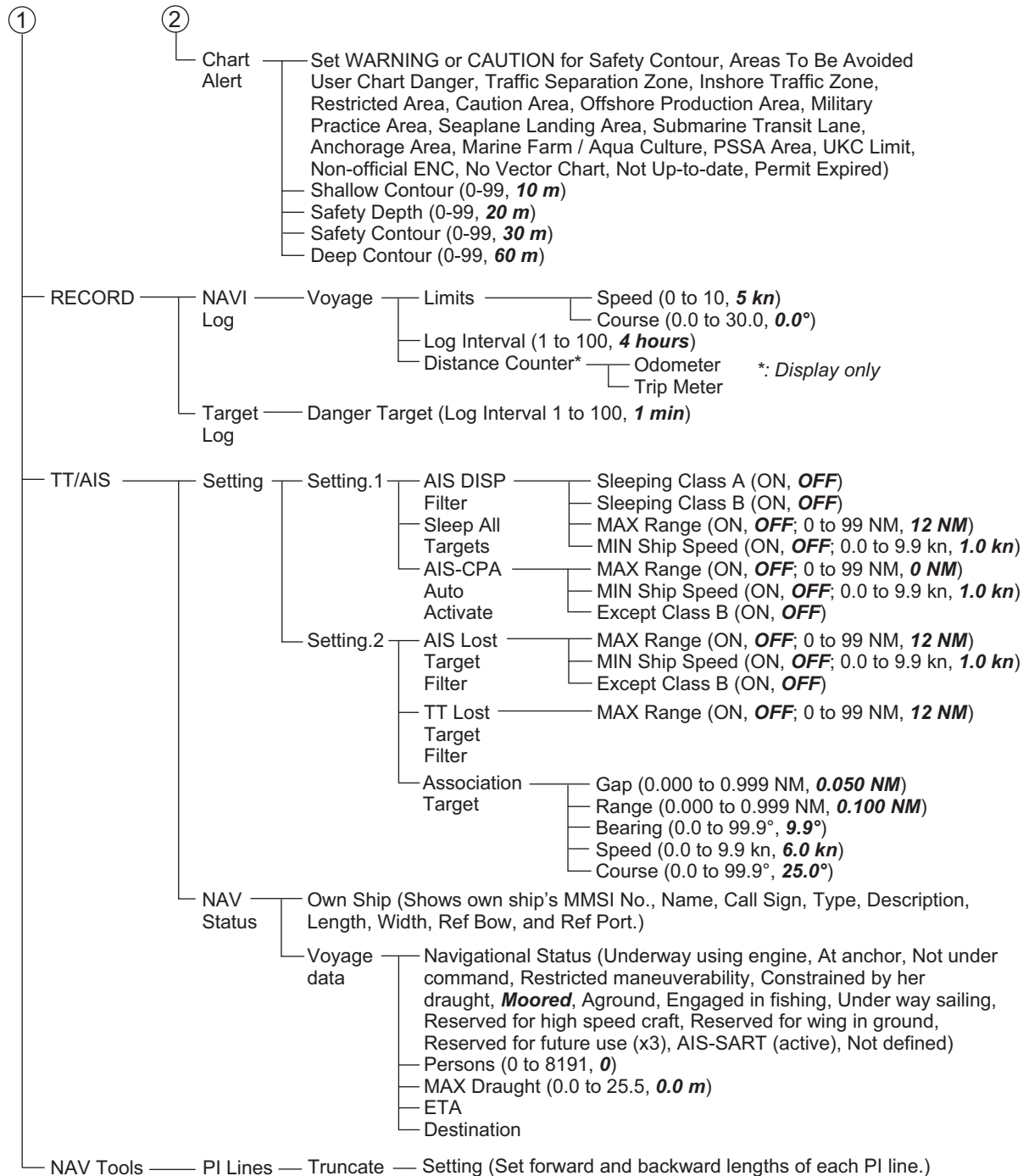
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APPENDIX 1 MENU TREE

