DOPPLER SPEED LOG
Marine Speed and Distance Measuring Equipment (SDME)

MODEL DS-80
<table>
<thead>
<tr>
<th>WARNING</th>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELECTRICAL SHOCK HAZARD</strong>&lt;br&gt;Do not open the equipment.&lt;br&gt;Only qualified personnel should work inside the equipment.</td>
<td><strong>WARNING</strong>&lt;br&gt;Keep heater away from equipment.&lt;br&gt;A heater can melt the equipment's power cord, which can cause fire or electrical shock.</td>
</tr>
<tr>
<td>Immediately turn off the power at the switchboard if water leaks into the equipment. Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.</td>
<td><strong>Use the proper fuse.</strong>&lt;br&gt;Fuse rating is shown on the equipment. Use of a wrong fuse can result in damage to the equipment.</td>
</tr>
<tr>
<td><strong>Do not disassemble or modify the equipment.</strong>&lt;br&gt;Fire, electrical shock or serious injury can result.</td>
<td><strong>Do not use the equipment for other than its intended purpose.</strong>&lt;br&gt;Improper use of the equipment can result in personal injury or equipment damage.</td>
</tr>
<tr>
<td><strong>WARNING LABEL</strong>&lt;br&gt;A warning label is attached to the Distributor, Transceiver and Terminal Box. Do not remove the labels. If a label is missing or illegible, contact a FURUNO agent or dealer.</td>
<td><strong>WARNING</strong>&lt;br&gt;To avoid electrical shock, do not remove cover. No user-serviceable parts inside.</td>
</tr>
</tbody>
</table>

Name: Warning Label (1)<br>Type: 86-003-1011-0<br>Code No.: 100-236-230
<table>
<thead>
<tr>
<th>Pub No.</th>
<th>Software (Prog. No.)</th>
<th>Outline of changes in Operator’s Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publicized for submission to type test BSH Apr/2000</td>
<td>03I-02J-02K (DS-800, DS-801, DS-810)</td>
<td></td>
</tr>
<tr>
<td>Publicized for submission to type test BSH June/2000</td>
<td>6550100003I (DS-800) 6550110003J (DS-801) 6550120003K (DS-810)</td>
<td></td>
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</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFICATIONS</td>
<td>SP-1</td>
</tr>
<tr>
<td>FOREWORD</td>
<td>1</td>
</tr>
<tr>
<td>SYSTEM CONFIGURATION</td>
<td>2</td>
</tr>
<tr>
<td>PRINCIPLE OF OPERATION</td>
<td>3</td>
</tr>
<tr>
<td>REMARKS ON USAGE</td>
<td>4</td>
</tr>
<tr>
<td>1 OPERATION OF DISPLAY UNIT</td>
<td>5</td>
</tr>
<tr>
<td>1.1 Control Description</td>
<td>5</td>
</tr>
<tr>
<td>1.2 Turning the Power On/Off</td>
<td>5</td>
</tr>
<tr>
<td>1.3 Adjusting Contrast, Panel Dimmer</td>
<td>6</td>
</tr>
<tr>
<td>1.4 Selecting a Display</td>
<td>6</td>
</tr>
<tr>
<td>1.5 Main Menu Operation</td>
<td>7</td>
</tr>
<tr>
<td>1.6 Distance Run Operation</td>
<td>7</td>
</tr>
<tr>
<td>1.7 System Setting</td>
<td>9</td>
</tr>
<tr>
<td>1.8 Demonstration Mode</td>
<td>11</td>
</tr>
<tr>
<td>2 OPERATION OF OPTIONAL EQUIPMENT</td>
<td>12</td>
</tr>
<tr>
<td>2.1 Digital Indicator DS-830, Distance Indicator DS-840</td>
<td>12</td>
</tr>
<tr>
<td>3 MAINTENANCE, TROUBLESHOOTING</td>
<td>14</td>
</tr>
<tr>
<td>3.1 Maintenance</td>
<td>14</td>
</tr>
<tr>
<td>3.2 Troubleshooting</td>
<td>15</td>
</tr>
<tr>
<td>3.3 Diagnostics, Checking Program Number</td>
<td>16</td>
</tr>
<tr>
<td>4 DIGITAL INTERFACE (IEC 61162-1)</td>
<td>17</td>
</tr>
<tr>
<td>4.1 I/O Sentences</td>
<td>17</td>
</tr>
<tr>
<td>4.2 Sentence Description</td>
<td>17</td>
</tr>
<tr>
<td>5 PARTS LOCATION AND PARTS LIST</td>
<td>19</td>
</tr>
<tr>
<td>Parts Location</td>
<td>19</td>
</tr>
<tr>
<td>Parts List</td>
<td>21</td>
</tr>
<tr>
<td>CALIBRATION SHEET</td>
<td>25</td>
</tr>
<tr>
<td>MENU OVERVIEW</td>
<td>26</td>
</tr>
<tr>
<td>Declaration of conformity</td>
<td>27</td>
</tr>
</tbody>
</table>
SPECIFICATIONS OF THE DOPPLER SPEED LOG
DS-80

