NORTHROP GRUMMAN

Sperry Marine

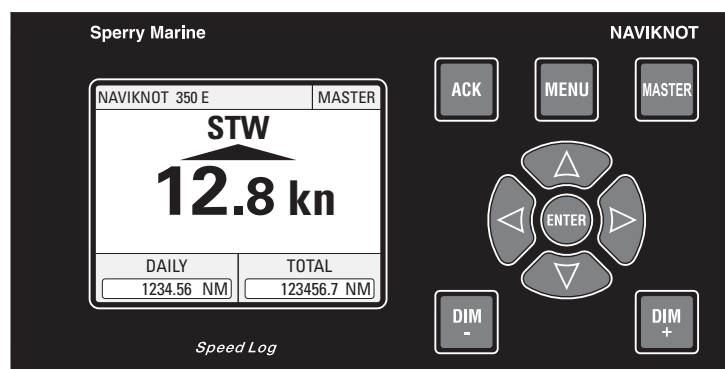# Operation, Installation and Service Manual

NAVIKNOT 350 E

Electromagnetic Speed Log

056345/C, 22 Jan 2008

Sperry Marine, with worldwide headquarters in Charlottesville, VA, and major engineering and support offices in Melville, NY, New Malden, England, and Hamburg, Germany, is part of the Northrop Grumman Electronic Systems sector.

Revision Record

Rev.	Date	Remarks
C	22 Jan 2008	minor corrections/additions
B	17 Aug 2007	minor corrections/additions
A	25 Jun 2007	initial version

Safety Instructions

Safety Notice Conventions

The following safety notice conventions are followed throughout this manual:

DANGER

A **Danger** notice contains an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, **will result in injury or death of personnel.**

WARNING

A **Warning** notice contains an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, **could result in injury or death of personnel.**

CAUTION

A **Caution** notice contains an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, **could result in damage to, or destruction of equipment.**

Note

A **Note** contains an essential operating or maintenance procedure, condition or statement, which is considered important enough to be highlighted.

Special safety symbols may be used in this manual to indicate:

Risk of electrical shock.
Used in conjunction with a **Danger** or **Warning** notice.

Electronic components sensitive to electrostatic discharge.
Used in conjunction with a **Caution** notice.

General Safety Information for the Operator

CAUTION

In the "Manual" and "Extern" modes, the NAVIKNOT 350 E transmits valid output signals and data to the receiving equipment connected.

The function of these modes is to maintain normal operation of speed receivers such as gyrocompasses, RADAR, ARPA etc., in case of failure of the Doppler transducer.

When operating the NAVIKNOT 350 E in the "Manual" mode, make sure that ship's crew are aware of the fact that speed and distance information from the log is based on manual input.
Operating the NAVIKNOT 350 E in the "Manual" mode may severely affect the proper function of equipment which depends on accurate speed and/or distance data.

When operating the NAVIKNOT 350 E in the "Extern" mode, make sure that ship's crew are aware of the fact that GPS ground speed data is displayed and transmitted as longitudinal water speed by the NAVIKNOT 350 E.
Operating the NAVIKNOT 350 E in the "Extern" mode may severely affect the proper function of equipment which depends on accurate longitudinal water speed data.

General Safety Information for Service Personnel

Safety information relating to system configuration, maintenance, servicing and troubleshooting is presented in the respective chapters.

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Chapter 1: Introduction

1.1 Design and Main Features

The NAVIKNOT 350 E is a compact solid-state microprocessor controlled system to determine a vessel's longitudinal speed and distance travelled through the water.
The system complies with IMO resolutions A. 824(19) and A.694(17) and with EN/IEC standards 61023, 61162 and 60945.

The NAVIKNOT 350 E has been type-approved by Germanischer Lloyd, in accordance with the Maritime Equipment Directive 2002/75/EC and assigned certificate no. 44675-07 Lux. In accordance with the mutual recognition agreement (MRA), USCG approval no. 165.105 / EC 0801 / 4467507 has been granted.

A basic system consists of the NAVIKNOT 350 E Electronics Unit, a Control and Display Unit (CDU) and an EM (electromagnetic) speed sensor with the Preamplifier E, type 2863. Up to three additional remote CDUs may be connected to the electronics unit.

Figure 1-1: NAVIKNOT 350 E system
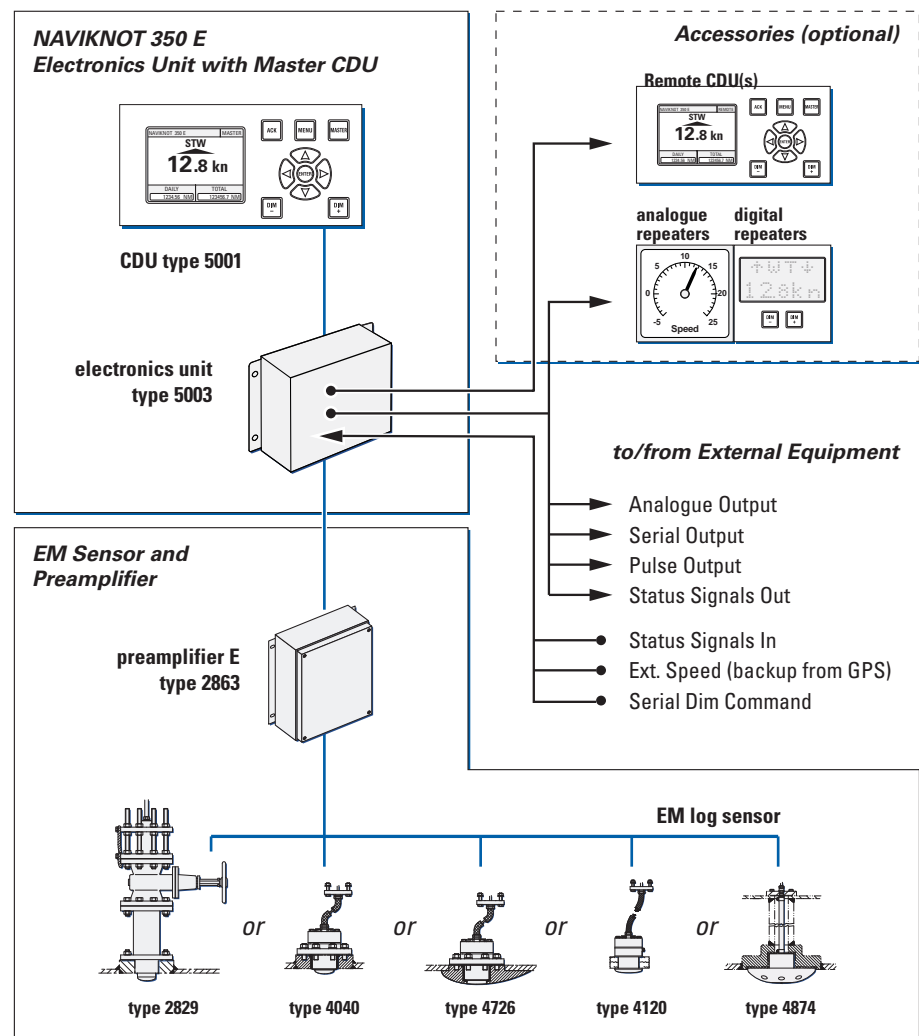
Data Outputs

The Electronics Unit receives the raw speed data from the preamplifier E and applies any necessary corrections according to a stored calibration table. The unit then transmits the calibrated water speed data to receiving equipment and to the connected CDUs. It also calculates the distance travelled and maintains the total and daily mile counters.

Serial speed and distance data is provided in the NMEA 0183 / IEC 61162 format at six RS-422 outputs. These are divided into two groups of three outputs each, which may be configured independently to suit the receiving equipment.

Analogue speed signals are provided at one voltage and one current output. The mapping of actual speeds to corresponding output values is configured for each output independently.

The distance travelled is also provided as a pulse signal at six contact closure outputs. These are divided into three groups of three, two and one output respectively, which may be configured independently to provide 10, 100, 200, 400 or 20000 pulses per nautical mile.

1.2 Operating Principle

The NAVIKNOT 350 E system utilizes the electromagnetic principle to determine the vessel's longitudinal speed through the water.
The EM sensor generates a magnetic field around itself when an AC current is applied to its excitation coil. The ship's motion through the water gives rise to an electrical field *(E)* perpendicular to the magnetic field *(B)* and the ship's motion *(V)*. The resulting signal is picked up by the sensor electrodes and passed on to the preamplifier. The preamplifier converts the sensed ("raw") speed to a digital format (NAVIKNOT protocol) and transmits it to the electronics unit.

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Figure 1-2:
EM-Log
operating principle

longitudinal
water speed
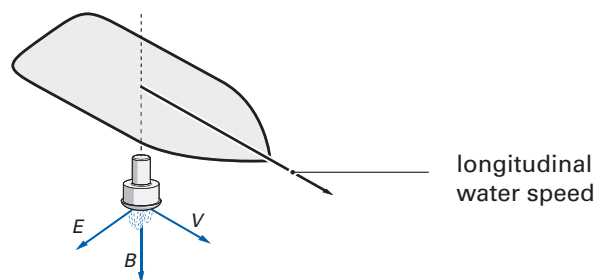
1.3 Technical Data

General

Speed/Distance Ranges and Accuracies

measuring range	
sensor FNF I, type 4040	–35 to +35 kn[1]
type 4726 with hydrofairing	–20 to +60 kn
sensor FNF II	–35 to +35 kn
sensor FNF III	–35 to +35 kn
sensor NF	–30 to +30 kn
accuracy relative to water flow at sensor head	0.1 kn or better

1 Negative values apply only if sensor location and vessel's hull shape permit the sensing of speeds astern.

NAVIKNOT Electronics Unit, Type 5003

Environmental Requirements

ambient temperature, operation	-15 °C – +55 °C
ambient temperature, storage	-25 °C – +70 °C
protection grade	IP 23 to DIN EN 60529
environmental conditions / EMC	in accordance with IEC 60945
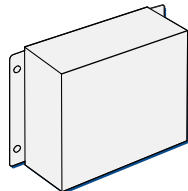
Power Supply

supply voltage	24 VDC (18-36 V)
max. ripple content	±4 Vpp; extreme values may not exceed 36 V or fall below 18 V
power consumption	5 W max.

Magnetic Clearance

to standard magnetic compass	0.5 m
to steering magnetic compass	0.4 m
reduced, to standard magnetic compass	0.3 m
reduced, to steering magnetic compass	0.3 m

Dimensions and Weight

width	340 mm
height	250 mm
depth	100 mm
weight	4.0 kg

Data Inputs

EM sensor speed data	NAVIKNOT serial protocol
Control and Display Unit data	NMEA 0183 / IEC 61162 (proprietary sentences)
ext. speed data (backup from GPS)	NMEA 0183 / IEC 61162
serial dimming command	NMEA 0183 / IEC 61162

Signal and Status Inputs

double ended ferry mode	connection to P.Gnd via ext. contact, latching
ext. alarm acknowledge status (mute)	connection to P.Gnd via ext. contact, momentary, normally open
ext. dim+ ext. dim-	connection to P.Gnd via ext. contact, momentary, normally open

Data Outputs

serial data RS-422 outputs, group 1 (3x)	NMEA 0183 / IEC 61162; *all or selected subset of:* longitudinal water speed distance travelled log status (proprietary sentence)
serial data RS-422 outputs, group 2 (3x)	NMEA 0183 / IEC 61162; *all or selected subset of:* longitudinal water speed distance travelled log status (proprietary sentence)

Signal and Status Outputs

analogue speed output, voltage	max. range -9.999 – 9.999 VDC; speed mapped to output voltage through definition of min. and max. speed/voltage pairs
analogue speed output, current	max. range 0 – 20 mA; speed mapped to output current through definition of min. and max. speed/current pairs
pulse outputs, group 1 (outputs 1,2 and 3)	10, 100, 200, 400 or 20000 p/nm
pulse outputs, group 2 outputs 4 and 5)	10, 100, 200, 400 or 20000 p/nm
pulse output 6	10, 100, 200, 400 or 20000 p/nm or ext. alarm mute
power failure/general alarm speed log failure alarm speed limit threshold alarm watch alarm acknowledge	potential-free relay contacts, each rated 30 VDC/1.0 A, 100 VDC/0.3 A, 125 VAC/0.5 A;

NAVIKNOT 350 E Control and Display Unit (CDU)

Environmental Requirements

ambient temperature, operation	-15°C – +55°C
ambient temperature, storage	-25°C – +70°C
protection grade	*Stock No. 73506*: frontside IP 65 to DIN EN 60529, if installed with seal in console panel; IP 23 if installed in console frame *Stock No. 73507 (in housing with bracket):* IP 65 to DIN EN 60529
environmental conditions / EMC	in accordance with IEC 60945
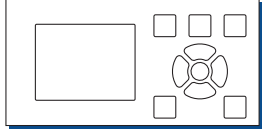
Power supply

supply voltage	24 VDC (18-36 V)
max. ripple content	±4 Vpp; extreme values may not exceed 36 V or fall below 18 V
power consumption	4 W max.

Magnetic Clearance
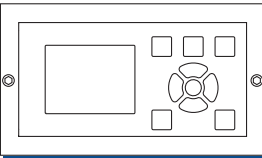
to standard magnetic compass	0.80 m
to steering magnetic compass	0.50 m
reduced, to standard magnetic compass	0.50 m
reduced, to steering magnetic compass	0.30 m

Dimensions and Weight
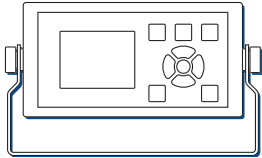
Stock No. 73506 (for console mounting)

width	192 mm	
height	96 mm	
depth	44 mm; approx. 100 mm backward clearance from mounting surface required for connector cable	
weight	2.4 kg	

Stock No. 79488 (Stock No. 73506 factory-assembled in console frame)

frame width	223 mm	
frame height	127 mm	

Stock No. 73507 (in housing with bracket)

width	256 mm	
max. height (unit in vertical position)	155 mm	
max. depth (unit in horizontal position)	116 mm	
weight	3.2 kg	

Preamplifier E, Type 2863

Environmental Requirements

ambient temperature, operation	–15 to +55 °C
ambient temperature, storage	–25 to +70 °C
protection grade	IP 56 to DIN EN 60529
environmental conditions / EMC	in accordance with IEC 60945
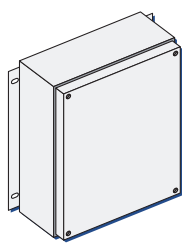
Power Supply

supply voltage	230 VAC or 115 VAC, 50-60 Hz
power consumption	24 W

Magnetic Clearance

to standard magnetic compass	0.3 m
to steering magnetic compass	0.3 m

Dimensions and Weight
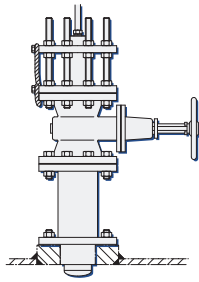
width	239 mm	
height	285 mm	
depth	83 mm	
weight	3.0 kg	

EM Log Sensors
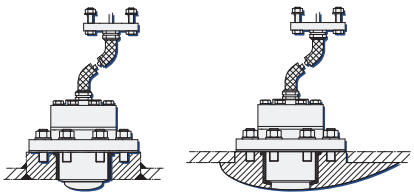
Common Operational Data

excitation voltage	24 VAC
excitation current	1 A
nominal output voltage	180 µV/kn
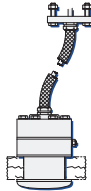
Sensor NF, Type 2829

sensor for steel or aluminium vessels, single or double bottom	
installation method	from inside vessel, through hull fittings
pressure resistance	> 4 bar (4000 hectopascal)
cable length	30 m
dimensions	see drawing 2829-0112-01
weight	sensor approx. 20 kg hull fittings approx. 50 kg
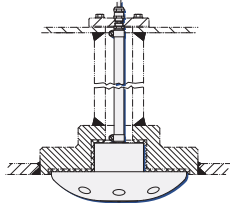
Sensor FNF I, Types 4040 and 4726

sensor for steel or aluminium vessels, single or double bottom	
installation method	from inside vessel, in drydock
pressure resistance	> 2 bar (2000 hectopascal)
cable length	20 m
dimensions	see drawing 4040-0112-01 or 4726-0112-01 respectively
weight	17.0 kg

Sensor FNF II, Type 4120

sensor for wooden or glass-fibre vessels	
installation method	from inside vessel, in drydock
pressure resistance	> 2 bar (2000 hectopascal)
cable length	20 m
dimensions	see drawing 4120-0120-01
weight	15.0 kg

Sensor FNF III, Type 4874

sensor for steel or aluminium vessels, single or double bottom	
installation method	from outside vessel; sensor can be exchanged without drydocking by a diver
pressure resistance	> 4 bar (4000 hectopascal)
cable length	30 m
dimensions	see drawing 4874-0112-01
weight	22.0 kg

Chapter 2: Operation

2.1 Display and Operating Keys
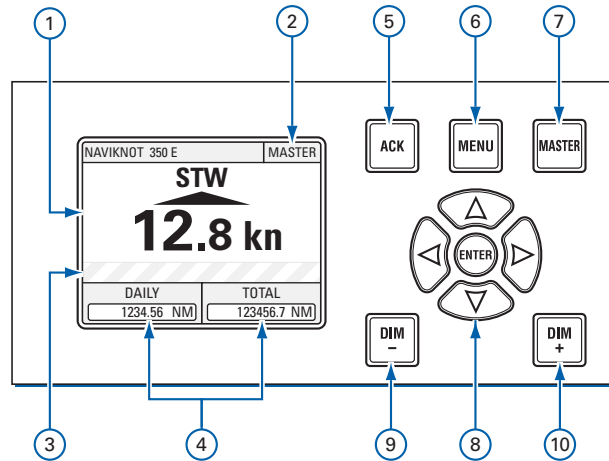
Display

① **Speed Display:** Shows the actual speed through the water along the vessel's longitudinal axis (fore-and-aft line).
Arrow pointing up, above value: speed is positive (ahead).
Arrow pointing down, below value: speed is negative (astern).

② **Mode Indicator:** indicates the operating mode (Master or Repeater).

③ **Alarm Display Area:** In case of pending alarms, the alarm code(s) and error messages are shown in this area.

④ **Mile Counters:** Show the distance travelled since last reset (daily miles) and total cumulative distance travelled (total distance).

Operating Keys

⑤ **ACK** key: Acknowledge pending alarms; mute alarm buzzer.

⑥ **MENU** key: Call up or quit the menu mode.

⑦ **MASTER** key: Requests Master operating mode for this unit.

⑧ Navigation Keypad:
UP, **DOWN**, **LEFT**, **RIGHT** keys navigate through the operating menu;
ENTER confirms and stores settings made in the menu mode.
In case active alarms are present, the left and right arrow keys scroll through the list of alarm messages.

⑨⑩ **DIM–** / **DIM+:** Adjust the display brightness.

2.2   External control devices

Depending on the installation, external devices may be present to remotely control certain functions of the NAVIKNOT 350 E:

- The audible alarm at the NAVIKNOT 350 E the may be muted from a remote device, e.g. a central alarm panel.