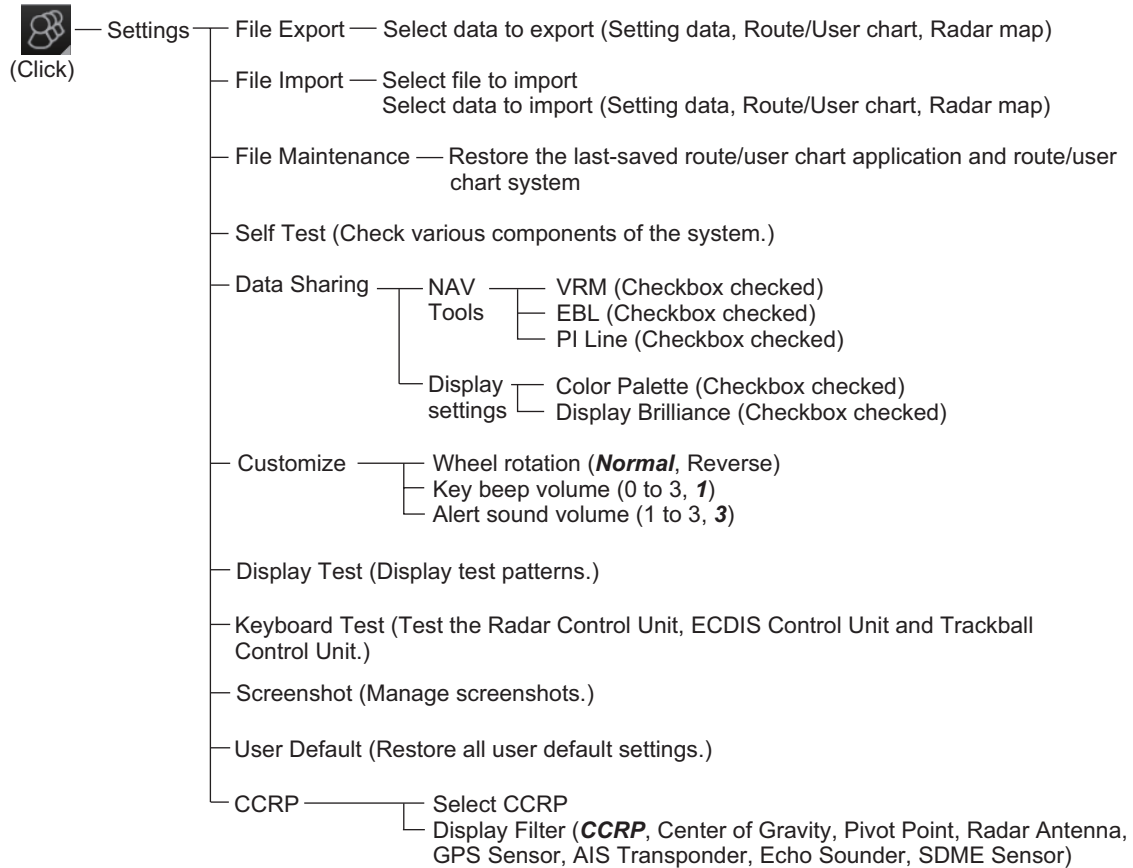
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Settings menu



APPENDIX 2 ABBREVIATIONS, SYMBOLS

Abbreviations

Abbreviation	Meaning
A/C	Anti Clutter
ACE	Automatic Clutter Elimination
ACK	Acknowledge
ACQ	Acquire
ACT	Activate
ADJ	Adjustment
AIS	Automatic Identification System
ALL	All
ALARM	Alarm
ANT	Antenna
Apr	April
ATON	Aid To Navigation
Aug	August
AUTO	Automatic
BB	Blackbox
BCR	Bow Cross Range
BCT	Bow Cross Time
BLU	Blue
BRG	Bearing
BRILL	Brilliance
BT	Bottom Tracking
CANCEL	Cancel
Caps	Capital (letters)
CAT	Category
CCRP	Common Consistent Reference Position
CH	Channel
COG	Course over the ground
CORRE	Correlation
CPA	Closest Point of Approach
CPU	Central Processing Unit
CSE	Course
CU/TM	Course-up/True Motion
CYA	CYAN
DATA	Data
Dec	December
DEMO	Demonstration
DISP	Display
DIST	Distance
DR	Dead Reckoning
E	English
E	East

APPENDIX 2 ABBREVIATIONS, SYMBOLS

Abbreviation	Meaning
EAV	Echo Average
EBL	Electronic Bearing Line
ENTER	Enter
ES	Echo Stretch
ESC	Escape
ETA	Estimated Time of Arrival
EXT	External
Feb	February
FILT	Filter
GAIN	Gain
GPS	Global Positioning System
GRN	Green
GRY	Gray
GYRO	Gyrocompass
HDG	Heading
HIDE	Hide
HL	Heading Line
IMO	International Maritime Organization
IND	Indication
INS	Integrated Navigation System
IR	Interference Rejection
J	Japanese
Jan	January
Jul	July
Jun	June
kyd	kiloyard
L	Long (pulse length)
L/L	Latitude/Longitude
LAN	Local Area Network
LIST	List
LL	Latitude, Longitude
LO	Low
MAG	Magnetic or Magenta
MAN	Manual
Mar	March
MARK	Mark
MAX	Maximum
MENU	Menu
MID	Middle
min	minute
MIN	Minimum
MMSI	Maritime Mobile Service Identity
MOB	Man Overboard
MODE	Mode
MON	Monitor
NAV	Navigation
Navtex	Navigational Telex
NM	Nautical miles
NO.	Number

