Meeting New IMO requirements

MARINE GPS NAVIGATOR
Model GP-90

- Fully meets new IMO Resolution MSC.112(73) and IEC 61108-1 Ed.2 for SOLAS carriage requirements on and after 1 July 2003
- Ideal sensor of SOG and COG for AIS, radars, and other navigational aids
- Augmentation to enhance accuracy by standard fitted WAAS and optional DGPS
- Display modes: VideoPlotter, 3-D Highway, Text, etc.
- Memory: 2,000 points for ship's past positions and marks (incl. 99 event marks max.); 999 waypoints; 30 routes each containing up to 30 waypoints

Advanced Electronic Position-Fixing System (EPFS) to meet New IMO Performance Requirements and IEC Testing Standards.

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TRADE MARK REGISTERED
MARCA REGISTRADA
An outstanding solution to SOLAS carriage requirements as a standalone positioning device and as a sensor for AIS, Radar, VDR, etc.

The FURUNO GP-90 is a new GPS navigator designed for SOLAS ships complying with the new GPS performance standard IMO Res MSC.112(73) and associated IEC standards required on and after 1 July 2003. It is a highly reliable standalone EPFS (Electronic Position-Fixing System) providing a navigation solution to the AIS, radars, VDRs, etc.

Receiver dependability is improved by fault detection using five satellites, i.e., Receiver Autonomous Integrity Monitoring (RAIM). The GP-90 indicates the integrity status in Safe, Caution, or Unsafe label. These indications are given with respect to user selected accuracy level, 10 m or 100 m. RAIM also works on DGPS signals.

A choice of display mode is available from VideoPlotter, Text, Highway, etc. In the highway mode, you can intuitively see how to steer and where the next waypoint is located relative to your ship. It is useful when you are following a series of waypoints along a planned route.

WAAS is standard fitted to improve the position accuracy and DGPS is optionally available with an internal or external differential receiver.

The GP-90 consists of an antenna unit and display unit. The display unit is a 6" silver bright LCD offering optimum viewing under the direct sunlight. Dual configuration with a second system provides a backup or remote operation to ensure system availability.

**Augmentation**

The GPS accuracy can be enhanced by a proper augmentation system. The following two methods, WAAS and DGPS are basically the same in that a reference station monitors the signal quality and transmits correction data to the users.

**WAAS**

WAAS is a GPS navigation system with differential correction by means of geostationary satellites. The US FAA has been testing this system and expects more field tests in 2003. Similar systems, using Satellite-Based Augmentation Systems (SBAS), are under development in Japan (MSAS: MSAT Satellite-based Augmentation System) and Europe (EGNOS: European Geostationary Navigation Overlay System). They are said to be fully interoperable and compatible. MSAS and EGNOS are expected to become fully operational in 2004 or after.
Increases the navigation efficiency and safety by feeding accurate positional data to AIS, Radars, INS, and many other nav aids.

**IMO performance standard MSC.112(73) and associated IEC standards are an epoch-making milestone in the radionavigation history.**

<table>
<thead>
<tr>
<th>Major functionality</th>
<th>MSC.112(73), IEC 61108-1 ed.2</th>
<th>A.819(19), IEC 61108-1 ed.1</th>
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</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>13 m (95%)</td>
<td>100 m (95%)</td>
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<tr>
<td>SOG (speed over ground)</td>
<td>Required to accuracy of SDME</td>
<td>SOG prohibited, no testing standard</td>
</tr>
<tr>
<td>COG (course over ground)</td>
<td>Required to accuracy of ±1° (~17 kt), ±3° (~17 kt)</td>
<td>COG prohibited, no testing standard</td>
</tr>
<tr>
<td>UTC</td>
<td>Required to output</td>
<td>Data is limited to only L/L</td>
</tr>
<tr>
<td>RAIM (Receiver autonomous integrity monitoring)</td>
<td>Required to indicate integrity indication of Safe, Caution, Unsafe at confidence level of 10 m and 100 m</td>
<td>No</td>
</tr>
<tr>
<td>Display update rate</td>
<td>1 s at latest</td>
<td>every 2 s</td>
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</tbody>
</table>

**How SOG and COG are measured?**

As locations of GPS satellites in view are known, analyzing Doppler shifts from them produces the latitudinal and longitudinal components of velocities of respective moving satellites relative to a GPS receiver. Vector sum of these components provides a speed over ground (SOG). Course over ground (COG) is at the same time found as an angle of the SOG vector relative to the north. Note COG is not a course made good (CMG) that is found by striking a segment between two locations (past and present). Accuracy of SOG is free from the moving speeds of the ship but that of COG is subject to the ship speed. The faster ship speed provides a longer vector; thus, the error of COG gets smaller. Suppose your ship is at anchor; the COG vector can be anywhere within a SOG error domain. Errors mostly results from ionospheric refraction of the GPS signals.