- External pushbuttons may be used to adjust the display brightness.

- If connected to a central dimming facility, the NAVIKNOT 350 E may receive dimming commands via a serial data connection.

- An external selector switch may be used to activate or de-activate the double-ended ferry mode. In this mode, the NAVIKNOT 350 E displays and transmits all speeds with the sign reversed.

2.3   Power-up Sequence

The separate components of the NAVIKNOT system are not equipped with power switches. All devices power up simultaneously, as soon as supply power is applied to the system.

Upon power up, the startup routine is executed:
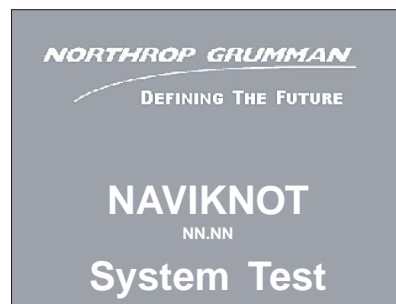
The startup screen is shown and a system test sequence is executed.

A status line at the bottom of the screen indicates the progress and results of the following tests:
RAM test
I/O test
Checksum test
Setup Data test

After the system test, the indication "waiting for main unit" may be briefly shown at the CDU, while the electronics unit initializes itself.

As soon as the system is fully operational, the actual speed and the daily and total mile counters are displayed.

Note

Should the NAVIKNOT electronics fail to establish communication with the CDU(s) after power-up, the indication "waiting for main unit" will be shown permanently at all connected CDUs. An audible alarm is sounded which must be locally acknowledged at each CDU.
The NAVIKNOT system will not operate properly until the cause of failure is eliminated and should be powered down until it can be serviced.

2.4 Display Indications in Normal Operational Mode

Speed Display

STW

12.8 kn

In the normal operational mode, the NAVIKNOT 350 E CDU permanently display the actual speed through the water (STW).

An up-arrow symbol above the speed value indicates positive speeds (ahead), a down-arrow symbol below the value indicates negative speeds (astern).
The value is displayed without sign.

Distance Counters

DAILY	TOTAL
1234.56 NM	123456.7 NM

Also permanently displayed are the distance counters (daily and total mile counters).
The counters display the distance made good through the water.
The count is incremented at positive speeds only; counting is halted during zero or negative speeds.

Operating Status Indications

Master/Remote status

NAVIKNOT 350 E	MASTER

NAVIKNOT 350 E	REMOTE

The indication "MASTER" is shown in the top right corner of the CDU which currently the master unit.
Other CDUs, if present, will show the indication "REMOTE"

Manual/External speed input active

MAN	STW

EXTERN	STW

When the manual or external input mode has been activated in the manual settings menu, the indication "MAN" or "EXTERN" respectively is shown in the top left corner of the speed display.

Speed not calibrated

STW	UNCAL

When the sensor calibration table is empty or calibration has been switched off, the indication "UNCAL" is shown in the top right corner of the speed display.

2.5 Requesting Master Control

In case more than one CDU is installed, only one of these can be assigned master control; all other CDUs will operate as remote units.

Only from the master, the operator can access the operating and service menus, acknowledge alarms and scroll through the alarm list.

Remote CDUs permanently display speed and distance. The only keys functional at a remote CDU are the **DIM-**/**DIM+** keys to adjust the brightness level and the **MASTER** key, which requests master control to be transferred to this CDU.

To request master control at a remote CDU:

| NAVIKNOT 350 E | REMOTE |

[MASTER]

| NAVIKNOT 350 E | MASTER |
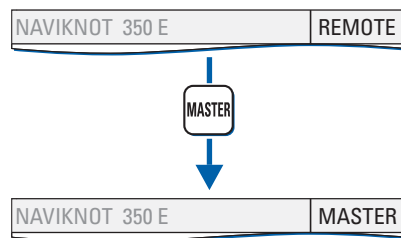
Press the **MASTER** key.
Master control is transferred and the mode indication changes from "REMOTE" to "MASTER".

Note   Master control can only be requested from a CDU which is currently operating as remote unit.
The current master cannot actively transfer control to a remote CDU. Any remote CDU may request master control at any time, i.e. control requests cannot be refused by the current master.

2.6 Adjusting the display brightness

The brightness of the display and keypad illumination is adjusted via the **DIM+/DIM-** keys:

NAVIKNOT 350 E	MASTER
STW	
12.8 kn	
DAILY	TOTAL
1234.56 NM	123456.7 NM

[DIM +]
[DIM –]
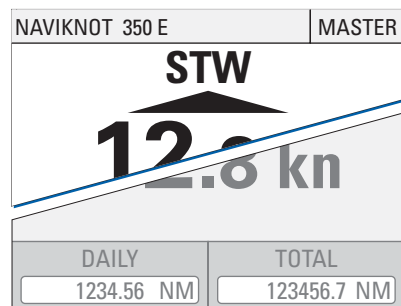
Press the **DIM+** key to increase the illumination brightness.
Press the **DIM-** key to reduce the illumination brightness.

Note   The display brightness can only be adjusted in normal operational mode. The brightness setting is not retained between power-ups. The NAVIKNOT 350 E always powers up at the second brightest level.

2.7 Optional Functions

The following functions may be available if the system is equipped with the respective external controls and configured accordingly.

Muting Alarms Remotely

On alarm, actuate the mute control at a remote device (e.g. a central alarm panel). The audible alarm is muted.

Note	A remotely muted alarm remains in the pending (unacknowledged) state. The alarm is indicated as pending in the alarm display area until the alarm is acknowledged at the NAVIKNOT 350 E or the cause of the alarm is eliminated.

Resetting/Acknowledging a Central Watch Alarm

If connected to a central watch alarm facility ('dead man alarm'), the NAVIKNOT 350 E automatically resets the watch alarm timer whenever a key is pressed on the unit.

Should a watch alarm be given, press any key at the NAVIKNOT 350 E to acknowledge the alarm and reset the watch alarm timer.

External Dimming

If external **DIM+/DIM-** pushbuttons are installed, these operate in parallel with the builtin **DIM+/DIM-** keys.

For future applications, the NAVIKNOT 350 E also possesses an input for serial data dimming commands from a central dimming facility.

Activating Double-Ended Ferry Mode

In certain installations, a switch may be installed to activate or de-activate the double-ended ferry mode. If this mode is active, If this mode is active, all speeds are displayed and transmitted with their sign reversed.

Note	In most installations where the double-ended ferry mode is used, it will be automatically activated via a general take-over system which transfers control between the forward and aft steering positions.

2.8 Operating Menu

The manual settings, user and service setup sub-menus are accessed through a multilevel operating menu.

Entering and Quitting the Menu Mode

```
NAVIKNOT 350 E          MASTER      MENU
          STW
      12
      MAIN MENU

   >  MANUAL SETTINGS        >
      USER SETUP
      SERVICE SETUP
```
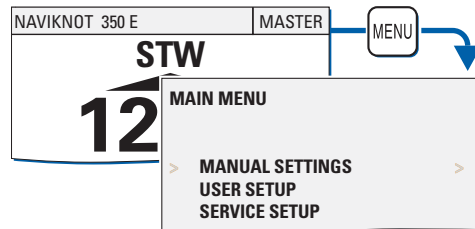
From the normal operational mode, press **MENU** to enter the menu mode.

The Main Menu screen is displayed.
The keys of the navigation keypad may now be used to navigate the menu, to select parameter settings and to edit parameter values.

```
MAIN MENU                      MENU

   >  MANUAL SETT NAVIKNOT 350 E      MASTER
      USER SETUP       STW
      SERVICE SETU
                     12.8 kn
```
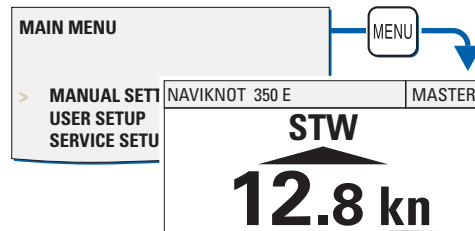
From the main menu screen, press **MENU** to return to the normal operational mode.

The Main Menu screen is closed and the normal operational display reappears.

Note ☞ In the menu mode, the **MASTER** and the **DIM-**/**DIM+** keys are disabled. Should an alarm condition occur while the menu mode is active, the audible alarm will sound, but the operator must return to normal operational mode to view the alarm message and acknowledge the alarm.

Navigating the Menu

In the menu mode, the operator may navigate through the menu using the **Right**, **Left**, **Up** and **Down** arrow keys.
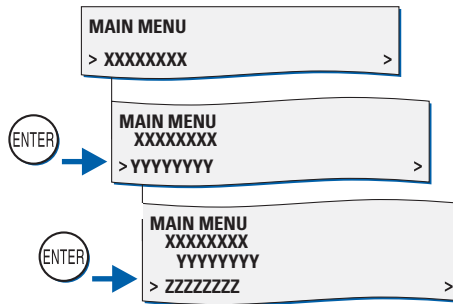
Arrow symbols (>) to the right of the window indicate that a sub-menu exists for the respective option.

Press **ENTER** to enter a sub-menu.
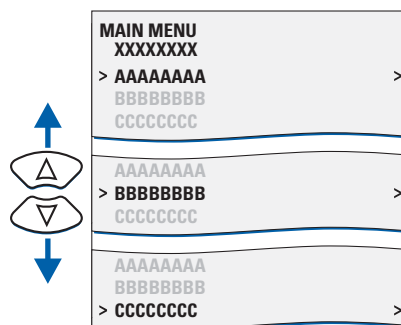
The arrow symbol (>) at the left of the window indicates the cursor position on the current menu level.

With the **Up/Down** arrow keys, move to the cursor to the required sub-menu position.
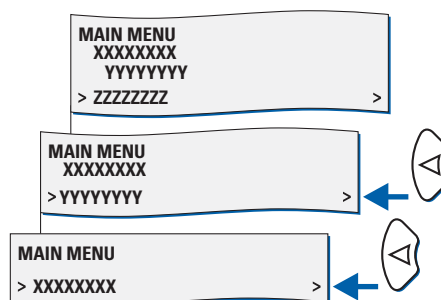
Press the **Left** arrow key to return to the next higher menu level.

Alternatively, **MENU** may be pressed to jump as high up as possible from the current level. In most cases, this will quit the menu immediately and return to normal operational mode.

Selecting Parameter Settings

In a number of sub-menus, the operator is expected to select parameter settings from a list of available options.

The available options and the current selection are indicated by different symbols:

Radio buttons: Allow to select exactly one of the available options.

⊙ : selected

○ : deselected

Checkboxes: Allow to select or activate none, one or more of the available options.

⊠ : selected

☐ : deselected

To select parameter settings in a sub-menu:
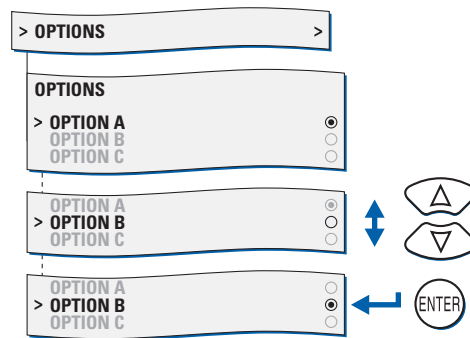
With the **Up/Down** arrow keys, move to the required option.

Press **ENTER** to confirm the selection and leave the option sub-menu.

MENU leaves the option sub-menu without changes.

Editing Parameter Values

In a number of sub-menus, parameters are set by editing a numerical value or an alphanumerical string.

To edit a parameter value in the respective sub-menu:
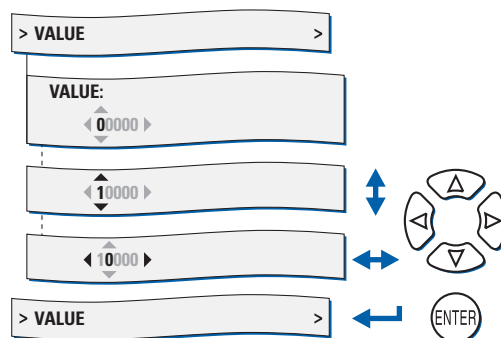
With the **Up/Down** arrow keys, edit the character at the current cursor position.

With the **Right/Left** arrow keys, move the cursor forward/back to edit the next/previous character.

Press **ENTER** to confirm the new value and leave the option sub-menu.

MENU leaves the option sub-menu without changes.

2.9 Manual Settings Menu

The Manual Settings menu provides access to settings which the operator may need to alter more or less frequently during normal operation.

Manual Settings – Overview

Figure 2-2:
Manual Settings

MAIN MENU
  MANUAL SETTINGS

> **SPEED MODE STW**   >

SPEED MODE STW   *speed data input mode*
  ○ **MAN**
  ○ **SENSOR**
  ○ **EXTERN**

> **MAN SPEED VALUE**   >

MAN SPEED VALUE   *manual input value*
  speed: -99 – +99 kn
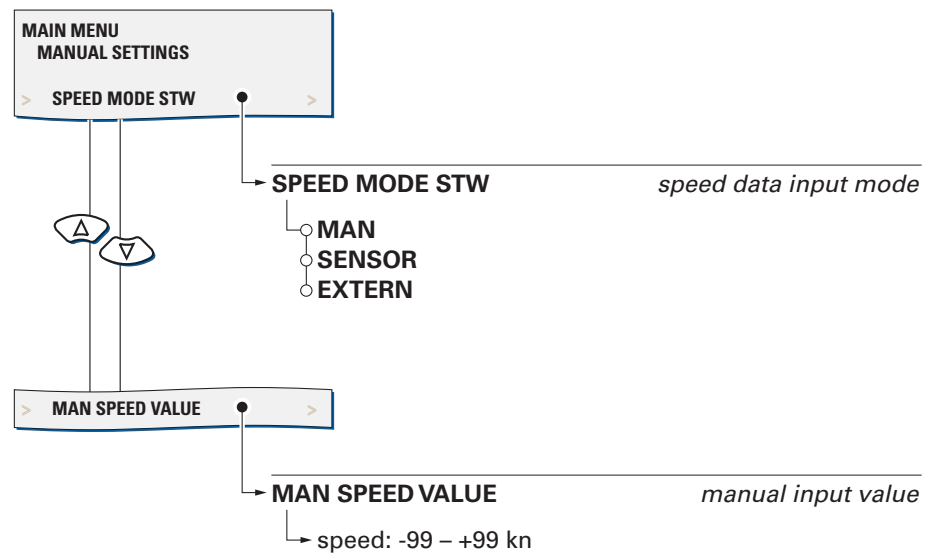
Manual Settings – Parameters

Speed Mode STW

Selects the speed input mode.

Settings: **MAN**
The actual speed value is entered manually.
This setting may be chosen only temporarily, to generate
speed output data in case of sensor failure or for testing.

    SENSOR
Speed data is read from the speed sensor input.
This setting must be active at all times during normal opera-
tion of the system.

    EXTERN
Speed data is read from the NMEA $--VTG sentence at one
of the NMEA inputs 1 or 2.
This setting allows to use speed data from a GPS instead of
manual input. Note that, while the $--VTG sentence contains
ground speed, the NAVIKNOT 350 E displays and transmits
the data as water speed. The external input may therefore
be chosen only temporarily, to generate output data in case
of transducer failure or for testing.

Man. Speed Value

Sets the input value in the manual input mode.

Value: **-99.9 – 99.9 kn**

2.10 User Setup

The User Setup menu provides access to settings which the operator may need to alter only occasionally.

User Setup – Overview

Figure 2-3:
User Setup

MAIN MENU
  USER SETUP

> DAMP. TIME DISPLAY

DAMP. TIME DISPLAY   *damping time constant for speed display*
  damping time: 0 – 60 s

> DAMP. TIME OUTPUT

DAMP. TIME OUTPUT   *damping time constant for speed outputs*
  damping time: 0 – 60 s

> RESET DAILY MILES

RESET DAILY MILES   *daily miles counter reset*
  reset counter to zero when user setup is quit

> TOTAL MILES COUNTER

TOTAL MILES COUNTER   *total miles counter start value*
  set start value: 0.0 – 999999.9 NM

> LCD COLOR

LCD COLOR   *screen colour scheme*
  WHITE
  BLUE
  BLACK

contd. on next page

Figure 2-4:
User Setup
(contd.)

> SCALE

SCALE   *speed display units*

SPEED SCALE

KN
M/S
FT/S

> SOFTWARE VERSION N●NN

SOFTWARE VERSION   *NAVIKNOT El. Unit*
                                                                    software version

version ID (read-only)
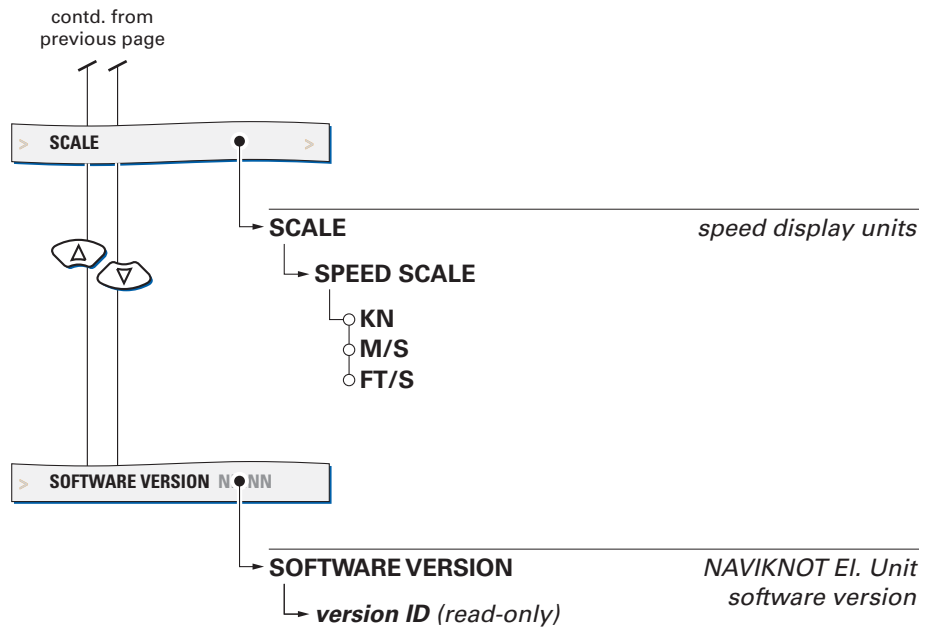
User Setup – Parameters

Damp. Time Display

Sets the damping time constant for the speed display.

The higher the time constant, the stronger sudden peaks of the actual speed display will be damped.

Value: **0 – 60 s**

Damp. Time Output

Sets the damping time constant for the speed outputs.

The higher the time constant, the stronger sudden peaks of the actual speed output will be damped. The output damping time constant is effective for both the analogue as well as the serial data outputs.

Value: **0 – 60 s**

Reset Daily Miles

Sets the reset flag for the daily miles counter.

If the reset flag is set, the daily miles counter is reset to zero as soon as the User Setup is quit.

Settings: **ON** (option checked)
                    Reset daily miles counter when User Setup is quit

                    OFF (option unchecked)
                    Leave daily miles counter untouched

Total Miles Counter

Sets the total miles counter to a desired start value.

