

9. GPS OPERATION

If the FURUNO GPS Navigator GP-320B is connected to this radar, you can set GP-320B from this radar.

9.1 Navigator Mode

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [GPS] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [Mode] and press the **ENTER** key.



Mode options

4. Use the Cursorpad (▲ or ▼) to select [GPS] or [WAAS] then press the **ENTER** key.
5. Press the **MENU/ESC** key to close the menu.

9.2 Datum

Select the type of datum which matches the paper charts you use for navigation. Select [WGS-84] if the radar is connected to an AIS Transponder.

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [GPS] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [Datum] and press the **ENTER** key.



Datum options

4. Use the Cursorpad (▲ or ▼) to select the type of datum and press the **ENTER** key. If you select [WGS-84] or [Tokyo], go to step 7. If you select [Other], go to the next step.
5. Use the Cursorpad (▲ or ▼) to select [Datum No] and press the **ENTER** key.



Datum No setting window

6. Use the Cursorpad (▲ or ▼) to select the datum number and press the **ENTER** key. (The setting range is 001 - 192 and 201 - 254. Refer to the appendix 2 "GEO-DETTIC CHART LIST".)
7. Press the **MENU/ESC** key to close the menu.

9.3 WAAS Setup

Geostationary satellites, the type used with WAAS, provide more accurate position data when compared to GPS. These satellites can be tracked automatically or manually. Auto tracking automatically searches for the best geostationary satellite from your current position.

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [GPS] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [WAAS] and press the **ENTER** key.



WAAS options

4. Use the Cursorpad (▲ or ▼) to select [Auto] or [Manual] then press the **ENTER** key. If you select [Auto], go to step 7. If you select [Manual], go to the next step.
5. Use the Cursorpad (▲ or ▼) to select [WAAS No] and press the **ENTER** key.



WAAS No setting window

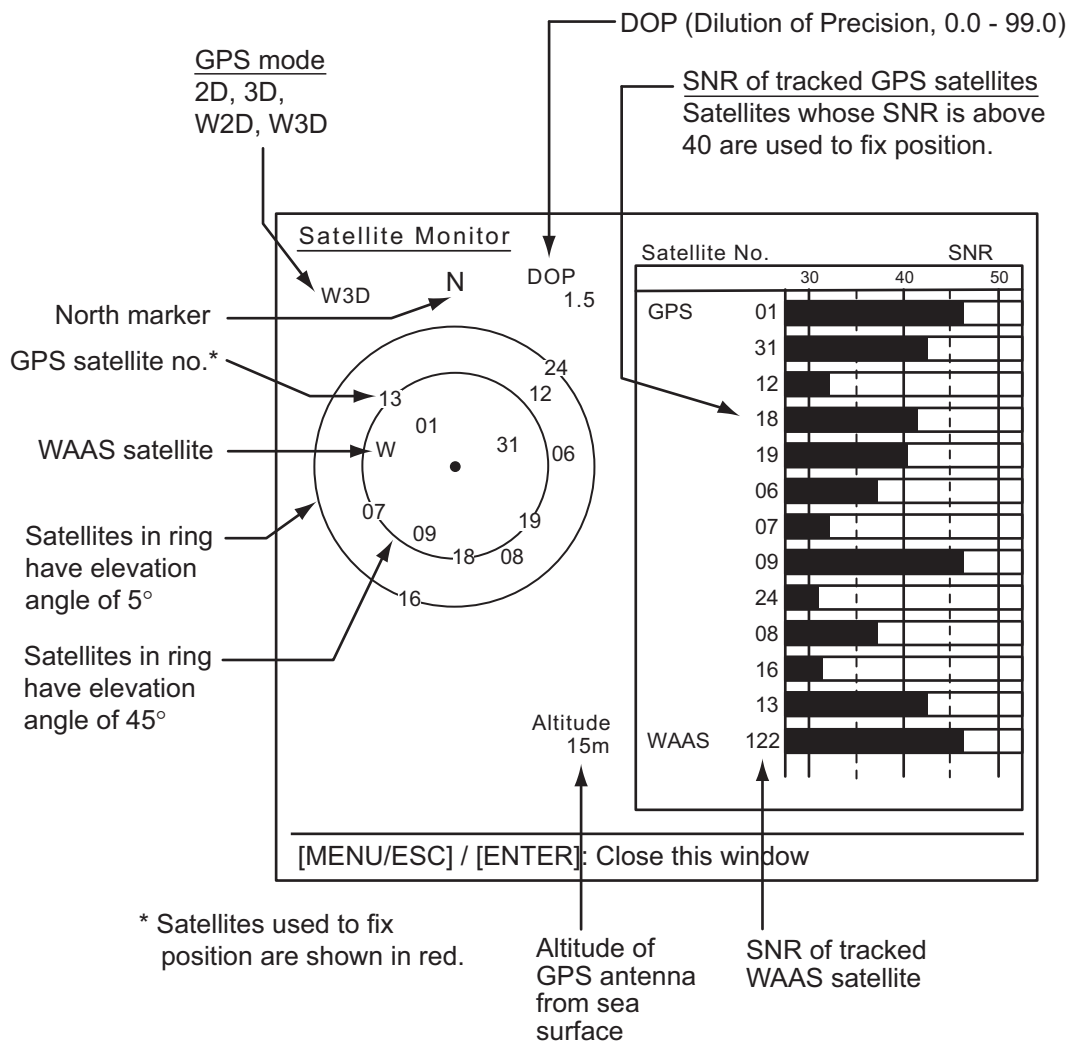
6. Use the Cursorpad (▲ or ▼) to select WAAS number and press the **ENTER** key. (The setting range is 120 - 158. Refer to the following table.)
7. Press the **MENU/ESC** key to close the menu.

Provider	Satellite type	Longitude	Satellite No.
WAAS	Inmarsat-3-F4 (AOR-W)	142°W	122
	Inmarsat-3-F3 (POR)	178°E	134
	Intelsat Galaxy XV	133°W	135
	TeleSat Anik F1R	107.3°W	138
EGNOS	Inmarsat-3-F2 (AOR-E)	15.5°W	120
	Artemis	21.5°E	124
	Inmarsat-3-F5 (IOR-W)	25°E	126
MSAS	MTSAT-1R	140°E	129
	MTSAT-2	145°E	137

9.4 Satellite Monitor

The Satellite Monitor provides the information about GPS and WAAS satellites. See your GPS navigator's owner's manual for detailed information.

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [GPS] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [Satellite Monitor] and press the **ENTER** key.

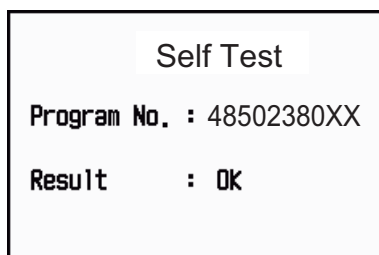


Satellite monitor

4. Press the **ENTER** key to close only the satellite monitor display.

9.5 Self Test

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [GPS] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [Self Test] and press the **ENTER** key.



XX: Program No.
(Program No. subject to change
depending on GPS Navigator.)

Self Test display

[Program No.]: 10 digit number

[Result]: The result of the test, [OK] or [NG] (No Good). If NG appears, try the self test again. If it appears again, contact your dealer for advice.

4. Use the Cursorpad (▲ or ▼) to select WAAS number and press the **ENTER** key.
(The setting range is 120 - 158. Refer to the following table.)
5. Press the **MENU/ESC** key to close the menu.

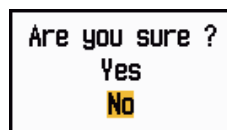
9.6 Cold Start

Cold start, which clears the Almanac from the GPS receiver, can be necessary in the following conditions:

- If you have turned off the power of the GPS receiver for a long time.
- The ship has moved far away from the previous fixing position (e.g., more than 500 km).
- Other reason that prevents the receiver from finding its position within five minutes after you turn on the power.

To do cold start, do the following:

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [GPS] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [Cold Start] and press the **ENTER** key.



Cold Start options

4. Use the Cursorpad (▲) to select [Yes] and press the **ENTER** key. After processing cold start, the long beep sounds. (To stop cold start, press the **MENU/ESC** key instead of the **ENTER** key.)
5. Press the **MENU/ESC** key to close the menu.

10. MAINTENANCE, TROUBLE-SHOOTING

This chapter has information about maintenance and troubleshooting that the user can follow to care for the equipment.

 WARNING	
	ELECTRICAL SHOCK HAZARD Do not open the equipment. Only qualified personnel can work inside the equipment.
	Turn off the power before you service the antenna unit. Post a warning sign near the power switch indicating that the power should be left off while you are servicing the antenna unit.
	Prevent the potential risk of being struck by the rotating antenna and exposure to RF radiation hazard.
	When you work on the antenna unit, wear a safety belt and hard hat. Serious injury or death can result if a person falls from the radar antenna mast.