As the WAAS utilizes the same frequency as the GPS, a single antenna can receive GPS and WAAS signals. Currently two Inmarsat GEO satellites are available for receiving the WAAS signal: AOR-W and POR. Major contributors of an error in a single frequency GPS system are receiver clock drift and signal delays by refraction. The WAAS reference stations on the earth monitor the GPS constellation and route GPS error data to the satellites via the master earth station. The Inmarsat or communication satellite broadcasts the differential corrections to marine and aviation users.

**DGPS**

Differential operation of the GPS consists of several essential elements. In a word, a reference receiver is placed at a known point (usually at radio beacon stations). It compares the known location with that predicted by the GPS reference receiver producing correction data. This data is broadcast in MSK modulated signals within the beacon band. The differential beacon receiver on ship receives and demodulates the signals, applying the correction data to the GPS receiver.
SPECIFICATIONS OF GP-90

**POWER SUPPLY**
12-24 VDC, 0.8-0.4 A

**EQUIPMENT LIST**

### Standard
1. Display Unit (Specify single or dual) 1 unit
2. Antenna Unit GPA-017S 1 unit
3. Antenna Cable 15 m
4. Interface Cable 5 x 2 pcs
5. Installation Materials and Spare Parts 1 set

### Option
1. DGPS Receiver Kit OP20-32-1/20-33
2. Whip Antenna FAW-1.2 for GPA-018S
3. Antenna Cable, 30/50 m
4. Interface Cable, 5/10 m
5. Antenna Base
   - CP20-0111 (Pipe mount), No.13-QA310 (Offset bracket), No.13-RC5160 (Handrail mount)
7. Interface Unit IF-2500
8. External DGPS Receiver GR-80
9. Rectifier PR-62

### GPS Receiver
- 12 discrete channels all-in-view, C/A code
- RX Frequency: L1 (1575.42 MHz)
- Time to First Fix: 12 s (Warm start)
- Tracking Velocity: 900 kt
- Geodetic System: WGS-84 (NAD-27 or others selectable)
- Update Rate: 1 s

### Positioning Augmentation

#### DGPS
- Reference Station: Automatic or manual selection
- Frequency Range: 283.5 - 325.0 kHz (all ITU regions)
- Format: RTCM SC-104 Ver 2.0 Type1, 7, 9, 16

#### WAAS
- Standard fitted in display unit
- Accuracy:
  - GPS: 10 m (95%)
  - DGPS: 5 m (95%)
  - WAAS: 3 m (95%), limited coverage
  - SOG: ±0.001 kt (calm sea)
  - COG: ±3° (SOG 1-17 kt), ±1° (SOG > 17 kt)
- Display:
  - 6" LCD (120 W, 91 H mm), 320 (H) x 240 (V) pixels,
  - L/L resolution: 0.001 min
- Display Modes: VideoPlotter, Highway, Text, Steering
- VideoPlotter
  - Scale: 0.02 to 320.0 nm,
  - Plot Interval: 1 s - 60 min or 0.01-99.99 nm
- Memory Capacity: 2,000 points for ship's track and marks, 999 waypoints with comments, 30 routes (containing 30 waypoints/route)
- Alarms:
  - Arrival, anchor watch, XTE, speed, time, water depth, trip, DGPS, WAAS
- Integrity indication:
  - Safe, Caution, Unsafe at accuracy level of 10 m or 100 m
- Interface (IEC 61162-1 Ed 2, NMEA 0183):
  - Output: GBS (satellite fault), GLL (L/L), VTG (SOG, COG), ZDA(UTC), WPL (WPT location), etc.
  - Input: DBT (Depth), HDT (Compass), MTW (Water temperature), TLL (TGT L/L), VBW (Dual grd/wat spd), etc.
- ENVIRONMENT (IEC 60945 test method)
  - Temperature: Display Unit: -15°C to +55°C
  - Antenna Unit: -25°C to +70°C
  - Waterproofing: Display Unit: IPX5 (IEC 60529), CFR46 (USCG)
  - Antenna Unit: IPX6 (IEC 60529)
  - EMC: IEC 60945 Ed. 4 (up to 2 GHz)

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**SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE**