INSTRUCTION MANUAL

SIMRAD HS52

GPS compass and DGPS navigator

20222360E   English

Document revisions

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A	27.04.2006	*FOS*		*GdR*
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Document history

Rev. A	Original issue.
Rev. B	Documentation of the PSXN,20 and RRE format included. Description of system performance at alarms has been changed
Rev. C	Additional description of the PSXN,20 format
Rev. D	Changes in the text of the RRE format and updated description of the PSXN,20 format
Rev. E	New part no. on the 30 m cable. Declaration of Conformity certificate included.

If you have any comments or constructive criticism to this manual, please send all such - in writing to:

documentation@sim.net

About this manual

This manual is intended as a reference guide for operating, installing and maintaining the HS52 Heading Sensor. Please take time to read this manual to get thorough understanding of the operation and system components.

In this manual the following notations are used:

Caution!   *Used to make the user aware of procedures and operational practice which, if not followed, may result in degraded performance or damage to the equipment.*

Note!   *Used to draw the user's attention to special features or behavior of the equipment.*

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Contents

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1. INTRODUCTION

1.1 HS52 System Components

The Simrad HS52 provides position and true heading output with no moving parts. The HS52 combines several vessel instruments with one compact navigation package; gyrocompass, GPS receiver equipment, speed log and Rate Of Turn indicator.

The HS52 comprises the following units:

SENSOR UNIT

1m

30m

DISPLAY UNIT

15m

PROCESSING UNIT

POWER INPUT
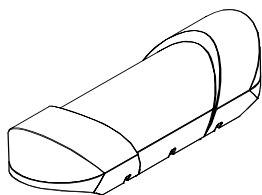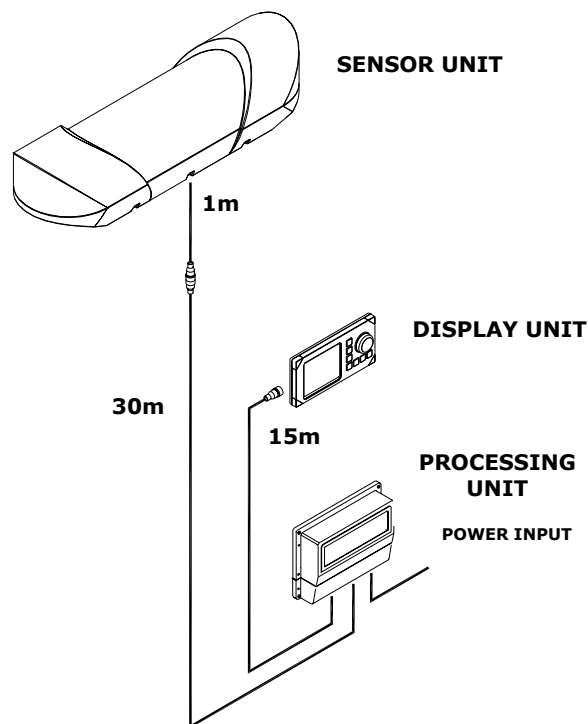
The Sensor unit contains two GPS sensors, electronic board with I/O and an inertial rate element.
The Sensor unit is to be mounted in the vessel's mast or flat on a roof or deck.
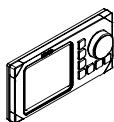
The Display unit contains an LCD for navigation information, main board with CPU, flash, power and I/O, and buttons for setup and operation of the HS52 system.
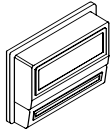
The Processing unit contains the main board with CPU, flash, power, I/O and a terminal list.

Precision heading is derived from the fixed-distance dual GPS antenna arrangement in the Sensor unit, using carrier phase data to generate heading information independent of latitude and vessel dynamics. GPS position and speed are calculated from both antennas, which give redundant position and velocity sources in this product. Input of DGPS corrections or reception of SBAS (WAAS/EGNOS) signals may improve position accuracy.

The inertial rate element provides yaw/ROT information. In case of short GPS outages, the inertial sensor automatically takes over as the prime source for heading determination until the GPS comes back on line. Working together seamlessly, the inertial and GPS elements of the system insure accurate, continuous and robust heading information.

The Processing unit includes configurable output serial lines and Ethernet connections making it easy to distribute HS52 data to multiple users on board the vessel.

The HS52 requires no scheduled maintenance or re-calibration. The system offers flexible configuration of the output variables and interface setup, depending on the vessel and application. It is easy to operate, install and align.

The HS52 system has the following features:
- True heading anywhere on earth
- 0.5º heading accuracy
- Heading accuracy unaffected by the latitude
- Heading available in periods of GPS drop-outs
- Compliant to WAAS, EGNOS and MSAS Satellite Based Augmentation Systems
- Capable of DGPS multi-reference station processing
- Combines several instruments with one robust, integrated product
- Only two-pair cable (no coax) between the mast unit and the Processing unit on the bridge.
- 20 Hz update rate on heading, rate of turn and position measurements
- Three RS-422 output serial lines to equipment requiring data from a IMO approved product
- Three RS-232 configurable output serial lines for non IMO critical purposes
- Output data on Ethernet
- 1PPS output for synchronization of other survey equipment

The product is type approved as:
- THD (Transmitting Heading Device) using GNSS principle. BSH type approval no. BSH/4615/4030233/06.
- GPS Receiver Equipment and has a Wheelmark

Be aware that the product can only be certified either as THD or GPS Receiver Equipment onboard and not both.

1.2 Definitions, Abbreviations and Acronyms

Definitions

Alignment	The process of adjusting the current internal navigation frame (sensor-frame) in the instrument to the true vessel body frame.
Heading	The direction of the main axis (bow direction) of the vessel. This is opposed to course, which is the direction of the vessel motion.
Yaw	A rotation about the vertical axis and is positive when turning eastward when the vehicle cruises in north direction. Normally yaw means the dynamic yaw motion.

Abbreviations and Acronyms

CEP	Circular Error Probability
COG	Course Over Ground
DGPS	Differential GPS
ESA	European Space Agency
FAA	Federal Aviation Administration, USA
DU	HS52 Display Unit
EPE	Estimated Position Error
GPS	Global Positioning System
GSA	A standard NMEA message including GPS satellite ID numbers, PDOP, HDOP and VDOP
HDOP	Horizontal Dilution Of Precision
HGT	GPS Antenna Height above the WGS-84 ellipsoid
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
I/O	Input/Output
NMEA	National Marine Electronics Association. NMEA 0183 is a standard for interchange of information between navigation equipment

PDOP	Positional Dilution Of Precision. A three dimensional geometry only, dependent on accuracy figure.
1PPS	One Pulse Per Second
PSXN20	A proprietary NMEA message including position, height and heading quality information
PU	HS52 Processing Unit
RFI	Radio Frequency Interference
RF	Radio Frequency
RMS	Root Mean Square
ROT	Rate of Turn
RRE	Range Residual Error, a specific Ashtech format
RTCM	Radio Technical Commission of Maritime Services
SBAS	Satellite Based Augmentation System
SOG	Speed over Ground
SS	Signal Strength
SSB	Single Side Band
UTC	Universal Time Co-ordinate. This is the official time in the world and has replaced GMT (Greenwich Mean Time) as the official time
VDOP	Vertical Dilution Of Precision
VHF	Very High Frequency
WER	World Error Rate
WGS-84	World Geodetic System of 1984

2. TECHNICAL SPECIFICATIONS

2.1   Health, Environment and Safety

Operation or troubleshooting of HS52 equipment will not imply any risk for high voltages, explosions or exposure to gas. The HS52 is type-approved according to IEC 60950/EN60950 standards regarding product safety (low voltage), and IEC 60945/EN60945 standards on electromagnetic compatibility (immunity/radiation) and vibration.

All HS52 electrical and electronic components have to be disposed separately from the municipal waste stream via designated collection facilities appointed by the government or local authorities. The correct disposal and separate collection of your old appliance will help preventing potential negative consequences for the environment and human health. It is a precondition for reuse and recycling of used electrical and electronic equipment. For more detailed information about disposal of your old appliance, please contact your local authorities or waste disposal service.

2.2   Restrictions in Guarantee

The liability of the manufacturer is limited to repair of the HS52 only, and excludes consequential damages such as customer's loss of profit or damage to other systems traceable back to HS52 malfunction. The warranty does not cover malfunctions of the HS52 resulting from the following conditions:

a) The customer has opened the Sensor unit

b) Over-voltage or incorrect power connection

c) The equipment has been exposed to extreme chock and vibrations

2.3   Restrictions in Use

Simrad HS52 is designed for use on board marine surface operated vessels with roll and pitch motions up to ±30°.

The HS52 function is based on GPS signals and requires free sight to the sky, minimum 4 visible satellites, and PDOP value less than 6 and otherwise normal conditions to operate.

2.4   Performance Data

Heading accuracy: ....0.5° RMS

Heading resolution:..0.01°

Heading operational measurement range: .Roll/pitch within ±30°

Rate of turn accuracy:.. 0.5º/s + 5%

Maximum turn rate: 80º/s

Maximum speed: ....515 m/s

Navigation update rate:...2 Hz

Position accuracy GPS, dynamic and static[1]: ....13 m 95% CEP

Position accuracy with DGPS:.....1.2 m RMS or 2.5 m 95% CEP

Position accuracy with SBAS:.....1.2 m RMS or 2.5 m 95% CEP

Velocity accuracy: ....0.03 m/s RMS or 0.07 m/s 95% CEP

COG accuracy (above 1 to 17 knots):.....................................±3°

COG accuracy (above 17 knots):..±1°

Settling time for heading: ....within 10 minutes

Settling time for position: ....within 2 minutes

Acquisition time no valid almanac:...................within 5 minutes

Acquisition time valid almanac: ....within 5 minutes

Re-acquisition time after 24 hours GPS signal ....

interrupt with valid almanac:..............................within 2 minutes

Re-acquisition time when subjected to power ....

interrupt of 60 s:...within 2 minutes

GPS position update: .... 2 Hz (50 Hz with extrapolation)

Sensitive acquisition[2]:...130 dBm

Sensitivity tracking[3]:..133 dBm

The performance figures are valid with a minimum of 4 visible satellites, HDOP less than 4, PDOP value less than 6, high quality DGPS corrections[4]   and otherwise normal conditions. Excessive multipath, GPS signal obstructions or interference may reduce the performance.

The HS52 Sensor unit includes two 16-channel GPS receivers. Frequency GPS L1 1575.42 MHz CA code. The position data

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[1] As specified by GPS SPS Performance Standards of October 2001

[2] As measured at he output of a 3 dBi linear polarized receiving antenna

[3] As measured at he output of a 3 dBi linear polarized receiving antenna

[4] Has no impact on heading accuracy.

output from the system is referred to the centre of the Sensor unit both horizontally and vertically.

2.5 Physical Dimensions

Sensor Unit

Width ....850 mm (33.5 in.)

Height: ....205 mm (8.1 in.)

Depth: ....262 mm (10.3 in.)

Weight: .... 8 kg (17.6 lbs.)

Color: ....White

Dimensional drawing..Page 64

Display Unit

Width: ....220 mm (8.7 in.)

Height: ....110 mm (4.3 in.)

Depth: ....39 mm (1.5 in.)

Weight: .... 0.5 kg (1.1 lbs.)

Color: ....Black

Dimensional drawing..Page 66

Processing Unit

Width: ....287 mm (11.3 in.)

Height: ....203 mm (8 in.)

Depth: ....60 mm (2.4 in.)

Weight: .... 1.3 kg (2.9 lbs.)

Color: .... Black

Dimensional drawing..Page 65

2.6　Power

Processing Unit

Nominal Voltage:.............. 12 or 24 VDC in range 10 to 31 VDC

Power consumption: .... 15 W

2.7　Environmental Specification

Sensor Unit

IEC 60945 Category: ....Exposed

Enclosure material, sensor housing: ....Polyethylene

Enclosure protection:...IP-66

Operating temperature range: ....-25 to +55ºC (-13 to 131°F)

Operating humidity (max.): 100%

Storage temperature range: ....-30 to +70ºC (-22 to 158°F)

Storage humidity (max.): 100%

Safe distance to standard compass:........................... 0.3 m (1.0 ft)

Display Unit

IEC 60945 Category: .... Protected

Enclosure material: ....Plastic

Enclosure protection:..............IP-56 from front, IP-43 from back

Operating temperature range: .... -15 to +55ºC (5 to 131°F)

Recommended operating temp. range (increased lifetime): ....0 to +40ºC (32 to 104°F)

Storage temperature range: ....-30 to +80ºC (-22 to 176°F)

Safe distance to standard compass:....................... 0.35 m (1.1 ft.)

Processing Unit

IEC 60945 Category: .... Protected

Enclosure material: .... Plastic/Anodized aluminum

Enclosure protection: IP-44

Operating temperature range: .... -25 to +55ºC (-13 to 131°F)

Storage temperature range: .... -25 to +60ºC (-13 to 140°F)

Safe distance to standard compass: .... 0.3 m (1.0 ft)

2.8   Cable

Processing Unit to Sensor Unit Cable

Type: .... 2x2x0.5 mm^2 with shield

Maximum length: .... 100 m (328 ft)

Diameter: .... 10 mm (0.4 in.)

Flame retardation: .... IEC 332-3/A

2.9   Interface

Configuration: .... Display unit connected to the Processing unit

Data outputs: .... Three RS-232 serial lines,
Three RS-422 serial lines,
Ethernet UDP/IP

Data inputs: .... One RS-232 and one RS-422 serial line

DGPS corrections: ..... RTCM 104 version 2.2 and SAPOS® EPS

Baud rate: .... Max. 38.4 kBaud

HDT, ROT, GGA and GLL data update rates: .... Up to 20 Hz

HDT, ROT, GGA and GLL data delay: .... Less than 50 ms

ZDA and VTG data update rate: .... Max 2 Hz

VTG data delay: .... Max 1 sec

ZDA data delay: .... 1 ms

1PPS signal accuracy: .... 0.5 ms

MTBF: .... 35000 h

MTTR: .... 1 h

Data output formats:
- NMEA 0183 DTM, GBS, GGA, GLL, GNS, GRS, GSA, GST, HDT, RMC, ROT, VTG and ZDA. These messages are according to IEC 61162-1 and follow the standard regarding unused fields on talker.