Abbreviation	Meaning
N	North
Nov	November
Oct	October
OFF	Off
OFFSET	Offset
OS	Own Ship
OWN	Own
PALETTE	Palette
PANEL	Panel Illumination
PC	Personal Computer
PERPENDIC	Perpendicular
PI	Parallel Index (lines)
POSN	Position
PULSE	Pulse
R	Relative
RAD	Radius
RAIN	Rain
RANGE	Range
REF	Reference
Rel	Relative
RM	Relative Motion
RNG	Range
ROT	Rate of Turn
S	South
S1 (2)	Short1(2) (pulse length)
SAR	Search And Rescue
SART	Search And Rescue Transponder
SEA	Sea
SEL	Select
Sep	September
SM	Statute Miles
SOG	Speed Over the Ground
SPD	Speed
SPEC	Specification
SSD	Solid State Drive, Solid State Device
STAB	Stabilization
STBY	Stand-by
SW	Switch
T	True
TARGET	Target
TB	True Bearing
TCPA	Time to Closest Point of Approach
TEMP	Temperature
TGT	Target
TGT, TGTS	Target, Targets
TIME	Time
TM	True Motion
TRAIL	Trail
True-G	True-ground

APPENDIX 2 ABBREVIATIONS, SYMBOLS

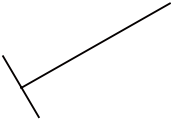
Abbreviation	Meaning
True-S	True-sea
TT	Tracked Target or Target Tracking
TTD	Tracked Target Data
TTG	Time to go
TTM	Tracked Target Information
TUNE	Tune
TX	Transmit
UNDO	Undo
UTC	Universal Time, Coordinated
VECT	Vector
VECTOR	Vector
VIEW	View
VRM	Variable Range Marker
W	West
W/O	Without
WHT	White
WOP	Wheel Over Point
WPT	Waypoint
WT	Water Tracking
YEL	Yellow

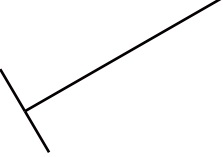
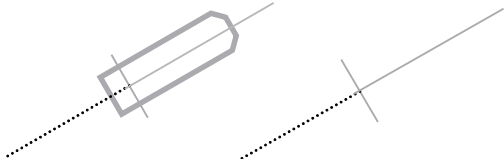
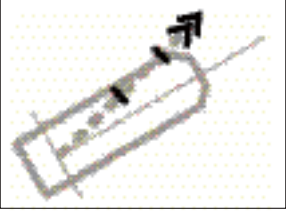
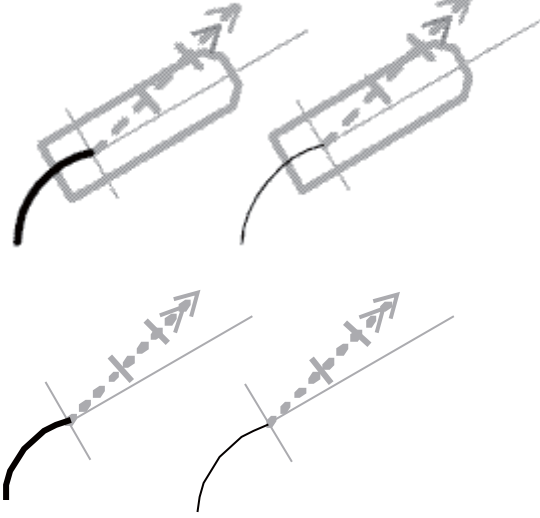
Symbols

Symbols on Control Unit

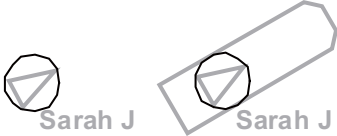
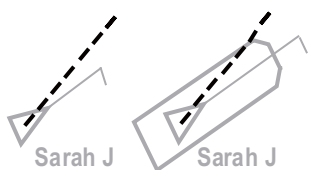
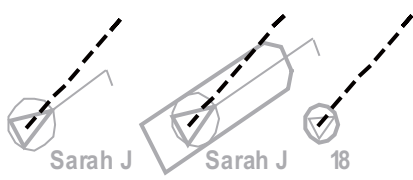
Symbol	Name
	Power switch
	Gain