1. GENERAL
   (1) Speed Range  Fore-Aft: -10.0 to +40 knots through-the-water
   (2) Distance Run  0.00 to 999,999.99 nautical miles through-the-water
   (3) Working Depth Water depth greater than 3 m beneath the keel.
   (4) Working Frequency 1.0 MHz
   (5) Speed Accuracy 1.0% or 0.1 knots whichever is the greater
   (6) Distance Accuracy 1.0% or 0.1 nm whichever is the greater

Note: Accuracy is subject to shallow water effects, to the effect of wind, current and tide, and sensor location. Any ultrasonic equipment having the same frequency may interfere with speed measurement. The Doppler Log transducer should be installed apart from the transducers of such kind of equipment.

2. DISPLAY UNIT
   (1) Display Character size 15 or 21 mm H on monochrome LCD
   (2) Indication
       Ship's speed Fore: ▲***,* knots (+40.0 kt max.)
           Aft: ▼***,* knots (-10.0 kt max.)
       Distance run ******,** nm
   (3) Other Function Diagnostic check

3. DIGITAL INTERFACE
   (1) Serial Signal
       Output: 2 ports; VBW, VLW in IEC 61162-1 (NMEA 0183 Ver 2.0)
       Input: 1 port; IEC 61162 (NMEA 0183 Ver 2.0)
   (2) Analog Signal
       Speed signal for Analog display: 2 port
       -3.3 mA to 10 mA/ -10 kt to +30 kt
       Analog current output: 1 port
       4 mA to 20 mA/ -10 kt to 30 kt
       Analog voltage output: 1 port
       -3.3 V to 10 V/ -10 kt to 30 kt
   (3) Distance run output 2 ports; Contact closure each 0.005 nm, forward speed,
       30 VDC: 0.4 A
   (4) System Check signal 1 port, 30 VDC: 0.2 A, default: closed
4. POWER SUPPLY
(1) System Source 100/110/115/200/220/230 VAC: 1.5/0.7 A max., 1 phase, 50-60 Hz

5. ENVIRONMENTAL CONDITION (IEC 60945)
(1) Ambient Temperature -15°C to +55°C (units for protected area)
   Analog display: 0°C to +50°C
(2) Relative Humidity 95% at 40°C
(3) Vibration IEC 60945 adopted
(4) Category of Equipment
   Display Unit/Distance indicator/Transceiver Unit:
      For protected area
   Transducer: For submerged use, 600 kPa x 12 h
   Distributor/Terminal box: For protected area

6. COATING COLOR
(1) Display Unit Cover: Munsell 2.5GY5/1.5 (light gray), Panel: N3.0 (gray)
(2) Distribution Box Munsell 2.5GY5/1.5 (light gray)
(3) Transceiver Unit Munsell 2.5GY5/1.5 (light gray)
(4) Terminal Box Munsell 2.5GY5/1.5 (light gray)
(5) Analog Display Munsell 2.5GY5/1.5 (light gray)

7. COMPASS SAFE DISTANCE
(1) Display Unit/Digital Indicator/Digital Distance Indicator
   Standard: 0.50 m, Steering: 0.40 m
(2) Transceiver Unit Standard: 2.05 m, Steering: 1.40 m
(3) Distribution Box Standard: 3.10 m, Steering: 2.10 m
(4) Terminal Box Standard: 0.65 m, Steering: 0.45 m

SAFETY PRECAUTION
- There is no unit giving rise to a dose rate > 0.5 mrem/h at 50 mm.
- There is no harmful radiation from the screen.
- All units of this equipment comply with EMC requirements in IEC 60945, as required by IMO Res. A.813 (19).
Foreword

Thank you for purchasing the FURUNO DS-80 Doppler Speed Log. We are confident you will discover why FURUNO has become synonymous with quality and reliability.

Dedicated in the design and manufacture of marine electronics equipment for half a century, FURUNO Electric Company has gained an unrivaled reputation as a world leader in the industry. This is the result of our technical excellence as well as our worldwide distribution and service network.

Please carefully read and follow the safety information and operating and maintenance instructions set forth in this manual before attempting to operate the equipment and conduct any maintenance. Your Doppler speed log will perform to the utmost of its ability only if it is operated and maintained in accordance with the correct procedures.

This equipment is designed, produced and documented by FURUNO Electric Co., Ltd., complying with ISO 9001 standards as certified by the Lloyd’s Register of Quality Assurance System.

Features

The FURUNO DS-80 displays ship’s speed relative to water, using the Doppler principle; ship’s speed is measured by detecting the Doppler shift frequency from the signal returned from the watermass.