- NMEA 0183 proprietary format PSXN, 20 and the specific Ashtech format RRE. See page 69 for description of these formats.
- Radar output on the AD-10 format (Simrad and Furuno radar compatible) and a 1PPS signal.
- 1 Hz. An NMEA ZDA message that is output at 1 Hz interval and according to IEC 61162-1. See page 24 for description of this format.
- STX104. A format used by service personnel for troubleshooting the system.

3. INSTALLATION

3.1 General

The following parts are supplied with a standard HS52 system:

- Sensor unit with 1 meter cable w/connector and 4 fastening bolts

- Display unit with 15 meters cable to the Processing unit and flush mounting kit

- Processing unit including 4 fastening screws

- 30 meters cable to be used between Sensor unit and Processing unit

- Documentation
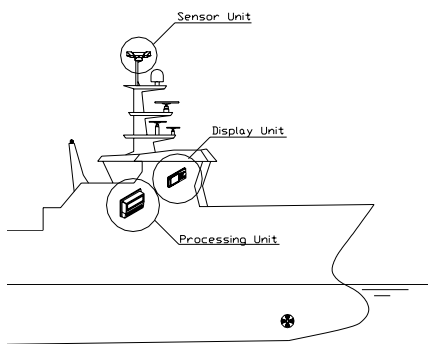
Caution!

The Sensor unit has to be mounted in a way that avoids blocking of the GPS signal.

The Processing and Display Unit can be mounted on the bridge or in the instrument room.

No units should be exposed to heavy vibration, transformers or similar.

3.2 Cable Connection

Use only shielded cables for the installation. This includes power input and signal cables. The cables should be of 0.5 mm^2 (AWG20) twisted pairs.

The cable to the Display unit and other cables (NMEA input/output, Ethernet) should not be run in parallel with other cables carrying RF or high current, such as VHF and SSB transmitters, battery charges/generators and winches.

3.3 Grounding

All units in the HS52 system use the Processing unit as a common ground/shield connection. The Processing unit should therefore have a proper ground connection to the hull/bonding system.

3.4 Sensor Unit

Location of the Unit

The Sensor unit is the most important part of the HS52 system, and great care should be taken when deciding the mounting location.

The space above the Sensor unit has to be free of obstructions of any kind. A GPS compass is more sensitive for blocking and reflections (multipath) of GPS signals than GPS sensors that are only used for calculating position. This since HS52 also utilizes carrier phase measurements for heading determination, and both GPS antennas need to see at least two common satellites at the same time.

The unit should be protected from direct illumination of radar beams and other transmitting antennas such as Inmarsat antennas.

The Sensor unit has to be mounted horizontally in the mast or directly on deck, with 5° maximum allowed deviation angle from the horizontal plane. If mounted in the mast, the distance from the unit to the nearest deck should be as large as possible to reduce problem due to the multipath effect.
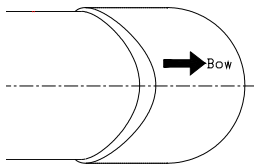
The unit should also be mounted parallel to the vessel's centerline with the bow arrow pointing forward. The heading offset feature will however compensate for a heading offset caused by the orientation of the Sensor unit. An eventual offset correction is performed after the calibration as described in *Head Offset* on page 36.
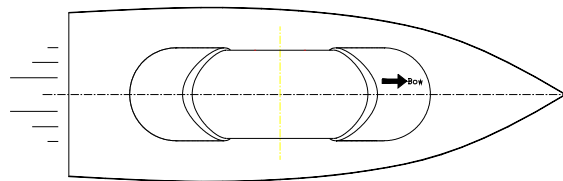
Mechanical Installation

The Sensor unit may be mounted in the mast or directly on the deck.

The dimensional drawing for the Sensor unit on page 64 shows dimensions and internal distance for the mounting holes and the cable outlet.
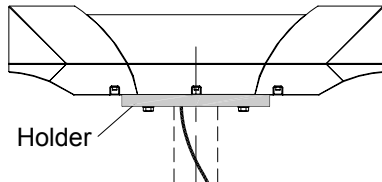
Holder

If necessary, a user-made holder may be used as shown on the figure when installing the unit.

Caution! *Independent of which fastening method that is used, the Sensor unit should not differ more than ±5° from the vessel's horizontal plane and the alongship axis. If the mounting is not within this tolerance, the heading accuracy will be degraded.*

Cable ties

Connectors with self-bonding tape

Cable duct
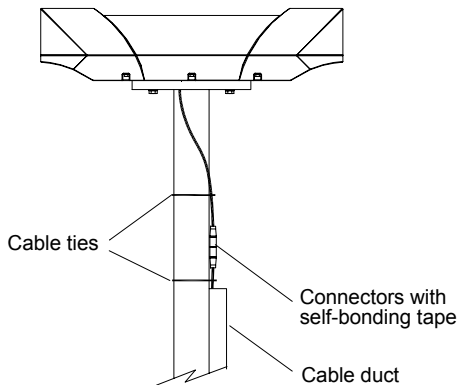
Connect the cable from the Processing unit to the cable from the Sensor unit.

Caution!

The connector junction must be sealed with self-bonding tape for waterproofing. After coiling, make bonding by hard pressure.
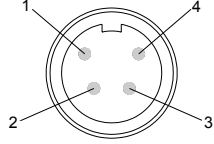
Use the required number of cable ties to fasten the cable to the mast.

Cable Wiring

The wiring for the Sensor unit cable in the Processing unit terminals is as follows:

| Cable Wire No.	Signal Description	Processing Unit Label
Screen	Cable shield	Chassis
4	Transmit	COMM+
3	Receive	COMM-
2	+24 VDC	PWR
1	Power ground	GND

If the Sensor unit connector needs to be reconnected to the cable, the wiring for the cable within the Sensor unit connector is as follows:

	Sensor Unit Connector	Cable Wire	Signal Description
	Pin no.	No.	
FRONT VIEW	Connector housing	Screen	Shield
	4	3	Receive
	3	2	+24 VDC
	2	4	Transmit
	1	1	Power ground

Waterproofing of Connectors

The Sensor unit connector junction has to be sealed with self-bonding tape and PVC/Vinyl tape for waterproofing. Proceed as follows:

1. Coil the self-bounding tape from one cable end to the other as shown in the figure below. Use at least two layers with tape. After coiling, make a bonding by pressure of fingers.

2. Coil at least two layers of PVC/Vinyl tape without stretching as shown in the figure below. After coiling, make a bonding by pressure of fingers.
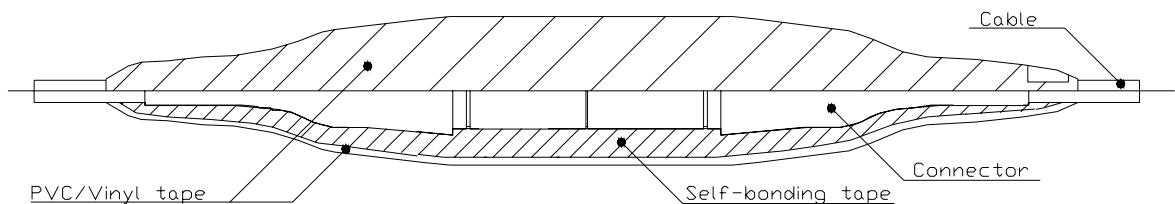
3.5   Display Unit

Location of the Unit

Avoid mounting the Display unit where it is easily exposed to sunlight, as this will shorten the lifetime of the display. If this is not possible, make sure the unit is always covered with the white protection cover when not used.

The unit is designed for installation in a protected environment and for operation within the temperature range. The best location is typically in the instrument room or on the bridge mounted close to the Processing unit.

Panel Mounting

Two mounting methods may be used when panel mounting the HS52 Display unit.

A drilling template, part no. 22084883, is supplied with the HS52 documentation. Use this template when making panel cut-out and drilling holes.
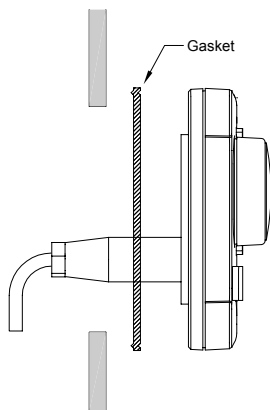
Gasket

1. Remove the front panel corners.

2. Drill the mounting holes and make panel cut-out according to supplied template.

3. Use the supplied gasket (part no. 22084693) between the panel and the unit.

4. Fasten the Display unit to the panel with the supplied 19 mm screws.

5. Apply the front panel corners.

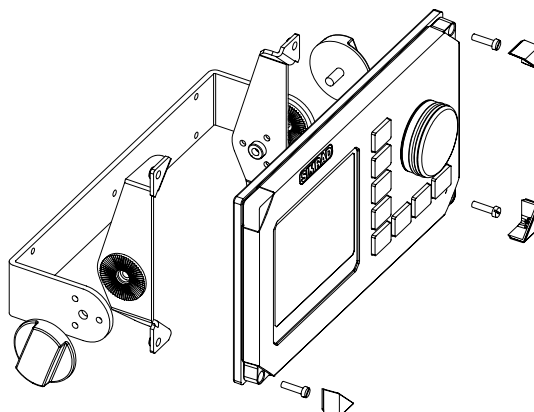6. Connect the Processing unit cable to the Display unit connector.

Caution!   *Do not over-tighten the mounting screws.*

Alternative Panel Mounting

This way of mounting is simpler, but will lift the unit from the panel surface. When installed adjacent to Simrad MarineLine equipment there will be a 5.5 mm (0,22") difference in height between the Display unit and other equipment.
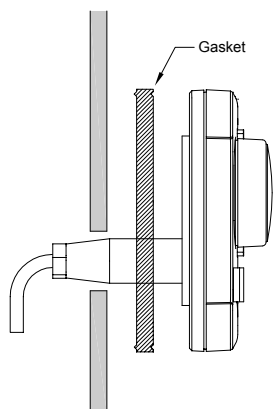
1. Remove the front panel corners.

2. Use the template and drill hole(s) only for the connectors.

3. Place the 7.5 mm gasket (part no. 22086029) between panel and unit, correctly oriented (see marking on gasket).

4. Fasten the Display unit to the panel with the supplied 19 mm screws.

5. Apply the front panel corners.

6. Connect the Processing unit cable to the Display unit connector.

Bracket Mounting (option)

An optional bracket, part no. 22084941, may be ordered from Simrad.

Note!

When the Display unit is bracket-mounted, it is not weatherproof from the back due to a breathing hole in the back cabinet. When bracket-mounted, the exposed parts of the plugs should be protected against salt corrosion.

1. Locate the cradle on the mounting site and mark the 4 holes for the screws on the mounting surface.

2. Drill the 4 holes and screw the cradle to the mounting surface.

3. Remove the front panel corners, and use the supplied screws to fasten the Display unit to the left and right brackets.

4. Apply the front panel corners.

5. Use the two locking knobs to assemble the cradle with the left and right brackets and adjust the Display unit for the best viewing angle.

6. Connect the cable from the Processing unit to the Display unit connector.

Display Unit Cable

The 15 m cable to the Processing unit has connector only at the Display unit end. Optional extensions cable (10 m) is available and has a male and a female connector.

The connector is of crimp type. It can be easily disassembled, if desired for ease of installation. The extracting tool (p.no. 44161792) may be ordered from Simrad.

HOW TO REMOVE PINS:

Extraction tool

Pull the wire

Insert tool in slot
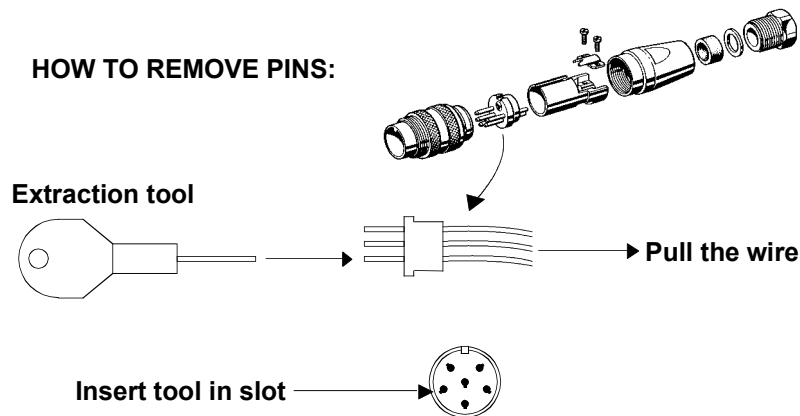
See the table below for pin configuration and color code for this cable. DO NOT MIX THE PINS AND THE CABLE COLORS!

Note!

Apply a thin layer of pure Vaseline on the connector threads and make sure the connectors are properly secured to the receptacle by the coupling ring. The connectors are weather proof according to IP56, when properly installed. The plug must be fitted with the plastic cap to keep the connector free of dirt and moisture. A separate screw cap for the Display unit comes as part of the installation kit.

Display Unit Cable			Processing Unit	
Cable pairs	**Color code**	**Connect or pin**	**Terminal pin**	
1st pair	Pink	5	PWR	
	Grey	4	GND	
2nd pair	Brown	1	Bus–	
	White	2	Bus+	
3rd pair	Yellow	3	POWC	
	Green	6	ALARM	

FRONT VIEW

Note!

*For installations that require special cable length, contact your Simrad distributor for information.*

3.6 Processing Unit

The Processing unit is not waterproof and should be mounted vertically in a protected place. Reserve sufficient space below the unit to allow insertion for cable connections.

It is recommended that ventilation or air conditioning is provided in order to keep the ambient operating temperature below +55ºC (+130ºF). The best location is typically in the instrument room or on the bridge.
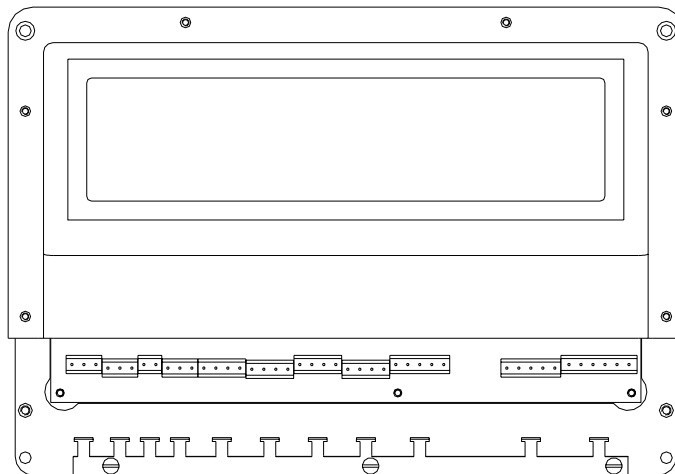
Dimensions for the Processing unit are shown on page 65.