Value: **0.0 – 999999.9 NM**

Note   The total miles counter may be set to any desired start value.
The daily mile count may thus be larger than the total mile count if the daily miles counter is not reset after altering the total mile counter.

LCD Color

Selects the screen colour scheme for the normal operational display.

Settings: **WHITE**
Speed display and mile counters use black lettering on a white background.

BLUE
Speed display and mile counters use white lettering on a blue background.

BLACK
Speed display and mile counters use white lettering on a black background.

Scale

Selects the unit of measure for the speed display.

The respective setting acts on the actual speed display at the CDU only and has no further effect on the output data, mile counters etc.

Settings: **KN**
Speed is displayed in knots.

M/S
Speed is displayed in metres per second.

FT/S
Speed is displayed in feet per second.

Software Version

Displays the software version of the NAVIKNOT Electronics Unit.

Settings: *none*
The version ID is read-only.

Chapter 3: Alarm System

3.1 Alarm Indication

Audible Alarm Indication

Single Beep: Invalid Action

A single short beep indicates that the operator attempted to carry out an invalid action.
This is the case e.g. if the operator attempts to enter the menu from a remote unit.

Continuous Beeping: Pending Alarm

Continuous on-off beeping indicates that a pending (unacknowledged) alarm is present.
Simultaneously, a corresponding alarm message is shown in the alarm window.

Visual Alarm Indication

If an alarm is active, a messages is shown in the alarm display area (above the mile counters) which specifies the alarm at hand.
Active alarms have one of two possible states:

< (1/1) SENSOR ERROR >
DAILY   TOTAL

Pending (unacknowledged):
The cause of the alarm is present and the operator has not yet acknowledged the alarm.
The alarm message is shown on a red flashing background.

< (1/1) SENSOR ERROR >
DAILY   TOTAL

Acknowledged:
The operator has acknowledged the alarm but the cause of the alarm is still present.
The alarm message is shown on a solid red background.

3.2 Acknowledging Alarms/Muting the Audible Alarm

Local Alarm Acknowledge

To acknowledge a pending alarm at the NAVIKNOT 350 E CDU:

< (1/1) SENSOR ERROR >
DAILY   TOTAL

ACK

< (1/1) SENSOR ERROR >
DAILY   TOTAL
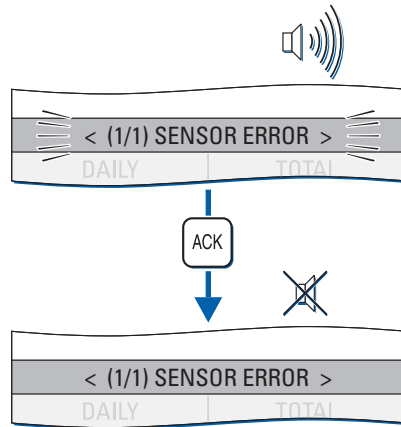
Press **ACK**.

The audible alarm indication is muted.

If the system is connected to a central alarm facility and configured accordingly, the audible alarm indication at the central alarm facility will also be muted.

Note

When an alarm has been acknowledged, the ext. alarm status output remains active until the cause of the alarm is eliminated.
When the cause of an alarm is eliminated, the alarm is acknowledged automatically and the alarm status is cleared.
The NAVIKNOT 350 E does not keep a history of past (inactive) alarms.

External Alarm Mute

To mute the audible alarm externally (e.g. from a central alarm panel):

< (1/1) SENSOR ERROR >
DAILY   TOTAL

ext. alarm mute

< (1/1) SENSOR ERROR >
DAILY   TOTAL
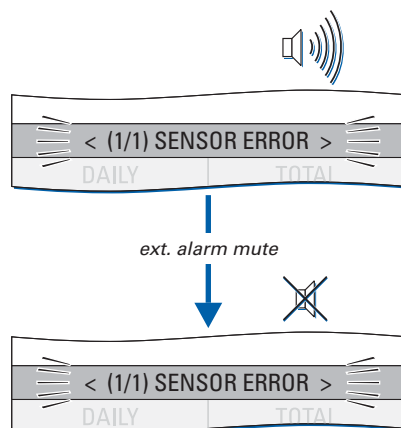
Actuate the external mute facility.

The audible alarm indication is muted.

The alarm state and visible indication are not affected, i.e. the alarm remains in the pending state until it is locally acknowledged at the NAVIKNOT 350 E CDU.

3.3 Viewing the active alarms

The total number of alarms and the index number of the currently displayed alarm are shown in front of the alarm message.

If more than one alarm is active, use the Left or Right arrow key to scroll through the list of alarm messages:
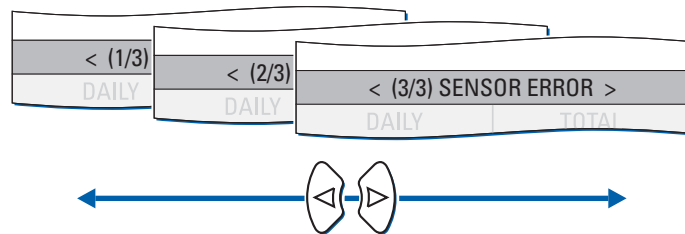
Note   As long as any pending (unacknowledged) alarms are present, these will automatically be redisplayed when other messages have been viewed, until all alarms have been acknowledged by the operator.

3.4 Error Messages

Table 3-1:
error messages

message text	cause	corrective action
WAITING FOR MAIN UNIT (shown on startup screen)	Communcation between electronics unit and CDU(s) could not be established	Check operation of the electronics unit; Check cabling between CDU and electronics unit. If error persists, power down the system and call service.
SENSOR1 ERROR	No valid data received from the preamplifier E	Check that the pream-plifier is operating; check cabling between preamplifier and elec-tronics unit; check cabling between sensor and preampli-fier, check sensor for proper operation.
EXT DIM TIMEOUT	No valid commands received at serial dim input.	Check connection between dimming device and electronics unit.
EU TIMEOUT	Communication lost between electronics unit to CDU	Check basic operation of the electronics unit (valid output generated at serial data / ana-logue outputs); Check cabling between CDU and electronics unit.

Note

In case of an "EU timeout" error, dashes will appear in the speed and dis-tance displays. The timeout error will be shown as the only fault present, because the CDU receives no error messages from the electronics unit when the communication is lost.

Chapter 4: Scheduled Maintenance

4.1 Maintenance by Shipboard Personnel

NAVIKNOT Electronics Unit, CDU and Preamplifier E

The electronic components of the NAVIKNOT 350 E system are solid-state devices and contain no consumable parts. Therefore, no set maintenance schedule is required.

The CDU front plate should be kept clean and a regular visual inspection of the system's cables and connectors should be carried out to detect any signs of damage or deterioration.

CAUTION	The CDU front plate is made of clear polycarbonate. Do not clean the front plate with organic solvents, acetone or any other substance which could damage or discolour plastic. Use only water and soap or a mild detergent to clean the front plate.

EM-Log Sensor Maintenance

Depending on the type of EM-sensor installed, certain maintenance procedures are to be carried out at regular intervals, such as cleaning of the sensor head and lubrication/overhaul of the sea valve, if applicable.

The recommended maintenance schedule and procedures are described in the installation, maintenance and service instructions for the respective sensor. The following documents apply:

  – Sensor NF: document no. 002829-0125-001;

  – Sensor FNF I: document no. 004040-0125-001;

  – Sensor FNF II: document no. 004120-0125-001;

  – Sensor FNF III: document no. 004874-0125-001.

Chapter 5: Installation

5.1 Mechanical Installation

EM-Log Sensor and Preamplifier

Details of the installation of the EM-log sensor and the preamplifier E are contained in the installation, maintenance and service instructions and the dimension/installation drawing for the respective sensor and preamplifier E. The following technical documents apply:

- Sensor NF: document no. 002829-0125-001;
- Sensor FNF I: document no. 004040-0125-001;
- Sensor FNF II: document no. 004120-0125-001;
- Sensor FNF III: document no. 004874-0125-001.

In general, field service will attend a vessel after the sensor has been installed mechanically by the shipyard or, in case of the sensor NF, after the hull fittings have been installed. In most cases, the vessel will be afloat at this point in time.
The preamplifier may be installed at the same time as the sensor or later, together with the other electronic components of the NAVIKNOT 350 E system.

NAVIKNOT Electronics Unit

The NAVIKNOT electronics unit is to be installed at a protected location. In most cases, it will be mounted in the vicinity of the master CDU.

The electronics unit is to be attached to a level surface with four M6 screws (or nuts and bolts). For the dimensions of the housing, refer to drawing 5003-0112-01. The electronics unit may be installed vertically, horizontally or inclined.

Control and Display Units

Console Mounting

To mount a NAVIKNOT CDU directly in a console panel (without console frame), a panel cutout is required as shown in drawing 5001-0112-02 (see Appendix). Suitable fasteners for console mounting are provided in the installation kit 22724, included with the CDU.

A backward clearance of approx. 100 mm from the mounting surface is required to protect the connector cable from being bent too strongly at the cable gland.

Console Frame Version

When ordered factory-assembled in a console frame, the NAVIKNOT CDU is already fastened to the frame. The required cutout for a standard 2x1 frame is shown in drawing 0012-0112-02 (see Appendix).

If a custom frame is delivered, installation-specific dimensional drawings for the frame and cutout will be provided with the equipment.

A backward clearance of approx. 90 mm from the frame top surface is required to protect the connector cable from being bent too strongly at the cable gland.

Housing with Bracket

The NAVIKNOT CDU in housing with bracket is shown in dimensional drawing 5001-0112-02 (see Appendix). The mounting bracket carries four holes of 5.3 mm dia. for fixing the bracket to any plane surface, such as a console panel, wall or ceiling. The required fasteners are to be provided by the shipyard or installer.

Connector Cable

The NAVIKNOT CDU connector cable terminates into a 6-wire pigtail for direct connection to the terminals at the Electronics Unit or to a separate terminal block. If required, a terminal block is to be provided by the shipyard or installer.

The installer must make sure that the end of the cable sheath is firmly secured to the vessel structure with tie-wraps or other suitable means, so that the individual wires are free from tension at the terminals.

5.2 Electrical Installation

Preamplifier E, Type 2863, AC Power Configuration

The preamplifier is delivered prewired for connection to 230VAC. If the amplifier is required to operate on 115 VAC, it must be reconfigured accordingly.
Details of the AC power configuration are described in the applicable installation, maintenance and service instructions for the sensor.

Wiring Up the System

DANGER

When the AC supply power is switched on, live voltages are present at certain terminals and tracks on the preamplifier PCB.
When wiring up the preamplifier, make sure the AC power supply is switched off and safeguarded against accidental switching-on.

CAUTION

When wiring up the system, make sure that the power supply for the NAVIKNOT system is switched off and is safeguarded against accidental switching-on.

CAUTION

Components on the devices' PCBs are sensitive to static discharge. Take the necessary precautions to prevent electrostatic discharges.

Wire up the system according to the connection diagrams and other relevant documents provided.

If installation-specific connection diagrams have been provided for a given system, these supersede any connection information contained in standard connection diagrams.

If wiring up according to standard connection diagrams, make sure beforehand that all data and signals to receive from or transmit to external equipment comply to the NAVIKNOT Electronics Unit interface specification, 5003-0120-001.

5.3 Initial System Configuration

Configuring the CDU(s)

If one CDU is installed only, the unit requires no further configuration.

In case more than one CDU is installed, each CDU must be assigned a unique ID through its local Service Setup menu.

CDU Setup Access Code

To prevent inadvertent or unauthorized changes to the CDU configuration, the local setup menu is protected by an access codes

To access the local CDU Service Setup:
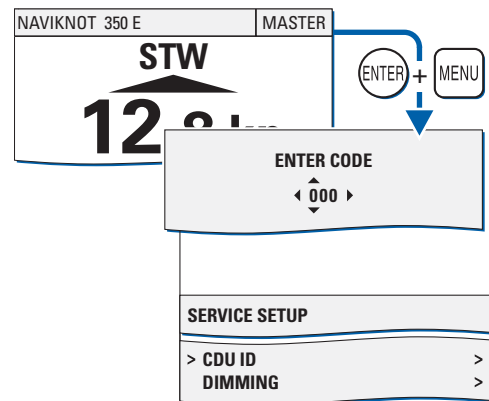
From the normal operational mode, simultaneously press **ENTER** and **MENU** to call up the CDU's local Service Setup menu mode.

When prompted for the setup code, enter code **600**.

The CDU's local Service Setup opens.

CDU Service Setup – Overview

Figure 5-1:
CDU Service Setup

```
SERVICE SETUP

>   CDU ID                    •        >
```

CDU ID   *this CDU's local ID*

  ID: 0 – 9

```
>   DIMMING                   •        >
```

DIMMING   *settings for
serial dimming*

GROUP ID

  dim group ID assignment: 00 – 99

CENTRAL DIM OFFSET

  offset: -7 – +7

DIM MIN VALUE

  brightness percentage: 00 – 99

DIM VALUE 2

  brightness percentage: 00 – 99

. . .

DIM MAX VALUE

  brightness percentage: 00 – 99
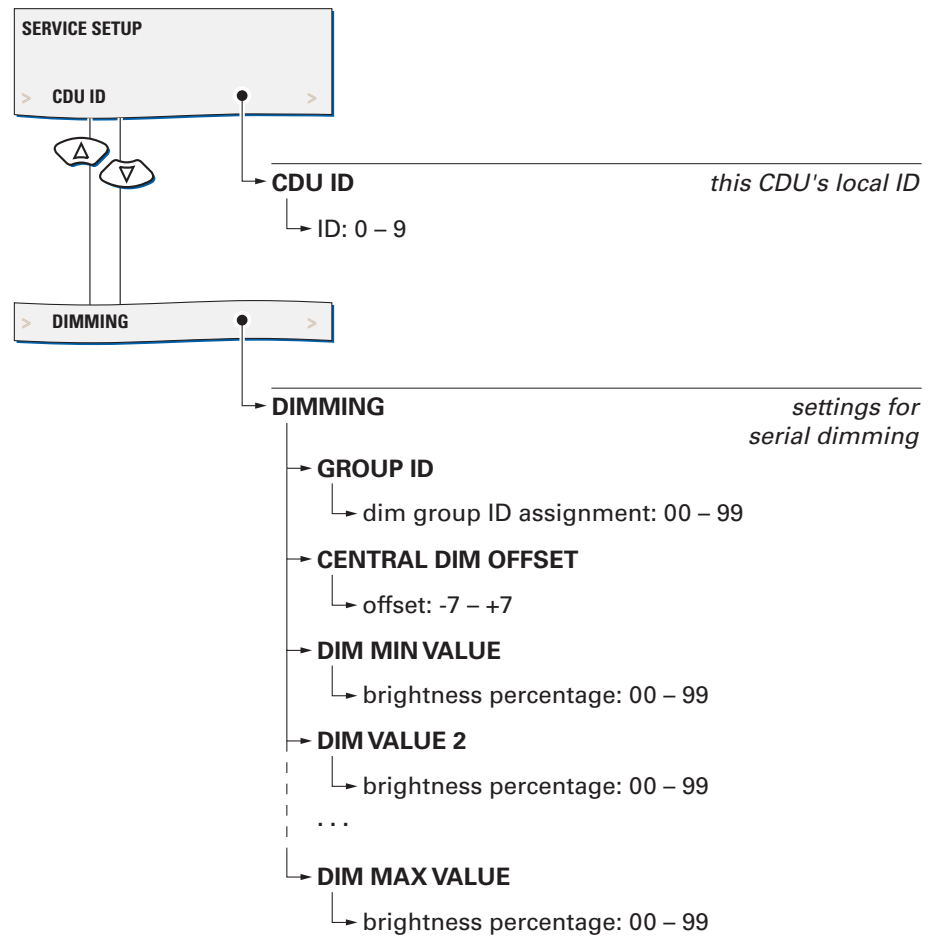
CDU Service Setup – Parameters

CDU ID

Sets the CDU's local ID.
The ID serves to identify the individual CDUs in systems where one or more remote CDUs are installed. The electronics unit uses the ID to keep track of which CDU is currently assigned master command.

Setting: **0 – 9**
            Select an ID between "1" and "9" if more than one CDU is installed. A given ID may only be assigned to one CDU within the system.
            In a single-CDU system, select ID "0".

Dimming

Group ID

Assigns the CDU to a dim group.
The ID setting is only effective if dimming commands are read from the proprietary NMEA sentence $PPLAI.

Setting: **00 – 99**
            Select an ID between "01" and "09" to assign the CDU to the respective dim group.
            Selecting ID "00" lets the CDU accept any dim command received, regardless of group assignment.

Central Dim Offset

Sets a local offset for the brightness level.

Setting: **-7 – +7**
            Select an offset as required to match the brightness of the CDU to that of other equipment controlled through the same dim command device.
            Offsets below 0 decrease, offsets above 0 increase the CDU's overall brightness by the corresponding number of brightness levels. However, the offset will not alter the brightness beyond the min. and max levels respectively.
            The factory default for the offset is 0.

Dim Values (min. through max.)

Maps the ordered brightness setting as read from the serial dim command to the NAVIKNOT 350 E's nine discrete brightness levels.

Settings: **00 – 99**

            For each brightness level, set the smallest intensity order at which the level should be active. If the order received is smaller than the set value, brightness is reduced to the next lower level.

Configuring System Parameters

When the system has been wired up, all configuration parameters are to be set to the required values in the Service Setup in order to make the NAVIKNOT system fully functional. For a description of the Service Setup, refer to Chapter 6 (System Configuration).

Note

As the first step in an initial system configuration, call up the Service Setup and the system type parameter to "NAVIKNOT 350 E".
Then, quit the setup menu and cycle the power to make sure that only those parameter settings and configuration options which apply to a NAVIKNOT 350 E system are available through the Service Setup.

After the initial system configuration, note all settings in the NAVIKNOT 350 E system setup table (see Appendix). Send one copy of the filled-out table to Sperry Marine for inclusion in the ship's file.

The operating parameters in the User Setup and Manual Settings menus should also be set as required for normal operation within the given system.

Chapter 6: System Configuration

6.1 Service Setup Menu

The Service Setup menu provides access to the system parameters which configure the NAVIKNOT 350 E according to the requirements of the installation at hand.

Setup Access Code

To prevent inadvertent or unauthorized changes to the system configuration, setup menus which are to be accessed by service personnel only are protected by access codes.

To access the Service Setup:

MAIN MENU	Call up the Main Menu.
	Select the Service Setup.
> SERVICE SETUP >	When prompted for the setup code, enter code **600**.
ENTER CODE ▲ ◄ **000** ► ▼	Press **ENTER** to continue.
SERVICE SETUP Page 1 > NEXT PAGE (2) > SYSTEM TYPE >	Page 1 of the Service Setup opens.