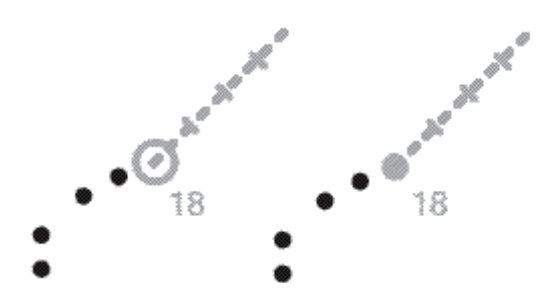
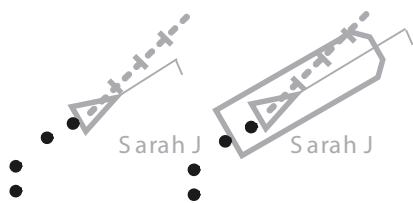
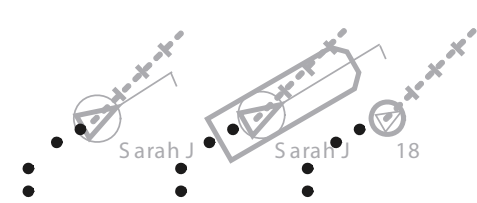
Symbols on display

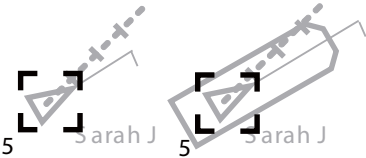
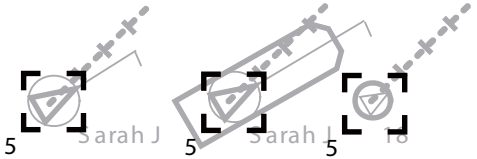
Symbol name and description	Symbol graphic(s)
Own ship - true scaled outline This can be displayed when based on user selection either beam width or length is more than 3 mm.	
Own ship - simplified symbol	
Own ship - minimized symbol	

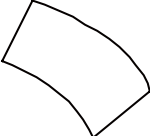
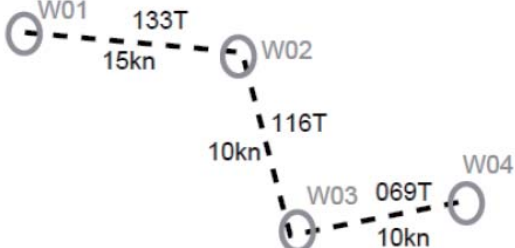
Symbol name and description	Symbol graphic(s)
Radar antenna position This symbol indicates location of the radar antenna. Select if position of radar antenna is displayed with symbol + in [MARK SETTING] menu.	
Own ship heading line This line originates from CCRP or Radar antenna position. CCRP: Consistent Common Reference Point	
Beam line This line passes through the CCRP or radar antenna position.	
Stern line	
Velocity vector - time increments	
Velocity vector - stabilization indicator Ground stabilization is indicated by double arrowhead and water stabilization is indicated as single arrowhead.	
Past track System past track is indicated by thick line. Raw sensor primary past track is indicated by thin line. Raw sensor secondary past track is indicated by gray thin line.	
Radar targets in acquisition state	 5 mm in diameter

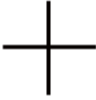
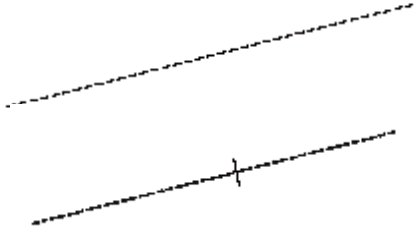
Symbol name and description	Symbol graphic(s)
Radar targets in acquisition state - automatically detected Automatically detected target symbol is red and it flashes until acknowledged.	 5 mm in diameter
Tracked radar targets	 3 mm in diameter
Tracked radar targets - dangerous targets Dangerous target symbol is red and it flashes until acknowledged.	 18
Reference targets TT: Std or small user selection by Symbol Display.	 R4 18
Sleeping AIS targets Orientation is towards heading (or COG if heading unknown). If both heading and COG are unknown the orientation is toward top of display.	 Sleeping AIS target with neither reported heading nor COG  
Activated AIS targets Orientation is towards heading (or COG if heading unknown). If both heading and COG are unknown the orientation is toward top of display.	 Activated AIS target with neither reported heading nor COG  
Activated AIS targets - true scaled outlines - This can be displayed when based on user selection either beam width or length is more than 3 mm. - AIS outline: ON/OFF	
Activated AIS targets - dangerous targets Dangerous target symbol is red and it flashes until acknowledged.	  Activated AIS target with neither reported heading nor COG  