NOTICE
Do not apply paint, anti-corrosive sealant or contact spray to plastic parts or equipment coating. Those items contain products that can damage plastic parts and equipment coating.

10.1 Preventive Maintenance

Regular maintenance helps keep your equipment in good condition and prevents future problems. Check the items shown in the table below to help keep your equipment in good condition for years to come.

Maintenance

Interval	Item	Check point	Remedy
When necessary	LCD	Dust on the LCD	Remove the dust from the LCD with the tissue paper and an LCD cleaner. To remove dirt or salt, use the LCD cleaner. Change the tissue paper often so as not to scratch the LCD.
3 to 6 months	Ground terminal on display unit	Check for tight connection and rust.	Tighten or replace as necessary.
	Display unit connectors	Check for tight connection.	Tighten if the connectors are loosened.
	Exposed nuts and bolts on the antenna unit	Check for corroded or loosened bolts.	Clean and repaint as necessary. Use sealing compound instead of paint.
	Antenna radiator	Check for dirt and cracks on the radiator surface.	Clean radiator surface with fresh-water-moistened cloth. Do not use plastic solvents to clean.

10.2 Fuse Replacement

The fuse on the power cable protects the equipment from overcurrent and equipment fault. If the fuse blows, find the cause before you replace the fuse. Use the correct fuse. A wrong fuse can damage the equipment.


WARNING

Use the correct fuse.

A wrong fuse can damage the equipment and cause fire.

Unit	Type	Code No.	Remarks
Display unit (fitted on power cable)	FRU-2P5S-FU-5A-B	000-168-869-10	12-24 VDC

10.3 Magnetron Life

When the life of the magnetron is reached, the targets do not appear on the display. If long-range performance appears to have decreased, contact a FURUNO agent or dealer about replacement of the magnetron. The magnetron changes with the type of antenna unit.

Part	Magnetron type	Code No.	Estimated life
Magnetron	E3571	000-146-867-11	Approx. 2,000 hours

10.4 Simple Troubleshooting

This section provides simple troubleshooting procedures which the user can follow to restore normal operation. If you cannot restore normal operation, do not check inside the unit. Have a qualified technician check the equipment.

Simple troubleshooting

Problem	Remedy
You cannot turn on the power.	• Check for blown fuse. • Check that the power connector is fastened. • Check for corrosion on the power cable connector. • Check for damaged power cable. • Check battery for correct voltage output.
There is no response when a key is pressed.	Turn off and on the power. If you do not get a response, the key is damaged. Contact your dealer for instructions.
The power is on and you operated the power key to transmit. The marks and letters appear, but no echo appears.	Check that the antenna cable is fastened.
Tuning is correctly adjusted, but sensitivity is poor.	Replace the magnetron. Contact your dealer.
The range is changed, but radar picture does not change.	• Try to change the range again. • Turn off and on the display unit.
Poor discrimination in range because of many echoes from the waves.	Adjust the sea clutter
The true motion presentation is not working correctly.	• Check that the setting of [Display Mode] in the [Display] menu is set to [True Motion]. • Check if the heading and position data are input and correct.
The range rings are not displayed.	Check that the setting of [Rings Brill] in the [Brill/Color] menu is set to other than [Off].
Target is not tracked correctly because of sea clutter.	Adjust the sea clutter and rain clutter.

10.5 Advanced-level Troubleshooting

This section describes how to cure hardware and software troubles which the qualified service persons must do.

Advanced-level troubleshooting

Problem	Probable cause or check points	Remedy
Power cannot be turned on.	1) Mains voltage/polarity 2) Power supply board	1) Correct the wiring and input voltage. 2) Replace power supply board.
Brilliance adjusted but no picture.	1) SPU Board	1) Replace SPU board.
Antenna not rotating.	1) Antenna drive mechanism	1) Replace the antenna drive mechanism.
Data and marks not displayed in transmit.	1) SPU board	1) Replace SPU board.
Set [GAIN] to maximum with [SEA] set at minimum. Marks and indications appear but no noise or echo.	1) Signal cable between antenna and display unit 2) IF amplifier 3) Video amplifier board	1) Check continuity and isolation of coaxial cable. 2) Replace IF amplifier. 3) Check coax line for fasten connection. If connection is good, replace SPU board.
Marks, indications and noise appear but no echo. (Transmission leak representing your ship position is absent.)	1) Magnetron 2) Modulator board 3) SPU board	1) Check magnetron current. 2) Replace modulator board. 3) Replace SPU board.
Picture not updated or picture freeze-up.	1) Bearing signal generator 2) SPU board 3) Video freeze-up	1) Check that signal cables are fastened. 2) Replace SPU board. 3) Turn off and on the radar.
Radar is correctly tuned but sensitivity is poor.	1) Dirt on radiator face 2) Deteriorated magnetron 3) Detuned MIC	1) Clean radiator. 2) Check the magnetron current with the radar transmitting on 48 nm range. If the current is below normal, magnetron may be defective. Replace the magnetron. 3) Check MIC detecting current. If MIC detecting current is below normal value, MIC may have become detuned.

10. MAINTENANCE, TROUBLESHOOTING

Problem	Probable cause or check points	Remedy
Range changed but radar picture does not change.	1) Faulty RANGE knob. 2) SPU board 3) Video freeze-up	1) Try to rotate the RANGE knob. If you can not operate the RANGE knob, replace the knob. 2) Replace SPU board. 3) Turn off and on radar.
Range rings are not displayed.	1) Adjust their brilliance on the [Brill/Color] menu. 2) SPU Board	1) Replace associated circuit board if unsuccessful. 2) Replace SPU Board.

10.6 Diagnostic Test

The diagnostic test checks the system for correct operation. This test is for use by service technicians, but the user can do this test to provide the service technician with information.

1. Press the **MENU** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [Tests] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [Self Test] and press the **ENTER** key.

[SELF TEST]

ROM : OK
 RAM : OK
 NMEA1 : --
 NMEA2 : --
 LAN : OK
 APPLICATION VERSION: 03589375-XX.XX
 FPGA VERSION : 0359372-XX.XX
 IP ADDRESS : XXX.XX.X.XX
 MAC ADDRESS : XX-XX-XX-XX-XX-XX

POWER SUPPLY : 24.0 V
 TEMPERATURE : 0 °C

INPUT NMEA			
BWC: OK	BWR: --	DBT: --	DPT: OK
GGA: --	GLL: OK	GNS: --	HT: --
HDG: OK	HDM: --	HDT: OK	THS: --
MTW: OK	MWV: --	RMB: OK	RMC: OK
VHW: --	VTG: OK	VWT: --	VWR: OK
XTE: OK	ZDA: OK		

Key, buzzer, knob control and cursorpad check

[MENU/ESC] x 3: Exit [FUNC]: Alarm Test

XX.XX: Program version no.

Self Test screen

Test results

- [ROM], [RAM]: The results of the ROM and RAM test are displayed as [OK] or [NG] (No Good).
- [NMEA1], [NMEA2]: The results of the ports NMEA1 and NMEA2 are displayed as OK or "- -". Ports NMEA1 and NMEA2 require a special connector to test them. When a special connector is not connected, "- -" is shown. If "- -" is displayed with a special connector, contact your dealer for instruction.
- [LAN]: LAN check results, [OK] or [NG].

10. MAINTENANCE, TROUBLESHOOTING

- [APPLICATION VERSION], [FPGA VERSION]: The program numbers and program version numbers (XX.XX) are displayed.
- [IP ADDRESS]: IP address of the equipment is shown.
- [MAC ADDRESS]: IMAC address of the equipment is shown.
- [POWER SUPPLY]: The voltage of the power supply is shown.
- [INPUT NMEA] window: The condition of all the NMEA sentences being input to this radar are displayed as OK or "-". "-" means no data input. Sentences are updated every second.

Key check

Press each key one by one. A key's on-screen location becomes green if the key is normal.

Buzzer check

The **FUNC** key tests on/off for the panel buzzer or external buzzer. To stop the buzzer, press the **FUNC** key again.

Knob control check

Rotate each control knob. The digit to the right of the control icon increments or decrements with control operation. Push each knob. The knob corresponding on-screen circle changes in green if the knob is normal.