Use the supplied mounting screws for fastening the Processing unit as shown on the figure below.
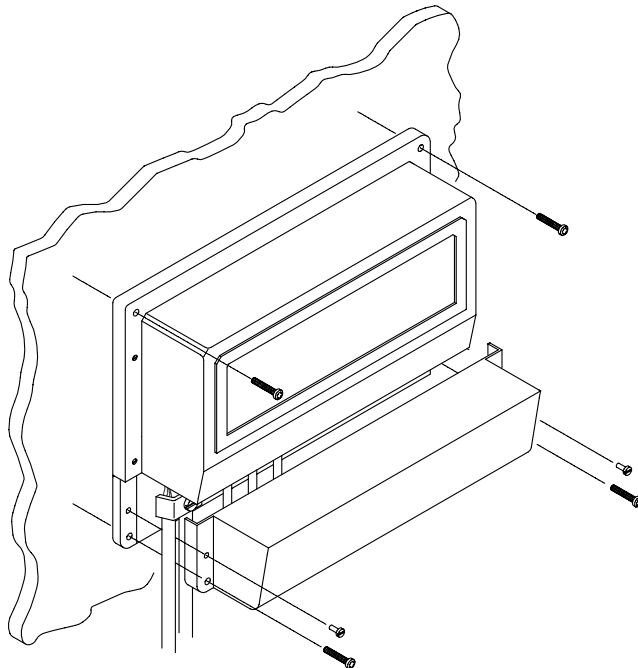
Cable Connections

Proceed as follows to connect the cables to the Processing unit:

1. Remove the bottom cover (terminal cover) to get access to the plug-in terminals.

2. Strip about 3 cm (1.2") of the cable's insulation and pull the screen backward to cover the insulation. Position the straps as shown in the drawing below and tighten well to make sure the screen has good contact with the chassis.
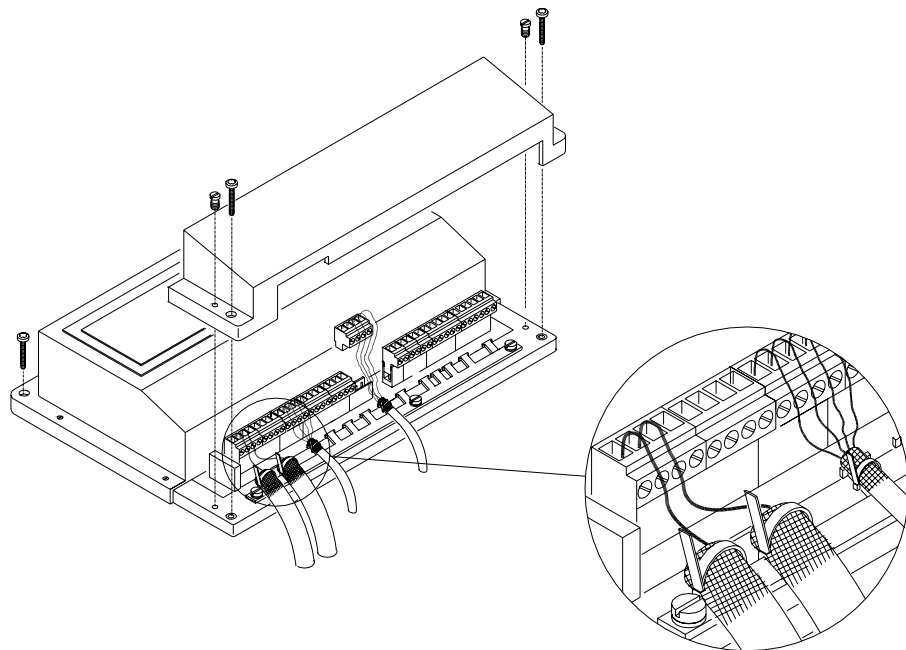
3. Provide sufficient wire length (about 3 cm (1.2")) so that the plug-in terminals can be easily connected/disconnected.

4. Pull out each terminal before connecting the wires. Remove all stands before putting on the terminal cover.

The pinout for each terminal is as follows:

|				
P200	Display Unit	6	ALARM	Green
		5	POWC	Yellow
		4	BUS+	White
		3	BUS-	Brown
		2	PWR	Pink
		1	GND	Grey
P201	Sensor Unit	6		
		5		
		4	COMM+	4
		3	COMM-	3
		2	PWR	2
		1	GND	1
P210			**Not Used**	
J60	Ethernet		RJ45	
J600			**Not Used**	
P80			**Not Used**	
P202	Data Out 1	4	232 OUT	
		3	422- OUT	
		2	422+ OUT	
		1	GND	
P203	Data Out 1	4	232 OUT	
		3	422- OUT	
		2	422+ OUT	
		1	GND	
P204	Data Out 2	4	232 OUT	
		3	422- OUT	
		2	422+ OUT	
		1	GND	
P205			**Not Used**	
P206			**Not Used**	
P207	Diff Input	3	422+ IN	
		2	422- IN/232 IN	
		1	GND	
P208	Radar	3	AD10_C	Clock
		2	AD10_D	Data
		1	AD10_GND	Common (C & D)
P401	ALARM	3	ALARM_NOT	
		2	COMMON	
		1	ALARM	
P400	Power	2	PWR_+	
		1	PWR_GND	

Connecting to Simrad Equipment

The figures on the following pages show how HS52 is connected to Simrad equipment.

All equipment using NMEA signal is connected to 232 OUT and GND, alternatively to 422– OUT and 422+ OUT on P202, P203 or P204. After the equipment is connected to HS52, the data output line has to be configured as described in ***Data Output*** on page 31.

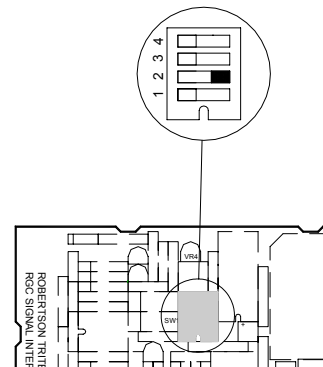Connection to Simrad Radar is done from P208.
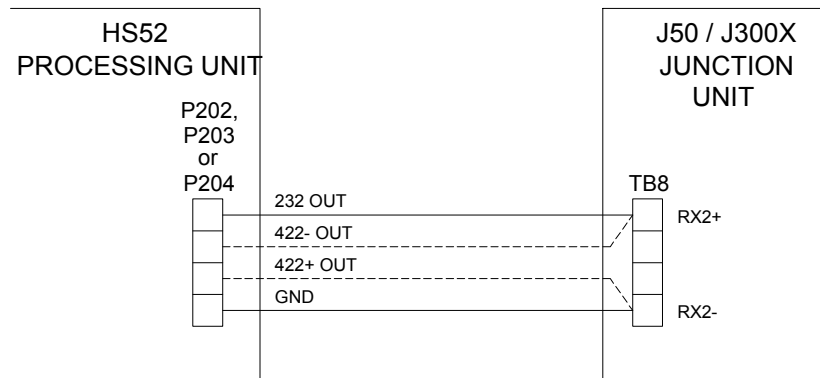
AP9MK3 Autopilot
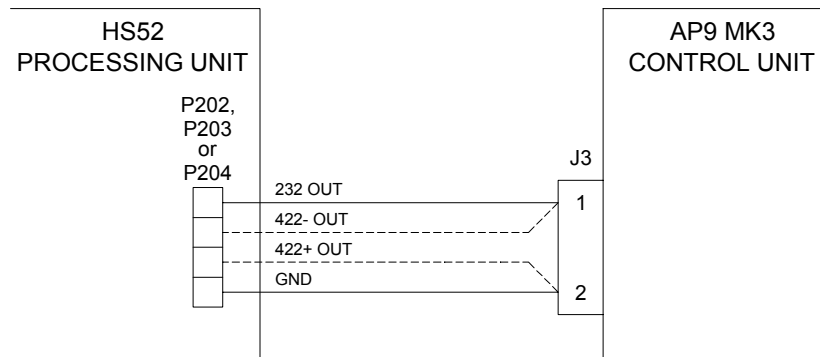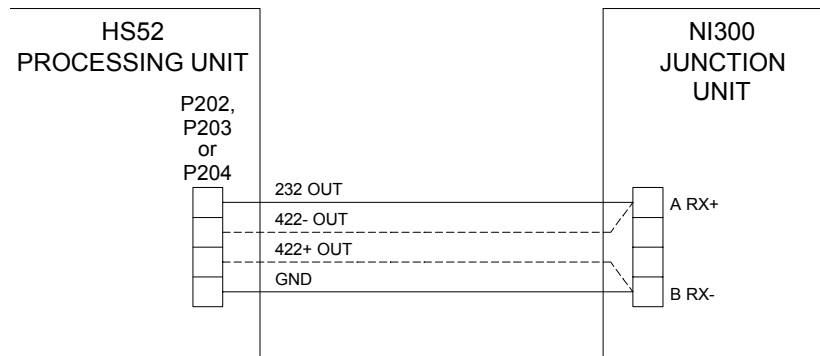

RGC Signal Interface Unit
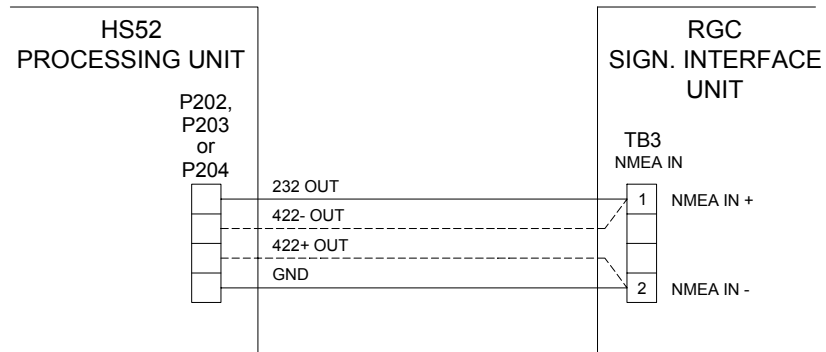
Note!   *DIP Switch SW1-2 on the Signal Interface PCB has to be set to NMEA according to the figure.*
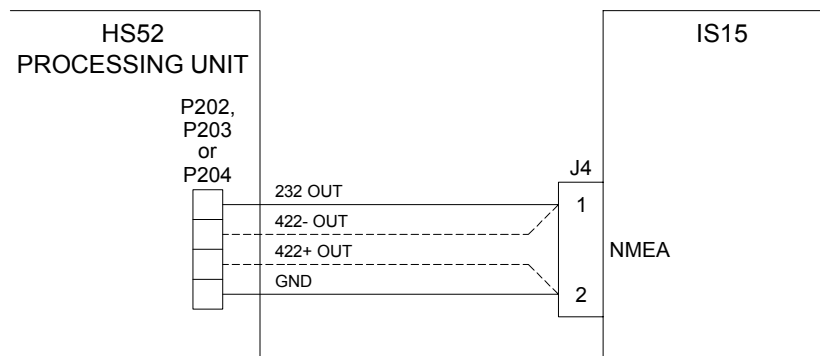
J50/J300 Junction Unit
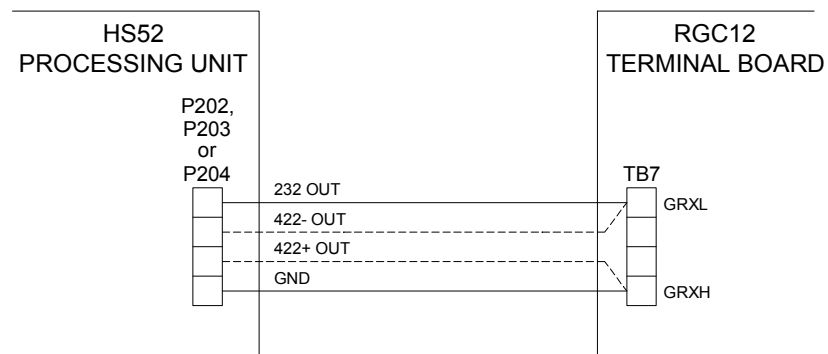

NI300X
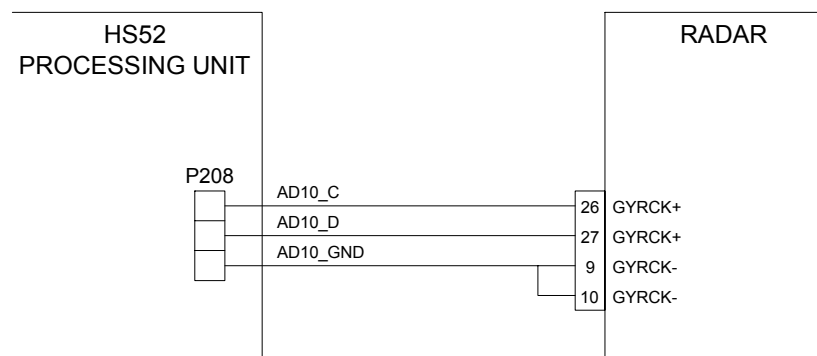

IS15 Instruments

RGC12 Gyro Compass

```
       HS52                                        RGC12
  PROCESSING UNIT                              TERMINAL BOARD

      P202,
      P203
       or
      P204
              232 OUT                       TB7
                                                   GRXL
              422- OUT
              422+ OUT
              GND
                                                   GRXH
```

Simrad RA40/RA50 Radar

```
       HS52                                        RADAR
  PROCESSING UNIT

      P208    AD10_C                      26   GYRCK+
              AD10_D                      27   GYRCK+
              AD10_GND                     9   GYRCK-
                                          10   GYRCK-
```

Note! *Requires the optional 36-pins connector 72099 for the Radar.*

Software set-up in Radar

1. Go to menu:

   MENU → SETUP → CUSTOM → PRESET1

2. Change **Input** from **NMEA** to **10 BIT**

3. Change **Head** from **TRUE** to **MAGNETIC**

3.7 1PPS Signal Connection

A 1 pulse-per-second (1PPS) signal synchronized with GPS time is available from the terminal blocks P208 named Radar on the Processing unit. This 1PPS signal originates from the GPS receiver within the Sensor unit. The 1PPS signal is buffered and fed to the P208 connector. The high level is at +5V (unloaded) with 180 Ohm load source impedance. The low level is at 0V. The 1PPS signal is active high and has a pulse width of 1 ms. The 1PPS is generated exactly once every second with its rising edge synchronized to GPS time. Synchronized with this signal it

is possible to output 1PPS time tag messages from HS52. This message is the **ZDA 1 Hz** format and is selectable as output format in the **Data Output 1** and **2** menu.