Symbol name and description	Symbol graphic(s)
Activated AIS targets - alternative	Associated targets represented by AIS target symbols 
	Associated targets represented by radar target symbols 
Activated AIS targets - heading lines	
Activated AIS targets - heading lines - turn indicators	
Velocity vectors	Radar target velocity vectors 
	AIS target velocity vectors 
	Associated target velocity vectors 

Symbol name and description	Symbol graphic(s)
Target past positions	Radar target past positions 
	AIS target past positions 
	Associated target past positions 
AIS aid to navigation (ATON) Physical (real) ATON is solid line and virtual ATON is dashed line. An ATON in off position is yellow.	
AIS search and rescue transmitter -SART	
AIS SAR vessel	
AIS base station	

Symbol name and description	Symbol graphic(s)
Selected targets	Selected radar targets 
	Selected AIS targets 
	Selected association targets 
	Selected AIS ATON 
	Selected AIS SART 

Symbol name and description	Symbol graphic(s)
Lost targets Lost target symbol is red and it flashes until acknowledged.	Lost radar targets 
	Lost AIS targets  
	Lost associated targets   
	LOST AIS ATON 
	Lost AIS SART 
Radar and AIS target acquisition area	
AIS SAR aircraft	
Waypoint	
Next waypoint	
Routes	
Event marker	 

Symbol name and description	Symbol graphic(s)
User cursor	
Electronic bearing line (EBL) Second example show with range marker.	
Variable range marker (VRM)	
Range rings	
Parallel index lines	
Trial maneuver Displayed (flashing) during trial maneuver.	T
Simulation mode Displayed (flashing) during TT performance test.	S
Drop mark	

Radar map symbols

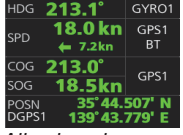
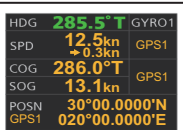
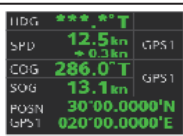
IMO and A types				B-type			
Category	Symbol	Color*	Name	Category	Symbol	Color	Name
Mark		Red	Buoy	Mark		7 colors	Buoy
		Green	Buoy			7 colors	Buoy
		Red	Buoy			7 colors	Buoy
		Green	Buoy			7 colors	Buoy
		Red	Buoy			7 colors	Danger
		Green	Buoy			7 colors	Danger
		Red	Buoy			7 colors	Mark
		Green	Buoy			7 colors	Mark
		Purple	Danger			7 colors	Mark
		Purple	Danger			7 colors	Mark
		Yellow-Orange	Mark			7 colors	Mark
		Yellow-Orange	Mark			7 colors	Mark
		Yellow-Orange	Mark			7 colors	Mark
Line		Purple	Nav Line	Line		7 colors	Mark
		White	Coast Line			7 colors	Mark
		Gray	Contour Line			7 colors	Nav Line
		Purple	Prohibited Area			7 colors	Coast Line
		Purple	Cable (Danger)			7 colors	Contour Line
		Yellow-Orange	Line Mark			7 colors	Prohibited Area
		Yellow-Orange	Line Mark			7 colors	Cable (Danger)
						7 colors	Line Buoy
						7 colors	Line Mark
						7 colors	Line Mark
						7 colors	Line Mark
						7 colors	Line Mark

*Fixed

Symbols on operating buttons

Symbol	Meaning
	Minimize button (on InstantAccess bar)
	Access AIS, Navtex functions (chart mode)
	Display received AIS message (radar mode)
	Access user profile, common settings
	Information (show program no., operator's manual)
	Undo, redo Note: This symbol is not displayed on the FURUNO 19-inch monitor unit.
	Screenshot capture
	Monitor brilliance (FURUNO monitor only)
	Color palette selection