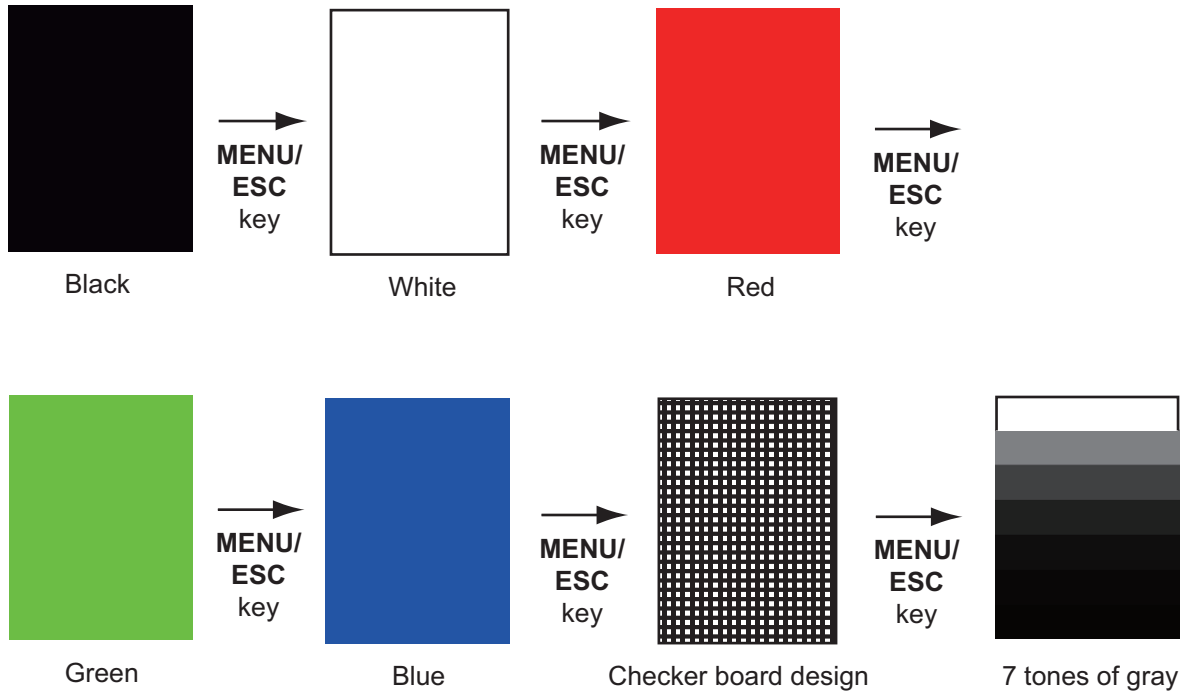
Cursorpad check

Press each arrow and diagonal dot one by one. The on-screen location changes in green if the key is normal.

4. Press the **MENU/ESC** key three times to escape from the test.
5. Press the **MENU/ESC** key to close the menu.

10.7 LCD Test

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [Tests] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [LCD Pattern] and press the **ENTER** key.



4. Press the **MENU/ESC** key several times to close the menu.

Note 1: You can cancel the test at any time when you press the **MENU/ESC** key.

Note 2: You can adjust the screen brilliance with the  key during the test.

10.8 Radar Sensor Test

This test checks the antenna unit DRS4DL (RSB-127) for proper operation.

1. Press the **MENU/ESC** key to open the menu.
2. Use the Cursorpad (▲ or ▼) to select [Tests] and press the **ENTER** key.
3. Use the Cursorpad (▲ or ▼) to select [Radar Sensor Test] and press the **ENTER** key.

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[ RADAR SENSOR TEST ]
BOOTER VERSION      : --
APPLICATION VERSION: --
FPGA VERSION        : --
IP ADDRESS           : --
MAC ADDRESS          : --
ROM                  : --
RAM                  : --
TX-HV                : -- V
5V                   : -- V
12V                  : -- V
ANTENNA STATUS       : --
HEADING PULSE        : --
TX TRIGGER           : --
VIDEO STATUS         : --
ANTENNA ROTATION     : -- rpm
TUNING VOLTAGE       : -- V
TUNE INDICATOR       : --
TOTAL ON TIME        : -- H
TOTAL TX TIME        : -- H
MAGNETRON MONITOR    : -- V

TT ECHO              : --
TT LAND ECHO         : --

[MENU/ESC]: Exit

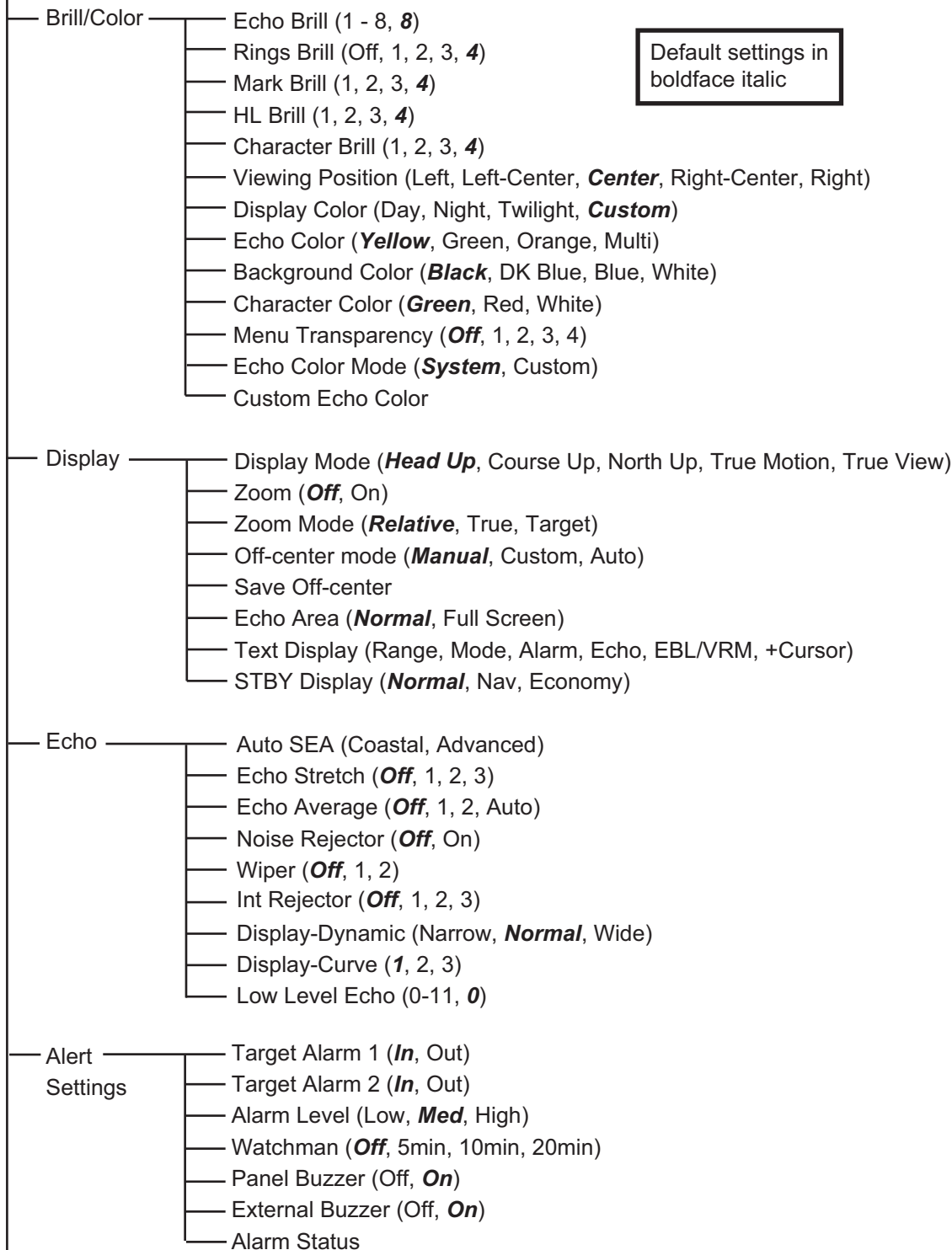
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Radar sensor test