Service-Setup – Overview

Figure 6-1:
Service Setup,
page 1

> SERVICE SETUP Page 1
>
> > **NEXT PAGE (2)**   >

↦ skip to page 2

> > **ANALOG OUTPUT**   >

↦ **ANALOG OUTPUT**   *settings for analogue*
                                                         speed outputs

   ↦ **VOLTAGE**

      ↦ **MINIMUM VOLTAGE**
        ↦ output value at min. speed: -9.999 – 9.999 V

      ↦ **MAXIMUM VOLTAGE**
        ↦ output value at max. speed: -9.999 – 9.999 V

      ↦ **MINIMUM SPEED**
        ↦ min. speed value: -99.9 – +99.9 kn

      ↦ **MINIMUM SPEED**
        ↦ max. speed value: -99.9 – +99.9 kn

   ↦ **CURRENT**

      ↦ **MINIMUM CURRENT**
        ↦ output value at min. speed: 0.00 – 20.00 mA

      ↦ **MAXIMUM CURRENT**
        ↦ output value at max. speed: 0.00 – 20.00 mA

      ↦ **MINIMUM SPEED**
        ↦ min. speed value: -99.9 – +99.9 kn

      ↦ **MINIMUM SPEED**
        ↦ max. speed value: -99.9 – +99.9 kn

Figure 6-2:
Service Setup,
page 1 (contd.)

contd. from
previous page

> **PULSE OUTPUT**   ●   >

→ **PULSE OUTPUT**   *settings for pulse outputs*

    → **PULSE OUTPUT 1–3**

        ○ **10 PULSE/NM**
        ○ **100 PULSE/NM**
        ○ **200 PULSE/NM**
        ○ **400 PULSE/NM**
        ○ **20000 PULSE/NM**

    → **PULSE OUTPUT 4–5**

        ○ **10 PULSE/NM**
        ○ **100 PULSE/NM**
        ○ **200 PULSE/NM**
        ○ **400 PULSE/NM**
        ○ **20000 PULSE/NM**

    → **PULSE OUTPUT 6**

        ○ **10 PULSE/NM**
        ○ **100 PULSE/NM**
        ○ **200 PULSE/NM**
        ○ **400 PULSE/NM**
        ○ **20000 PULSE/NM**
        ○ **MUTE RELAY**

> **RS422 OUTPUT 1-3**   ●   >

→ **RS422 OUTPUT 1–3**   *settings for RS-422 outputs*
group 1 (outp.1-3)

    → **NMEA SETTINGS**

        → **MESSAGES**

           □ **VBW**
           □ **VHW**
           □ **VLW**
           □ **VLW extended**
           □ *VTG*
           □ **PPLAK**
           □ *DRU*
           □ *DPT*
           □ *XDR*

        → **BAUDRATE**
          ○ **4800 BAUD**
          ○ **9600 BAUD**
          ○ **38400 BAUD**

        → **DATA LOGGER**
        data logging function for factory use only;
do not alter settings or access menu
unless instructed by Sperry Marine.

Figure 6-3:
Service Setup,
page 1 (contd.)

contd. from
previous page

> RS422 OUTPUT 4-6   ●   >

RS422 OUTPUT 4–6   *settings for RS-422 outputs*
                             group 2 (outp.4-6)
└─ **NMEA SETTINGS**

　　└─ **MESSAGES**
　　　　□ **VBW**
　　　　□ **VHW**
　　　　□ **VLW**
　　　　□ **VLW extended**
　　　　□ VTG
　　　　□ **PPLAK**
　　　　□ DRU
　　　　□ DPT
　　　　□ XDR

　　└─ **BAUDRATE**
　　　　○ **4800 BAUD**
　　　　○ **9600 BAUD**
　　　　○ **38400 BAUD**

> NMEA INPUT 1   ●   >

NMEA INPUT 1   *settings for NMEA input 1*

　　└─ **MESSAGES**
　　　　□ **VTG**
　　　　□ **DDC**
　　　　□ **PPLAI**

　　└─ **BAUDRATE**
　　　　○ **4800 BAUD**
　　　　○ **9600 BAUD**
　　　　○ **38400 BAUD**

> NMEA INPUT 2   ●   >

NMEA INPUT 2   *settings for NMEA input 2*

　　└─ **MESSAGES**
　　　　□ **VTG**
　　　　□ **DDC**
　　　　□ **PPLAI**

　　└─ **BAUDRATE**
　　　　○ **4800 BAUD**
　　　　○ **9600 BAUD**
　　　　○ **38400 BAUD**

Figure 6-4:
Service Setup,
page 2

SERVICE SETUP Page 2

> NEXT PAGE (1)   >

→ skip to page 1

> SYSTEM TYPE   >

→ **SYSTEM TYPE**   *system type configuration*
  └○ **NAVIKNOT 350E**
     type must be set to 350E

> SENSOR SENSITIVITY   >

→ **SENSOR SENSITIVITY**   *EM-sensor*
                                            sensitivity value
  └→ sensitivity: 0.50 – 1.50

> RELAY SPEED LIMIT   >

→ **RELAY SPEED LIMIT**   *relay output*
                                            threshold values
  └→ **MINIMUM VALUE**
     └→ min. threshold value: -99.9 – +99.9 kn
  └□ **MINIMUM VALUE ON**

  └→ **MAXIMUM VALUE**
     └→ max. threshold value: -99.9 – +99.9 kn
  └□ **MAXIMUM VALUE ON**

> CALIBRATION   >

→ **CALIBRATION**   *sensor calibration settings*
  └□ **CAL. TABLE ON**

  └→ **CAL. TABLE**
     └→ *access calibration table entries*

  └→ **ZERO POINT**
     └→ *calibrate zero point (0 kn)*

  └→ **TWO WAY TRIAL RUN**
     └→ *initiate two way calibration trial run*

  └→ **ONE WAY TRIAL RUN**
     └→ *initiate one way calibration trial run*

> NETWORK SETUP   >

→ **NETWORK SETUP**   *network setup*
  └→ *for future use;*
     not functional in current software release

Service Setup – Parameters

Analog Output

Configures the analogue speed outputs (voltage and current output).

Voltage

Configures the analogue output voltage range.

The output voltage range is defined by two pairs of values:
The minimum speed and associated minimum voltage determine the lower limit of the output range, while the maximum speed and associated maximum voltage define its upper limit.

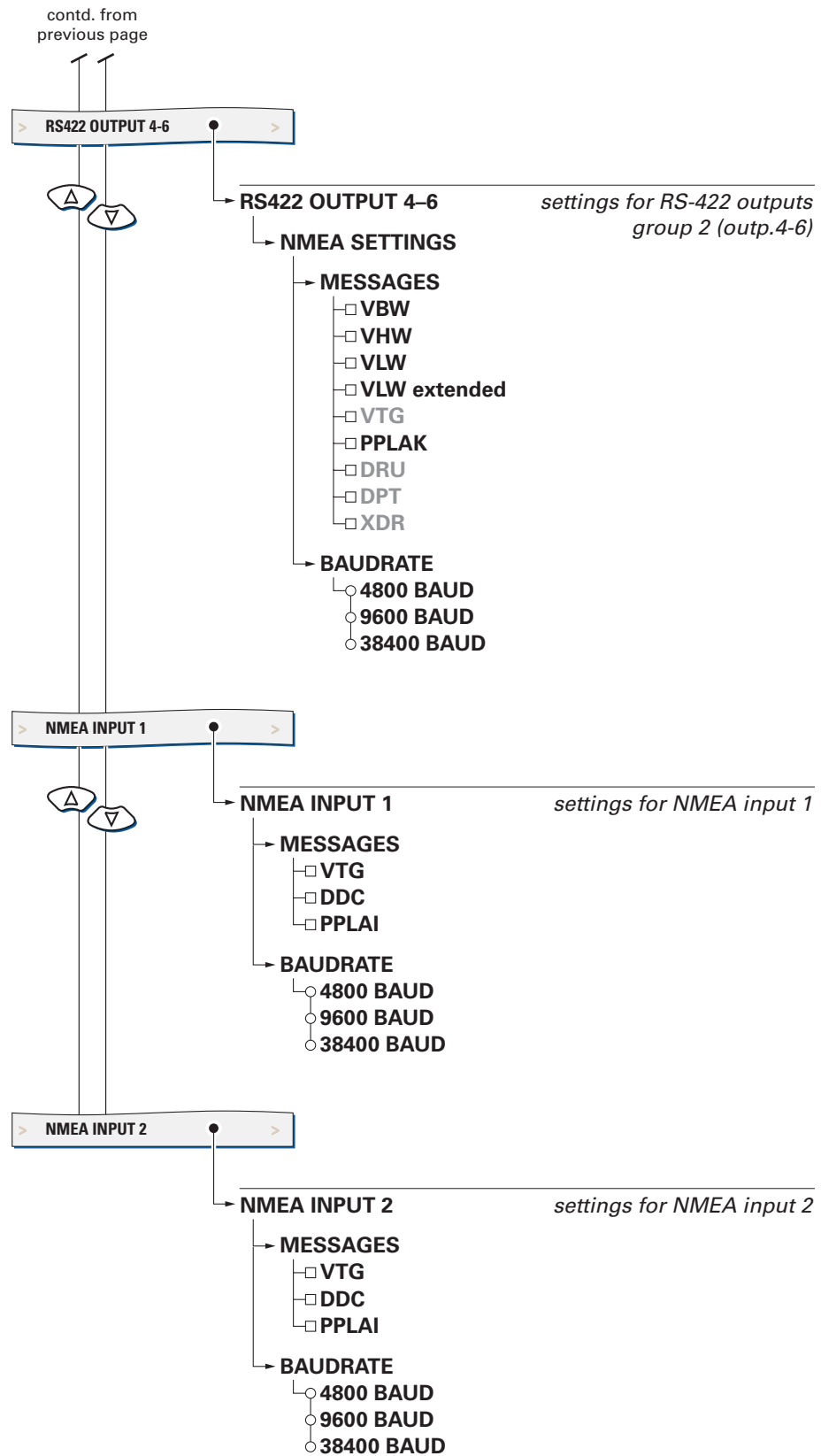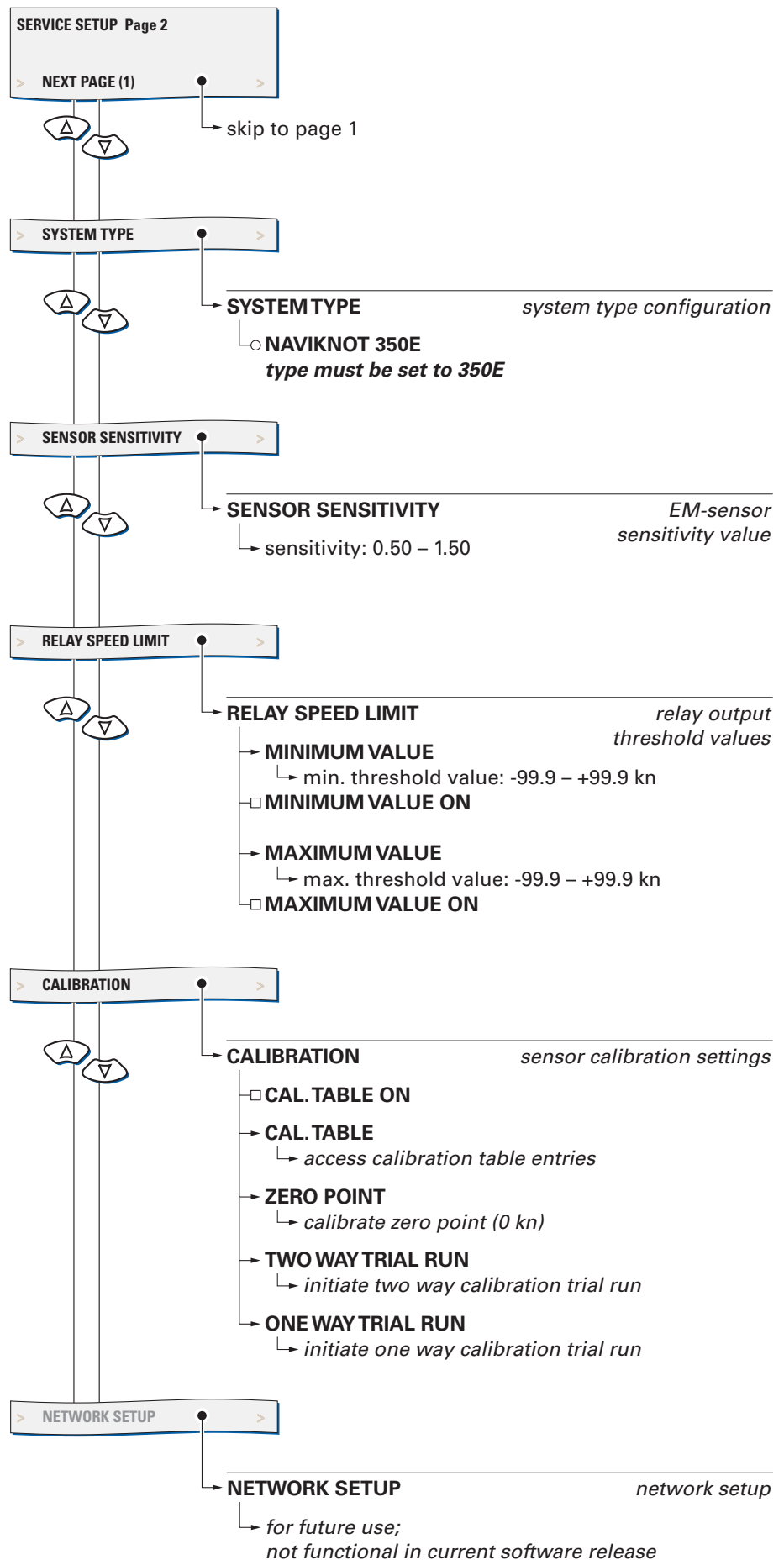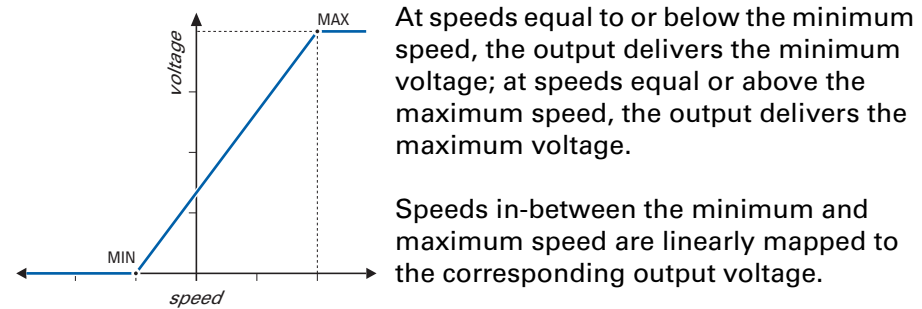At speeds equal to or below the minimum speed, the output delivers the minimum voltage; at speeds equal or above the maximum speed, the output delivers the maximum voltage.

Speeds in-between the minimum and maximum speed are linearly mapped to the corresponding output voltage.

The absolute limits of the output are -9.999 V min. and 9.999 V max.

Example:
Moving coil speed indicators are to be used which are scaled from -5 kn at zero deflection to +25 kn at a full-scale deflection of 10 VDC.
The required settings are:
min. voltage = 0.000 V; min. speed = -5 kn;
max. voltage = 9.999 V; max. speed = +25 kn

Settings: **Minimum Voltage**
              value: **-9.999 – 9.999 VDC**

              Maximum Voltage
   value: **-9.999– 9.999 VDC**

              Minimum Speed
              value: **-99.9 – +99.9 kn**

              Maximum Speed
              value: **-99.9 – +99.9 kn**

Current

Configures the analogue output current range.

The output current range is defined by two pairs of values:
The minimum speed and associated minimum current determine the lower limit of the output range, while the maximum speed and associated maximum current define its upper limit.
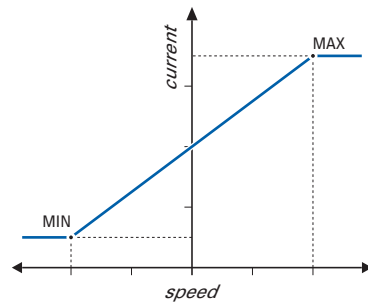
At speeds equal to or below the minimum speed, the output delivers the minimum current; at speeds equal or above the maximum speed, the output delivers the maximum current.

Speeds in-between the minimum and maximum speed are linearly mapped to the corresponding output current.

The absolute limits of the output are 0.00 mA min. and 20.00 mA max.

Example:
The speed range of -25 to +25 kn is to be mapped to a 4 – 20 mA output.
The required settings are:
min. current = 4.00 mA; min. speed = -25 kn;
max. voltage = 20.00 mA; max. speed = +25 kn

Settings: **Minimum Current**
               value: **0.00 – 20.00 mA**

               Maximum Current
               value: **0.00 – 20.00 mA**

               Minimum Speed
               value: **-99.9 – +99.9 kn**

               Maximum Speed
               value: **-99.9 – +99.9 kn**

Pulse Output

Configures the pulse signal outputs.

The outputs are divided into three individually configurable groups.
Each group may be configured to deliver 10, 100, 200, 400 or 20000
pulses per nautical mile.
The generated pulses possess a fixed "on" duty cycle of 100 ms for the
10, 100 or 200 pulse/NM setting, 50 ms for the 400 pulse/NM setting and
1 ms for the 20000 pulse/NM setting.

Group 3 (output 6) may alternatively be configured to generate an alarm
mute signal. This signal, a 100 ms pulse, is used to mute the audible
alarm indication at a central alarm facility when the respective alarm is
acknowledged locally at the NAVIKNOT 350 E CDU.

Pulse Output 1–3

Configures group 1 of the pulse outputs (outputs 1 – 3).

Settings: **10 Pulse/NM**
              The output delivers 10 pulses per nautical mile.

              100 Pulse/NM
              The output delivers 100 pulses per nautical mile.

              200 Pulse/NM
              The output delivers 200 pulses per nautical mile.

              400 Pulse/NM
              The output delivers 400 pulses per nautical mile.

              20000 Pulse/NM
              The output delivers 20000 pulses per nautical mile.

Pulse Output 4–5

Configures group 2 of the pulse outputs (outputs 4 – 5).

Settings: **10 Pulse/NM**
              The output delivers 10 pulses per nautical mile.

              100 Pulse/NM
              The output delivers 100 pulses per nautical mile.

              200 Pulse/NM
              The output delivers 200 pulses per nautical mile.

              400 Pulse/NM
              The output delivers 400 pulses per nautical mile.

              20000 Pulse/NM
              The output delivers 20000 pulses per nautical mile.

Pulse Output 6

Configures group 6 of the pulse outputs (output 6).

Settings: **10 Pulse/NM**
            The output delivers 10 pulses per nautical mile.

            100 Pulse/NM
            The output delivers 100 pulses per nautical mile.

            200 Pulse/NM
            The output delivers 200 pulses per nautical mile.

            400 Pulse/NM
            The output delivers 400 pulses per nautical mile.

            20000 Pulse/NM
            The output delivers 20000 pulses per nautical mile.

            MUTE RELAY
            When an alarm is acknowledged locally at the
            NAVIKNOT 350 E CDU, the output delivers a pulse to mute
            the audible alarm indication at a central alarm facility.

RS422 Output 1–3

Configures group 1 of the RS-422 serial data outputs (outputs 1–3).

Messages

Selects the NMEA sentences to transmit.

If the NAVIKNOT 350 E cannot provide valid data for an NMEA sentence field, a null field (empty field) is sent. Status fields for invalid or unknown data are marked as invalid ("V"). The Talker ID is "VM" for all sentences except the proprietary $PPLAK. Other sentences than those described below must not be activated for the NAVIKNOT 350 E.

Settings: **VBW**
Longitudinal water speed and status (valid/invalid) are transmitted using the $--VBW sentence.

VHW
Longitudinal water speed is transmitted using the $--VHW sentence.

VLW / VLW extended
The distance travelled through the water since last reset (daily miles) and total cumulative water distance (total miles) are transmitted using the $--VLW sentence.
The "extended" form of the sentence includes trailing fields for ground distances as per IEC 61162-1:2000, the non-extended form omits these fields.

PPLAK
Log status and operating mode information is transmitted using the proprietary $PPLAK sentence.

Baudrate

Selects the transmit baudrate.

Settings: **4800 Baud**
Data is transmitted at 4800 Baud
(standard according to NMEA / IEC 61162-1)

9600 Baud
Data is transmitted at 9600 Baud
(non-standard)

38400 Baud
Data is transmitted at 38400 Baud
(high-speed according to IEC 61162-2)

Data Logger

Access data logging functions for factory use. Field service must not alter any setting and should not access this menu unless instructed by Sperry Marine.

RS422 Output 4–6

Configures group 2 of the RS-422 serial data outputs (outputs 4–6).

Messages

Selects the NMEA sentences to transmit.

If the NAVIKNOT 350 E cannot provide valid data for an NMEA sentence field, a null field (empty field) is sent. Status fields for invalid or unknown data are marked as invalid ("V"). The Talker ID is "VM" for all sentences except the proprietary $PPLAK. Other sentences than those described below must not be activated for the NAVIKNOT 350 E.

Settings: **VBW**
              Longitudinal water speed and status (valid/invalid) are
              transmitted using the $--VBW sentence.

              VHW
              Longitudinal water speed is transmitted using the $--VHW
              sentence.

              VLW / VLW extended
              The distance travelled through the water since last reset
              (daily miles) and total cumulative water distance (total
              miles) are transmitted using the $--VLW sentence.
              The "extended" form of the sentence includes trailing fields
              for ground distances as per IEC 61162-1:2000, the non-extended
              form omits these fields.

              PPLAK
              Log status and operating mode information is transmitted
              using the proprietary $PPLAK sentence.

Baudrate

Selects the transmit baudrate.

Settings: **4800 Baud**
              Data is transmitted at 4800 Baud
              (standard according to NMEA / IEC 61162-1)

              9600 Baud
              Data is transmitted at 9600 Baud
              (non-standard)

              38400 Baud
              Data is transmitted at 38400 Baud
              (high-speed according to IEC 61162-2)

NMEA Input 1

Configures the NMEA input 1.

Messages

Selects the NMEA sentences to receive.

Settings: **VTG**
Enables the input to receive external speed data from the
$--VTG sentence. The external data is evaluated if the opera-
tor activates the "EXTERN" speed mode in the Manual Set-
tings menu.

DDC
Dimming commands are read from the $--DDC sentence.

PPLAI
Dimming commands are read from the proprietary $PPLAI
sentence.

Baudrate

Selects the receive baudrate

Settings: **4800 Baud**
Data is received at 4800 Baud
(standard according to NMEA / IEC 61162-1)

9600 Baud
Data is received at 9600 Baud
(non-standard)

38400 Baud
Data is received at 38400 Baud
(high-speed according to IEC 61162-2)

NMEA Input 2

Configures the NMEA input 2.

Messages

Selects the NMEA sentences to receive.

Settings: **VTG**
Enables the input to receive external speed data from the
$--VTG sentence. The external data is evaluated if the opera-
tor activates the "EXTERN" speed mode in the Manual Set-
tings menu.

DDC
Dimming commands are read from the $--DDC sentence.

PPLAI
Dimming commands are read from the proprietary $PPLAI
sentence.

Baudrate

Selects the receive baudrate

Settings: **4800 Baud**
Data is received at 4800 Baud
(standard according to NMEA / IEC 61162-1)

9600 Baud
Data is received at 9600 Baud
(non-standard)

38400 Baud
Data is received at 38400 Baud
(high-speed according to IEC 61162-2)

System Type

Configures the NAVIKNOT system type.

For the NAVIKNOT 350 E, the type must be set to 350E; all other options are to be ignored.

Settings: **NAVIKNOT 350E**

Sensor Sensitivity

Sets the sensitivity value for the EM-Log sensor.

The required setting is noted on a label attached to the sensor and is also recorded in the delivery documents for the sensor.

For a detailed explanation of the effect of the sensitivity setting, refer to chapter 7, "EM Sensor Calibration".

Value: **0.5 – 1.5**

Relay Speed Limit

Sets the lower and/or upper switching thresholds for the speed limit relay output.

The speed limit relay output provides a status signal to external equipment, to indicate that the actual speed has exceeded or fallen below a set threshold. This signal may be e.g. for speed-dependent rudder angle limiting or similar applications.

The switching behaviour of the limit relay is determined by the combined settings of two values, the minimum (lower threshold) and the maximum (upper threshold) value:
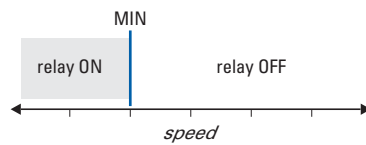
If only a minimum threshold value is set and active, the relay is attracted at speeds below and released at speeds above the threshold value.
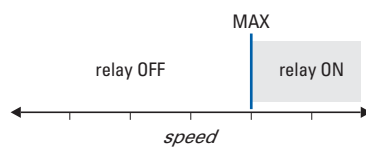
If only a maximum threshold value is set and active, the relay is attracted at speeds above and released at speeds below the threshold value.
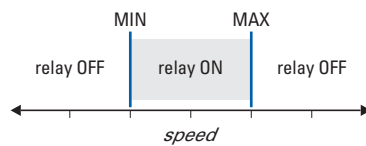
If both a minimum and a maximum threshold value are set and active, the relay is released at speeds below the min. value, attracted at speeds in-between both values and released again at speeds above the max. threshold.
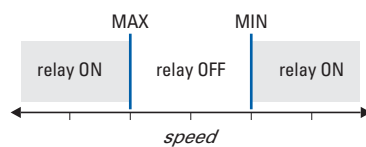
If the max. threshold is set to a value below the min. threshold, the relay is attracted at speeds below the min. value, released at speeds in-between both values and attracted again at speeds above the max. threshold.

If both threshold values are de-activated or set to exactly the same value, the limit relay function is disabled.

Minimum Value

Sets the lower switching threshold for the limit relay.

Value: **-99.9 – +99.9 kn**

Minimum Value ON

Activates or de-activates switching at the lower threshold

Settings: **ON** (option checked)
                Switching is active at the lower threshold

                OFF (option unchecked)
                Switching is inactive at the lower threshold

Maximum Value

Sets the upper switching threshold for the limit relay.

Value: **-99.9 – +99.9 kn**

Maximum Value ON

Activates ore de-activates switching at the upper threshold

Settings: **ON** (option checked)
                Switching is active at the upper threshold

                OFF (option unchecked)
                Switching is inactive at the upper threshold

Calibration

Turns sensor calibration on or off, edits the calibration table and accesses the calibration trial run menus.

Cal. Table On

Activates or de-activates the calibration table.

Settings: **ON** (option checked)
Calibration is active. The NAVIKNOT 350 E corrects the data received from the preamplifier E according to the calibration table. The resulting calibrated speed is displayed and transmitted at the data outputs.

OFF (option unchecked)
Calibration is disabled. The NAVIKNOT 350 E does not apply any corrections to the data received from the preamplifier E. Raw speed only is displayed and transmitted at the data outputs. The indication "Uncal" is shown on the CDU display as a reminder that calibration is disabled.

Cal. Table

Edits the calibration table entries directly.

Settings: *refer to chapter 7, "EM Sensor Calibration", for a detailed description of the calibration and related procedures*

Zero Point

Sets the calibration zero point (correction value at a true speed of 0 kn).

Settings: *refer to chapter 7, "EM Sensor Calibration", for a detailed description of the calibration and related procedures*

Two Way Trial Run

Accesses the sub-menu for conducting a two-way calibration trial run.

Settings: *refer to chapter 7, "EM Sensor Calibration", for a detailed description of the calibration and related procedures*

One Way Trial Run

Accesses the sub-menu for conducting a one-way calibration trial run.

Settings: *refer to chapter 7, "EM Sensor Calibration", for a detailed description of the calibration and related procedures*

Network Setup

This option is reserved for future applications. Settings are not relevant and have no effect in the current software release.

Chapter 7: EM Sensor Calibration

Once the NAVIKNOT 350 E system has been installed and the basic configuration carried out, the EM sensor must be calibrated to make sure that the system's speed and distance outputs meet the specified accuracy.
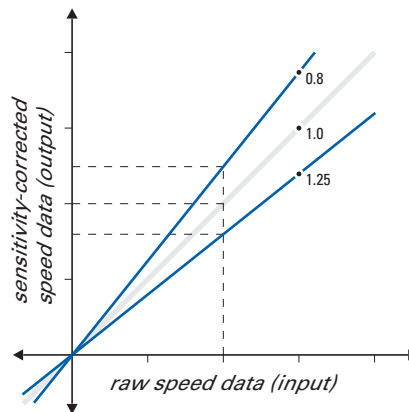
7.1 Sensor Sensitivity Setting

Upon installation or exchange of the speed sensor, the sensor's sensitivity value must be stored in the NAVIKNOT 350 E electronics unit.

Sensitivity is a characteristic property of the individual sensor installed and is noted on a label attached to the sensor. It is also recorded in the delivery documents for the given sensor.

The sensitivity value is a dimensionless number for the ratio between the sensor's return signal and the nominal standard of 180 µVAC/kn. Typical values for EM sensors range from 0.7 to 1.14.

Figure 7-1:
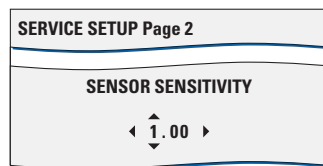effect of the
sensor sensitivity

Note   When checking the effect of the sensitivity setting, bear in mind that the value does not equal the gain applied but, rather, its reciprocal. Thus, for example, a sensitivity value of 0.8 multiplies the raw speed by 1.25, while a value of 1.25 multiplies it by 0.8.

To set the sensitivity value:

SERVICE SETUP Page 2

SENSOR SENSITIVITY

◄ 1.00 ►

1. Go to page 2 of the Service Setup and select the Sensor Sensitivity submenu.

2. With the **Up/Down** and **Right/Left** keys, set the sensitivity as required.

3. press **ENTER** to store the value and exit the submenu.

7.2 EM Sensor Calibration

To minimize the deviation between the vessel's actual water speed and the speed displayed and transmitted, the NAVIKNOT 350 E stores sensor-specific calibration data in a so-called calibration table.

The calibration table holds up to 21 entries ("calibration points"), each of which relates an uncalibrated raw value to a corresponding true water speed value. The entries holding the lowest and highest uncalibrated values determine the range over which calibration is effective.

Note To calibrate speeds astern, at least one calibration point with a negative uncalibrated speed value must be stored. Otherwise, calibration is effective for speeds ahead only.

The effects of setting calibration points (i.e. adding entries to the calibration table) at different states of calibration are illustrated below.
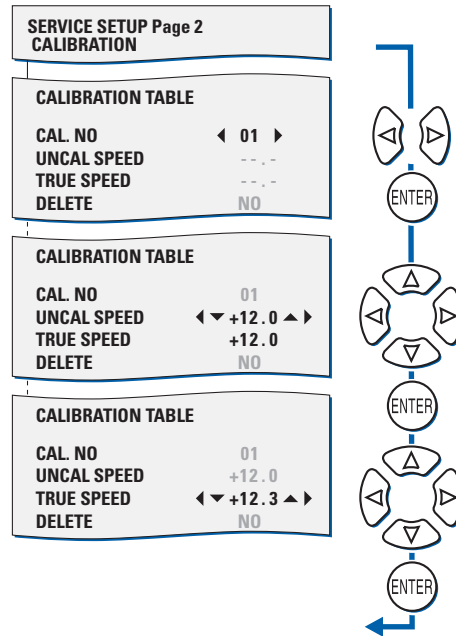
Figure 7-2:
effect of calibration
table entries
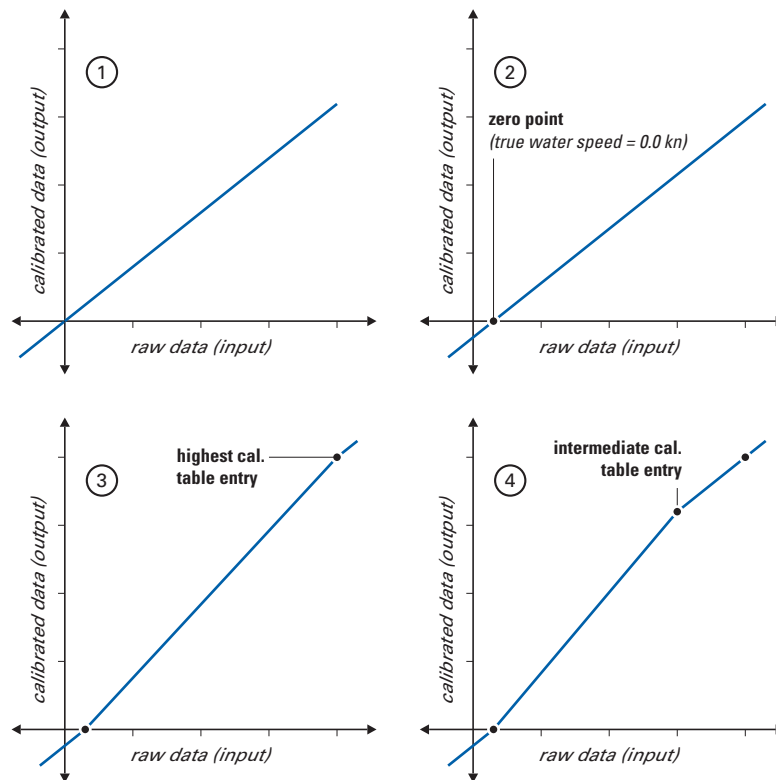
① calibration table empty:
  linear sensor characteristic assumed;
  display and output = 0.0 kn at raw sensor data value of 0.0 kn

② zero point calibrated
  linear sensor curve is offset by zero point calibration value

③ one additional point calibrated (highest table entry)
  calibration points joined by straight line (linear interpolation)

④ additional intermediate points calibrated
  calibrated range is split into linear segments of different slope

Editing the Calibration Table Directly

To add, edit or delete calibration points directly, go to page 2 of the
Service Setup and select the Calibration | Cal.Table sub-menu.
The data stored at calibration point no. 00 is shown (dashes will appear
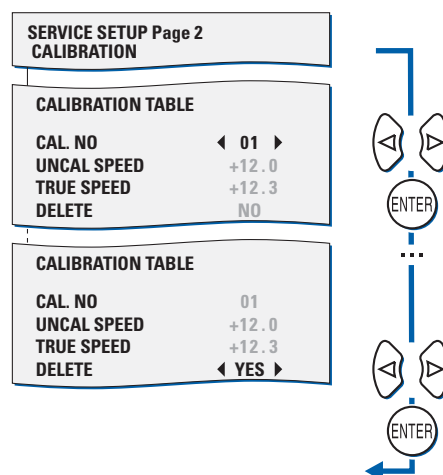if the table is empty).

To add or edit a calibration point:

```
SERVICE SETUP Page 2
CALIBRATION

CALIBRATION TABLE

CAL. NO              ◀ 01 ▶
UNCAL SPEED            - - . -
TRUE SPEED            - - . -
DELETE                NO
```

```
CALIBRATION TABLE

CAL. NO              01
UNCAL SPEED      ◀ ▼ +12.0 ▲ ▶
TRUE SPEED          +12.0
DELETE               NO
```

```
CALIBRATION TABLE

CAL. NO              01
UNCAL SPEED         +12.0
TRUE SPEED      ◀ ▼ +12.3 ▲ ▶
DELETE               NO
```

1. With the **Right/Left** keys,
    select the calibration
    point to add or edit.
    Press **ENTER** to continue.

2. With the **Up/Down** keys
    (knots) and the **Right/Left**
    keys (tenths of knots), set
    the uncalibrated speed
    to the required value.
    The true speed indica-
    tion is altered by the
    same amount.
    Press **ENTER** to continue.

3. With the **Up/Down** keys
    and the **Right/Left** keys,
    now alter the true speed
    indication as required.
    The uncalibrated speed
    value is not altered.
    Press **ENTER** to store the
    edited data.

4. Press **ENTER** again to continue editing or **MENU** to quit the Cal.Table
    sub-menu.

To delete a calibration point:

```
SERVICE SETUP Page 2
CALIBRATION

CALIBRATION TABLE

CAL. NO              ◀ 01 ▶
UNCAL SPEED         +12.0
TRUE SPEED          +12.3
DELETE               NO
```

```
CALIBRATION TABLE

CAL. NO              01
UNCAL SPEED         +12.0
TRUE SPEED          +12.3
DELETE          ◀ YES ▶
```

5. With the **Right/Left** arrow
    keys, select the calibra-
    tion point to delete.

6. With **ENTER**, go down to
    the "delete" option,
    press the **Right** or **Left** key
    to select "yes", then
    press **ENTER** to delete the
    calibration point.

7. Select another calibra-
    tion point to delete or
    press **MENU** to quit the
    Cal.Table sub-menu.

Note   Upon quitting the Cal. Table sub menu, the entries are sorted and renum-
bered according to their uncalibrated speed values. Point 00 always
holds the entry with the smallest uncalibrated speed value.

Zero Point Calibration

Before any entries for non-zero speeds are stored in the calibration table or calibration trial runs are conducted, the zero point calibration should be carried out.

The "zero point" refers to the calibration table entry which holds the uncalibrated ("raw") speed value corresponding to a true water speed of zero knots. Two methods are available to calibrate the zero point: manual and auto.

Note — Both the manual and the automatic zero point calibration require that the vessel is stationary.

Manual Entry

The manual entry method permits zero point calibration in waters which are not free of current. However, the longitudinal component of the current must be known and it must be small enough to regard the sensor as operating near zero speed.

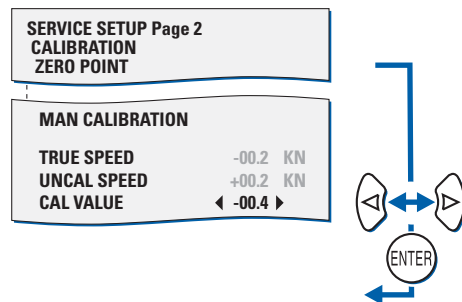***To carry out the manual zero-point calibration:***

1. Go to page 2 of the Service Setup;
   select the Calibration | Zero Point | Man Calibration sub-menu.

   Three values are shown, the true speed, the uncalibrated speed and the calibration value (i.e. the difference of the two speeds).
   The uncalibrated speed is the raw speed value as currently received from the EM sensor (not editable).
   The objective of the calibration is now to alter the calibration value until the displayed true speed value matches the known actual water speed.
   Thus, in waters free of current, the displayed true speed value must be brought to zero; in the presence of current, the true speed value must be made equal to the known longitudinal component of the current.


```
SERVICE SETUP Page 2
  CALIBRATION
  ZERO POINT

  MAN CALIBRATION

  TRUE SPEED        -00.2  KN
  UNCAL SPEED       +00.2  KN
  CAL VALUE       ◄ -00.4 ►
```

2. With the **Right/Left** arrow keys, alter the calibration value until the displayed true speed exactly matches the known actual water speed.

3. Press **ENTER** to confirm the setting and leave the manual calibration sub-menu.

Note — When the manual entry is stored, the true speed entered is automatically subtracted from both the uncalibrated and true speed values.
Thus, the entry written to the table will always contain the uncalibrated value corresponding to a true speed of zero knots.

Automatic Entry

With the automatic entry method, the required zero point setting is determined automatically. Automatic entry may only be used when the vessel is stationary in waters free of current, i.e., if the actual water speed is known to be zero.

To carry out the automatic zero-point calibration:

1. Go to page 2 of the Service Setup;
   select the Calibration | Zero Point | Auto Calibration sub-menu.

   As with the manual entry method, the true speed, the uncalibrated speed and the calibration value are shown.
   However, the true speed value is fixed to zero knots and cannot be adjusted by the operator. The uncalibrated speed is the raw speed value as currently received from the EM sensor, thus the calibration value will be equal to the uncalibrated speed with the sign reversed.

| SERVICE SETUP Page 2 |
| CALIBRATION |
| ZERO POINT |

MAN CALIBRATION	
TRUE SPEED	+00.0 KN
UNCAL SPEED	+00.2 KN
CAL VALUE	-00.2
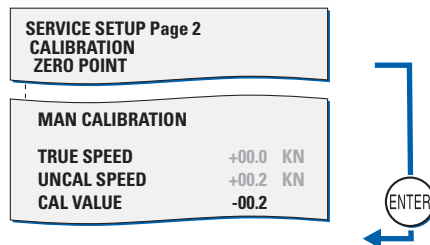
(ENTER)

2. Press **ENTER** to confirm the setting and leave the auto calibration sub-menu.

Calibration by Trial Runs

Calibration by trial runs is the recommended method to calibrate the EM-sensor in the NAVIKNOT 350 E. system. The procedure resembles the familiar "milepost run", but permits any known distance to be taken as the length of a run.

The known distance may be given by the distance between sidebearings to prominent landmarks. The regular procedure in this case is to start and stop the run clock exactly at the points in time when the landmarks are sighted athwartships.
If landmarks cannot be used, the known distance will usually be obtained from a reference system (e.g. DGPS) operated by a supervisor who will also announce when to start and stop the run clock.

Generally, for each correction value to be determined, a two way trial run should be carried out, i.e. the same known distance "I" should be traversed in opposite directions (runs A and B). This will make the effects of drift due to wind and current cancel out each other automatically. Only when no wind and current are present, a one way trial run may be carried out.

The first two or one way trial run should be carried out at maximum sea speed, to define the upper limit of the calibrated range. Additional trial runs may be carried out later at lower speeds to improve the accuracy within the calibrated range.

Figure 7-3: calibration by trial runs
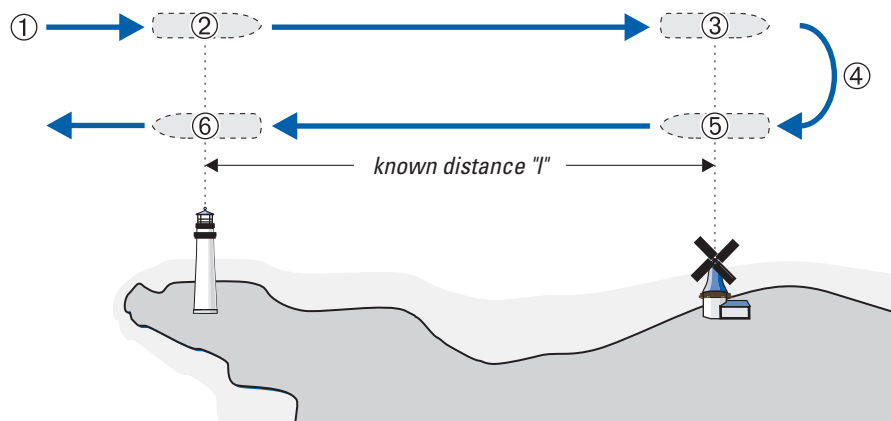
①   approach to run A or one-way run

②   start of run A or one-way run

③   end of run A or one-way run

④   approach to run B

⑤   start of run B

⑥   end of run B

Two Way Trial Run

Note   During a two way trial run, the vessel's heading during runs A and B should ideally be parallel to the direction of the effective drift, as the drift component perpendicular to the heading cannot be compensated for.

To carry out a two way trial run:

1. Bring the vessel on the required course for the approach to run A.

2. Approach the run with the speed (engine rev.s) at which the calibration is to be carried out. Keep the heading and speed steady.

3. Go to page 2 of the Service Setup and select the Calibration | Two Way Trial Run sub-menu.
   The run clock is shown, indicating 00:00 s run time and the uncalibrated water speed as received from the EM sensor.

```
SERVICE SETUP Page 2
CALIBRATION

TWO WAY TRIALRUN

TIME                 00:00   S
SPEED                20.2    KN
```
ENTER

```
TIME                 00:02:30  S
SPEED                20.2      KN
```
ENTER

◁   ▷

```
DISTANCE        ◀ 01.000  NM ▶
UNCAL SPEED        20.2     KN
TRUE SPEED         20.0     KN
CAL VALUE          -0.2
```
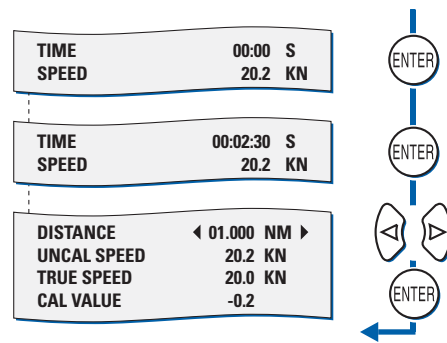ENTER

4. Exactly at the start of run A (first landmark athwartships or "start" announced by supervisor), press **ENTER** to start the run clock.

5. Exactly at the end of run A (second landmark athwartships or "stop" announced by supervisor), press **ENTER** to stop the run clock.

The display now indicates the run distance (editable), the average uncalibrated speed for the run, the true speed over ground (calculated from the run time and distance) and the calculated calibration value.

6. With the **Right/Left** arrow keys, alter the distance value until the distance displayed exactly matches the known distance "l" over ground as taken from the sea chart or given by the supervisor. Press **ENTER** to store the run parameters.

   The run clock is shown again, indicating 00:00 s run time and the uncalibrated water speed as received from the EM sensor.

7. Turn the vessel around and bring it on the required course for the approach to run B. This is the exact reverse of the course maintained during run A.
   Approach the run with the same speed (engine rev.s) at which run A was carried out. Keep the heading and speed steady.

```
TIME              00:00   S
SPEED             20.2    KN
```

```
TIME              00:02:30  S
SPEED             20.2    KN
```

```
DISTANCE        ◄ 01.000  NM ►
UNCAL SPEED       20.2    KN
TRUE SPEED        20.0    KN
CAL VALUE         -0.2
```

8. Exactly at the start of run B (second landmark athwart-ships or "start" announced by supervisor), press **ENTER** to start the run clock.

9. Exactly at the end of run B (first landmark athwart-ships or "stop" announced by supervisor), press **ENTER** to stop the run clock.

The display again indicates the run distance, the average uncali-brated speed, the true speed over ground and the calculated calibra-tion value.

10. With the **Right/Left** arrow keys, alter the distance value until the dis-tance displayed exactly matches the known distance "l" over ground as taken from the sea chart or given by the supervisor. Press **ENTER** to store the run parameters.

The Two Way Trial Run sub-menu is quit automatically.

As the result of the two way trial run, one new entry will now be found in the calibration table.
The uncalibrated speed stored at this entry is the average of the two averaged uncalibrated speeds from run A and run B.
The true speed stored at this entry is the average of the two true speeds calculated for run A and run B.
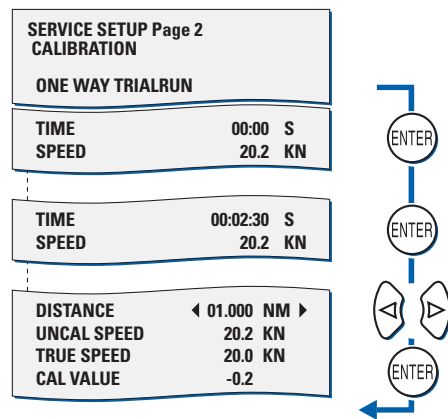
One Way Trial Run

Note   In a one way trial run, any drift due to wind and/or current will adversely affect the calibration. Conducting a one way trial run in the presence of drift, may degrade instead of improve the speed accuracy.

To carry out a one way trial run:

1. Bring the vessel on the required course for the approach to the run.

2. Approach the run with the speed (engine rev.s) at which the calibration is to be carried out. Keep the heading and speed steady.

3. Go to page 2 of the Service Setup and select the Calibration | One Way Trial Run sub-menu.
    The run clock is shown, indicating 00:00 s run time and the uncalibrated water speed as received from the EM sensor.

SERVICE SETUP Page 2	
CALIBRATION	
ONE WAY TRIALRUN	
TIME	00:00 S
SPEED	20.2 KN

TIME	00:02:30 S
SPEED	20.2 KN

DISTANCE	◀ 01.000 NM ▶
UNCAL SPEED	20.2 KN
TRUE SPEED	20.0 KN
CAL VALUE	-0.2

4. Exactly at the start of the run (first landmark athwartships or "start" announced by supervisor), press **ENTER** to start the run clock.

5. Exactly at the end of the run (second landmark athwartships or "stop" announced by supervisor), press **ENTER** to stop the run clock.

The display now indicates the run distance (editable), the average uncalibrated speed for the run, the true speed over ground (calculated from the run time and distance) and the calculated calibration value.

6. With the **Right/Left** arrow keys, alter the distance value until the distance displayed exactly matches the known distance "l" over ground as taken from the sea chart or given by the supervisor. Press **ENTER** to store the run parameters.

    The One Way Trial Run sub-menu is quit automatically.

As the result of the trial run, one new entry will now be found in the calibration table, holding the average uncalibrated speed and the calculated true speeds for the run.

Chapter 8: Troubleshooting

8.1 NAVIKNOT Electronics Unit and CDU(s)

The NAVIKNOT 350 E electronics unit and the CDU are complex electronic devices. In case of malfunction, it would neither be practical nor economical to carry out troubleshooting and servicing in the field down to the level of individual circuit components.

Unless instructed otherwise by Sperry Marine engineering, field service personnel should limit troubleshooting to the basic checks given below.

- For the electronics unit:
    - Visual inspection of mechanical components, the electronics unit PCB and wiring.
    - Continuity checks of wiring connections.
    - Checks for short circuit or overload conditions or reversed polarity of the external supply powers.
    - Checks of the on-board supply voltages and I/O signals and data. The presence of voltages, signals and data is indicated by diagnostic LEDs on the PCB.
      Exact voltage levels must be checked with a voltmeter.
      The data content on serial I/O lines must be checked with the aid of suitable analyzing tools, such as PC-based protocol interpreters or terminal programs.

  When components on the PCB, other than socketed ICs or the exchangeable system software flashboard, are assumed to cause malfunction, the complete PCB, Stock No. 20692, is to be exchanged.

- For the CDU(s):
    - Visual inspection of mechanical components and wiring.
    - Continuity checks of wiring connections at the terminals or terminal block to which the 6-wire CDU connection cable is fastened.
    - Checks for the presence and correct polarity of the external supply power.

  The CDU is not field-serviceable and should not be opened for troubleshooting purposes. Defective CDUs must be sent back to Sperry Marine for repair.

Location of Parts on the Electronics Unit PCB

Figure 8-1 below shows the locations of exchangeable components, connectors and diagnostic LED indicators on the NAVIKNOT 350 E electronics unit PCB.

Figure 8-1:
location of parts on the
electronics unit PCB
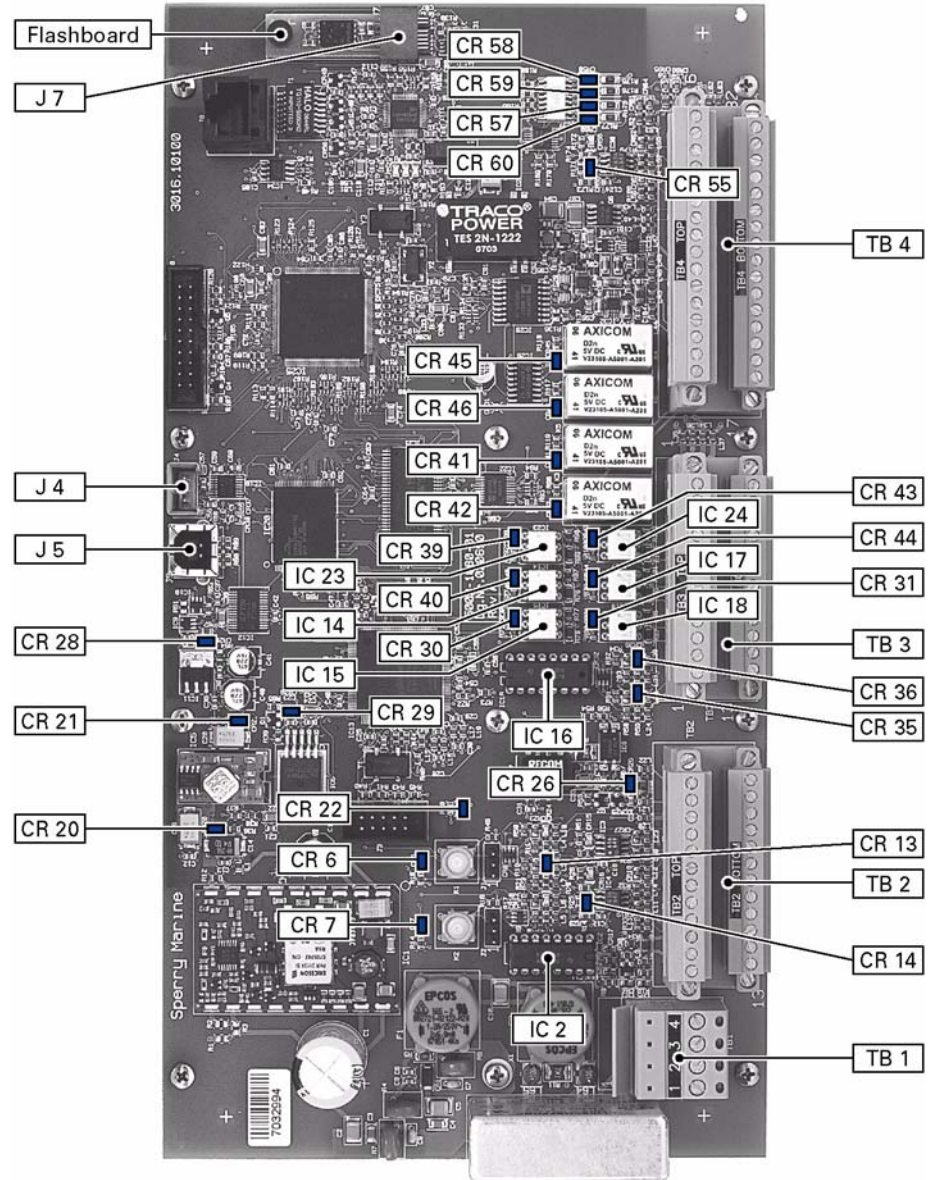
Exchangeable Components

Part	Function	Stock No.
Flash-board	Flashboard (flash-memory card), pre-programmed with system software	020705-0000-000
IC 2	quad RS-422 output driver IC; drives serial data RS-422 outputs 1 to 3	046485-0000-000
IC 14	photocoupler/photo relay; pulse output 1 contact closure	042842-0000-000
IC 15	photocoupler/photo relay; pulse output 2 contact closure	042842-0000-000
IC 16	quad RS-422 output driver IC; drives serial data RS-422 outputs 4 to 6	046485-0000-000
IC 17	photocoupler/photo relay; pulse output 3 contact closure	042842-0000-000
IC 18	photocoupler/photo relay; pulse output 4 contact closure	042842-0000-000
IC 23	photocoupler/photo relay; pulse output 5 contact closure	042842-0000-000
IC 24	photocoupler/photo relay; pulse output 6 contact closure	042842-0000-000

Terminal Boards and Connectors

	Function
TB 1	24 VDC supply power in/out
TB 2	speed sensor interfaces, CDU interfaces
TB 3	serial data and pulse outputs
TB 4	analogue outputs, status in-/outputs, ext. data inputs
J 4	RS-232 service interface connector
J 5	USB programming connector (for factory use only)
J 7	Socket for exchangeable system software flashboard

Diagnostic LEDs

As an aid in troubleshooting, a number of diagnostic LED indicators are provided on the NAVITWIN IV PCB. These indicate the presence of supply voltages, activities on the serial data I/O lines and the current states of the status I/O ports.

Table 8-3:
Diagnostic LEDs

LED	Colour	Indication
CR 6	red	CPU status indicator, normally off, flashes at boot-up
CR 7	red	CPU status indicator, normally off, flashes at boot-up
CR 13	green	activity on Tx line, CDUs, TB 2.15/2.16, 2.19/2.20
CR 14	green	activity on Rx line, CDUs, TB 2.13/2.14, 2.17/2.18
CR 20	green	internal +12 VDC supply power present
CR 21	green	internal +5 VDC supply power present
CR 22	red	CPU status indicator, normally off, flashes at boot-up
CR 28	green	internal +3.3 VDC supply power present (Vcc)
CR 29	green	internal +1.2 VDC reference present
CR 30	green	pulse relay output active, outp. 2, TB 3.15/3.16
CR 31	green	pulse relay output active, outp. 1, TB 3.13/3.14
CR 35	green	activity on Tx line, serial data outputs group 1, TB 3.1/3.2, 3.3/3.4, 3.5/3.6
CR 36	green	activity on Tx line, serial data outputs group 2, TB 3.7/3.8, 3.9/3.10, 3.11/3.12
CR 39	green	pulse relay output active, outp. 6, TB 3.23/3.24
CR 40	green	pulse relay output active, outp. 4, TB 3.19/3.20
CR 41	green	relay output active, log failure alarm, TB 4.19/4.20
CR 42	green	relay output active, power failure alarm, TB 4.17/4.18
CR 43	green	pulse relay output active, outp. 5, TB 3.21/3.22
CR 44	green	pulse relay output active, outp. 3, TB 3.17/3.18
CR 45	green	relay output active, watch alarm trigger, TB 4.23/4.24
CR 46	green	relay output active, speed limit, TB 4.21/4.22
CR 55	green	activity on Rx line, serial dim input, TB 4.28/4.29
CR 57	green	status input active, double ended ferry, TB 4.11/4.12
CR 58	green	status input active, ext. dim+, TB 4.15/4.16
CR 59	green	status input active, ext. dim-, TB 4.13/4.14
CR 60	green	status input active, ext. alarm mute, TB 4.9/4.10

8.2 EM Sensor and Preamplifier

Malfunction of the EM sensor, resulting in a "Sensor1 Failure" alarm being given, may be caused by a mechanical or electrical defect in the sensor or by a defective preamplifier. As the preamplifier contains no built-in test circuitry, only a basic electrical check is possible in the field.