Select 1PPS as clock data format in the **General** setup menu to activate 1PPS signal output on the P208 connector. The signal will then be available on the AD10_D pin with the ground reference on the GND_D pin.

ZDA 1 Hz Message

This 1PPS time tag message is output once per second, approximately 0.5 seconds before the time pulse. The message format is ASCII text using the ZDA message defined in *NMEA 0183 Standard for interfacing marine electronic devices*, Version 2.3. The message contains the UTC time when the message is output. The next time pulse appears at the first integer second after the time in the message.

Format: **$INZDA,***time***,***day***,***month***,***year***,***csum term*

Explanation:

time	UTC time on format hhmmss.ss where hh is hours (00 - 23), mm is minutes (00 - 59) and ss.ss is seconds (00.00 - 59.99).
day	Day of month (01 - 31).
month	Month of year (01 - 12).
year	Year on format yyyy.
csum	Checksum (exclusive or) of all characters between, but not including, the preceding **$** and *****, hexadecimal (00 - FF).
term	CR-LF (two bytes, values 13 and 10).

This format is recommended used together with 1PPS signal output on the terminal block P208 on the Processing Unit. This since the message is output synchronized with the 1PPS signal and is easier/faster to decode than the standard NMEA output with a number of NMEA messages included.

3.8 External Alarm

To comply with the IMO Transmitting Heading Device type approval (not mandatory for GPS Receiver Equipment approval), the Simrad HS52 has to be connected to an external alarm. This since the acoustic alarm in the Display unit is not within the required minimum level of 75 dB. Therefore the Processing unit has built-in alarm functionality. An alarm will open the alarm relay, which can be used to trigger an external alarm. The diagram below shows how an external alarm can be connected to the Processing unit terminal block P401.

FROM UPS SUPPLY
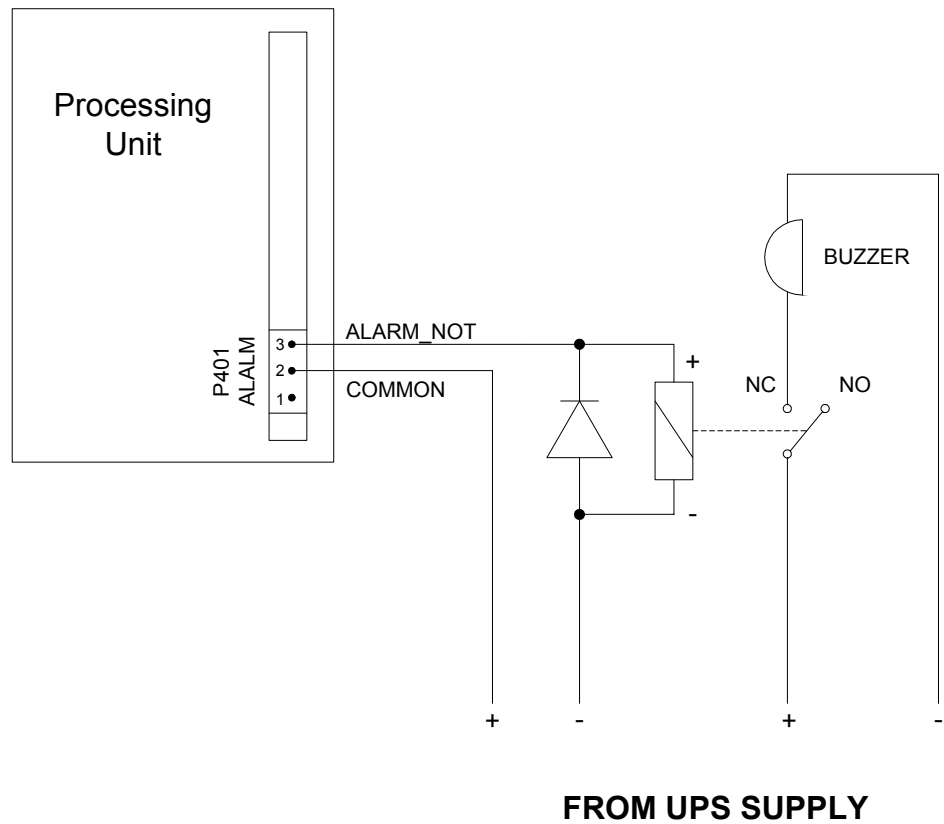
3.9   Software Setup Procedure

This chapter describes a number of basic installation settings that must be performed as part of the Simrad HS52 installation. Some of these settings may also need to be changed during operation. In addition to the basic installations settings, a number of advanced setting are available. The advanced settings are described in chapter 3.10. Failure to correctly set the values in the installation settings may prohibit the product from functioning properly.

Before attempting to turn on the Simrad HS52 product and perform an installation setup, the hardware and electrical installation must be completed in accordance with the installation instructions.

The SETUP menu is entered on the Display unit by pressing and holding the **SETUP** button for 5 seconds.

```
SETUP
 → Display adjustments->
   Diff. corrections->
   SBAS setup->




   [Activate]
   [Discard]
```
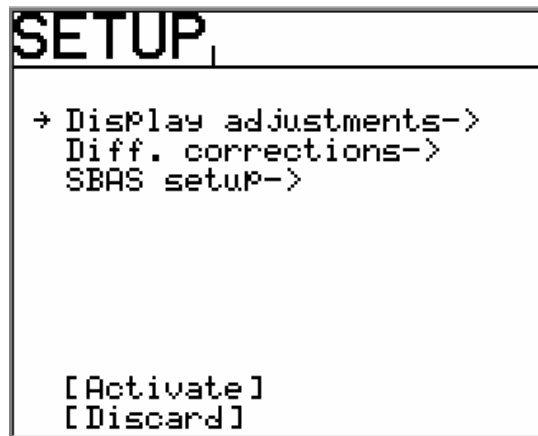
The settings are grouped into the following submenus:

- Display adjustments

- Diff. corrections

- SBAS setup

- Activate

- Discard

Use the arrow buttons ⬆⬇ to select category, and the rotary knob to enter a submenu.

The arrow buttons are also used to return from a submenu to the SETUP menu.

Note!   *Activate and **Discard** selection together with the rotary knob are used to exit the SETUP menu: changes are accepted by using **Activate**, and all changes are erased when selecting **Discard**.*
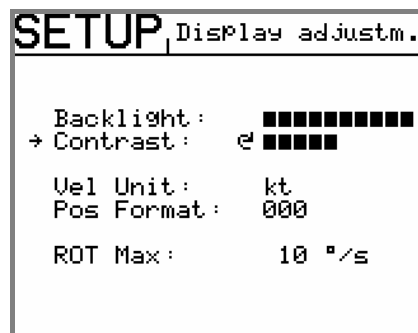
Example:

The following example shows how to change the **ROT Max** value in the **Display adjustment** submenu using the keys and the rotary knob:

1) Press the **SETUP** key for 5 seconds until the Setup menu appear on the screen.

2) Select **Display adjustment** by turning the knob clockwise

3) Press the arrow down key until the cursor is at the **ROT Max** position

4) Turn the knob to left or right until wanted value appear on the screen

5) Press the **SETUP** key to get back to the main menu

6) Press the arrow down key until the cursor is at the **Activate** position and then turn the knob clockwise. Then the new setup is activated.
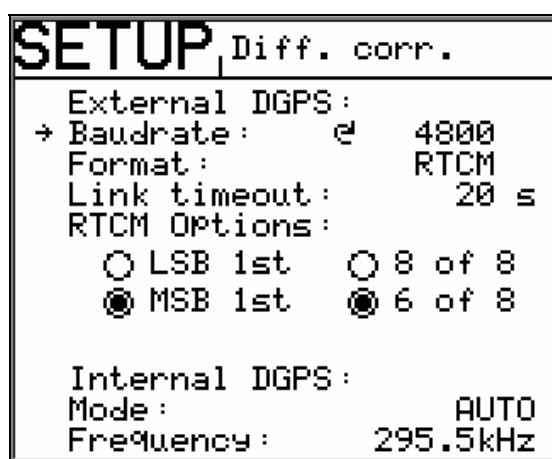
Display Adjustments

In the **Display adjustments** submenu the backlighting and contrast of the display are adjusted. The format for velocity (knots or m/s) and resolution on position displayed may be specified, together with the maximum rate of turn (ROT) value to be shown on the display. Default value for ROT is 20°/s.

```
┌──────────────────────────────┐
│ SETUP Display adjustm.       │
│                              │
│                              │
│    Backlight:   ■■■■■■■■■     │
│  → Contrast:   ☜ ■■■■■        │
│                              │
│    Vel Unit:    kt           │
│    Pos Format:  000          │
│                              │
│    ROT Max:     10 °/s        │
│                              │
└──────────────────────────────┘
```

When navigation information (NAV1 or NAV2 menu, refer page 45) are selected, the display backlighting may be increased or decreased by using the rotary knob.

Differential Corrections

The signal cable with the differential corrections is connected to the terminal block P207 on the Processing unit. If data from more than three stations are available on the input serial line, the nearest three stations are used. The selection of reference station algorithm are dependent on receiving RTCM message type 3 (station coordinates) to function properly.

```
SETUP Diff. corr.

    External DGPS:
  → Baudrate:        ↵    4800
    Format:                RTCM
    Link timeout:          20 s
    RTCM Options:
       ○ LSB 1st    ○ 8 of 8
       ◉ MSB 1st    ◉ 6 of 8


    Internal DGPS:
    Mode:                  AUTO
    Frequency:         295.5kHz
```

The description of the selections in the **Diff. corrections** submenu is as follows:

- **External DGPS**. The following selections are available:
    - **Baudrate**. The rate at which bits are transmitted. 4800 is standard RTCM rate.

    - **Format**. The input format on the DGPS corections can be selected between the following:
        o RTCM. When this format is selected the correct **RTCM Options** must be chosen. If not, the differential corrections will not be used in the position solution.
        o CMR.
        o None.

    - **Link timeout**. The timeout interval for use of old DGPS correction in the position solution. The timout interval on the DGPS link can be input in the range 10 to 99 seconds.

    - **RTCM Options**. Select the correct RTCM properties. The default **RTCM Options** is with the properties **MSB 1st** and **6 of 8**.

For a Sensor unit with internal IALA beacon receiver built-in (not available for HS52 due to IMO type approval) the mode and frequency for the built-in beacon receiver can be set under the title "Internal DGPS". For Sensor units with internal IALA beacon receiver the setting in Internal DGPS is as follows:

- **Internal DGPS**. To activate the internal beacon receiver the mode **AUTO** or **MANUAL** need to be selected. In mode **AUTO** the IALA automatically selects which station to track. If the radio signal is week the mode **MANUAL** could be preferable, especially for a vessel that stays in coverage of the same radio beacon for a long period of time. In the mode **MANUAL** the radio will stick to the selected frequency and not scan the entire frequency range every time the signal get below a certain threshold.

SBAS Setup

For Sensor units with serial number 1200 or higher receivers that utilize SBAS correction signals are built-in. For these Sensor units the SBAS setup menu is used to select SBAS satellites.

The following configuration settings are available:

- **SBAS mode**. The preferred option is to manually select which two (or one) satellites to track. This forces HS52 to use only the satellites listed. However, automatic search for the Geo stationary satellites is available by selecting **AUTO** to let the HS52 automatically search for the Geo stationary satellites, but this option is not recommended due to less control of the signals used. In order to not use SBAS select **OFF**. The default setting is **OFF**.

- **Test mode**. EGNOS is not expected to be fully operational before the second half of 2006. Up to now EGNOS transmits on PRN 124 and 126. The recommended PRN is 124 as PRN 126 is mostly used for system testing. To be able to use corrections from these satellites you need to enable test mode **MODE1** (ignore message type 0). Be aware that a SBAS system is not recommended used as long as message type 0 is received and test mode **MODE1** and **MODE2** are used. For more information about the current EGNOS and EGNOS Testbed system status, see the ESA homepage (www.esa.int/export/esaSA/navigation.html). WAAS is at the moment fully operational and transmits on PRN 122 and PRN 134 and the test mode for WAAS should therefore be set to **NORMAL**. Two more WAAS satellites are launched

in autumn 2005 and will probably be available some time in 2006. For more information, see the FAA homepage (http://gps.faa.gov/index.htm).
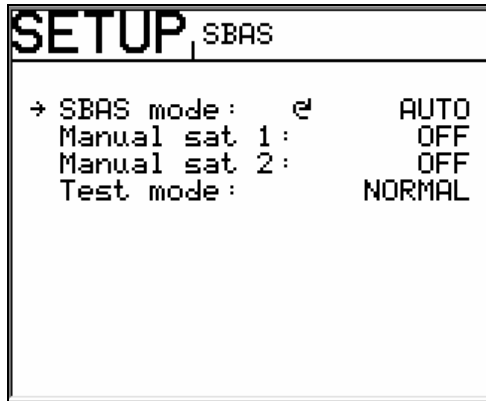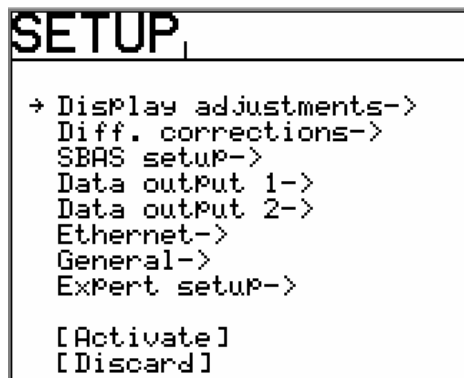

Use the rotary knob to enter the satellite numbers manually. For more information on how to use SBAS corrections, see page 52.

3.10 Advanced Software Setup Procedure

The Simrad HS52 includes a number of advanced installation settings that may need to be changed to optimize the installation onboard the vessel. The advanced setup menu is entered by first pressing the **SETUP** button twice (two slight presses) and then holding the button for at least 5 seconds. The following additional setup submenus will then be available in the **SETUP** menu.