4. Press the **MENU/ESC** key three times to close the test screen.

APPENDIX 1 MENU TREE

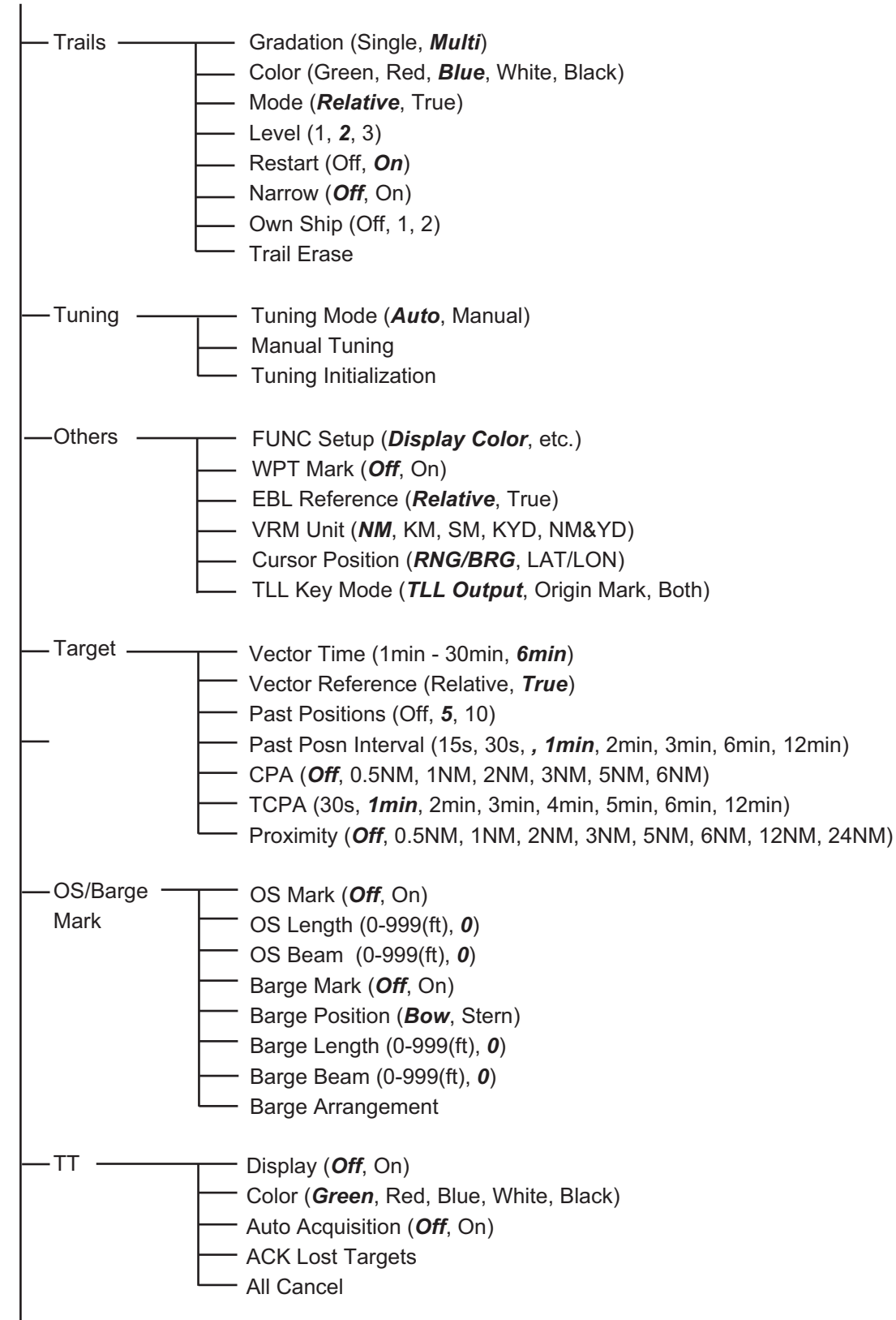
MENU/ESC key



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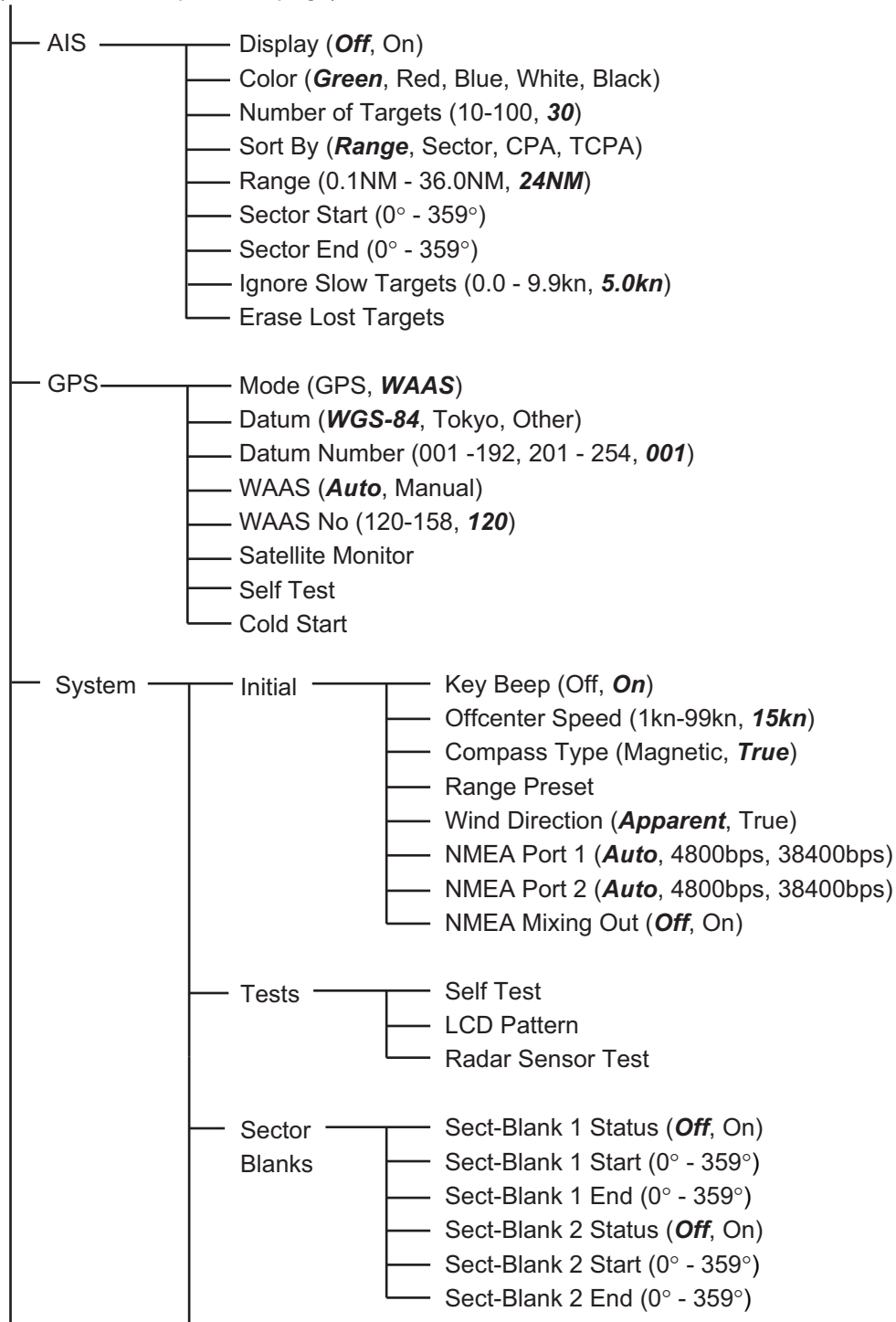
APPENDIX 1 MENU TREE

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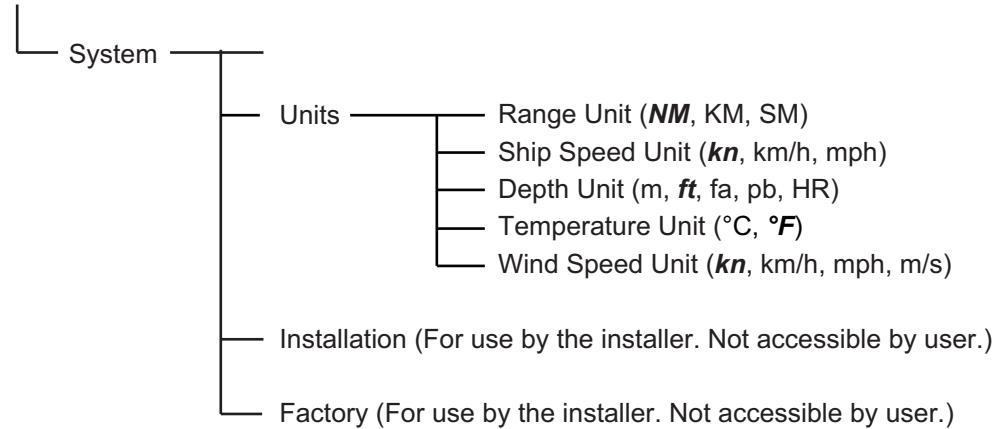
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APPENDIX 1 MENU TREE

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APPENDIX 2 GEODETIC CHART LIST