The applicable troubleshooting procedures are described in the installation, maintenance and service instructions for the respective sensor. The following documents apply:

- Sensor NF: document no. 002829-0125-001;
- Sensor FNF I: document no. 004040-0125-001;
- Sensor FNF II: document no. 004120-0125-001;
- Sensor FNF III: document no. 004874-0125-001.

Chapter 9: Corrective Maintenance

The NAVIKNOT 350 E CDU, the electronics unit and the preamplifier are generally not field-serviceable on the component level. Defective devices must be sent back to Sperry Marine for repair.

The only corrective maintenance procedures which may be performed by field service personnel are the exchange of the system software in the electronics unit and the replacement of the RS-422 output drivers and the pulse output relays.

CAUTION

The NAVIKNOT 350 E electronics unit contains electrostatic sensitive components.

Electrostatic discharge may permanently damage components.

When servicing the electronics unit, take precautions to prevent electro-static discharge. Avoid touching any of the electronic circuitry.

9.1 Exchanging the System Software

Downloading Software from the Flashboard

The NAVIKNOT 350 E electronics unit keeps two separate copies of the system software, one in an onboard flash memory and the other on the exchangeable software flashboard 20705.

The system always boots up from the onboard memory. Should, at power-up, a different software version be found on the flashboard than is currently stored onboard, the software from the flashboard is auto-matically copied to the onboard memory and the system is restarted.

This allows both to upgrade to newer and to downgrade to previous releases by simply exchanging the flashboard.

CAUTION

It cannot be guaranteed that parameters settings in the User and Setup menus and the currently active manual settings are left intact during the software download.
Before exchanging the flashboard, record all settings to be able to re-enter them manually, if required.

Exchanging the Flashboard

1. Power down the NAVIKNOT 350 E system.

2. Open the electronics unit and locate the old flashboard in its socket (J7) on the PCB.
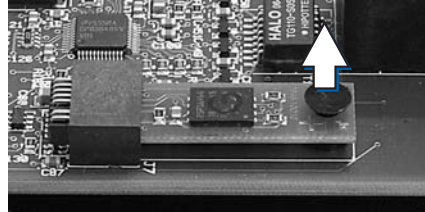
3. Carefully remove the plastic pin which secures the flashboard to the PCB.

4. Pull the old flashboard out of the socket, making sure to touch it at the edges only.
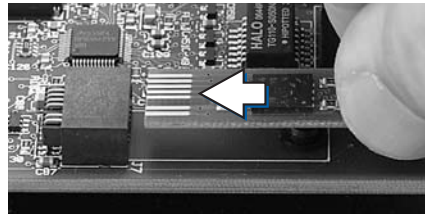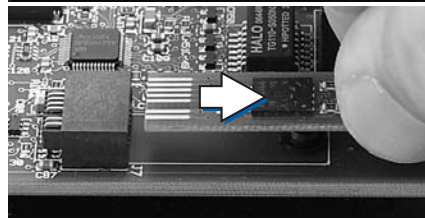
5. Insert the new flashboard into the socket.

6. Secure the flashboard with the plastic pin.
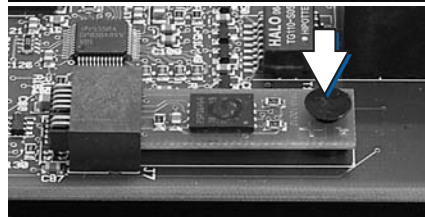
7. Power-up the NAVIKNOT 350 E system.

8. The electronics unit will recognize the new flashboard and download the updated software to the onboard memory.

9. The CDU shows the "waiting for main unit" message for several minutes while the software is downloaded. During the download, the LEDs CR 6, 7 and 22 on the electronics unit PCB will flash in sequence.
   Upon completion of the download, the system automatically restarts.

| **CAUTION** | Do not disconnect power or otherwise interrupt the power-up process after an exchange of the flashboard. |

Uploading Software via the Service Interface

The system software may also be uploaded from a PC or laptop via the RS-232 service interface on the electronics unit PCB.

At the time of writing of this manual, however, an upload program for field service use is not yet available. Sperry Marine will issue an official Service Bulletin as soon as such a program becomes available.

9.2   Replacing RS-422 Output Driver ICs

The RS-422 output drivers, ICs 2 and 16, are socketed 16-pin DIL chips. If failure or malfunction of RS-422 outputs is attributed to a defective driver IC, the respective chip can easily be replaced against a new one.

The driver ICs are standard quadruple RS-422 line drivers (MC3487), available from Sperry Marine Hamburg under part no. 46485.

9.3   Replacing Pulse Output Relays

The pulse output relays, ICs 14, 15, 17, 18, 23 and 24, are socketed solid state relays in a 6-pin DIL package.
If failure of a pulse output is attributed to a defective relay, the respective component can easily be replaced against a new one.

The pulse relays are photocoupler photo relays (TLP 598G), available from Sperry Marine Hamburg under part no. 42842.

Appendix

A Setup and Configuration Tables

The following tables (blank forms) are appended to this manual:

Designation	Drawing No.
NAVIKNOT 350 E Setup Table	5003-0125-01
NAVIKNOT 350 E Record of Calibration Trial Runs	5003-0125-04

Note
After installation of the NAVIKNOT 350 E, please return a filled-out copy of the Setup Table to Sperry Marine for inclusion in the ship's file. When permanent changes are made to the system configuration, please return an updated copy of the Setup Table to Sperry Marine.

B Drawings

The following drawings are appended to this manual:

Designation	Drawing No.
NAVIKNOT Electronics Unit Dimension Drawing	5003-0112-01
NAVIKNOT Control and Display Unit (in housing with bracket) Dimension Drawing	5001-0112-01
NAVIKNOT Control and Display Unit (for console frame or panel mounting) Dimension Drawing	5001-0112-02
Console Frame Layout NAVIKNOT CDU Dimension Drawing	0021-0112-86
Console Cutout 2x1 Dimension Drawing	0012-0112-02
Electromagnetic Log NAVIKNOT 350 E Standard Connection Drawing	5001-0153-11

Note
All appended documents and drawings are revision-controlled separately at Sperry Marine.
In case of doubt, verify the current revision status of the drawings with Sperry Marine. This manual's revision status does not change when the revision of an appended document or drawing changes.

NORTHROP GRUMMAN

Sperry Marine

NAVIKNOT 350 E
Setup Table

Vessel: _____ Hull No.: _____

IMO No.: _____ Shipyard: _____

Service Station / Installer: _____ Date / Signature:

_____ _____ / _____

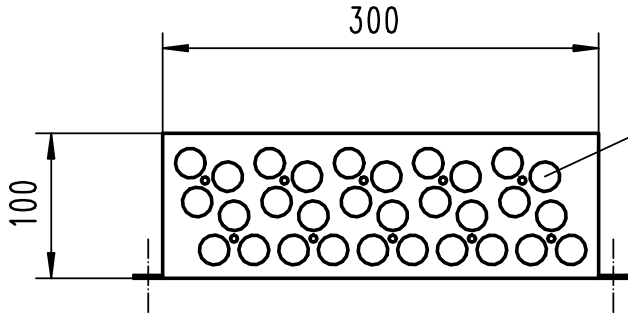## CDU Configuration (local CDU setups)

CDU1, ID: _____ CDU2, ID: _____ CDU3, ID: _____ CDU4, ID: _____

Dim Grp.: _____ Dim Grp.: _____ Dim Grp.: _____ Dim Grp.: _____

User Setup

	Damping Times	LCD Color	Speed Scale
Display (s):		○ white	○ kn
Output (s):	_____	○ blue	○ m/s
	_____	○ black	○ ft/s

Service Setup - Page 1

Analog Output

Voltage

Min. Voltage (V): _____ Max. Voltage (V): _____

Min. Speed (kn): _____ Max. Speed (kn): _____

Current

Min. Current (mA) _____ Max. Current (mA): _____

Min. Speed (kn): _____ Max. Speed (kn): _____

Pulse Output

Pulse Output 1-3	Pulse Output 4-5	Pulse Output 6
○ 10 Pulse/NM	○ 10 Pulse/NM	○ 10 Pulse/NM
○ 100 Pulse/NM	○ 100 Pulse/NM	○ 100 Pulse/NM
○ 200 Pulse/NM	○ 200 Pulse/NM	○ 200 Pulse/NM
○ 400 Pulse/NM	○ 400 Pulse/NM	○ 400 Pulse/NM
○ 20000 Pulse/NM	○ 20000 Pulse/NM	○ 20000 Pulse/NM
		○ Mute Relay

RS-422 Output 1-3

Messages	Baudrate
☐ VBW	○ 4800 Baud
☐ VHW	○ 9600 Baud
☐ VLW	○ 38400 Baud
☐ VLW extended	
☐ PPLAK	

RS-422 Output 4-6

Messages	Baudrate
☐ VBW	○ 4800 Baud
☐ VHW	○ 9600 Baud
☐ VLW	○ 38400 Baud
☐ VLW extended	
☐ PPLAK	

NMEA Input 1

Messages	Baudrate
☐ VTG	○ 4800 Baud
☐ DDC	○ 9600 Baud
☐ PPLAI	○ 38400 Baud

NMEA Input 2

Messages	Baudrate
☐ VTG	○ 4800 Baud
☐ DDC	○ 9600 Baud
☐ PPLAI	○ 38400 Baud

Service Setup - Page 2								

System Type ☒ NAVIKNOT 350 E

Sensor Sensitivity Value: _____

Relay Speed Limit Min.Value (kn): _____ ☐ Min. Value ON

Max.Value (kn): _____ ☐ Max. Value ON

Calibration ☐ Cal. Table ON

Calibration Table								
Cal. No.	Uncal. Sp	True Spd.	Cal. No.	Uncal. Sp	True Spd.	Cal. No.	Uncal. Sp	True Spd.
0			7			14		
1			8			15		
2			9			16		
3			10			17		
4			11			18		
5			12			19		
6			13			20		

NORTHROP GRUMMAN

Sperry Marine

NAVIKNOT 350 E
Record of Calibration Trial Runs

Vessel: _____ Hull No.: _____

IMO No.: _____ Shipyard: _____

Service Station / Installer: Date / Signature:

_____ _____ / _____

Location of runs:

Remarks:

Run #: _____ engine RPM: _____

	run parameters			computed values	
	elapsed time (s)	distance (NM)	heading (°)	avg. uncal. spd.	true water speed
Run A (or single run)					
Run B (return run)					
averaged values (cal. table entry)					

Run #: _____ engine RPM: _____

	run parameters			computed values	
	elapsed time (s)	distance (NM)	heading (°)	avg. uncal. spd.	true water speed
Run A (or single run)					
Run B (return run)					
averaged values (cal. table entry)					

Run #: _____ engine RPM: _____

	run parameters			computed values	
	elapsed time (s)	distance (NM)	heading (°)	avg. uncal. spd.	true water speed
Run A (or single run)					
Run B (return run)					
averaged values (cal. table entry)					

300

100

⌀20,5 (30*)

Schirmgeflecht über den
Kabelmantel gezogen und
mit Schellen oder Kabel-
bindern befestigt.

Draw the screen back over
the outer cable cover
and attach it to the unit
with clamps or cable bands.

7

35

250

180

45

320

340
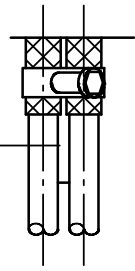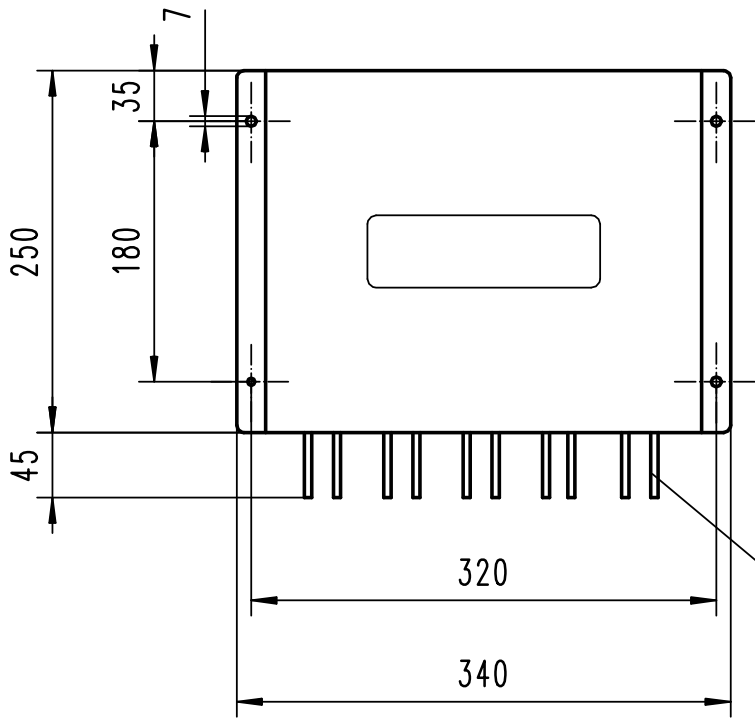
Gewicht/Weight : 4 kg
Schutzart/Protection grade : IP 23

				NORTHROP GRUMMAN Sperry Marine		DATE	NAME	DIMENSION DRAWING Electronics Unit		SCALE
					DRAWN	06.12.2006	Ho.			/
					CHD	see ECO				
				HAMBURG GERMANY	DOS	5003-0112-01				
				DRAWING No. 5003-0112-01						SHEET
B	982016	15.03.07	Ho.							1
A	981992	27.02.07	Ho.	FIRST ANGLE PROJECTION		DIMENSIONS IN MILLIMETERS				SHEETS
0	–	06.12.06	Ho.							1
REV	ECO-No.	DATE	NAME	STOCK No. 73510				REPLACEMENT FOR:	FREE SCALE: DIN ISO 2768 mH	
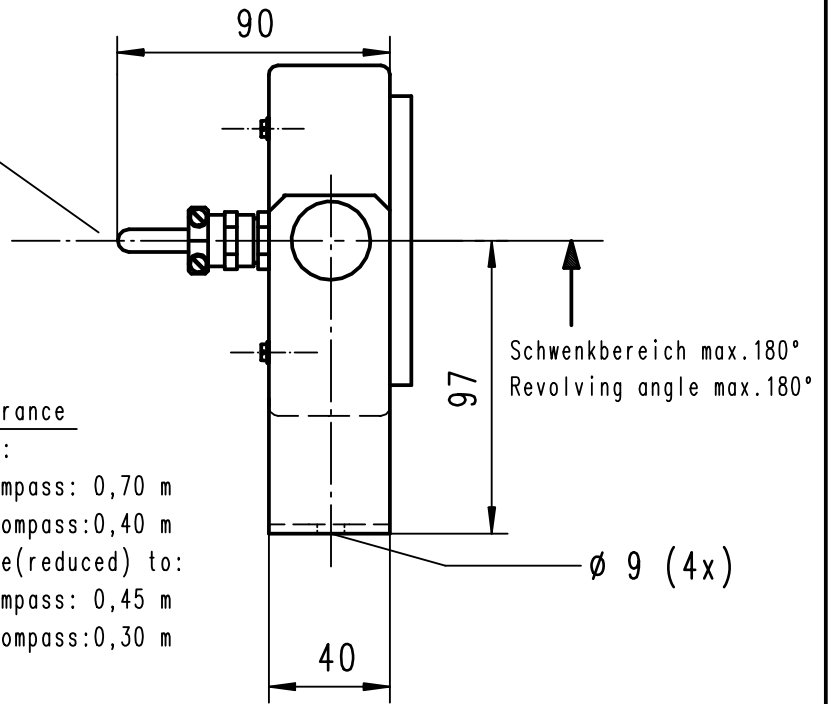
90

Kabellänge 3,2m
Length of cable

Schwenkbereich max.180°
Revolving angle max.180°

97

Magnetischer Schutzabstand/Magnetic Clearance
Mindestabstand vom:/Minimum Clearance to:
Magnet-Regelkompaß/Standard Magnetic Compass: 0,70 m
Magnet-Steuerkompaß/Steering Magnetic Compass:0,40 m
Reduz.Mindestabst. vom:/Minimum Clearance(reduced) to:
Magnet-Regelkompaß/Standard Magnetic Compass: 0,45 m
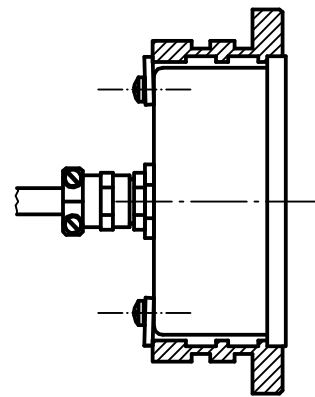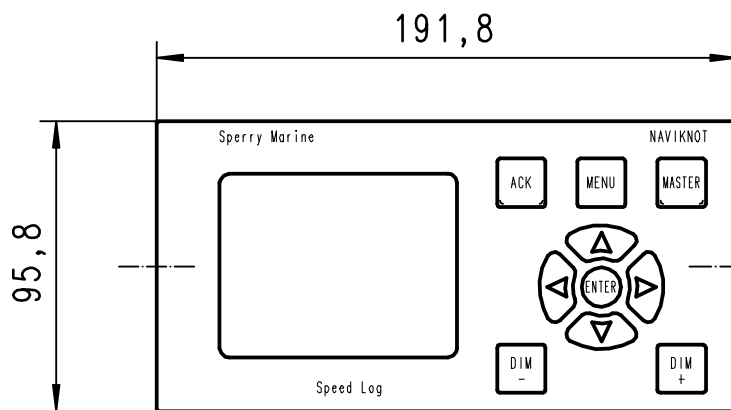Magnet-Steuerkompaß/Steering Magnetic Compass:0,30 m

Ø 9 (4x)

40

256

Sperry Marine   NAVIKNOT

ACK   MENU   MASTER

△
◁ ENTER ▷
▽

DIM −   DIM +

Speed Log

155

2x98=196
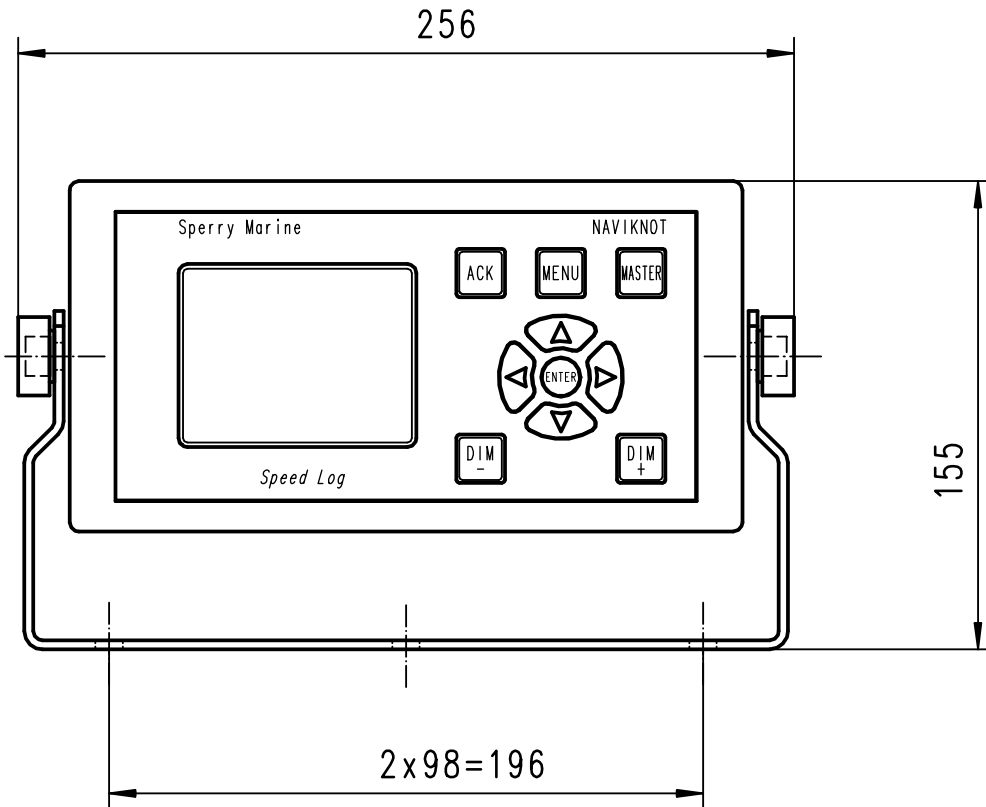
Abstand der Befestigungsbohrungen.