- Data output 1
- Data output 2
- Ethernet
- General
- Expert setup

```
SETUP

→ Display adjustments->
  Diff. corrections->
  SBAS setup->
  Data output 1->
  Data output 2->
  Ethernet->
  General->
  Expert setup->

  [Activate]
  [Discard]
```

Note!   *The advanced setup submenus are reserved for users with dedicated responsibility for the Simrad HS52 product on board the vessel.*

Data Output

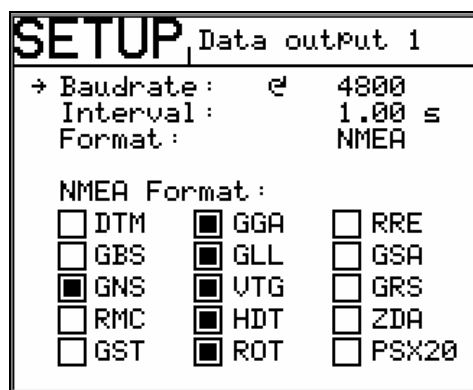The Processing unit has two individually configurable output serial lines.

On output line **Data output 1** two RS-232 and two 422 serial lines are available. The signal cables can be connected to both terminal block P202 and P203.

On **Data output 2** one RS-232 and one 422 serial lines are available. The signal cables are to be connected to terminal block P204.

Note!   *All six serial lines may be used simultaneously!*

The setup of baud rate, interval and output formats for each port is performed in the **Data output 1** and **Data output 2** submenu. The signal has always none parity, 8 data bits, 1 stop bits and no handshake.

```
SETUP Data output 1

→ Baudrate:    ↵   4800
  Interval:        1.00 s
  Format:          NMEA

  NMEA Format:
  □ DTM    ■ GGA    □ RRE
  □ GBS    ■ GLL    □ GSA
  ■ GNS    ■ VTG    □ GRS
  □ RMC    ■ HDT    □ ZDA
  □ GST    ■ ROT    □ PSX20
```

The description of the selections are as follows:

Baud rate: The rate at which bits are transmitted. 4800 is standard NMEA rate.

Interval: Interval in seconds between each NMEA sentence.

Example:

Interval setting	Hz
1 sec	1 Hz
0.5 sec	2 Hz
0.2 sec	5 Hz
0.1 sec	10 Hz
0.05 sec	20 Hz

Format: Format on data output line. The following selections are available:
o   NMEA
o   ZDA 1Hz. See page 24 for discription of this format.
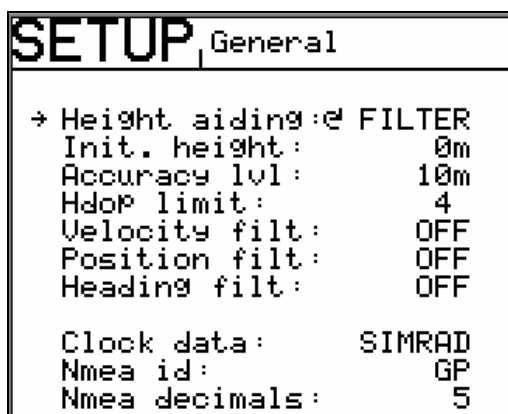o   STX104. A format used by service personnel for troubleshooting the system.
o   None

Note!   *The product is only approved as IMO GPS Receiver Equipment and Transmitting Heading Device as long as NMEA is selected as output format and none of the default selected NMEA formats (DTM, GGA, ZDA, HDT) are removed*

NMEA Format: NMEA sentences to be sent to the output line. Select the wanted NMEA sentence by turning the rotary knob. Be aware that the RRE format is a specific message and does not comply with NMEA standards. See page 69 for description of the RRE format.

WARNING!   **If "none" is selected as output format, no data will be sent to output line.**
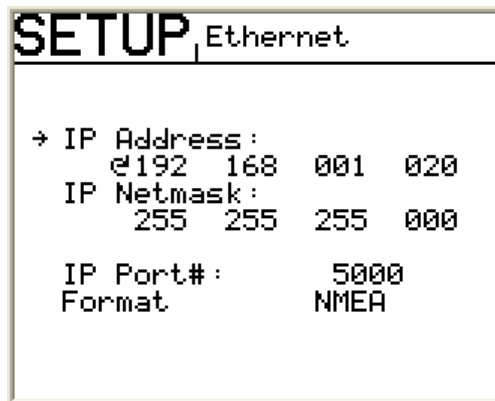
Caution!   **All HS52 output serial lines connected to equipment requiring data from a IMO approved GPS Receiver Equipment have to be output as RS-422 signal and with 4800 baud rate. The RS-232 serial lines are to be used for non IMO critical purposes only, like monitoring, logging of data and for maintenance.**

Ethernet

The Processing unit can output data on Ethernet from terminal J60. In the **Ethernet** submenu the IP address, net mask, IP port number and output format have to be specified. For the NMEA format the messages GGA, GLL, VTG, HDT, ROT and RRE are included.

```
SETUP Ethernet


→ IP Address:
    ←192   168   001   020
  IP Netmask:
      255   255   255   000

  IP Port#:      5000
  Format       NMEA
```

IP Address: Default setting: 192 168 001 020.

IP Net mast: Default setting: 255 255 255 000.

IP Port#.   The IP port number, default is 5000.

Format: Format on Ethernet line. The following selections are available:

- o   NMEA
- o   ZDA 1 Hz. See page 24 for discription of this format.
- o   STX104. A format used by service personnel for troubleshooting the system.
- o   None

WARNING!   **If "None" is selected as output format, no data will be sent to Ethernet line.**

Caution!   *A change in IP Address and IP Net mask parameter will not take effect before the HS52 is restarted!*

General

The **General** submenu includes the selections; height aiding, accuracy level for integrity indication, velocity filtering, position filtering, heading filtering, clock data output format, NMEA id and number of decimals used in the NMEA GGA/GLL position solution.

```
SETUP|General

→ Height aiding:🔁 FILTER
  Init. height:        0m
  Accuracy lvl:       10m
  Hdop limit:          4
  Velocity filt:     OFF
  Position filt:     OFF
  Heading filt:      OFF

  Clock data:      SIMRAD
  Nmea id:             GP
  Nmea decimals:        5
```

Height Aiding

For operations with weak satellite geometry the position output can be made more accurate by using height aiding. For normal operations height aiding should be set to **Filter** or **Off**. When **Filter** or **Fixed** is selected, an initial height has to be entered. The value to be entered in **Init. height** is the GPS height value **HGT** shown in the position display window no. 1, see *Navigation/POS Display* on page 46. The **HGT** value needs to be observed and averaged over some minutes. Be aware that the GPS input height value is the WGS84 antenna height (height of the Sensor unit). The WGS84 antenna height might for some locations differ from the mean sea level height with as much as 100m.

Note!   *Height aiding is active only with input of differential GPS.*

Accuracy lvl

This parameter is used for selection of the preferred accuracy level for the position solution. The integrity indication SAFE, CAUTION and UNSAFE are set according to the accuracy level. The POS-Q status bar will show reduced when the 95% horizontal position accuracy is less than the selected level. For further explanation see Monitoring on page 42.

Hdop Limit

This parameter is used for selection of the preferred HDOP limit. The default value is 4 and the product will then be

according to IMO GPS Receiver Equipment approval. Indication of exceeded HDOP limit will be shown on the Display unit by a flashing HDOP text behind the time indication, see the secondary **NAV1/POS** display on page 46.

Velocity Filtering

The Simrad HS52 outputs raw data for SOG and COG with the default velocity filter setting **OFF**. When smoothing of the SOG and COG measurements is required, the filter period could be selected in the range 1 to 99 seconds in steps of one second. With a high filter period more smoothing of the SOG and COG measurements will be achieved and the response to speed and course changes gets slow. In general we don't recommend the use of filter constants above 10s for a moving vessel.

Position Filtering

The Simrad HS52 outputs raw position data with the default filter setting **OFF**. When smoothing of the position measurements is required, the filter period could be selected in the range 1 to 99 seconds in steps of one second. With a high filter period more smoothing of the position measurements will be achieved and the response to position changes gets slow. In general we don't recommend the use of filter constants above 10s for a moving vessel.

Heading Filtering

The Simrad HS52 outputs raw heading data with the default filter setting **OFF**. When smoothing of the heading measurements is required, the filter period could be selected in the range 1 to 99 seconds in steps of one second. With a high filter period more smoothing of the heading measurements will be achieved and the response to heading changes gets slow. In general we don't recommend the use of filter constants above 10s for a moving vessel.

Clock Data

On the Processing unit terminal P208, output to radar (AD-10 format) or a 1-second PPS pulse are available. The default setting is for **Simrad** radar. Other selections are **Furuno, 1PPS** or **OFF**.

Nmea Id

The NMEA ID for the HS52 output lines can be selected between the following; IN, HE, HC, GP and TI. The default setting is GP and the product will then be according to the IMO GPS Receiver Equipment approval.

Nmea Decimals

The number of decimals used in the NMEA GGA/GLL position solution can be selected in the range 3 to 6. The value is 6, which gives the highest position resolution. The default value is 5.

Expert Setup

The **Expert setup** submenu includes the selections; heading offset, alarm sound, position and heading alarm, GPS cold restart, run mode and logging of data.
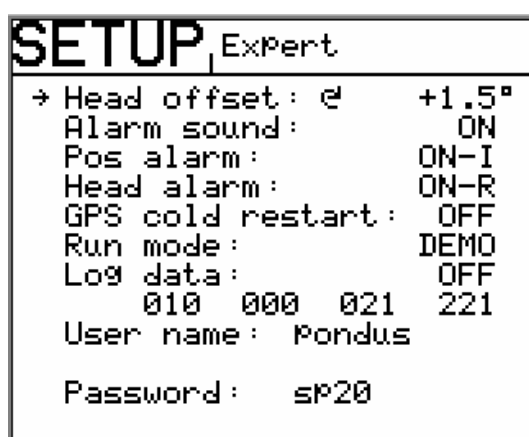
The instructions for the different selections are as follows:

Head Offset

The **Head offset** feature allows you to correct for a constant compass heading offset that may be present as a result of an off axis misalignment between the Sensor unit and the vessel alongship axis.

Note!

*It is important that the Sensor unit is mounted accurately in the alongship direction so the **Head offset** value does not exceed ±5°. If the mounting orientation is not within these tolerances the heading accuracy will be degraded. Instead of exceeding a Head offset value of ±5° the Sensor unit orientation should be adjusted mechanically.*

The system has to be calibrated on board the vessel after installation. A typical calibration consists of calibrating the direction of GPS antennas within the Sensor unit against an external reference. Type of reference must be decided according to the required accuracy. Alternative references for calibrating the heading offset of the Sensor unit could be:

- The heading of the pier or quay the vessel is moored to.

- An external compass reading like from a gyro compass.

- Two fixed points on the chart that the vessel is sailing between.

The observation period for the heading difference should continue for an as long as possible period in order to eliminate errors in the HS52 measurements caused by multipath effects. These may be particularly pronounced in the static conditions of a harbor area.

The average value for observations from each of the two different systems should then be used, and the offset between the two systems (reference value minus HS52 reading) input as the **Head offset** value.

The offset value can be either positive or negative.

Example:
If the heading measured by the reference system is 32.1º and the Simrad HS52 heading 28.5 degrees during the calibration period, **3.6** (32.1 - 28.5) should be entered in the **Expert setup** submenu as the **Head offset** value.
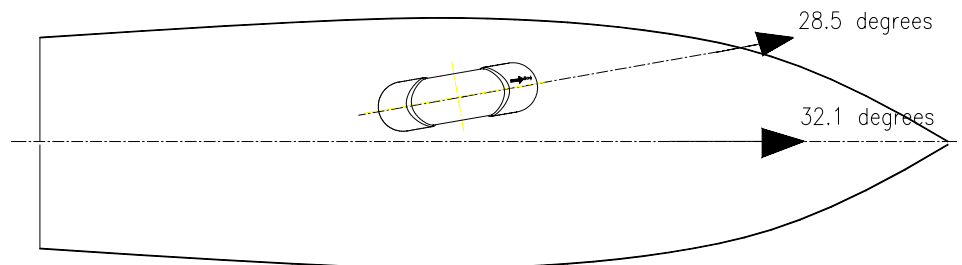
Alarm Sound

Used for turning the alarm sound on and off, see *Alarms* on page 49 for details. The sound, if enabled, will be present as long as the alarm condition is present, and the alarm is not acknowledged. If the alarm switch is connected to an external alarm panel we recommend that the internal alarm sound is disabled. The default setting is **OFF** and the product will then be according to IMO THD and GPS Receiver Equipment approval.

Pos Alarm

Used for to enable or disable the the position alarm. The following selections are available:

- <u>ON-R</u>. Position alarm enabled when position gets reduced.

- <u>ON-I</u>. Position alarm enabled when position gets invalid. This is the default value.

- <u>Off</u>. Used for turning off all alarm text and alarm sound for position.

Note!

The product is only approved as IMO GPS Receiver Equipment if this alarm setting is set to either ON-R or ON-I.

Head Alarm

Used for to enable or disable the heading alarm. The following selections are available:

- <u>ON-R</u>. Heading alarm enabled when position gets reduced. This is the default value.

- <u>ON-I</u>. Heading alarm enabled when position gets invalid.

- <u>Off</u>. Used for turning off all alarm text and alarm sound for heading.

Note!

The product is only approved as IMO THD if this alarm setting is set to ON-R.

GPS Cold Restart

Used for restart of the GPS receivers when that is required. This is done by selecting ON on this selection, then press the **SETUP** key to return to the main menu and leaving the Setup menu by selection **Activate** to save the configuration. Then the GPS receivers will be restarted automatically without futher actions. However, its recommended to restart the system anyway to be 100% sure that the GPS receivers have been reset. The default setting is **OFF**.

Run Mode

Used for switching the HS52 between NORMAL and DEMO mode. DEMO mode is used for simulating input data to the system.

WARNING!

The Simrad HS52 must not be switched to DEMO mode when the system is in operation!

Caution!

A change in the Expert setup parameter "Run mode" will not take effect before the Simrad HS52 is restarted

### *Log Data, Server Address, User Name and Password*

Used for service purposes.

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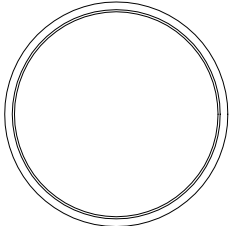# 4. OPERATING INSTRUCTIONS

4.1   Overview

The Display unit is used for setup and operation of the HS52. Each of the push buttons is clearly identified with the primary function in large text, and a secondary function listed in smaller text. Each button provides you with the ability to access a primary display, a secondary display and/or multiple function displays.

Adjustable settings are provided in the SETUP mode. The settings allow adjustment of mounting orientation, selection of differential correction, setup of output serial line formats, Ethernet and the display. Refer *Software Setup Procedure*, page 21.
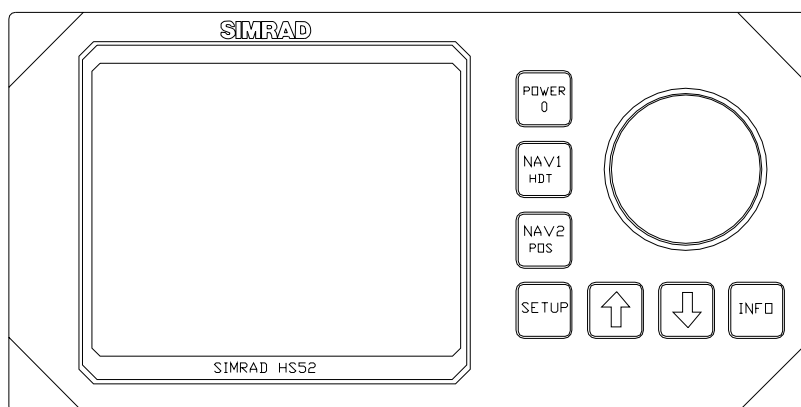
The Display unit consists of the main elements as listed below.

	FUNCTION	REF. PAGE
POWER ⓞ	Power on/off.	42
NAV1 HDT	Displays Navigation/HDT display with compass rose or details.	45
NAV2 POS	Displays Navigation/POS with position and accuracy ellipse.	46
SETUP	Displays SETUP menu.	21
⬇ ⬆	Used for maneuvering in the SETUP submenus.	21
INFO	Used for displaying additional system information.	46

	FUNCTION	REF. PAGE
	The rotary knob is used for entering values in SETUP submenus, and for adjusting the display brightness.	21

4.2 Turning the System ON/OFF

A single press on the **POWER** button switches the system ON, and the following start up information is shown on the display:

```
GPS
SENSOR
```
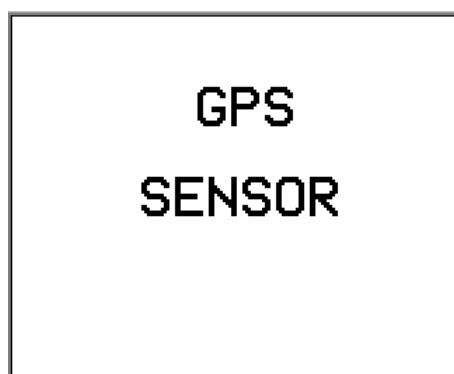
Once installed, calibrated and started, the HS52 needs no manual intervention during operation.

After power on, up to 2 minutes is needed for full position accuracy and up to 10 minutes for full heading accuracy is obtained. Since there normally is no reason for turning the unit off, it should be left running continuously.

The HS52 will be shut down in a controlled way when the **POWER** button is pressed for 1-2 seconds. Then the message *Shutdown in process* will appear on the screen. If the **POWER** button is pressed and held for 5 seconds or more, the system is shut down immediately. Typically used if the system has a hang-up and does not respond on any commands. The configuration of HS52 is however stored on the internal flash disk independent on how the unit is powered off.

4.3 Performance Monitoring

The navigation display NAV1 and NAV2 includes on the left side of the screen data quality and status information. The indicators are as follows:

- **HDG-Q**. The quality of the heading measurements. The heading status indicator is a three level state status bar showing normal, reduced or invalid heading. Two black bar graphs indicate normal accuracy, one black and one white bar graph indicate reduced accuracy and two white bar graphs indicate invalid heading.
- **POS-Q**. The quality of the position measurements. The position status indicator is a three level status bar showing normal, reduced or invalid position. Two black bar graphs indicate normal accuracy, one black and one white bar graph indicate reduced accuracy and two white bar graphs indicate invalid position.
- **Integrity**. The system integrity is a three level status indication plus a number showing the selected accuracy level in meters. The states are Safe, Caution and Unsafe. On the display, the visual indicators are shortened into SAFE, CAUTN and USAFE.
- **LNK**. The link indicator shows whether any valid RTCM 104 message is received on any correction link within the selected time limit. If a radio beacon receiver is built-in in the Sensor unit (delivered on request only) the limit is according to IMO requirements set to 10 seconds. The link status indicator is a two level status bar showing whether a valid RTCM message is received (one black bar graph) or not (one white bar graph).
- **DIF**. The DGPS indicator is a two level status bare showing whether differential corrections are input and used in the position solution or not. One black bar graph indicates that differential corrections are used. One white bar graph indicates that it is not used.
- **COG**. The course over ground status indicator is a two level status bar showing whether a valid COG is calculated (one black bar graph) or not (one white bar graph). Be aware that COG will only be valid (calculated) as the vessel is moving.
- **SOG**. The speed over ground status indicator is a two level status bar showing whether a valid SOG is calculated (one black bar graph) or not (one white bar graph).

The Simrad HS52 GPS receivers include a RAIM exclusion and detection algorithm implemented to detect satellite failure. The RAIM algorithm is implemented as described in "Guidelines for the use of differential GPS in offshore surveying". 3rd Draft May 1994. The same algorithm is used both for the GPS heading and GPS position calculation.
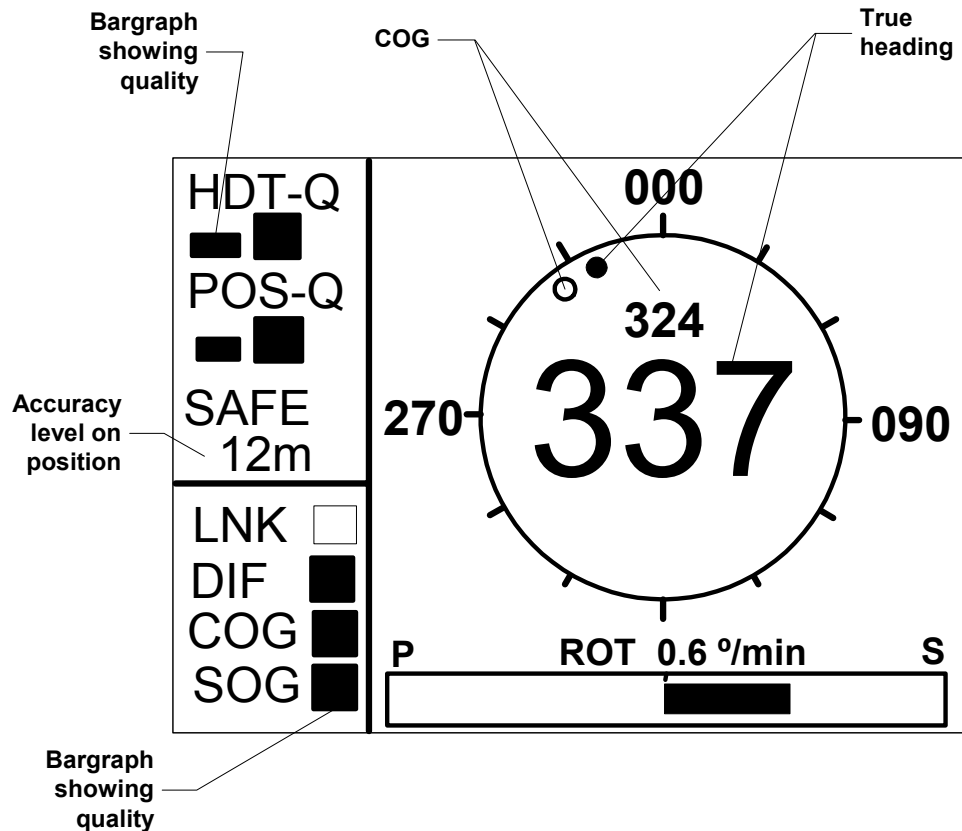
The integrity indication for different position accuracy levels are expressed in three states that satisfies the requirements in IEC 61108-1 second edition 2003-07. The states are Safe, Unsafe and Caution. On the display, the visual indicators are shortened into SAFE, CAUTN and USAFE. The position accuracy level is selectable from the display and is normally between 10m and 100m, see page 34 for setup of the accuracy level.

The system integrity value is often referred to as the horizontal external reliability. It gives an indication of how large a horizontal position error might be at the condition of an arbitrary undetected satellite failure.

Safe indicates that the system accuracy is better than the selected accuracy level and that a single satellite failure can not make the actual horizontal position error exceed the selected accuracy level (95% confidence level).

Caution indicates that the system accuracy is better than the selected position accuracy level, but a single satellite failure might not be detected, and at failure the actual horizontal position error might exceed the selected accuracy level (95% confidence level). At four satellites (three when height aiding is chosen), there is no way to detect a satellite failure and the system will always be in the state caution. The expected accuracy and HDOP might still be reasonable good.

**Unsafe** indicates that the system accuracy has exceeded the selected accuracy level (95% confidence level).

Bargraph showing quality

COG

True heading

HDT-Q

POS-Q

Accuracy level on position

SAFE 12m

LNK

DIF

COG

SOG

Bargraph showing quality

000

324

337

270

090

P   ROT 0.6 °/min   S

A reduced HDT_Q status indication will be shown after 60 seconds of GPS heading loss. An invalid HDT-Q status indication will be shown after 300 seconds of GPS heading loss in the system, and the output of heading data will terminate. In the first 300 seconds after loss of GPS heading, the heading output is determined from the inertial element.

The data quality status information indicated on the Display unit is also included in some of the NMEA messages that can be output on the serial lines.
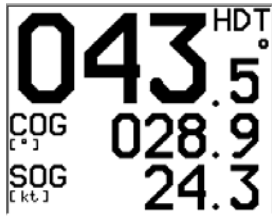
Navigation/HDT Display

When pressing the **NAV1/HDT** button, the HS52 will toggle between two different displays for heading information.
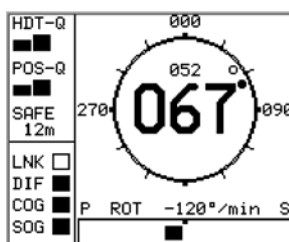
Primary NAV1/HDT display, shown after the start-up screen when the HS52 is turned ON.

True heading is shown as a big number in the centre of the compass with the COG value above it.
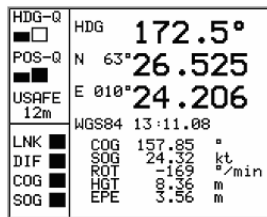
Secondary NAV1/HDT display.

This display shows heading, course over ground and speed over ground values in big characters.
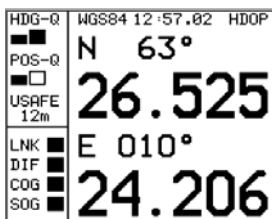
Navigation/POS Display

The HS52 will toggle between three different displays for position information when the **NAV2/POS** button is pressed.

The primary display is shown when the **NAV2/POS** button is pressed once. The display shows main navigation information.

The secondary display appears when pressing the **NAV1/POS** button twice. The display presents position information in large numbers.
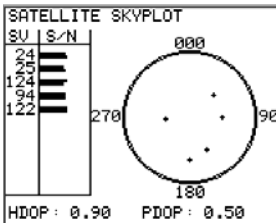

The third display appears when pressing the **NAV1/POS** button three times. This display shows satellites in sight by the Sensor unit, and which satellites the Simrad HS52 is tracking. The satellites are presented according to satellite geometry. The bars on the left side of this display indicate the signal-to-noise level for each satellite.

Info Displays

When pressing the **INFO** button, the system will page through a number of displays for information about system configuration and performance. The information on some of these displays is mainly used for troubleshooting the system.
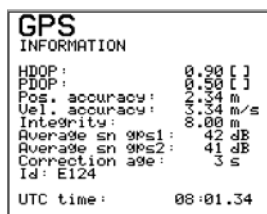
In the GPS information display details for the position solution is presented. This information is mainly for trouble shooting of the system.

An explanation of the information shown is as follows:

HDOP/	
PDOP	Quality indicators for the GPS solution.
Pos. accuracy	Shows the estimated accuracy of the position solution (95% CEP).
Vel. Accuracy	Shows the estimated RMS accuracy of the velocity solution (95% CEP).
Average sn gps1/	
Average sn gps2	Shows the average signal-to-noise ratio on GPS receivers 1 and 2.
Correction age	Indicates the age of differential corrections. If Simrad HS52 receives no differential correction, the displayed correction age will be high. See *No Differential Corrections* on page 60 for troubleshooting loss of differential signal.
Id	Shows the actual reference station identity number utilized in the position solution. When a SBAS satellite is used as source for differential corrections, the SBAS satellite used will be shown with the letter E (EGNOS), W(WAAS), M(MSAS), S(SBAS other SBAS system or Id not known) in front. For example "Id: E124" indicates that EGNOS satellite 124 is used as DGPS source.
UTC time	World time referred to UTC.

HEADING
ADVANCED INFORMATION

```
Gps hdt:       207.27 °
Deviation      -0.32 °
Accuracy:       0.23 °
Last heading:   123 s
Common sat. :     5
Baseline err:  2.34 [ ]
Meas err:      0.34 [ ]
Clock offset:   156 mm
Bias:          3.00 °/s
Scalefactor:   0.01 %
```

In this display, a number of additional information on the heading solution is presented. This information is mainly used for troubleshooting the system.

An explanation of the information shown is as follows:

Gps hdt	The heading determined from GPS alone.
Deviation	The difference in heading determined from GPS and the internal gyro element.
Accuracy	The instantaneous heading accuracy determined from GPS alone. The instantaneous accuracy might differ from the specified accuracy which is a figure determined for the combination of GPS heading and heading from the internal data element. The specified accuracy figure for the product is also calculated as a standard deviation over a number of samples. The figure shown as Accuracy might occasionally be higher than the specified heading accuracy. If the Accuracy figure shown is much higher (3 times or more) than the specified accuracy, then the performance of the system is poor. Check

Reduced Heading Indication, page 61 in this manual for troubleshooting the system.

Last heading   This is the time since the system calculated the GPS heading. If GPS signals drops out this figure will increase. In the first 300 seconds after loss of GPS heading, the heading output is determined from the inertial element. After 300 seconds of loss of GPS heading in the system the output of heading data will terminate. If so, see *Invalid Heading*, page 61 for trouble shooting the system.