001: WGS84		091: NORTH AMERICAN 1927BH	: Bahamas (excl. San Salvador Is.)
002: WGS72		092: NORTH AMERICAN 1927SS	: Bahamas, San Salvador Is.
003: TOKYO	: Mean Value (Japan, Korea & Okinawa)	093: NORTH AMERICAN 1927CN	: Canada (incl. Newfoundland Is.)
004: NORTH AMERICAN 1927	: Mean Value (CONUS)	094: NORTH AMERICAN 1927AB	: Alberta & British Columbia
005: EUROPEAN 1950	: Mean Value	095: NORTH AMERICAN 1927EC	: East Canada
006: AUSTRALIAN GEODETIC 1984	: Australia & Tasmania	096: NORTH AMERICAN 1927MO	: Manitoba & Ontario
007: ADINDAN-MN	: Mean Value (Ethiopia & Sudan)	097: NORTH AMERICAN 1927NE	: Northwest Territories & Saskatchewan
008: ADINDAN-E	: Ethiopia	098: NORTH AMERICAN 1927YK	: Yukon
009: ADINDAN-MA	: Mali	099: NORTH AMERICAN 1927CZ	: Canal Zone
010: ADINDAN-SE	: Senegal	100: NORTH AMERICAN 1927CR	: Caribbean
011: ADINDAN-SU	: Sudan	101: NORTH AMERICAN 1927CA	: Central America
012: AFG	: Somalia	102: NORTH AMERICAN 1927CU	: Cuba
013: AIN EL ABD 1970	: Bahrain Is.	103: NORTH AMERICAN 1927GR	: Greenland
014: ANNA 1 ASTRO 1965	: Cocos Is.	104: NORTH AMERICAN 1927MX	: Mexico
015: ARC 1950-MN	: Mean Value	105: NORTH AMERICAN 1983AK	: Alaska
016: ARC 1950-B	: Botswana	106: NORTH AMERICAN 1983CN	: Canada
017: ARC 1950-L	: Lesotho	107: NORTH AMERICAN 1983CS	: CONUS
018: ARC 1950-M	: Malawi	108: NORTH AMERICAN 1983MX	: Mexico, Central America
019: ARC 1950-S	: Swaziland	109: OBSERVATORIO 1966	: Corvo & Flores Is. (Azores)
020: ARC 1950-ZR	: Zaire	110: OLD EGYPTIAN 1930	: Egypt
021: ARC 1950-ZM	: Zambia	111: OLD HAWAIIAN-MN	: Mean Value
022: ARC 1950-ZB	: Zimbabwe	112: OLD HAWAIIAN-HW	: Hawaii
023: ARC 1960-MN	: Mean Value (Kenya & Tanzania)	113: OLD HAWAIIAN-KA	: Kauai
024: ARC 1960-K	: Kenya	114: OLD HAWAIIAN-MA	: Maui
025: ARC 1960-T	: Tanzania	115: OLD HAWAIIAN-OA	: Oahu
026: ASCENSION IS. 1958	: Ascension Is.	116: OMAN	: Oman
027: ASTRO BEACON "E"	: Iwo Jima Is.	117: ORDNANCE SURVEY OF GREAT BRITAIN 1936-NM	: Mean Value
028: ASTRO B4 SOR. ATOLL	: Tern Is.	118: ORDNANCE SURVEY OF GREAT BRITAIN 1936-E	: England
029: ASTRO POS 71/4	: St. Helena Is.	119: ORDNANCE SURVEY OF GREAT BRITAIN 1936-IM	: England, Isle of Man & Wales
030: ASTRONOMIC STATION 1952	: Marcus Is.	120: ORDNANCE SURVEY OF GREAT BRITAIN 1936-SSI	: Scotland & Shetland Is.
031: AUSTRALIAN GEODETIC 1966	: Australia & Tasmania	121: ORDNANCE SURVEY OF GREAT BRITAIN 1936-WL	: Wales
032: BELLEVUE (IGN)	: Efate & Erromango Is.	122: PICO DE LAS NIVIES	: Canary Is.
033: BERMUDA 1957	: Bermuda Is.	123: PITCAIRN ASTRO 1967	: Pitcairn Is.
034: BOGOTA OBSERVATORY	: Columbia	124: PROVISIONS SOUTH CHILEAN 1963: South Chile (near 53°S)	
035: CAMPO INCHAUSPE	: Argentina	125: PROVISIONAL SOUTH AMERICAN 1956MN: Mean Value	
036: CANTON IS. 1966	: Phoenix Is.	126: PROVISIONAL SOUTH AMERICAN 1956BO: Bolivia	
037: CAPE	: South Africa	127: PROVISIONAL SOUTH AMERICAN 1956NC: Chile-Northern Chile (near 19°S)	
038: CAPE CANAVERAL	: Mean Value (Florida & Bahama Is.)	128: PROVISIONAL SOUTH AMERICAN 1956SC: Chile-Southern Chile (near 43°S)	
039: CARTHAGE	: Tunisia	129: PROVISIONAL SOUTH AMERICAN 1956CO: Columbia	
040: CHATHAM 1971	: Chatham Is. (New Zealand)	130: PROVISIONAL SOUTH AMERICAN 1956EC: Ecuador	
041: CHUA ASTRO	: Paraguay	131: PROVISIONAL SOUTH AMERICAN 1956GY: Guyana	
042: CORREGO ALEGRE	: Brazil	132: PROVISIONAL SOUTH AMERICAN 1956PR: Peru	
043: DJAKARTA (BATAVIA)	: Sumatra Is. (Indonesia)	133: PROVISIONAL SOUTH AMERICAN 1956VN: Venezuela	
044: DOS 1968	: Gizo Is. (New Georgia Is.)	134: PUERTO RICO	: Puerto Rico & Virgin Is.
045: EASTER IS. 1967	: Easter Is.	135: QATAR NATIONAL	: Qatar
046: EUROPEAN 1950-WE	: Western Europe	136: QORNOQ	: South Greenland
047: EUROPEAN 1950-CY	: Cyprus	137: ROME 1940	: Sardinia Is.
048: EUROPEAN 1950-EG	: Egypt	138: SANTA BRAZ	: Sao Miguel, Santa Maria Is. (Azores)
049: EUROPEAN 1950-ESC	: England, Scotland, Channel & Shetland Is.	139: SANTO (DOS)	: Espirito Santo Is.
050: EUROPEAN 1950-EIS	: England, Ireland, Scotland & Shetland Is.	140: SAPPER HILL 1943	: East Falkland Is.
051: EUROPEAN 1950-GR	: Greece	141: SOUTH AMERICAN 1969MN	: Mean Value
052: EUROPEAN 1950-IR	: Iran	142: SOUTH AMERICAN 1969AG	: Argentina
053: EUROPEAN 1950-SA	: Italy, Sardinia	143: SOUTH AMERICAN 1969BO	: Bolivia
054: EUROPEAN 1950-SI	: Italy, Sicily	144: SOUTH AMERICAN 1969BR	: Brazil
055: EUROPEAN 1950-NF	: Norway & Finland	145: SOUTH AMERICAN 1969CH	: Chile
056: EUROPEAN 1950-PS	: Portugal & Spain	146: SOUTH AMERICAN 1969CO	: Columbia
057: EUROPEAN 1979	: Mean Value	147: SOUTH AMERICAN 1969EC	: Ecuador
058: GANDAJIKA BASE	: Republic of Maldives	148: SOUTH AMERICAN 1969GY	: Guyana
059: GEODETIC DATUM 1949	: New Zealand	149: SOUTH AMERICAN 1969PA	: Paraguay
060: GUAM 1963	: Guam Is.	150: SOUTH AMERICAN 1969PR	: Peru
061: GUX 1 ASTRO	: Guadalcanal Is.	151: SOUTH AMERICAN 1969TT	: Trinidad & Tobago
062: HJORSEY 1955	: Iceland	152: SOUTH AMERICAN 1969VZ	: Venezuela
063: HONG KONG 1963	: Hong Kong	153: SOUTH ASIA	: Singapore
064: INDIAN-TV	: Thailand & Vietnam	154: SOUTHEAST BASE	: Porto Santo & Madeira Is.
065: INDIAN-BIN	: Bangladesh, India & Nepal	155: SOUTHWEST BASE	: Faial, Graciosa, Pico, Sao Jorge & Terceira Is.
066: IRELAND 1965	: Ireland	156: TIMBALAI 1948	: Brunei & East Malaysia (Sarawak & Sabah)
067: ISTS 073 ASTRO 1969	: Diego Garcia	157: TOKYO JP	: Japan
068: JOHNSTON IS. 1961	: Johnston Is.	158: TOKYO KP	: Korea
069: KANDAWALA	: Sri Lanka	159: TOKYO OK	: Okinawa
070: KERGUELEN IS.	: Kerguelen Is.	160: TRISTAN ASTRO 1968	: Tristan da Cunha
071: KERTAU 1948	: West Malaysia & Singapore	161: VITI LEVU 1916	: Viti Levu Is. (Fiji Is.)
072: LA REUNION	: Mascarene Is.	162: WAKE-ENIWETOK 1960	: Marshall Is.
073: L. C. 5 ASTRO	: Cayman Brac Is.	163: ZANDERIJ	: Surinam
074: LIBERIA 1964	: Liberia	164: BUKIT RIMPAH	: Bangka & Belitung Is. (Indonesia)
075: LUZON	: Philippines (excl. Mindanao Is.)	165: CAMP AREA ASTRO	: Camp Momurdo Area, Antarctica
076: LUZON-M	: Mindanao Is.	166: G. SEGARA	: Kalimantan Is. (Indonesia)
077: MAHE 1971	: Mahe Is.	167: HERAT NORTH	: Afghanistan
078: MARCO ASTRO	: Salvage Islands	168: HU-TZU-SHAN	: Taiwan
079: MASSAWA	: Eritrea (Ethiopia)	169: TANANARIVE OBSERVATORY 1925	: Madagascar
080: MERCHICH	: Morocco	170: YACARE	: Uruguay
081: MIDWAY ASTRO 1961	: Midway Is.	171: RT-90	: Sweden
082: MINNA	: Nigeria	172: TOKYO	: Mean Value (Japan, Korea & Okinawa)
083: NAHRWAN-O	: Masirah Is. (Oman)	173: AIN EL ABD 1970	: Bahrain Is.
084: NAHRWAN-UAE	: United Arab Emirates	174: ARC 1960	: Mean Value (Kenya, Tanzania)
085: NAHRWAN-SA	: Saudi Arabia	175: ARS-A	: Kenya
086: NAMIBIA	: Namibia		
087: MAPARIMA, BWI	: Trinidad & Tobago		
088: NORTH AMERICAN 1927WU	: Western United States		
089: NORTH AMERICAN 1927EU	: Eastern United States		
090: NORTH AMERICAN 1927AK	: Alaska		