The output is interfaced with ARPA, AIS, and other shipborne equipment in IEC 61162-1 format.

The main features of the DS-80 are

- Simple operation. In most cases all that is required to display ship’s speed is to turn on the equipment.
- Pair-beam system effectively reduces error caused by pitching. The transducer assembly symmetrically emits two sonic beams, one fore and the other aft. By averaging the Doppler shift in both directions accurate speed data is available under rough sea conditions.
- Speed and distance information on the adjustable-contrast LCD display.
- Analog display, digital Indicator and digital distance indicator display optionally available.
- Complies with IMO Res. A.824(19) and IEC 61023: 1997.
SYSTEM CONFIGURATION

DISPLAY UNIT
DS-800

TERMINAL BOX
DS-802

DISTRIBUTION BOX
DS-801

DIMMER MF-22L-1/MF-22L-2

IEC 61162-1 Input
Power ON SW Signal
Distance Run Signal
IEC 61162-1 Output

DIMMER MF22L-1/MF22-2

TERMINAL BOX
DS-802

DIGITAL INDICATOR DS-830
DISTANCE INDICATOR DS-840

DIMMER MF-22L-1/MF-22-2

TERMINAL BOX
DS-802

RANGE SWITCH BOX
DS-839

ANALOG DISPLAY UNIT MF-22A-1

DIMMER MF-22L-1/MF-22-2

SHIP’S MAINS
115/230 VAC

STANDARD SUPPLY

OPTIONAL SUPPLY

LOCAL SUPPLY

TRANSCEIVER
UNIT DS-810

TRANSDUCER
DS-820

JUNCTION BOX
CI-630

DIMMER MF-22L-1/MF-22-2

115/230 VAC

115/230 VAC

115/230 VAC
The Doppler speed log measures ship’s speed by using the Doppler Effect, which is observed as a frequency shift resulting from relative motion between a transmitter and receiver or reflector of acoustic or electromagnetic energy. A common example of the Doppler Effect is a train. When a train is approaching, the whistle has a higher pitch than normal. You can hear the change in pitch as the train passes.

The DS-80 has a pair-beam, one directed in the fore direction and the other in the aft direction, which emits ultrasonic waves at an angle of $\theta$ to the waterline towards ship’s fore and aft directions. The frequency of the received signal is then compared with that of the transmitted frequency to measure doppler shift to calculate ship’s speed.

The relative motion causes the Doppler shift and the ultrasonic waves reflected at the watermass (plankton or any underwater objects) are received at the frequency of $f_r = f_o + f_d$ where $f_d$ is the number of frequency shifts counted at the receiver circuit. To calculate ship’s speed, the following formula is used.

$$V = \frac{f_d}{f_o} \cdot \frac{c}{2 \sin \theta}$$

$c$: Underwater velocity

Note that the sound velocity in water changes with water temperature and water pressure but the DS-80 readout is automatically compensated for change by using a temperature sensor.
Remarks on Usage

The DS-80 measures ship’s speed by detecting the Doppler shift frequency of the echo reflected by a watermass (water layer containing plankton and other micro-organisms) located within the measuring area, which is usually about 2 m. In some instances, however, no signal is returned because of too few plankton in the sensing depths. This phenomenon can occur in particular areas in particular seasons. The probable cause is the plankton are lying in deep water because an ice-melted cold water mass covers the sea surface. Similar cases may also occur in a freshwater lake. Under these circumstances the DS-80 will not show the correct ship’s speed.

Conditions Affecting the Accuracy
(with ref to IMO A.824/3.3)
The Doppler speed log DS-80 is designed for reliable and accurate performance through FURUNO’s long experience and advanced technology. It operates on the best choice of system frequency and power output. As far as the sonic energy is used, the performance (accuracy) may be reduced or even lost under:

- rough weather (may be sea state 6 or severer)
- improper location of sensor, e.g., too close to the propeller, thrusters, drain tubes, echo sounder transducer
- depth under the keel if less than 3 m

The accuracy will not be affected by:
- water temperature (sound velocity)
- salinity
- pitch/roll ±10°

Beware of Transducer Location
The transducer may be damaged if it hits the dry dock blocks. Take the following measures to prevent damage to the transducer.

1. Before delivering the ship, draw up a suitable docking plan taking into account the dimensions and location of the transducer. Store the plans onboard the ship.
2. Place the dry dock blocks according to the plan.
3. Have a diver check the position between the transducer and the blocks before removing the water. Confirm that the transducer will not touch the blocks.
1. OPERATION OF DISPLAY UNIT

1.1 Controls

- Opens/closes the menu.
- Selects display; speed plus distance or speed.
- Turns power on/off.
- Adjusts LCD contrast.
- Adjusts panel illumination.
- Registers options on menus.
- Omnipad Selects items, options on menus.
- MENU
- ENT
- DISP
- DIM
- *
- DS-80
- PWR
- Turns power on/off.

1.2 Turning the Power On/Off

1.2.1 Power on

Press the [POWER] switch to turn on the equipment. The last-used display appears. The example below shows the speed and distance run.

<table>
<thead>
<tr>
<th>SPEED</th>
<th>STW</th>
<th>DISTANCE</th>
<th>Run</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.0 kt</td>
<td>12.50 nm</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** STW means Speed Through Water. This indication flashes when transducer temperature, which can be monitored on the TEST display (see page 16), is abnormal. This means speed accuracy is less than stated in the specifications.

1.2.2 Power off

Press the [POWER] switch to turn the power off.

**Note:** Keep the DS-80 energized continuously unless it fails. Turning off the DS-80 may cause an inconvenience in associated equipment, such as a radar.
1.3 Adjusting Contrast, Panel Dimmer

1.3.1 Contrast

1. Press the [*] key to open the contrast adjustment dialog box.

2. Press the Omnipad at ▲ or ▼ to adjust the contrast. The setting range is 0 to 63 and the default setting is 48.

3. Press the [ENT] key.

Note: The contrast is automatically set to default (48) when the power is turned on.

1.3.2 Panel dimmer

1. Press the [DIM] key to show the dimmer adjustment dialog box.

2. Press the Omnipad at ▲ or ▼ to adjust the dimmer. The setting range is 1 to 8 and the default setting is 4.

3. Press the [ENT] key to conclude.

Note: The [DIM] key is inoperative when dimmer is controlled externally.

1.4 Selecting a Display

Press the [DISP] key to select display desired. Each time the key is pressed the display shows speed and distance run or speed alone as below.

- Arrow indicates direction: ▲ indicates fore; ▼, aft.
- The distance run indication shows the total distance run in forward speed only.
- The distance run is backed up when the power is turned off.

Note: Speed error may occur in rough seas because of air bubbles, etc. When speed error occurs, the speed indication freezes, and “KT” is highlighted and blinks. If speed error continues more than 30 seconds, the speed indication changes to “.”.
1.5 Main Menu Operation

Functions of the DS-80 are selected through the menu.

1. Press the [MENU] key to open the menu.

2. Press the Omnipad at ▲ or ▼ to select a menu item (current selection is highlighted) and press the [ENT] key. For example, when DISTANCE RUN DISPLAY is selected the following display appears. Distance run is a form of contact closure, 200 pulses/nm. To select IEC 61162 sentence, see paragraph 1.6.1.

3. Press the Omnipad at ▲ or ▼ to select the menu item desired and press the [ENT] key. For example select RESET.

4. Press the Omnipad at ▲ or ▼ to select the menu option desired and press the [ENT] key.

5. Press the [MENU] key twice to close the menu. (Some menus require only a single pressing of the [MENU] key.)

To enter numerical data

Some menus require input of numeric data. This is done with the Omnipad.

1. Select the digit or sign (+ or -) to change with ▲ or ▼ on the Omnipad. (The cursor shows the digit or sign selected.)

2. Enter a figure at each digit by hitting the Omnipad at ▲ or ▼. The example below shows the DISTANCE RUN DISPLAY menu, where you may adjust the distance run indication for SET.

3. Press the [ENT] key to conclude.

1.6 Distance Run Operation

The operator may adjust and reset the distance run indication and select display method.

1.6.1 Selecting display method

The default setting provides for independent display and adjustment of the distance run indication on all displays (display unit, Digital Indicator, distance indicator).

To show the same distance run indication on all displays do the following:

1. Press the [MENU] key to open the menu.
2. Press the Omnipad at ▲ to select DISTANCE RUN DISPLAY and press the [ENT] key.


4. Press ▲ to select IEC 61162(VLW) and press the [ENT] key.

5. Press the [MENU] key twice to close the menu.

### 1.6.2 Adjusting distance run

Distance run can be changed when the menu item DATA DISPLAY is selected to CONTACT CLOSURE. It may also be changed only at the display unit when IEC 61162(VLW) is selected.

1. Press the [MENU] key to open the menu.

2. Use ▲ to select DISTANCE RUN DISPLAY and press the [ENT] key.


4. Press the Omnipad at ▲ or ▼ to select the digit to change.

5. Press the Omnipad at ▲ or ▼ to change value. The setting range is 0.00 nm to 999999.99 nm.

6. Press the [ENT] key followed by pressing the [MENU] key twice to conclude your selection and close the menu.

### 1.6.3 Resetting distance run to zero

Distance run can be reset to zero when the menu item DATA DISPLAY is selected to CONTACT CLOSURE. It may also be reset to zero only at the display unit when IEC 61162(VLW) is selected.

1. Press the [MENU] key to open the menu.

2. Press the Omnipad at ▼ to select DISTANCE RUN DISPLAY and press the [ENT] key.


4. Press the Omnipad at ▼ to select ON.
5. Press the [ENT] key to finish and press the [MENU] key twice to close the menu.