APPENDIX 3 DATA COLOR AND MEANING

	Indication color	Sensor color	HDG	L/L	SPD	COG/SOG	Display example
SYSTEM	GRN	WHT	THS-A HDT	GNS-A,D,F,P,R GGA-1,2,3,4,5 GLL-A,D and (status: A) RMC-A,D,F,P,R and (status: A) *1	VBW-A VHW	VTG-A,D,P	 <i>All values in green.</i>
	YEL	WHT		DGPS update interval in GGA, GNS sentence is higher than 10 seconds. RAIM error in GBS sentence is longer than 10 m. *2			 <i>Position in yellow characters.</i>
	YEL-ORG	YEL-ORG		GNS-M,S GGA-7,8 GLL-M,S RMC-M,S	VBW-V	VTG-E,M,S RMC-E,M,S or (status: V)	 <i>SPD, COG, SOG and POSN values and pos. source name in red.</i>
	GRN (***)	WHT	THS-E, M, S, N	GNS-N, GGA-N, GLL-N, RMC-N or (status: V) *3		VTG-N *4	 <i>HDG value shown with asterisks.</i>
LOCAL	GRN	WHT	THS-A HDT	GNS-A,D,F,P,R GGA-1,2,3,4,5 GLL-A,D and (status: A) RMC-A,D,F,P,R and (status: A) *1	VBW-A VHW	VTG-A,D,P	Same as corresponding indication in SYSTEM.
	YEL	WHT		DGPS update interval in GGA, GNS sentence is higher than 10 seconds. RAIM error in GBS sentence is longer than 10 m. *2			Same as corresponding indication in SYSTEM.
	YEL-ORG	YEL-ORG		GNS-M,S GGA-7,8 GLL-M,S RMC-M,S	VBW-V	VTG-E,M,S RMC-E,M,S or (status: V)	Same as corresponding indication in SYSTEM.
	GRN (***)	WHT	THS-E, M, S, N	GNS-N, GGA-N, GLL-N, RMC-N or (status: V) *3		VTG-N RMC-N	Same as corresponding indication in SYSTEM.
MANUAL	YEL	YEL (MAN) (DR)	Manual setting value (Type A or B) Correction setting value (Local setting)	Manual setting value (Dead Reckoning) GNS-E GGA-6 GLL-E RMC-E	Manual setting value		 <i>HDG, SPD and POSN values and "MAN" in yellow characters.</i>

*1: Navigational status in RMC, GNS sentence shown in "S" only (IEC 61162-1 ed4).

*2: Navigational status in RMC, GNS sentence shown in "C", "U" only (IEC 61162-1 ed4).

*3: Navigational status in RMC, GNS sentence shown in "V" only (IEC 61162-1 ed4).

*4: Navigational status in RMC sentence shown in "V" only (IEC 61162-1 ed4).

*5: "CORR1" replaces "MAN" in case of heading offset.

SPECIFICATIONS OF MARINE RADAR/ARPA FAR-32x0/33x0 SERIES

1 ANTENNA RADIATOR

1.1 Type Slotted waveguide array

1.2 Beam width and sidelobe attenuation

Radiator type	X-band			S-band
	XN12CF	XN20CF	XN24CF	SN36CF
Length	4 ft	6.5 ft	8 ft	12 ft
Horizontal beam width	1.9°	1.23°	0.95°	1.8°
Vertical beam width	20°			25°
Sidelobe within ±10°	-24 dB	-28 dB	-28 dB	-24 dB
Sidelobe outside ±10°	-30 dB	-32 dB	-32 dB	-30 dB

1.3 Polarization Horizontal

1.4 Rotation 24 rpm or 42 rpm (for high speed craft)

2 TRANSCEIVER

2.1 TX Frequency and modulation

X-band (Magnetron) 9410 MHz ±30 MHz, P0N

S-band

Magnetron radar 3050 MHz ±30 MHz, P0N

Solid state radar CH1: 3043.75 MHz (P0N)/ 3063.75 MHz ±5 MHz (Q0N) or
CH2: 3053.75 MHz (P0N)/ 3073.75 MHz ±5 MHz (Q0N)

2.2 Output power

FAR-3210/3310 12 kW

FAR-3220/3320/3320W 25 kW

FAR-3230S/3330S/3330SW 30 kW

FAR-3230S-SSD/3330S-SSD 250 W (equivalent to magnetron radar 30 kW)

2.3 Transmitter

Magnetron radar FAR-3210/3310/3220/3320(W)/3230S/3330S(W)

Solid state radar FAR-3230S-SSD/3330S-SSD

2.4 Pulselength, Pulse Repetition Rate and Range scale

Magnetron radar:

Range	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
S1	3000*	0.07 μs																		
S2	3000*			0.15 μs																
M1	1500				0.3 μs															
M2	1200						0.5 μs													
M3	1000								0.7 μs											
L	600**										1.2 μs									

1/2/4/8/16/32/72/120 NM ranges: non-IMO radar only

*: 2200 Hz with TT range on 32 NM.

** : 500 Hz on 96 NM range.

Solid state radar: Pulselength of P0N/Q0N

Range	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				
S1	2400*	0.07/5.0 μs																						
S2	2000*			0.18/7.5 μs																				
M1	1500				0.3/12.5 μs																			
M2	1060						0.5/17.5 μs																	
M3	1000								0.7/18.3 μs															
L	600										1.2/18.3 μs													

1/2/4/8/16/32/72/120 NM ranges: non-IMO radar only

*: 1800 Hz (S1) and 1500 Hz (S2) with TT range on 32 NM.