APPENDIX 2 GEODETIC CHART LIST

176: ARS-B	: Tanzania	221: INDIAN 1960	: Con Son Is. (Vietnam)
177: ASCENSION IS. 1958	: Ascension Is.	222: INDIAN 1975	: Thailand
178: CAPE CANAVERAL	: Mean Value (Florida & Bahama Is.)	223: INDONESIAN 1974	: Indonesia
179: EASTER IS. 1967	: Easter Is.	224: CO-ORDINATE SYSTEM 1937 OF ESTONIA	: Estonia
180: EUROPEAN 1950	: Portugal & Spain	225: EUROPEAN 1950	: Malta
181: JHONSTON IS. 1961	: Jhonston Is.	226: EUROPEAN 1950	: Tunisia
182: NAHRWAN	: Saudi Arabia	227: S-42 (PULKOVO 1942)	: Hungary
183: NAPARIMA, BWI	: Trinidad & Tobago	228: S-42 (PULKOVO 1942)	: Poland
184: NORTH AMERICAN 1927	: Caribbeen	229: S-42 (PULKOVO 1942)	: Czechoslovakia
185: OLD HAWAIIAN	: Oahu	230: S-42 (PULKOVO 1942)	: Latvia
186: SAPPER HILL 1943	: East Falkland Is.	231: S-42 (PULKOVO 1942)	: Kazakhstan
187: TIMBALAI 1948	: Brunei & East Malaysia (Sarawak & Sabah)	232: S-42 (PULKOVO 1942)	: Albania
188: TOKYO	: Japan	233: S-42 (PULKOVO 1942)	: Romenia
189: TOKYO	: South Korea	234: S-JTSK	: Czechoslovakia
190: TOKYO	: Okinawa	235: NORTH AMERICAN 1927	: East of 180W
191: WAKE-ENIWETOK 1960	: Marshall Is.	236: NORTH AMERICAN 1927	: West of 180W
192: HU-TZU-SHAN	: Taiwan	237: NORTH AMERICAN 1983	: Aleutian Is.
201: ADINDAN	: Burkina Faso	238: NORTH AMERICAN 1983	: Hawaii
202: ADINDAN	: Cameroon	239: SOUTH AMERICAN 1969	: Baltra, Galapagos Is.
203: ARC 1950	: Burundi	240: ANTIGUA IS. ASTRO 1943	: Antigua, Leeward Is.
204: AYABELLE LIGHTHOUSE	: Djibouti	241: DECEPTION IS.	: Deception Is., Antarctica
205: BISSAU	: Guinea-Bissau	242: FORT THOMAS 1955	: Nevis, St. Kitts, Leeward Is.
206: DABOLA	: Guinea	243: ISTS 061 ASTRO 1968	: South Georgia Is.
207: EUROPEAN 1950	: Tunisia	244: MONTSERRAT IS. ASTRO 1958	: Montserrat, Leeward Is.
208: LEIGON	: Ghana	245: FEUNION	: Mascarene Is.
209: MINNA	: Cameroon	246: AMERICAN SAMOA 1962	: American Samoa Is.
210: M' PORALOKO	: Gebon	247: INDONESIAN 1974	: Indonesia
211: NORTH SAHARA 1959	: Algeria	248: KUSAIE ASTRO 1951	: Caroline Is., Fed. States of Micronesia
212: POINT58	: Mean Solution (Burkina Faso & Niger)	249: WAKE Is. ASTRO 1952	: Wake Atoll
213: POINTE NOIRE 1948	: Congo	250: EUROPEAN 1950	: Iraq, Israel, Jordan, Kuwait, Lebanon, Saudi Arabia, and Syria
214: SIERRA LEONE 1960	: Sierra Leone		
215: VOIROL 1960	: Algeria	251: HERMANN SKOGEL	: Yugoslavia (Prior to 1990) Slovenia, Croatia, Bosnia and Herzegovina, Serbia
216: AIN EL ABD 1970	: Saudi Arabia		
217: INDIAN	: Bangladesh		
218: INDIAN	: India & Nepal	252: INDIAN	: Pakistan
219: INDIAN 1954	: Thailand	253: PULKOVO 1942	: Russia
220: INDIAN 1960	: Vietnam (near 16N)	254: VOIROL 1874	: Tunisia/Algeria

APPENDIX 3 DIGITAL INTERFACE

Input Sentences

All ports common

ALR, BMC, BMR, DBT, DPT, GGA, GLL, GNS, GSA, GSV, HDG, HDM, HDT, MTW, MWV, RMB, RMC, THS, TTM, VDM, VHW, VTG, VWR, VWT, XTE, ZDA

Output Sentences

The NMEA(HDG) port does not handle all output sentences.

ACK, RSD, TLL, TTM

FURUNO Proprietary Sentences

Input: PFEC (GPast, GPstd, GPtst, GPwav, DRtnm, DRtsm, idfnc, pireq)

Output: PFEC (GPclr, GPint, GPpsp, GPset, GPtrq, GPwas, idatr, idfnc, pidat,)

Data Sentences

Input: PFEC (GPast, GPstd, GPtst, GPwav, DRtnm, DRtsm, idfnc, pireq)

Output: PFEC (GPclr, GPint, GPpsp, GPset, GPtrq, GPwas, idatr, idfnc, pidat,)

Sentence Description

ALR-Set Alarm State

\$**ALR,Hhmmss.ss,xxx,A,A,c—c,*hh<CR><LF>
1 2 3 4 5

1. Time of alarm condition change, UTC (000000.00 to 240001.00)
2. Unique alarm number (identifier) at alarm source (000 to 999)
3. Alarm condition (A=threshold exceeded, V=not exceeded)
4. Alarm acknowledge state (A=acknowledged, V=not acknowledged)
5. Alarm description text (alphanumeric)

BMC- Bearing and Distance to Waypoint-Great Circle

\$ GPBWC,hhmmss.ss,llll.ll, a,llll.ll,a,yyy.y,T, yyy.y,M,yyy.y,N,c--c,A,*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13

1. UTC of observation (000000.00 to 240001.00)
2. Waypoint latitude (0.00000 to 9000.00000)
3. N/S
4. Waypoint longitude (0.00000 to 18000.00000)
5. E/W
6. Bearing, degrees true (0.00 to 360.00)
7. Unit, True
8. Bearing, degrees (0.00 to 360.00)
9. Unit, Magnetic
10. Distance, nautical miles (0.000 to 10000)
11. Unit, N
12. Waypoint ID (Max. 13 characters)
13. Mode Indicator (A=Autonomous D=Differential S=Simulator)

APPENDIX 3 DIGITAL INTERFACE

BWR-Bearing Waypoint to Waypoint

\$ GPBWR,hhmmss.ss,llll.ll,a,yyyy.y,T,yyy.y,M,yyy.y,N,c--c,A,*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13

1. UTC of observation (000000.00 to 240001.00)
2. Waypoint latitude (0.00000 to 9000.00000)
3. N/S
4. Waypoint longitude (0.00000 to 18000.00000)
5. E/W
6. Bearing, degrees true (0.00 to 360.00)
7. Unit, True
8. Bearing, degrees (0.00 to 360.00)
9. Unit, Magnetic
10. Distance, nautical miles (0.000 to 10000)
11. Unit, N
12. Waypoint ID (Max. 13 characters)
13. Mode Indicator (A=Autonomous D=Differential S=Simulator)

DBT-Depth Below Transducer

\$**DBT,xxxx.x,f,xxxx.x,M,xxxx.x,F,*hh<CR><LF>
1 2 3 4 5 6

1. Water depth (0.00 to 99999.99)
2. feet
3. Water depth (0.00 to 99999.99)
4. Meters
5. Water depth (0.00 to 99999.99)
6. Fathoms

DPT-Depth

\$**DPT,x.x,x.x,x.x,*hh<CR><LF>
1 2 3

1. Water depth relative to the transducer, meters (0.00 to 99999.99)
2. Offset from transducer, meters (-99.99 to 99.99)
3. Minimum range scale in use (no use)

GGA-Global Positioning System (GPS) Fix Data

\$**GGA,hhmmss.ss,llll.lll,a,yyyyy.yyy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx,*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13 14