The distance run indication reads 0.00.

1.7 System Setting
The system setting provides the fundamental parameters for intended performance of the DS-80.

1.7.1 Displaying the system menu
1. Press the [MENU] key to open the menu.
2. Select SYSTEM MENU and press the [ENT] key.

<table>
<thead>
<tr>
<th>SYSTEM MENU</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHIP SPEED AVG</td>
</tr>
<tr>
<td>SPEED OFFSET</td>
</tr>
<tr>
<td>TRACK DEPTH</td>
</tr>
<tr>
<td>XDR OFFSET</td>
</tr>
<tr>
<td>SPD DATA SELECT</td>
</tr>
<tr>
<td>ENT: SET</td>
</tr>
</tbody>
</table>

3. Select averaging time period desired among 15, 30, 45 and 60 seconds.
4. Press the [ENT] key.
5. Press the [MENU] key twice to close the menu.

1.7.3 Speed offset (calibration)
Calibration of any speed log is necessary through the sea trials during the commissioning tests. Fill in the calibration sheet which is on page 25 of this manual. Use the resultant data to calculate speed offset and enter it as below. The setting range is -25.0% to +25.0%.
1. Open the SYSTEM MENU.
2. Select SPEED OFFSET and press the [ENT] key.

<table>
<thead>
<tr>
<th>SYSTEM MENU</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHIP SPEED AVG</td>
</tr>
<tr>
<td>SPEED OFFSET</td>
</tr>
<tr>
<td>TRACK DEPTH</td>
</tr>
<tr>
<td>XDR OFFSET</td>
</tr>
<tr>
<td>SPD DATA SELECT</td>
</tr>
<tr>
<td>ENT: SET</td>
</tr>
</tbody>
</table>

3. Select the digit to change with ◀ or ▶ and change the value with ▲ or ▼ on the Omnipad.
4. Press the [ENT] key.
5. Press the [MENU] key twice to close the menu.

1.7.4 Tracking depth
Doppler shift measuring depth in the DS-80 is 2 m at default. If the speed readout is unstable due to air bubbles near the ship’s hull, increase or decrease the track depth to stabilize the readout. The setting range is 1.0 m to 9.9 m.
1. Open the SYSTEM MENU.
2. Select TRACK DEPTH and press the [ENT] key.

3. Select the digit to change ▼ or ► and change the value with ▲ or ▼ on the Omnipad.

4. Press the [ENT] key.

5. Press the [MENU] key twice to close the menu.

1.7.6 Speed data selection

When the DS-80 fails to work as an SDME, the display unit can be used as a monitor display tool for a GPS speed or other equipment measuring the ship's speed.

1. Open the SYSTEM MENU.

2. Select SPD DATA SELECT and press the [ENT] key.

3. Select the option GPS and press the [ENT] key.

4. Press the [MENU] key twice to close the menu.

See the illustration below for speed display information. If the speed displayed is unstable perform the check described in paragraph 3.2.

"AUTO" position indicates a Doppler speed (SDME) but if the DS-80 fails, a GPS speed will be indicated.

Note 1: If the log speed fails, the display unit reads a GPS speed, but speed data will not be output to other equipment.

Note 2: Doppler speed is used to calculate speed when both DOPPLER and GPS are abnormal in AUTO.
1.7.7 System menu 2

The System Menu 2 contains the diagnostic test and selection of dimmer control and display language.

1. Press the [MENU] key to open the menu.
2. Select SYSTEM MENU 2 and press the [ENT] key.

```
SYSTEM MENU2
TEST
DIMMER INTERNAL
LANG. ENGLISH
ENT: SET
```

**TEST:** Checks the equipment for proper operation. For further details see Chapter 3.

**DIMMER:** See paragraph 1.3.2.

**LANG.** Selects the language to use in menus, English or Japanese.

1.8 Demonstration Mode

The demonstration mode outputs the Doppler speed signal to external equipment. This checks if the signal is being correctly output.

1. Press the [MENU] key to open the menu.
2. Select DEMO and press the [ENT] key.
4. Select the digit to change with ◀ or ▶.
5. Use ▲ or ▼ to set. (The setting range is -10.0 to +40.0 kt, and the default setting is +10.0 kt.)
7. Press the [ENT] key to open the DATA DISPLAY menu.
8. Press ▲ to select ON and press the [ENT] key.
9. Press the [MENU] key twice to close the menu.

The indication “DEMO” appears at the top right-hand corner when the demo mode is on. To turn off the demonstration display, show the DEMO menu and set SPD to OFF.
2 OPERATION OF OPTIONAL EQUIPMENT

The Digital Indicator DS-830 and Distance Indicator DS-840 have the same controls as the display unit. This chapter explains the features which are not shared with the display unit.