3 PROCESSOR UNIT

- 3.1 Minimum range 22 m
- 3.2 Range discrimination 26 m
- 3.3 Range accuracy 1% of the maximum range of the scale in use or 10 m, whichever is the greater
- 3.4 Bearing discrimination 2.1° (XN12CF), 1.5° (XN20CF), 1.2° (XN24CF), 2.0° (SN36CF)
- 3.5 Bearing accuracy $\pm 1^\circ$
- 3.6 Range scale and Range ring interval (RI)

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

32	48	72	96	120
8	8	12	16	20
4	6	6	6	6

- 3.7 Warm-up time 3 min. approx. (solid state radar excluded)
- 3.8 Orientation mode Head-up RM, STAB head-up RM, Course-up RM, North-up RM
North-up TM, Stern-up RM
- 3.9 Stabilization mode Ground or sea stabilization
- 3.10 Target tracking (TT) Auto or manual acquisition: 200 targets in 32 NM
Auto tracking on all acquired targets,
Past position: 5/10 pts on all activated targets
Vector time: Off, 30 s, 1-60 min
- 3.11 AIS Capacity: 2000 targets,
Past position: 5/10 pts on all activated targets
Vector time: Off, 30 s, 1-60 min
- 3.12 Radar map 10 maps, 4,000 pts per map
- 3.13 Acquisition zone 2 zones

4 MONITOR UNIT

- 4.1 Display Color LCD, raster-scan non-interlace, daylight display
- 4.2 Screen size
MU-190 19-inch, 376.32 x 301.06 mm, SXGA (1280 x 1024 pixel)
MU-231 23.1-inch, 470.40 x 352.80 mm, UXGA (1600 x 1200 pixel)
- 4.3 Brightness 450 cd/m² typical (MU-190), 400 cd/m² typical (MU-231)

- 4.4 Effective radar diameter 264.6 mm (MU-190), 335.2 mm (MU-231)
- 4.5 Visible distance 1.02 m nominal

5 INTERFACE

5.1 Processor unit (EC-3000)

Serial I/O	7 ports (IEC61162-1/2: 2 ports, IEC61162-1: 5 ports)
Input	ABK, ACK, ACM, ACN, ALR, CUR, DBT, DPT, DTM, GGA, GLL, GNS, HBT, HDT, MTW, MWV, RMC, THS, VBW, VDM, VDO, VDR, VHW, VTG, ZDA
Output	ABM, ACK, ALC, ALF, ALR, ARC, BBM, EVE, HBT, OSD, RSD, TLB, TTD, TTM, VSD
Digital input	1 channel: contact signal, 100 ohm max. or 24VDC input
Alarm output	6 channels: contact signal, load current 250 mA Normal close: 2, Normal open: 2, System fail: 1, Power fail: 1
DVI output	2 ports: DVI-D (DVI 1/2), 1 port: DVI-I or RGB (DVI 3)
USB	4 ports (3 ports for control units)
LAN	2 ports: Ethernet 1000Base-T for network equipment and sensor adapter

5.2 Sensor adapter (option)

MC-3000S (serial)	8 ports: I/O, IEC61162-1/2: 4 ports, IEC61162-1: 4 ports
MC-3010A (analog)	3 ports: Input, -10 to +10 V, 0 to 10 V or 4 to 20 mA
MC-3020D (digital-in)	3 ports: relay contact, logics set from program
MC-3030D (digital-out)	3 ports: relay contact, normal open and normal close available

6 POWER SUPPLY

6.1 Power supply unit (w/ antenna and transceiver unit)

FAR-3210/3310 (X-band, 12 kW)

PSU-014 (24rpm) 100-230 VAC: 2.0-1.0 A, 1 phase, 50-60 Hz

PSU-014 (42rpm) 100-230 VAC: 2.4-1.1 A, 1 phase, 50-60 Hz

FAR-3220/3320/3320W (X-band, 25 kW)

PSU-014 (24rpm) 100-230 VAC: 2.4-1.2 A, 1 phase, 50-60 Hz

PSU-014 (42rpm) 100-230 VAC: 3.7-1.6 A, 1 phase, 50-60 Hz

FAR-3230S/3330S/3330SW (S-band, magnetron)

PSU-014 (24rpm) 100-230 VAC: 3.7-1.6 A, 1 phase, 50-60 Hz

PSU-015 (42rpm) 100-230 VAC: 6.4-2.7 A, 1 phase, 50-60 Hz

FAR-3230S-SSD/3330S-SSD (S-band, SSD)