1. UTC of position (no use)
2. Latitude (0.00000 to 9000.00000)
3. N/S
4. Longitude (0.00000 to 18000.00000)
5. E/W
6. GPS quality indicator (1 to 5, 8)
7. Number of satellite in use (00 to 99)
8. Horizontal dilution of precision (0.00 to 999.99)
9. Antenna altitude above/below mean sea level (-999.99 to 9999.99)
10. Unit, m
11. Geoidal separation (-999.99 to 9999.99)
12. Unit, m
13. Age of differential GPS data (0 to 99)
14. Differential reference station ID (0000 to 1023)

APPENDIX 3 DIGITAL INTERFACE

HDG-Heading, Deviation and Variation

\$**HDG,x.x,x.x,a,x.x,a*hh<CR><LF>
1 2 3 4 5

1. Magnetic sensor heading, degrees (0.00 to 360.00)
2. Magnetic deviation, degrees (0.0 to 180.00)
3. E/W
4. Magnetic variation, degrees (0.0 to 180.00)
5. E/W

HDM-Heading, Magnetic

\$**HDM,x.x,M*hh<CR><LF>
1 2

1. Heading, degrees (0.00 to 360.00)
2. Magnetic (M)

HDT- HeadingTrue

\$**HDT,xxx.x,T*hh<CR><LF>
1 2

1. Heading, degrees (0.00 to 360.00)
2. True (T)

MTW-Water Temperature

\$**MTW,x.x,C<CR><LF>
1

1. Water temperature, degrees C (-9.999 to 99.999)

RMB-Recommended Minimum Specific Navigation Information

\$GPRMB,A,x.x,L,CCCC,CCCC,xxxx.xx,a,xxxxxx.xx,a,xxx.x,xxx,xx.x,A,a*hh <CR><LF>
1 2 3 4 5 6 7 8 9 10 11 12 13 14

1. Data status (A=Data valid, V=Navigation receiver warning)
2. Cross track error (NM) (0.00 to 9.99)
3. Direction to steer (L/R)
4. Origin waypoint ID
5. Destination waypoint ID
6. Destination waypoint latitude (0.0000 to 9000.000)
7. N/S
8. Destination waypoint longitude (0.0000 to 18000.000)
9. E/W
10. Range to destination, nautical miles (0.000 to 10000)
11. Bearing to destination, degrees true (0.0 to 359.9)
12. Destination closing velocity, knots (-99.9 to 99.9)
13. Arrival status (A=Arrival circle entered or perpendicular passed, V=Not entered/passed)
14. Mode indicator (A= Autonomous D= Differential mode E=Estimated (dead reckoning mode) M=Manual input mode S= Simulator N=Data not valid)

RMC-Recommended Minimum Specific GNSS Data

```
$**RMC,hhmmss.ss,A,lll.ll,a,yyyy.yy,a,x.x,x.x,ddmmyy,x.x,a,a*hh<CR><LF>
      1  2  3  4  5  6  7  8  9  10 11 12 13
```

1. UTC of position fix (000000 - 235959)
2. Status (A=data valid, V=navigation receiver warning)
3. Latitude (0000.00000 - 9000.0000)
4. N/S
5. Longitude (0000.00000 - 18000.0000)
6. E/W
7. Speed over ground, knots (0.00 - 99.94)
8. Course over ground, degrees true (0.0 - 360.0)
9. Date (010100 - 311299)
10. Magnetic variation, degrees E/W (0.00 - 180.0/NULL)
11. E/W
12. Mode indicator (A= Autonomous mode D= Differential mode S= Simulator
F=Float RTK P=Precise R=Real time kinematic E=Estimated (DR) M=Manual)
13. Navigational status indication (S=Safe C=Caution U=Unsafe V=Navigational status not valid)

THS-True Heading and Status

```
$**THS,xxx.x,a*hh<CR><LF>
      1  2
```

1. Heading, degrees True (0.00 to 360.00)
2. Mode indicator (A=Autonomous E=Estimated M=Manual input
S=Simulator V=Data not valid)

TTM-Tracked Target Message

```
$**TTM,05,12.34,23.4,R,45.67,123.4,T,1.23,8.23,N,c--c,T,R,hhmmss.ss,M*hh<CR><LF>
      1  2  3  4  5  6  7  8  9  10 11 12 13  14  15
```

1. Target number (00 to 999)
2. Target distance from own ship (0.000 - 99.999)
3. Bearing from own ship, degrees (0.0 - 359.9)
4. True or Relative (T)
5. Target speed (0.00 - 999.99, null)
6. Target course, degrees (0.0 - 359.9, null)
7. True or Relative
8. Distance of closet point of approach (0.00 - 99.99, null)
9. Time to CPA, min., "-" increasing (-99.99 - 99.99, null)
10. Speed/distance units (N=nm)
11. Target name (null)
12. Target status (L=Lost Q=Acquiring T=Tracking)
13. Reference target (R, NULL otherwise)
14. UTC of data (null)
15. Type of acquisition (A=Automatic M=Manual)

VDM-AIS VHF Data-Link Message

!**VDM,x,x,x,x,s--s,x,*hh<CR><LF>
1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 to 9)
2. Message sentence number (1 to 9)
3. Sequential message identifier (0 to 9, NULL)
4. AIS channel Number (A or B)
5. Encapsulated ITU-R M.1371 radio message (1 - 63 bytes)
6. Number of fill-bits (0 to 5)

VHW- Water Speed and Heading

\$GPVHW,x.x,T,x.x,M,x.x,N,x.x,K,*hh <CR><LF>
1 2 3 4 5 6 7 8

1. Heading, degrees (0.0 to 359.9, null)
2. T=True (fixed)
3. Heading, degrees (0.0 to 359.9, null)
4. M=Magnetic (fixed)
5. Speed, knots (0.0 to 9999.9)
6. N=Knots (fixed)
7. Speed, knots (0.0 to 9999.9)
8. K=km/hr (fixed)

VTG- Course Over Ground and Ground Speed

\$GPVTG,x.x,T,x.x,M,x.x,N,x.x,K,a,*hh <CR><LF>
1 2 3 4 5 6 7 8 9

1. Course over ground, degrees (0.0 to 359.9)
2. T=True (fixed)
3. Course over ground, degrees (0.0 to 359.9)
4. M=Magnetic (fixed)
5. Speed over ground, knots (0.00 to 9999.9)
6. N=Knots (fixed)
7. Speed over ground (0.00 to 9999.9)
8. K=km/h (fixed)
9. Mode indicator (A=Autonomous, D=Differential E=Estimated (dead reckoning)
M=Manual input S=Simulator N=Data not valid)

VWR-Wind Relative Bearing and Velocity

\$**VWR,x.x,x,x,x,N,x.x,M,x.x,K<CR><LF>
1 2 3 4 5 6 7 8

1. Measured wind angle relative to the vessel, degrees (0.0 to 180.0)
2. L=Left semicircle, R=Right semicircle
3. Velocity, knots (0.0 to 9999.9)
4. Unit (N, fixed)
5. Velocity (0.0 to 999.9)
6. Unit (M, fixed)
7. Velocity, km/h
8. Unit (K, fixed)

VWT- True Wind Speed and Angle

\$**VWT,x.x,x,x.x,N,x.x,M,x.x,K<CR><LF>
 1 2 3 4 5 6 7 8

1. Measured wind angle relative to the vessel, degrees (0.0 to 180.0)
2. L=Left semicircle, R=Right semicircle
3. Velocity, knots (0.0 to 9999.9)
4. Unit (N, fixed)
5. Velocity (0.0 to 999.9)
6. Unit (M, fixed)
7. Velocity, km/h
8. Unit (K, fixed)

XTE- Cross-Track Error, Measured

\$**XTE,A,A,x.x,a,N,a,*hh<CR><LF>
 1 2 3 4 5 6

1. Status: A=data valid V=LORAN C blink or SNR warning
2. Status: V=LORAN C blink or SNR warning
3. Magnitude of cross-track error (0.0000 - 9.9999)
4. Direction to steer, L/R
5. Units, nautical miles (fixed)
6. Mode indicator (A=Autonomous mode D=Differential mode S=Simulator mode)

ZDA- Time and Date

\$GPZDA,hhmmss.ss,xx,xx,xxxx,xx,xx<CR><LF>
 1 2 3 4 5 6

1. UTC (000000 to 235959)
2. Day (01 to 31)
3. Month (01 to 12)
4. Year (UTC, 0000 to 9999)
5. Local zone, hours (-13 to ± 13)
6. Local zone, minutes (00 to ± 59)

APPENDIX 4 JIS CABLE GUIDE

Cables listed in the manual are usually shown as Japanese Industrial Standard (JIS). Use the following guide to locate an equivalent cable locally.

JIS cable names may have up to 6 alphabetical characters, followed by a dash and a numerical value (example: DPYC-2.5).

For core types D and T, the numerical designation indicates the *cross-sectional Area (mm²)* of the core wire(s) in the cable.