2.1 Digital Indicator DS-830, Distance Indicator DS-840

2.1.1 Selecting a display

Press the [DISP] key to select the display mode. Each time the key is pressed the display shows speed plus distance run or speed alone as below.

Digital Indicator DS-830

Distance Indicator DS-840

2.1.2 Menu operation

1. Press the [MENU] key to show the display below.

2. For details refer to the following:

DISTANCE RUN DISPLAY: See paragraph 1.6.

SYSTEM MENU 2: See 1.7.7 System Menu 2.

2.1.3 Adjusting dimmer and contrast

See paragraph 1.3.
Example:

If the analog speedometer reads 14.2 kt at a temperature of −15°C, the correct speed through the water is 15 kt. Failure of correction in low temperature can result in a maximum error of −0.8 kt or 5.3% for 14.2 kt readout. IMO limit of ±2% is exceeded over 10.0 – 30.0 kt reading but correction by this graph brings a correct measurement.

At +55°C, an error of +0.0 kt (+2.7%) occurs at a speed of 30 kt; no other point IMO limit of ±2% is exceeded.

When the digital display and analog display readouts are different, take precedence of the digital readout. At temperatures 0°C to 50°C, the speedometer never exceeds the IMO limits.
3 MAINTENANCE, TROUBLESHOOTING

WARNING
ELECTRICAL SHOCK HAZARD
Do not open the equipment.
Only qualified personnel should work inside the equipment.

3.1 Maintenance
3.1.1 Preventive maintenance
Check the following points regularly to maintain performance.
- Check that the connectors on all units of the system are firmly fastened and free of rust. Clean if soiled or corroded.
- Check that all ground wires are tightly fastened.
- Dust and dirt on the display unit including the screen may be removed with a soft cloth. Do not use chemical cleaners to clean the display unit; they can remove paint and markings.

3.1.2 Transducer maintenance
Marine life (barnacles, etc.) adhering to the transducer face will reduce sensitivity. Periodically remove any marine life from the transducer face with fine sandpaper or a piece of wood.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Rating, Qty</th>
<th>Type, Code No.</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Unit</td>
<td>1A, 2 pcs.</td>
<td>FGMB 1A 125 VAC, 000-114-805</td>
<td>Fuse holder in power cable</td>
</tr>
<tr>
<td>Distribution Box</td>
<td>3A, 2 pcs.</td>
<td>FGBO 3A 250 VAC 000-549-021</td>
<td>Inside unit</td>
</tr>
<tr>
<td>Transceiver Unit</td>
<td>1A, 2 pcs.</td>
<td>FGBO 1A 250 VAC, 000-549-019</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION
Do not paint the transducer.
Painting will affect performance.

3.1.3 Fuse replacement
Fuses in the units of the system protect the electrical circuitry from burning by overcurrent. If the equipment cannot be energized check the fuse in the power cable connected to the display unit. Locate the cause before replacing the fuse.

CAUTION
Use the proper fuse.
Use of a wrong fuse can cause fire or equipment damage and void the warranty.
3.2 Troubleshooting

This section provides troubleshooting procedures. Advanced level troubleshooting should be done by referring to the Service Manual (optional supply).

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannot turn on the power.</td>
<td>Loosened power cable</td>
<td>Fasten the power cable.</td>
</tr>
<tr>
<td>Power is on but nothing appears on the screen.</td>
<td>Contrast too low.</td>
<td>Press the [*] key several times.</td>
</tr>
<tr>
<td><strong>Doppler speed indication</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="speed.png" alt="Speed Display" /> Last correct speed is displayed (display freezes).</td>
<td>Ship’s speed cannot be calculated because of air bubbles, etc. (Speed error : 30 seconds)</td>
<td></td>
</tr>
<tr>
<td><img src="speed1.png" alt="Speed Display" /> Speed shown as &quot;**<em>.</em>&quot;.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="speed2.png" alt="Speed Display" /> STW flashing</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GPS speed indication</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="gps.png" alt="Speed Display" /> Speed indication shown as &quot;**<em>.</em>&quot;.</td>
<td>GPS data error.</td>
<td></td>
</tr>
<tr>
<td><img src="gps1.png" alt="Speed Display" /> &quot;GPS&quot; is replaced with &quot;----&quot;.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If any abnormal speed indication continues contact your dealer for advice.
3.3 Diagnostics, Checking Program Number

The diagnostic facility checks the ROM, RAM, SIO and displays program ID.

1. Press the [MENU] key to open the menu.

2. Select SYSTEM MENU2 and press the [ENT] key.

3. Press the [ENT] key. The following display appears.

   TEST START ?
   (STOP: PWR OFF)

   ARE YOU SURE ?
   YES NO

4. Press the [ENT] key to start the test. In a few moments the display should changes as shown at the top of the adjacent column.