PSU-016 (24rpm) 100-230 VAC: 2.8-1.4 A, 1 phase, 50-60 Hz

PSU-018 (42rpm) 100-230 VAC: 5.6-2.5 A, 1 phase, 50-60 Hz

6.2 Processor unit (EC-3000) 100-115/220-230 VAC: 1.5/0.7 A, 1 phase, 50-60 Hz

6.3 Monitor unit

MU-190 100-230 VAC: 0.7-0.4 A, 1 phase, 50-60 Hz

MU-231 100-230 VAC: 1.0-0.6 A, 1 phase, 50-60 Hz

6.4 Sensor adapter (option) 24 VDC: 1.4 A (for 11 units), input to MC-3000S, the sources of other sensor adapters are fed from MC-3000S

- 6.5 Switching HUB (option)
HUB-3000 100-230 VAC: 0.1 A max. 1 phase, 50/60 Hz
HUB-100 100-230 VAC: 0.1 A max. 1 phase, 50/60 Hz
- 6.6 Transformer (RU-1803, option) 440 VAC, 1 phase, 50/60 Hz
- 6.7 De-icer (option) 100-115/220-230 VAC: 2.6/1.3 A, 1 phase, 50-60 Hz

7 ENVIRONMENTAL CONDITIONS

- 7.1 Ambient temperature
Antenna unit -25°C to +55°C (storage: -25°C to +70°C)
Indoor units -15°C to +55°C
- 7.2 Relative humidity 95% or less at +40°C
- 7.3 Degree of protection
Antenna unit IP56
Processor unit IP20 (IP22: option)
Sensor adapter IP20 (IP22: option)
Transceiver unit IP20
HUB HUB-100: IP20, HUB-3000: IP22
Control/ monitor/ power supply unit IP22
- 7.4 Vibration IEC 60945 Ed.4

8 UNIT COLOR

- 8.1 Antenna unit N9.5
- 8.2 Power supply unit N2.5
- 8.3 Processor unit N2.5
- 8.4 Control/ monitor unit N2.5
- 8.5 Transceiver unit N2.5
- 8.6 HUB HUB-100: N3.0, HUB-3000: N2.5

9 PERFORMANCE MONITOR

- 9.1 PM-32 (X-band)
Frequency range 9380 to 9440 MHz
Input power +18 dBm to +30 dBm
Output power -21 dBm (1st pulse max. output), -41 dBm (1st pulse min. output)
Step level 8 to 12 dB (1st pulse to last pulse)
- 9.2 PM-52A (S-band, MAG)
Frequency range 3040 to 3080 MHz
Input power +25 dBm to +40 dBm
Output power -38 dBm (1st pulse max. output), -58 dBm (1st pulse min. output)
Step level 8 to 12 dB (1st pulse to last pulse)
- 9.3 PM-52B (S-band, SSD)
Frequency range 3063.75 ±2 MHz
Input power +5 dBm to +25 dBm
Output power -52 dBm (1st pulse max. output), -72 dBm (1st pulse min. output)
Step level 8 to 12 dB (1st pulse to last pulse)

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Declaration of Conformity



0735

We **FURUNO ELECTRIC CO., LTD.**

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

MARINE RADAR FAR-3xx0

(Model name, type number)

to which this declaration relates conforms to the following standard(s) or normative document(s)

IMO Resolution A.278(VIII)
IMO Resolution A.694(17)
IMO Resolution A.820(19)
IMO Resolution A.823(19)
IMO Resolution MSC.191(79)
IMO Resolution MSC.192(79)
ITU-R M.628-3
ITU-R M.1177-3
2000 HSC Code 13

IEC 60945 Ed. 4.0: 2002
IEC 61162-1 Ed. 4.0: 2010
IEC 61162-2 Ed. 1.0: 1998
IEC 62288 Ed. 1.0: 2008
IEC 62388 Ed. 2.0: 2013

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- EC Type Examination (Module B) Certificate No. MED-B-8886 and MED-B-8966 (high speed craft) issued by DET NORSKE VERITAS (DNV), Norway.
- EC Quality System (Module D) Certificate No. BSH/4613/02208/2345/12 issued by Federal Maritime and Hydrographic Agency (BSH), The Federal Republic of Germany.

This declaration is issued according to the provisions of European Council Directive 96/98/EC on marine equipment modified by Commission Directive 2012/32/EU and 2013/52/EU.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
April 14, 2014

(Place and date of issue)

Yoshitaka Shogaki
Department General Manager
Quality Assurance Department

(name and signature or equivalent marking of authorized person)