For core types M and TT, the numerical designation indicates the *number of core wires* in the cable.

1. Core Type

D: Double core power line

T: Triple core power line

M: Multi core

TT: Twisted pair communications
(1Q=quad cable)

2. Insulation Type

P: Ethylene Propylene
Rubber

3. Sheath Type

Y: PVC (Vinyl)

4. Armor Type

C: Steel

5. Sheath Type

Y: Anticorrosive vinyl
sheath

6. Shielding Type

S: All cores in one sheath

-S: Individually sheathed cores

SLA: All cores in one shield, plastic
tape w/aluminum tape

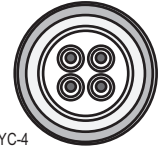
-SLA: Individually shielded cores,
plastic tape w/aluminum tape



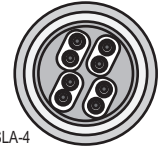
DPYC



TPYC



MPYC-4



TTYCSLA-4

EX: ^{1 2 3 4 5 6}
TTYCYSLA - 4
Designation type # of twisted pairs

^{1 2 3 4}
MPYC - 4
Designation type # of cores

The following reference table lists gives the measurements of JIS cables commonly used with Furuno products:

Type	Core Area	Core Diameter	Cable Diameter	Type	Core Area	Core Diameter	Cable Diameter
DPYC-1.5	1.5mm ²	1.56mm	11.7mm	TTYCS-1	0.75mm ²	1.11mm	10.1mm
DPYC-2.5	2.5mm ²	2.01mm	12.8mm	TTYCS-1T	0.75mm ²	1.11mm	10.6mm
DPYC-4	4.0mm ²	2.55mm	13.9mm	TTYCS-1Q	0.75mm ²	1.11mm	11.3mm
DPYC-6	6.0mm ²	3.12mm	15.2mm	TTYCS-4	0.75mm ²	1.11mm	16.3mm
DPYC-10	10.0mm ²	4.05mm	17.1mm	TTYCSLA-1	0.75mm ²	1.11mm	9.4mm
DPYCY-1.5	1.5mm ²	1.56mm	13.7mm	TTYCSLA-1T	0.75mm ²	1.11mm	10.1mm
DPYCY-2.5	2.5mm ²	2.01mm	14.8mm	TTYCSLA-1Q	0.75mm ²	1.11mm	10.8mm
DPYCY-4	4.0mm ²	2.55mm	15.9mm	TTYCSLA-4	0.75mm ²	1.11mm	15.7mm
MPYC-2	1.0mm ²	1.29mm	10.0mm	TTYCY-1	0.75mm ²	1.11mm	11.0mm
MPYC-4	1.0mm ²	1.29mm	11.2mm	TTYCY-1T	0.75mm ²	1.11mm	11.7mm
MPYCSLA-4	1.0mm ²	1.29mm	11.4mm	TTYCY-1Q	0.75mm ²	1.11mm	12.6mm
MPYC-7	1.0mm ²	1.29mm	13.2mm	TTYCY-4	0.75mm ²	1.11mm	17.7mm
MPYC-12	1.0mm ²	1.29mm	16.8mm	TTYCY-4S	0.75mm ²	1.11mm	21.1mm
TPYC-1.5	1.5mm ²	1.56mm	12.5mm	TTYCY-4SLA	0.75mm ²	1.11mm	19.5mm
TPYC-2.5	2.5mm ²	2.01mm	13.5mm	TTYCYS-1	0.75mm ²	1.11mm	12.1mm
TPYC-4	4.0mm ²	2.55mm	14.7mm	TTYCYS-4	0.75mm ²	1.11mm	18.5mm
TPYCY-1.5	1.5mm ²	1.56mm	14.5mm	TTYCYSLA-1	0.75mm ²	1.11mm	11.2mm
TPYCY-2.5	2.5mm ²	2.01mm	15.5mm	TTYCYSLA-4	0.75mm ²	1.11mm	17.9mm
TPYCY-4	4.0mm ²	2.55mm	16.9mm				

APPENDIX 5 RADIO REGULATORY INFORMATION

USA-Federal Communications Commission (FCC)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Caution: Exposure to Radio Frequency Radiation.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65.

This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Canada-Industry Canada (IC)

This device complies with RSS 210 of Industry Canada.

Operation is subject to the following two conditions:

- (1) This device may not cause interference, and
- (2) This device must accept any interference, including interference that may cause undesired operation of this device.

L'utilisation de ce dispositif est autorisée seulement aux conditions suivantes :

- (1) il ne doit pas produire de brouillage et
- (2) l'utilisateur du dispositif doit être prêt à accepter tout brouillage radioélectrique reçu, même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

Caution: Exposure to Radio Frequency Radiation.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le dispositif rayonnant et le corps.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

SPECIFICATIONS OF MARINE RADAR MODEL1815

1 ANTENNA UNIT

- 1.1 Antenna type Patch array
- 1.2 Radiator length 18-inch
- 1.3 Horizontal beam width 5.2°
- 1.4 Vertical beam width 25°
- 1.5 Sidelobe -20 dB or less (within ±20° of main-lobe)
-25 dB or less (outside ±20° of main-lobe)
- 1.6 Rotation 24 rpm

2 TRANSCEIVER MODULE (CONTAINED IN ANTENNA UNIT)

- 2.1 Tx frequency 9410±30 MHz
- 2.2 Radiation type P0N
- 2.3 Output power 4 kW
- 2.4 Duplexer Ferrite circulator
- 2.5 Intermediate frequency 60 MHz
- 2.6 Range scale, Pulse length (PL) and Pulse repetition rate (PRR)

Range (NM)	PL (μs)	PRR (Hz approx.)
0.0625 to 1.5	0.08	360
1.5 to 2	0.3	360
3 to 36	0.8	360
- 2.7 Minimum range 25 m
- 2.8 Range resolution 25 m
- 2.9 Range accuracy 1 % of range in use or 0.01 NM, whichever is greater
- 2.10 Bearing resolution 5.2°
- 2.11 Bearing accuracy ±1°

3 DISPLAY UNIT

- 3.1 Screen type 8.4-inch color LCD, 640 (V) x 480 (H) dots, VGA
- 3.2 Effective radar diameter 128 mm
- 3.3 Brightness 0.27 to 600 cd/m² typical (16 steps)
- 3.4 Range scales and Ring interval

Range scale (NM)	0.0625	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	36
Ring interval (NM)	0.03125	0.0625	0.125	0.125	0.25	0.25	0.5	0.5	1	1	2	2	3	4	6	12
Number of rings	2	2	2	4	3	4	3	4	3	4	3	4	4	4	4	3
- 3.5 Marks Heading line, Bearing scale, Range ring, Tuning indicator, Cursor, North mark, Variable range marker (VRM), Electric bearing line (EBL), Target alarm zone, Zoom window, Waypoint mark*, Origin mark*
- 3.6 Alphanumeric indication Range, Range ring interval, Display mode (H UP/ C UP/ N UP/ TM/ TRUE VIEW), Off-center (OFFCENT (M/A/C)), Heading data*, Target trails, Tuning indicator, Target alarms, Echo stretch (ES),

Echo average (EAV), Electric bearing line (EBL), Vector time*, Range and bearing to cursor or cursor position*, Interference rejecter (IR), Auto anti-clutter (A/C Auto), Variable range marker (VRM), Navigation data*(position, speed, course), ARPA/AIS/ships target data*

*: external data required

4 INTERFACE

4.1 Number of ports

NMEA

3 ports (IEC61162-2, I/O: 2, I: 1)

Contact closure

1 port (output for external buzzer, 0.3 A max.)

4.2 Data sentences

Input

ALR, BWC, BWR, DBT, DPT, DTM, GGA, GLL, GNS, GSA, GSV, HDG, HDT, HDM, MTW, MWV, RMB, RMC, THS, TTM, VDM, VHW, VTG, VWR, VWT, XTE, ZDA

Output

ACK, RSD, TLL, TTM

5 POWER SUPPLY

12-24 VDC: 3.0-1.5 A

6 ENVIRONMENTAL CONDITIONS

6.1 Ambient temperature

Antenna unit

-25°C to +55°C (storage: -30°C to +70°C)

Display unit

-15°C to +55°C (storage: -30°C to +70°C)

6.2 Relative humidity

95% or less at +40°C

6.3 Degree of protection

Antenna unit

IP26

Display unit

IP56

6.4 Vibration

IEC 60945 Ed.4

7 UNIT COLOR

7.1 Antenna unit

N9.5 (cover), PANTONE2945C (bottom)

7.2 Display unit

N2.5

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Declaration of Conformity

[MODEL1815]

Bulgarian (BG)	С настоящото Furuno Electric Co., Ltd. декларира, че гореспоменат тип радиосъоръжение е в съответствие с Директива 2014/53/ЕС. Цялостният текст на ЕС декларацията за съответствие може да се намери на следния интернет адрес:
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Online Resource

http://www.furuno.com/en/support/red_doc



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