Common sat.   Shows the number of common satellites seen by the two GPS antennas. The number of common satellites have to be two or higher to determine heading. If the number is less than two, see *Invalid Heading*, page 61 for trouble shooting the system.

The other information in this display is only of interest to service personnel.

In the SBAS page information of which SBAS system used by the Simrad HS52 is presented together with the selected satellite by its PRN number, the message rate of this satellite and status on SBAS warnings.

The DGPS page includes information of the external connected IALA beacon receiver (WER number) and if delivered it also include information on the internal receiver built-in the Sensor unit (WER, Serial Number, SS and Frequency (FQ)). Any received DGPS text message will also be shown.

Number of satellites used in the GPS position fix with indication of increasing or decreasing azimuth (Az) and elevation (El).

This display is mainly used by service personnel.

Number of satellites used in the GPS position solution and the number of satellites tracked by GPS antenna no. 1 (Tr1) and 2 (Tr2) is shown in this display.

This display is mainly used by service personnel.

```
ALARM
INFORMATION

Time    Alarm     Code
10:12.34 POS,HEAD  08,07
   LSQ failed
   Old gyro data
03:42.23 POS,HEAD  09,03
   Missing init Position
   Old GPS heading
11:13.56 POS,HEAD  02,12
   To few satellites
   Filter reset large bias
```

The alarm page includes information of the last three alarms on the system. For each alarm time, type of alarm and identification code for the alarm is presented. Below each alarm a description of each identification code is displayed.

```
SYSTEM
INFORMATION

GPS COMPASS

DU: v 2.01 2006-04-7
SU: v 4.08 2002-04-29
    Sn 5
PU: v 3.00.01 2003-08-10
    Sn 10
GPS 1: 169-614471-E8a
GPS 2: 169-614471-E8a
```

Software version for each unit (Distribution Unit = DU, Sensor Unit = SU and Processing Unit = PU), together with internal serial number for Sensor and Processing unit. The date behind each unit's software version refers to manufacture date for the unit.

```
SYSTEM
INFORMATION

System load:        36%
Sensor unit:
  Temp [°C]:       30.21
  Rate [r/s]:    -0.0456
  Rate status:        OK
  PPS status:         OK
  Checksum error:     23
  Time jump error:     2
  Sync error:          5
Navigation status:
  P:  1  H:  2  A:  3
```

System load as a percentage of used CPU capacity in the Processing unit is presented in the system information, together with Sensor unit status. The Sensor unit status is mainly used by service personnel.

4.4   Alarms

The Simrad HS52 will generate three types of alarms. These are position, heading and no data alarm.

It is possible to enable the heading alarm and the position alarm individually and to set all alarms enabled or all alarms disabled. The no data (lack of data) alarm will be enabled as long as any alarm is enabled. The alarm setup is available from the Expert setup menu.

From the same menu it is also possible to enable or disable use of the alarm sound on and off. The sound, if enabled, will be present as long as the alarm condition is present, and the alarm is not acknowledged. To comply with the IMO approval the alarm switch has to be connected to an external alarm panel. It is then recommend disabling the internal Display unit alarm sound. For description of how to connect an external alarm to the Processing unit, see *External Alarm* on page 25.

A no data alarm occurs when the Processing unit has not received data from any sensor the last second.

A position alarm occurs when the position is invalid. The reason for invalid position might be too few available satellites or that

the HDOP has passed the limit. The HDOP default limit value is 4.

A heading alarm is activated when the heading gets reduced or the heading is invalid, depending on the settings in *Expert Setup* on page 36 and onwards. This might be due to bad satellite geometry for a long period of time or the system has been unable to determine a valid GPS heading.

At power up the alarm switch will be active until the position and heading are valid. A system restart message will be present.

The alarm text will remain in the display until the **NAV1** or **NAV2** button is pressed. No heading data will be output from HS52 and shown on the display as long as the heading alarm situation is present. The last valid position determined will be output from HS52 and shown on the display as long as the position alarm situation is present.

Note!   *No alarm will be activated if the system is setup to not respond to alarm situations. Refer to **Expert Setup** on page 36.*
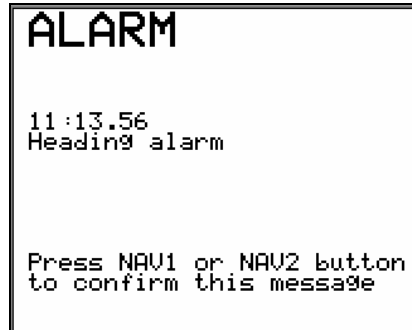
Position Alarm Display

If the default setting is used for the position alarm an alarm will be activated if the system has been unable to determine position the last two seconds See *No Valid Data,* page 58 for troubleshooting. The following alarm text shown will be displayed. When a position alarm occurs, the time indication on the NAV2/POS displays will freeze on the time for the last GPS fix and the last GPS fix is the position shown on the displays (both time and position on the displays are then frozen).

```
ALARM

11:13.56
Position alarm



Press NAV1 or NAV2 button
to confirm this message
```
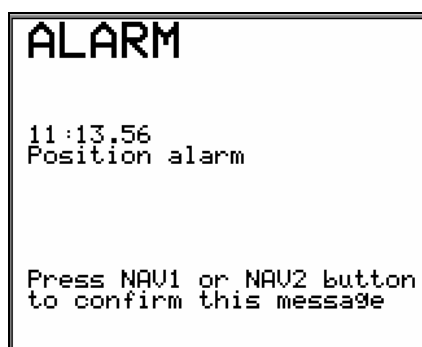
Heading Alarm Display

If the default setting is used for heading alarm an alarm will be activated 60 seconds after the system is unable to determine GPS heading and the HDT-Q indication has become reduced - see *Troubleshooting*. The heading value on the NAV1/HDT

displays will be blanked out and the system stops sending out heading data. The alarm text shown in the figure below will be displayed. See *Invalid Heading* on page 61 for troubleshooting.

```
ALARM


11:13.56
Heading alarm



Press NAV1 or NAV2 button
to confirm this message
```

Position and Heading Alarm Display

If both heading and position data is invalid, the display will show:

```
ALARM


11:13.56
Head. and Pos. alarm



Press NAV1 or NAV2 button
to confirm this message
```
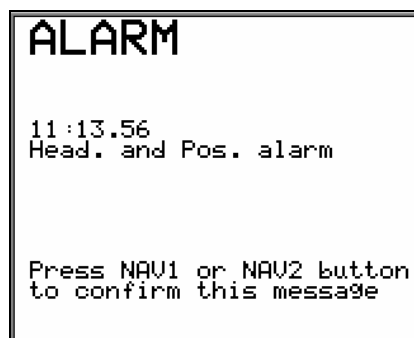
System Restart

System restart is activated at power up of the system and when the watchdog has been activated.

```
ALARM


11:13.56
No data



Press NAV1 or NAV2 button
to confirm this message
```
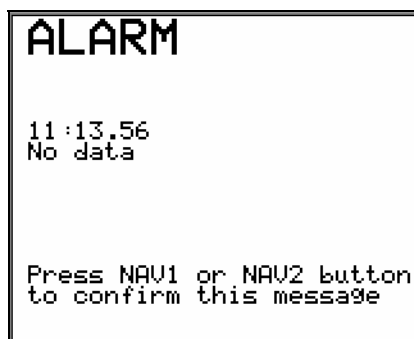
4.5 Watchdog

A HW implemented Watchdog will restart the system if the application program for any reason is not operating properly. The external equipment connected to the Alarm Switch will within 5 seconds detect an alarm condition as long as position and heading alarm is enabled, see ***Expert Setup*** on page 36 for details. If so, a message will appear after restart on the display indicating this (system restart).

4.6 Operation

The HS52 will normally output signals on the serial lines without any involvement from the user. However, the following should be taken into consideration during operation:

Adjust Backlight on Display

The rotary knob is used for adjusting the display brightness. Turn the rotary knob clockwise to increase the brightness and anti-clockwise to reduce it. For more information on how to adjust the display settings, see chapter on Display Adjustments, page 27, on how to proceed.

SBAS Corrections

```
SBAS
INFORMATION
SBAS system:      WAAS
Satellite used:    122
Message rate:     0.99
SBAS warning:       NO
```

The display to the left illustrates a typical configuration of SBAS satellites for WAAS. For more information on how to change the SBAS settings, see chapter ***SBAS Setup*** for how to proceed

Selection of Satellites

The current satellite status (November 2005) is:

Satellite no. PRN	SBAS system	Status
122 and 134	WAAS	Is commissioned and approved. Launch of more satellites are planned during 2005 and operational in 2006.
124 and 126	EGNOS	Will probably be operational in 2006.
120	EGNOS TESTBED	Will probably be discontinued

Use of SBAS Corrections

It is possible either to specify which Geo satellite to track or to let the receiver choose which Geo satellites to track using Automatic mode. However, it is recommended specifying which Geo satellites to track. This enables the receiver to keep better track of the specified satellites without starting to search for PRN numbers every time it looses track of the satellite.

In Automatic mode the receiver will select which two satellites to track. Be aware that occasionally the chosen satellites might be from two different SBAS systems.

The recommended setting is to select one or two Geo satellites for tracking.

Height Aided GPS Position

In periods with weak satellite geometry, the position can be made more accurate by using height aiding function in the **General** submenu. Refer *General*, page 34.

The height aiding improves the solution by using the knowledge that a vessel at sea has only small short-term variations in height caused by heave. The long-term variations caused by tide are taken care of in the system. The height value used, as input to the GPS solution is a low-pass filtered value of the measured height.

A start value for the low-pass filter should be specified for use at system start-up. The value to use is the height of the Sensor unit above the WGS-84 ellipsoid when the sea level is at its mean value. This height can be found in the primary **Navigation/POS** display, where the **HGT** value is the GPS height. Refer *Navigation/POS Display*, page 46. The value should be monitored for some minutes, and the average value should be used.

Note!

The height difference between mean sea level and the WGS-84 ellipsoid can be significant. Values between +/- 100 meters can be encountered.

For normal operation, height aiding should be set to **FILTER** (recommended) or **OFF**. When **FILTER** or **FIXED** is selected, an initial height has to be entered.

Height aiding is active only with input of differential GPS. For more information on how to enable height aiding, see chapter *General* on page *34*.

5. MAINTENANCE

5.1   General

Service on the HS52 hardware in the field can consist of:

- Replacing damaged cables.

- Replacing failed Sensor unit.

- Replacing failed Display unit.

- Checking the fuse in the Processing unit or replacing the whole unit.

The Sensor unit is not designed for service in the field and opening the housing will result in damage or degradation of the unit and void the warranty. A failed Sensor unit has to be shipped back to Simrad in the original transportation box or another appropriate box for service. The return address is provided in the last pages of this manual.

The software in HS52 can be upgraded to latest version in the field by connecting an external PC to the Processing unit. A software upgrade has to be performed by Simrad service people or representatives.

5.2   Periodic Maintenance

The user should execute all necessary maintenance. This includes normal cleaning of all units and inspection of cables and connectors at intervals. Components which malfunction should either be replaced or sent back to Simrad for service.

The periodic maintenance of the HS52 components is as follows:

Sensor Unit

Make a visual inspection at 2-3 months intervals, and at the start of each season.

Re-calibration of the Sensor Unit

The direction of the Sensor unit relative to the vessel's heading has to be recalculated only if the Sensor unit has been moved or dismounted from its holder. Then the calibration procedure described in *General* section, page 34 has to be followed for re-calibration of the heading.

Processing Unit

No special maintenance is required. It is advisable, however, at the start of each season to make a visual inspection of the terminals below the bottom cover (terminal cover) and check all connections.

Display Unit

The Display unit will under normal use require little maintenance.

If the unit requires any form of cleaning, use fresh water and a mild soap solution (not a detergent). It is important to avoid using chemical cleaners and hydrocarbons such as diesel, petrol etc.

Make sure that all open connectors on the Display unit are fitted with a protection cap.

It is advisable at the start of each season to check all connections to the unit and cover with Vaseline or WD40. If the Display unit is not removed from the vessel, it should be covered with the white protection cover.

5.3 Repairs and Modifications

Repair of the HS52 units is limited to replacement of damaged cables, Sensor unit, Processing unit, or Display unit.

Replacing Damaged Cables

Power off the Processing unit and dismount the damaged cable. If the connector is not damaged it may be re-used, else a new connector has to be made available.

Assemble the connector to the new cable as described in the wiring information for the damaged cable. Refer the *INSTALLATION* section, page 11 onwards.

Terminate the cable to the Processing unit as described in *Cable Connections*, page 18.

Replacing Damaged Units

No HS52 units are designed for service in the field, and a damaged unit has to be shipped back to Simrad for repair.

Caution!   *Opening the Sensor unit housing may result in permanent damage to the unit!*

Install the new unit according to procedures described in the *INSTALLATION* section, page 11 onwards.

Repair of the Processing Unit

The Processing unit is not designed for service in the field. All repairs and modifications of the unit, except for changing the fuse in the power inlet, installation of new software version and setup of the system, have to be done by Simrad. Contact you nearest Simrad dealer if the processing unit fails.

The fuse in the power inlet is located behind the power terminal block P400 and is marked F400. A spare fuse is available beside it and its location is marked F401. The fuse is of type NANO^2 Littelfuse series 451 superfast (FF) and of 1.5 A.

5.4   Troubleshooting

A GPS compass is a complex system and performance is dependent of a proper installation and a successful sea trial.

In case of a failure, the user will be helped by the Display unit, which contains several test features that will assist you in isolating a probable fault.

Pressing any button resets the audible alarm. The visual alarm will remain and alternate with the operating display until the fault has been rectified. Refer to the table below for hints and try to solve the problem yourself, or consult your nearest Simrad dealer for assistance.

The next sections contain some hints for troubleshooting.

No Response

In normal operation it takes about one minute from the Display unit is powered on until information appears in the display. If the display screen is still black after three minutes from power on, do as follows:

- Check the power connection to the Processing unit and check that the Processing unit is supplied with the correct voltage. See power specifications on page 8.

- Check that the fuse on the Processing unit is not blown. This fuse is located behind the power terminal block P400 and is marked F400. A spare fuse is available beside it and its location is marked F401.

- Press the **POWER** button on the Display unit, two or three times in case of poor connection.

If there is still no information on the display, consult your nearest Simrad dealer for assistance.