   The ROM, RAM and SIO (if special connector is used) are checked for proper operation and the results shown as OK or NG (No Good). For NG, contact your dealer for advice.

   The program number also appears here.

   “PUSH KEY” is highlighted, prompting you to check the controls. Operate any control (except the [POWER] switch) within five seconds. The name of the activated control appears on screen if it is operating normally. Note that if no control is operated within five seconds, the equipment automatically begins checking the LCD.

   Transducer temperature

   Name of control operated appears here.

   TEST
   ROM : OK 12.3CX
   RAM : OK
   SIO : OK
   PUSH KEY
   (STOP: PWR OFF)

   No. of times test consecutively executed.

   6550100003I = Display Unit DS-800
   6550110003J = Distribution Box DS-801
   6550120003K = Transceiver Unit DS-810

   Control operated and indication

<table>
<thead>
<tr>
<th>Control</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>▲</td>
<td>UP</td>
</tr>
<tr>
<td>▼</td>
<td>DOWN</td>
</tr>
<tr>
<td>◀</td>
<td>LEFT</td>
</tr>
<tr>
<td>▶</td>
<td>RIGHT</td>
</tr>
<tr>
<td>MENU</td>
<td>MENU</td>
</tr>
<tr>
<td>ENT</td>
<td>ENT</td>
</tr>
<tr>
<td>DISP</td>
<td>DISP</td>
</tr>
<tr>
<td>DIM</td>
<td>DIM</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

5. The equipment automatically checks the LCD, displaying the following in order.

   <LCD CHECK>
   ALL ON 2 SEC.
   ALL OFF 3 SEC.

6. The test repeats itself. To stop the test, turn the power switch off and on again.
4 DIGITAL INTERFACE (IEC 61162-1)

4.1 I/O Sentences

Input
GGA, VTG

Output
VBW, VLW

4.2 Sentence Description

GGA - Global positioning system (GPS) fix data

Time, position and fix related data for a GPS receiver.

- Differential reference station ID, 0000-1023*
- Age of differential GPS data*
- Units of geoidal separation, m*
- Geoidal separation*
- Units of antenna altitude, m*
- Antenna altitude above/below
- Mean sea level (geoid)*
- Horizontal dilution of precision*

$--GGA, hhmmss.ss. 1111.11, a, yyyy.yyy, a, x, xx, x.x, x.x, M, x.x, M, x.x, xxxx*hh<CR><LF>

- Number of satellites in use, 11-12, may be different from the number in view*
- GPS quality indicator (note 1)
- Longitude - E/W*
- Latitude - N/S*
- UTC of position*

NOTES

1 GPS quality indicator: 0 = fix not available or invalid
   1 = GPS SPS mode, fix valid
   2 = differential GPS, SPS mode, fix valid
   3 = GPS PPS mode GPS fix valid

* Not used.
VTG - Course over ground and ground speed
The actual course and speed relative to the ground.

\[ \text{\$--VTG, x.x, T, x.x, M, x.x, N, x.x, K^{*}hh<CR><LF}>\]

- Speed, km/h*
- Speed, knots
- Course degrees magnetic*
- Course degrees true*

*: Not used.

VBW - Dual ground/water speed
Water-referenced and ground-referenced speed data.

\[ \text{\$--VBW, x.x, x.x, A, x.x, x.x, A, x.x, A, x.x, A^{*}hh<CR><LF}>\]

- Status, stern ground speed*
- Stern transverse ground speed*
- Status, stern water speed*
- Stern transverse water speed*
- Status, ground speed*
- Transverse ground speed*
- Longitudinal ground speed*
- Status, water speed*
- Transverse water speed*
- Longitudinal water speed¹, knots (-10.0 to 39.9 kt)

NOTES
1. Longitudinal speed: “-” astern.
* Not used.

VLW - Distance travelled through the water
The distance travelled, relative to the water.

\[ \text{S--VLW, x.x, N, x.x, N hh<CR><LF}>\]

- Distance since reset, nautical miles (0 to 999,999.99 nm)
- Total cumulative distance, nautical miles (0 to 999,999.99 nm)
5  PARTS LOCATION AND PARTS LIST

Parts Location

Display unit DS-800

U10 (ROM)

ICP Board 65P6000, parts side

Distribution box DS-801

From right TB1, TB2, TB3

TB101

POWER switch

JPW Board

Distribution Box DS-801, inside view
Transceiver unit DS-810

Transceiver Unit DS-810, inside view
Parts List

This equipment contains complex modules in which fault diagnosis and repair down to component level are not practicable (IMO A.694(17)/8.3.1). Only some discrete components are used. FURUNO ELECTRIC CO., LTD. believes identifying these components is of no use for shipborne maintenance; therefore, they are not listed in this manual. Major modules can be located on parts location photos on the preceding page.
<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>TYPE</th>
<th>CODE No.</th>
<th>REMARKS</th>
<th>SHIPPABLE ASSEMBLY</th>
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<tr>
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<td>PRINTED CIRCUIT BOARD</td>
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<tr>
<td>65P6000, ICP</td>
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</tbody>
</table>
### CALIBRATION SHEET FOR DS-80 DOPPLER SPEED LOG