No Valid Data

In normal operation it can take up to 15 minutes from the Display unit is powered on to full accuracy on all data is obtained, and the indicators showing valid data. If all the indicator boxes are still white after 15 minutes from power on, then do as follows:

- Check if the Sensor unit cable is properly connected to the Processing unit. Check also that the junction of the connectors on this cable is properly connected. If not, switch off the power and connect the cable and connectors properly and power on the unit again.

- Check that the cable from the Sensor unit to the Processing unit properly terminated. Check that the termination is according to the wiring schematics described in Cable Wiring on page 13. If not, switch off the power and connect the cable and connectors properly and power on the unit again.

- Check if the Display unit cable is properly connected to the Processing unit. Check that the cable from the Display unit to the Processing unit properly terminated and according to the wiring schematics described in Display Unit Cable on page 17. If not, switch off the power and connect the cable and connectors properly and power on the unit again.

- If all connections are correct and still no valid data, the mounting location of the Sensor unit may not be suitable, less than four satellites are in view, or there may be an obstruction between the Sensor unit and the GPS satellites. Check the mounting location and consider relocation according to the guidance described in "Location of the Unit" on page 12.

If there are still no valid data, contact your nearest Simrad dealer for assistance.

Invalid Position

The reason for invalid position can be one of the following:

- The position status will be invalid when there are no data from the Sensor unit, or there are no data from the GPS receivers, or there is no Sensor unit connected to the Processing unit. The system will always indicate invalid position for a short period of time at system reboot.

- The position status will be invalid when there are no or less than 4 valid satellites (3 satellites if height aiding is enabled)

- The position status will be invalid when the actual HDOP is exceeding the selected HDOP limit. See chapter on *Hdop Limit* on page 34 for selection of the HDOP value.

- The position status will be invalid if there for other reasons than mentioned above is not possible to compute a GPS position or the position quality is low. This might be due to large satellites residuals, position jumps or no least squares method convergence.

If invalid position, then proceed as follows:

- The Sensor unit is unable to see enough GPS satellites. Press the **NAV2/POS** button until the Skyplot appears, and check that at least three satellites are listed in the Satellite Skyplot - see "Navigation/POS Display" on page 46. If the criterion above is not fulfilled, the mounting location of the Sensor unit may not be suitable or there may be an obstruction between the Sensor unit and the GPS satellites. Check the mounting location and consider moving the vessel to another location or a relocation of the Sensor unit according to the guidance described in "Location of the Unit" on page 12.

If there are still no valid position data, consult your nearest Simrad dealer for assistance.

Reduced Position

The reason for reduced position can be:
- The position status reduced will only occur if the horizontal position accuracy exceeds the selected accuracy level. See chapter General for selection of the accuracy level.

No Differential Corrections

The possible reason for a white box for differential correction indication (DIF) could be one of the following:

- No differential corrections are input through terminal port P205 or P206 on the Processing unit. If differential corrections are input through one of these terminal ports, check that the parameters are properly set up in the Display unit setup menu **Diff. input** - see page 28.

- You can be out of range to a radio reference station and the differential corrections are therefore missing. If the reference station is too far away or it is in the shadow of geographical obstructions or other equipment on board, reception may be unreliable or missing. Pressing the **INFO** button and the display GPS Information shows the identification number of the reference stations connected to the HS52.

- The reference station can be out of function. Check the status of the reference station with the authorities responsible for it, or consult your nearest Simrad dealer for assistance.

Invalid Heading

The possible problem can be one of the following:
- The heading status will be invalid if there is no data from the Sensor unit or no Sensor unit is connected to the Processing unit. The system will always indicate invalid heading for a short period of time at system reboot.
- If the system looses GPS heading for a certain period of time, the heading accuracy will slowly decrease. The heading status will after 60 seconds become reduced, and after 300 seconds be invalid. The reason for missing GPS heading might be too few visible satellites, low geometry or excessive multipath.
- If the filter integrity check algorithm detects a large mismatch between the GPS heading and the integrated system filter, the heading status will be invalid, and the heading filter will be reset.

If invalid heading, then proceed as follows:
- The Sensor unit is unable to see enough GPS satellites. Press the **NAV2/POS** button until the Skyplot view appears. Check that at least four satellites are listed in the Satellite Skyplot, see Navigation/POS Display on page 46, and that the PDOP value is less than 6. Check also the number of common satellites seen by the two GPS antennas by pressing the **INFO** button and looking at the value for **Common sat.** in the advanced heading information display, se Info Displays on page 46 . The number of common satellites has to be three or higher to keep a heading. To find a new heading after the loss of GPS heading at least four common satellites with a reasonable geometry have to be present. If one of the criteria's above is not fulfilled, the mounting location of the Sensor unit may not be suitable or there may be an obstruction between the Sensor unit and the GPS satellites. Check the mounting location and consider moving the vessel to another location or a relocation of the Sensor unit according to the guidance described in chapter Location of the Unit on page 12.

If it is still not working after checking the above items, consult your nearest Simrad dealer for assistance.

Reduced Heading Indication

The reason for reduced heading can be one of the following:

- At system restart or at heading filter initialization there is a certain filter initialization period where the heading accuracy will be reduced.

- If the filter integrity check algorithm detects a mismatch between the GPS heading and the integrated system filter, the heading status will be reduced.

- If the system loses GPS heading for a period of time the heading accuracy will slowly decrease. The heading status will after 60 seconds become reduced, and after 300 seconds be invalid.

If reduced heading, then proceed as follows:

- The number of GPS satellites the Sensor unit is able to see is too few. Press the **NAV2/POS** button until the Skyplot view appears. Check that at least four satellites are listed in the Satellite Skyplot, Navigation/POS Display on page 46, and that the PDOP value is less than 6. Check also the number of common satellites seen by the two GPS antennas by pressing the **INFO** button and looking at the value for **Common sat.** in the advanced heading information display, see Info Displays on page 46. The number of common satellites has to be three or higher to keep a heading. To find a new heading after the loss of GPS heading at least four common satellites with a reasonable geometry have to be present. If one of the criteria's above is not fulfilled, it may be an obstruction between the Sensor unit and the GPS satellites. Consider moving the vessel to another location to see whether that helps.

If it is still reduced after checking the above items, consult your nearest Simrad dealer for assistance.

Simulated Data

If the HS52 system is not sending out real data, check whether the system is operation in demonstration mode with only simulated output data. If the system operates in demonstration mode the text **DEMO** appear at the bottom of the status field as shown in the figure.

Refer *Expert Setup* on page 36.

6. FIGURES AND DRAWINGS

This section contains outline drawings showing the mechanical dimensions of the different HS52 parts. To scale drawings are available upon request.

The following drawings are enclosed:

Name	Drw. no	Rev.
Sensor Unit, dimensions	3822-MA-015	1

The following figures are enclosed:

Name	Page
Processing Unit, dimensions	65
Display Unit, dimensions	66

6.1   Sensor Unit, Dimensions
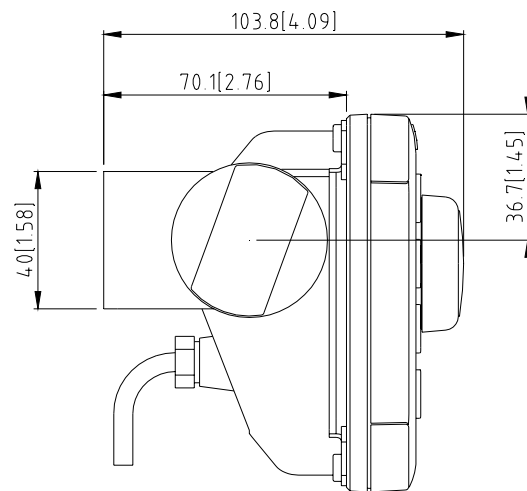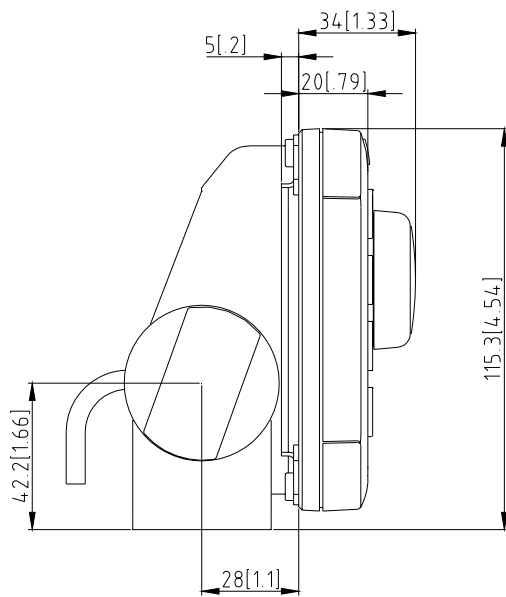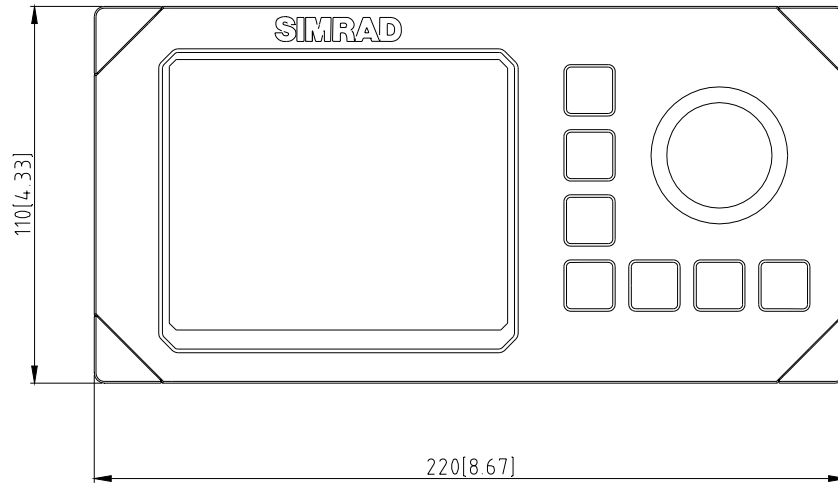
6.2   Processing Unit, Dimensions

6.3   Display Unit, Dimensions

Note!   *Mounting bracket is optional*

7. PARTS LIST

7.1 Standard Delivery

The standard HS52 consists of:

Part no.	No.	Description
20214136	1	HS52 Sensor unit, including 1 meter cable and 4 fastening bolts
20214144	1	HS52 Processing unit including 4 fastening screws
20214151	1	HS52 Display unit, including 15 meter cable, flush mounting kit and protecting cover
20214334	1	HS52 30 meter cable
20214169	1	HS52 Standard English documentation, including cut-out templates and Quick Reference guide.

7.2 Optional Equipment

The HS52 can be delivered with following optional equipment:

Part no.	Description
22084941	Mounting bracket for Display unit

7.3 Documentation

The HS52 system includes English documentation only.

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8. APPENDIX A – PROPR. NMEA MESSAGE

This chapter describes the NMEA 0183 proprietary message PSXN, 20 and the special Ashtech RRE format output from HS52. The PSXN,20 format is according to IEC 61162-1 and follows the standard regarding unused fields on talker.

Description:

$PSXN,20,_horiz-qual_**,**_hgt-qual_**,**_head-qual_**,**_rp-qual_*****_csum term_

$GPRRE,_nsat_**,**_id_**,**_res...id_,res,hpos-err,vpos-err*****_csum term_

Explanation:

_20_	An identification of this message in a series of PSXN messages (20 to 24)
horiz-qual	Horizontal position and velocity quality: 0 = normal, 1 = reduced performance, 2 = invalid data.
hgt-qual	Height and vertical velocity quality: 0 = normal, 1 = reduced performance, 2 = invalid data.
head-qual	Heading quality: 0 = normal, 1 = reduced performance, 2 = invalid data.
rp-qual	Roll and pitch quality: 0 = normal, 1 = reduced performance, 2 = invalid data.
nsat	Number of satellites in use (00 - 99).
_id_	Satellite ID number, PRN (01 – 32).
res	GPS range residual in metres on format m.m (no fraction if the value is greater than 99.9 metres).
hpos-err	Horizontal position error estimate in metres on format hhh.h
vpos-err	Vertical position error estimate in metres on format vvv.v
csum	Checksum (exclusive or) of all characters between, but not including, the preceding **$** and *****, hexadecimal (00 - FF).
term	CR-LF (2 bytes, values 13 and 10).

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9. APPENDIX B – DECLARATION OF CONFORMITY

DECLARATION OF CONFORMITY

(according to ISO/IEC Guide 22 and EN 45014)

Manufacturer's Name:	**Kongsberg Seatex AS**
Manufacturer's Address:	**Pirsentert, 7462 Trondheim, Norway**

declares that the product

Product Names:	**Simrad HS52** *or* **Seapath 20 NAV (SPH 20 NAV)**
Product Items/Part Numbers:	*Simrad HS 52*: Sensor Unit (SU) 20214136, Processing Unit (PU) 20214144 and Display Unit (DU) 20214151 *Seapath 20 NAV*: Sensor Unit (SU) M350-10_01, Processing Unit (PU) M350-20_01 and Display Unit (DU) 20213492

conforms with the navigation equipment requirements of **Marine Equipment Directive (MED) 96/98/EC as modified by directive 2002/75/EC (Annex A1, 4.14) and with reference to the following regulations and Product Standards**

Applicable regulations/resolutions	Test standards
Solas 74 as amended, IMO Res. MSC.112 (73), IMO Res. A.694 (17)	IEC 61108-1 (2003)
	IEC 61162-1/C4 (2000)
	IEC 60945 (2002)

Certificate references:

- **MED-B-3728**
- **MED-D-370, Appendix, rev. no. 1**
- **USCG Approval number 165.130/EC0575/3728**
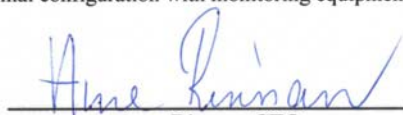
Issued by Det Norske Veritas

Supplementary information:

Further, and applicable for use as THD GNSS methode (currently MED list A2), the product is found complaint with IMO resolution MSC 116 (73) using test standard ISO 22090-3 (2004). Certificate reference BSH/4615/4030233/06, issued by Bundesamt für Seeschifffart und Hydrographie.

The product was tested in its normal configuration with monitoring equipment connected.

Date and Signature

2007-01-03

Arne Rinnan, CTO

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