<table>
<thead>
<tr>
<th>DATE:</th>
<th>TEST SITE</th>
<th>SHIP'S LENGTH (M)</th>
<th>DRAFT Fore</th>
<th>Aft</th>
<th>Mean (m)</th>
<th>TRIM (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SHIP'S NAME</th>
<th>Ser. No.</th>
<th>DOCKYARD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location of Transducer</th>
<th>(m) from bow or frame No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RUN NO.</th>
<th>ENGINE</th>
<th>TRUE SPEED</th>
<th>DOPPLER SPEED LOG</th>
<th>ERROR (%)</th>
<th>EM-LOG (kt)</th>
<th>DEPTH (m)</th>
<th>COURSE (deg)</th>
<th>WIND (m/s)</th>
<th>SEA STATE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOAD</td>
<td>RADIO LOG/MILE POST</td>
<td>DISTANCE RUN (n.m.)</td>
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<td>OUT</td>
<td>TRUE TIME (s)</td>
<td>TRUE SPEED (kt)</td>
<td>TRUE TIME (s)</td>
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<td>MEAN</td>
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</tr>
</tbody>
</table>
Default settings in bold italic.

[MENU] key

DISTANCE RUN DISPLAY
- DATA DISPLAY (CONTACT CLOSURE, IEC 61162-1(VLW))
  - RESET (ON, OFF)
  - SET (0.0 nm-999999.99 nm, 0.00 nm)

DEMO
- SPEED (-10.0 to +40.0 kt, +10.0 kt)
  - DATA DISPLAY (OFF, ON)

SYSTEM MENU
- SHIP SPD AVG (15, 30, 45, 60 SEC)
  - SPEED OFFSET (-25.0% to +25.0%, 0%)
  - TRACK DEPTH (1.0 m to 9.9 m, 2 m)
  - XDR OFFSET (-40° to +40°, 0°)
  - SPD DATA SELECT (GPS, DOPPLER, AUTO)

SYSTEM MENU2
- TEST (Check of ROM, RAM, LCD, Key Panel)
  - DIMMER (INTERNAL, EXTERNAL)
  - LANG. (ENGLISH, JAPANESE)
Declaration of conformity

We, FURUNO ELECTRIC CO., LTD.

(Manufacturer)

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

(Address)

hereby declare under our sole responsibility that the product

Doppler speed log model DS-80 consisting of: Display unit DS-800, Distribution box DS-801,
Transducer unit DS-810/DS-820; optional units: Terminal box DS-802, Digital display DS-830,
Remote distance indicator DS-840, Junction box CI-630, Dimmer box MF-22L, Transducer
seachest DS-850/DS-784/DS-783/DS-781/DS-786/DS-782

(Model names, type numbers)

is/are

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

EN 60945 (IEC 60945 Third edition: 1996-11)
EN 61162-1
EN 61023

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

For assessment, see

• EC – type approval certificate no. 6299/055/99 of 25 July 2000 issued by Federal Maritime and Hydrographic Agency, the Federal Republic of Germany
• Test report FLJ 12-99-041 of February 29, 2000 prepared by Furuno Labotech International Co., Ltd.

This declaration is issued according to the provisions of European Council Directive 96/98/EC on marine equipment modified by Commission Directive 98/65/EC.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
August 23, 2000

Hiroaki Komatsu
Manager,
International Rules and Regulations

(Place and date of issue) (name and signature or equivalent marking of authorized person)
INDEX

C
Contrast .......................................................... 6
Control description ......................................... 5

D
Demonstration mode ........................................ 9
Diagnostics ................................................... 14
Digital indicator ........................................... 12
Digital interface ............................................ 16
DIM key .......................................................... 6
Dimmer ........................................................... 6
Distance run
  adjusting ..................................................... 9
  display method ............................................ 8
  resetting to zero ........................................ 8

F
Fuse replacement ........................................... 13

M
Maintenance ................................................... 13
MENU key .................................................... 7
Menu operation .............................................. 7
Menu tree ..................................................... 24

P
Parts list ....................................................... 20
Parts location .............................................. 18
POWER switch .............................................. 5

S
Ship's speed
  averaging time ............................................ 9
  offset ....................................................... 10
  source ....................................................... 11
System configuration ...................................... 2
System menu ............................................... 9
System menu2 ............................................. 11

T
Transducer
  maintenance .............................................. 13
  position offset ......................................... 10
Troubleshooting .......................................... 14

U
UNIT key ...................................................... 7

W
Water tracking depth ...................................... 10