Distance between fixing holes.

Gewicht/Weight: 3,2 kg

191,8

95,8

Sperry Marine

NAVIKNOT

| ACK | MENU | MASTER |

△
◁ ENTER ▷
▽

DIM −   DIM +

Speed Log

Kabellänge 3,2m
Length of cable

90

43

Magnetischer Schutzabstand/Magnetic Clearance
Mindestabstand vom:/Minimum Clearance to:
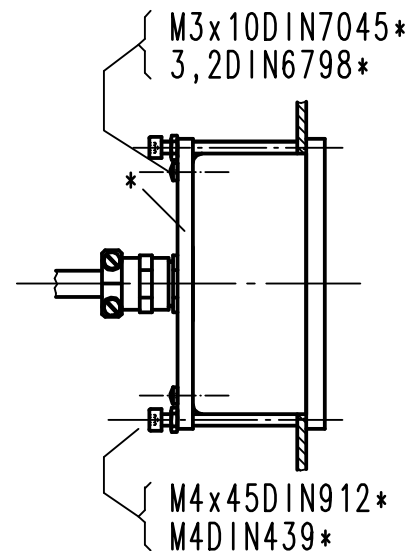 Magnet-Regelkompaß/Standard Magnetic Compass: 0,70 m
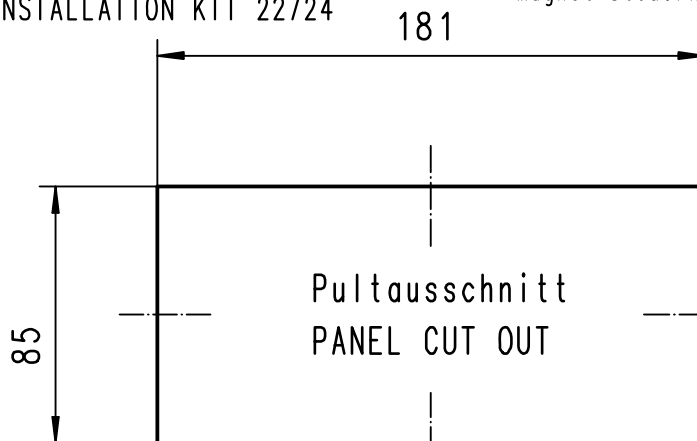 Magnet-Steuerkompaß/Steering Magnetic Compass:0,40 m
Reduz.Mindestabst. vom:/Minimum Clearance(reduced) to:
 Magnet-Regelkompaß/Standard Magnetic Compass: 0,45 m
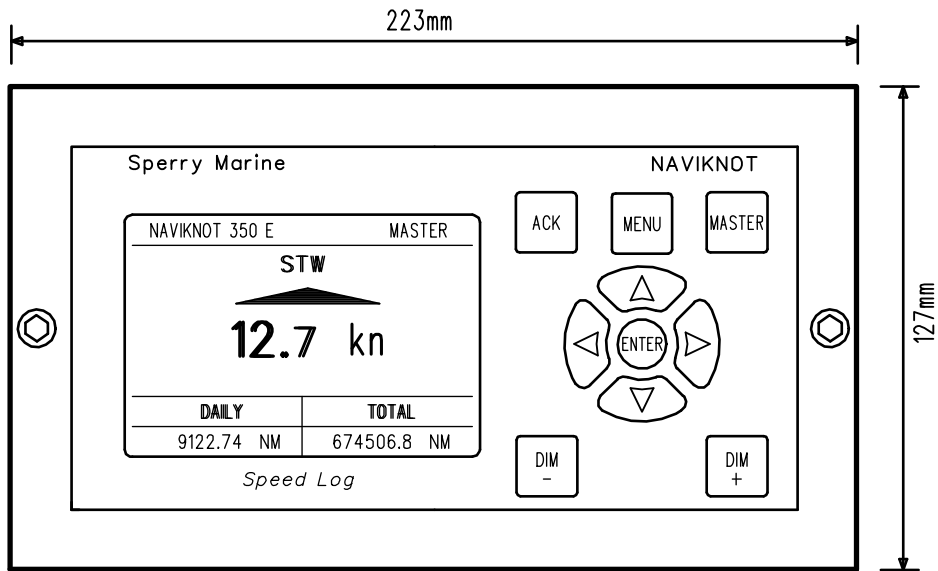 Magnet-Steuerkompaß/Steering Magnetic Compass:0,30 m

Einbau in Pultrahmen
INSTALLATION IN CONSOLE FRAME

* = Montagesatz 22724
   INSTALLATION KIT 22724

181

85

Pultausschnitt
PANEL CUT OUT

{ M3x10DIN7045*
{ 3,2DIN6798*

*

{ M4x45DIN912*
{ M4DIN439*

Pulteinbau
PANEL INSTALLATION

Gewicht/Weight: 2,4 kg

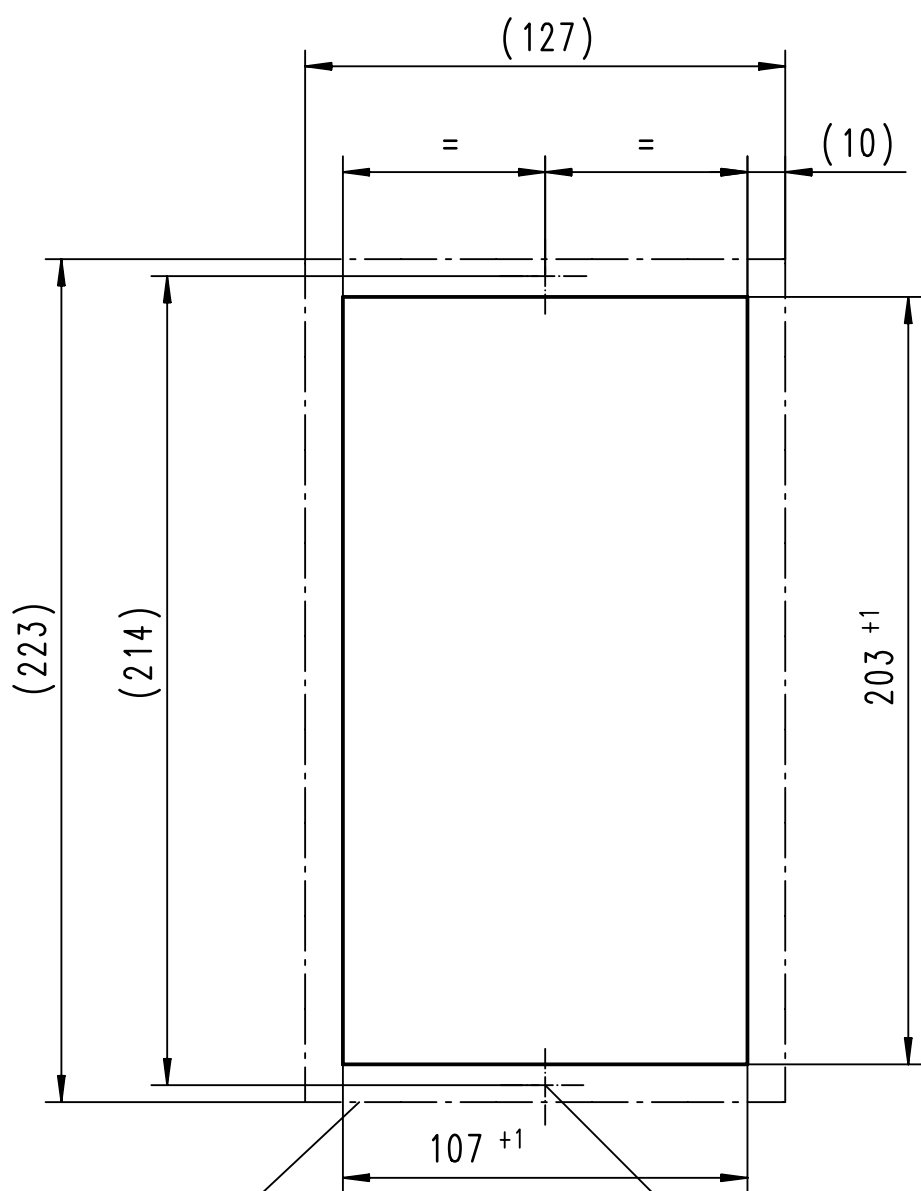|				NORTHROP GRUMMAN Sperry Marine HAMBURG GERMANY		DATE	NAME	DIMENSION DRAWING NAVIKNOT 350/450 Control and Display Unit Frontseitig wasserdicht IP 65 Watertight front IP 65	SCALE /
					DRAWN	27.11.2006	Ho.		
					CHD	see ECO			
					DOS	5001-0112-02			SHEET 1
				DRAWING No. 5001-0112-02					
A1	982028	27.03.07	Ho.						
A	982006	06.03.07	Hinr	⊏◁⊕ FIRST ANGLE PROJECTION		DIMENSIONS IN MILLIMETERS			SHEETS
0	−	27.11.06	Ho.						1
REV	ECO-No.	DATE	NAME	STOCK No. 73506				REPLACEMENT FOR:	FREE SCALE: DIN ISO 2768 mH

223mm

Sperry Marine   NAVIKNOT

| NAVIKNOT 350 E | MASTER |

STW

12.7 kn

DAILY	TOTAL
9122.74 NM	674506.8 NM

Speed Log

ACK   MENU   MASTER

△
◁ ENTER ▷
▽

DIM −   DIM +

127mm

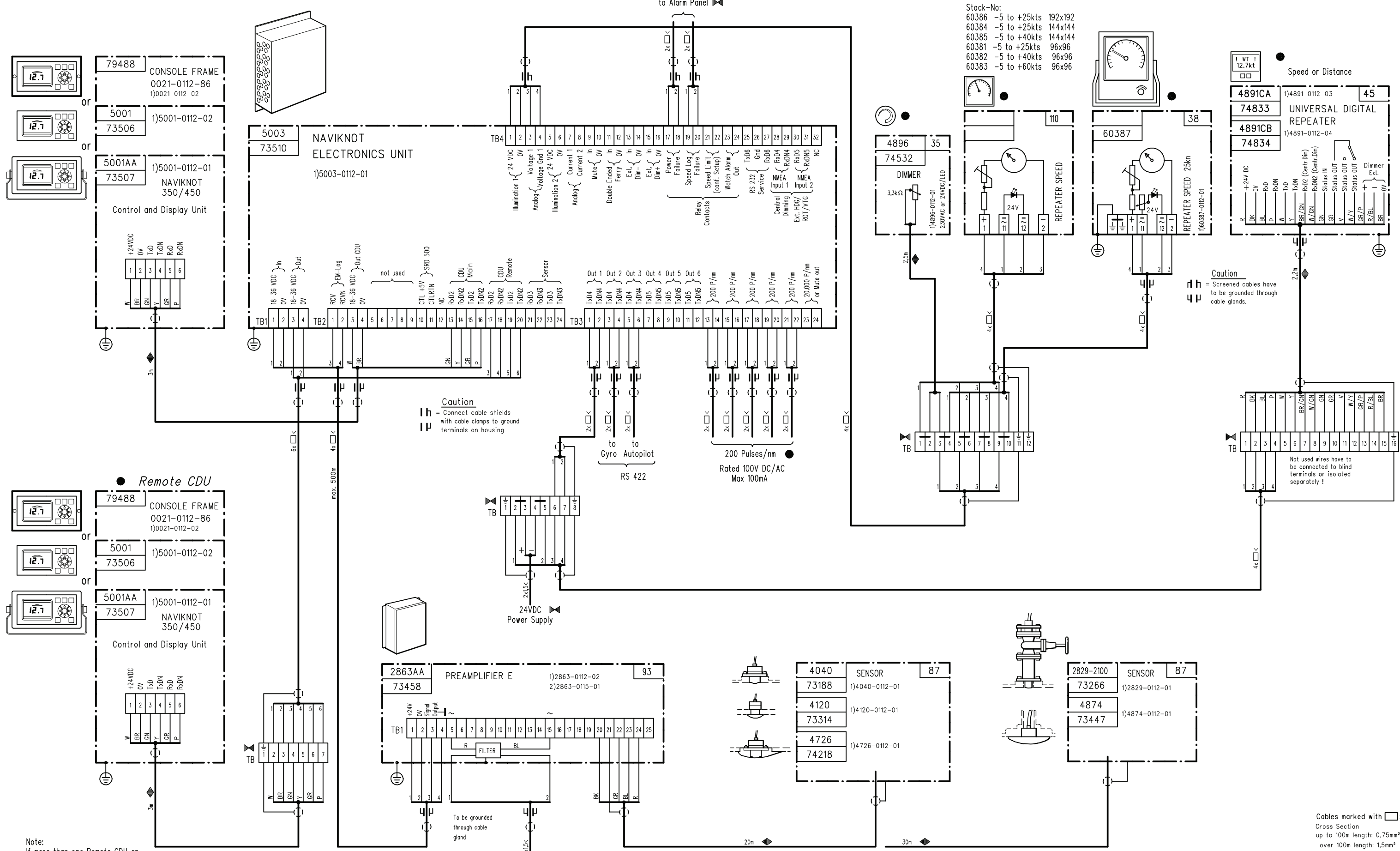Depth: 150mm

(127)

(10)

(223)

(214)

203 +1

107 +1

Platzbedarf für Rahmen
Space requirement for frame

M5 bei Montage vom Pultrahmen
abbohren und gewindeschneiden
Drilled off from console frame
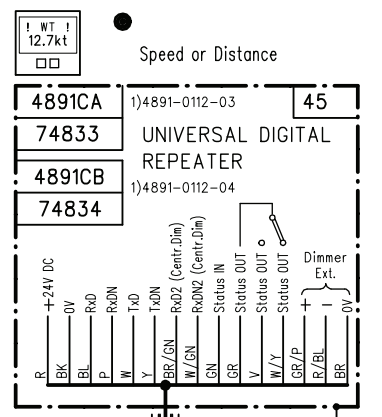and threaded M5

Pultplatte max. 20 mm dick
Thickness of panel max.20 mm

REV	ECO-No.	DATE	NAME						
AC	98351	20.04.01	Ho.						
AB	99669	10.07.96	Ho.						
AA	99224	15.02.94	Ho.						

NORTHROP GRUMMAN
Sperry Marine
HAMBURG   GERMANY

	DATE	NAME
DRAWN	10.02.1994	Ho.
CHD		see ECO
DOS	0012-0112-02	

DRAWING No.
0012-0112-02

FIRST ANGLE PROJECTION

DIMENSIONS IN MILLIMETERS

STOCK No.
.

DIMENSION DRAWING

Pultausschnitt

Console cut out

1 * 2

REPLACEMENT FOR:
Ausgabe 00A

FREE SCALE:
DIN ISO 2768 mH

SCALE
/

SHEET
1

SHEETS
1

 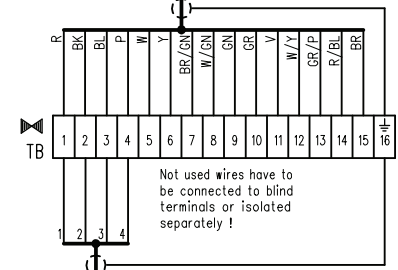
to Alarm Panel
79488 CONSOLE FRAME 0021-0112-86 1)0021-0112-02
or
5001 73506 1)5001-0112-02
or
5001AA 73507 1)5001-0112-01 NAVIKNOT 350/450
Control and Display Unit
+24VDC 0V TxD TxDN RxD RxDN
W BR GN Y GR P
3m
5003 73510 NAVIKNOT ELECTRONICS UNIT 1)5003-0112-01
TB4
Illumination 1 24 VDC 0V
Analog Voltage 1 Voltage Gnd 1
Illumination 2 24 VDC 0V
Analog Current 1 Current 2
Mute In 0V
Double Ended Ferry In 0V
Ext. Dim- In 0V
Ext. Dim+ In 0V
Power Failure
Speed Log Failure
Speed Limit (conf. Setup)
Watch Alarm Out
Relay Contacts
RS 232 Service TxD6 Gnd
NMEA Input 1 RxD4 RxDN4
NMEA Input 2 RxD5 RxDN5
NC
Central Dimming Ext. HDG/ ROT/VTG
TB1 18-36 VDC In 0V 18-36 VDC Out 0V
TB2 RCV RCVN EM-Log 18-36 VDC Out CDU 0V not used CTL +5V CTLRTN NC SRD 500
CDU Main RxD2 RxDN2 TxD2 TxDN2
CDU Remote RxD2 RxDN2 TxD2 TxDN2
Sensor RxD3 RxDN3 TxD3 TxDN3
TB3 Out 1 TxD4 TxDN4 Out 2 TxD4 TxDN4 Out 3 TxD4 TxDN4 Out 4 TxD5 TxDN5 Out 5 TxD5 TxDN5 Out 6 TxD5 TxDN5
200 P/nm 200 P/nm 200 P/nm 200 P/nm 200 P/nm 20,000 P/nm or Mute out
Caution
= Connect cable shields with cable clamps to ground terminals on housing
6x
4x
max. 500m
2x 2x 2x
to Gyro to Autopilot
RS 422
2x 2x 2x 2x 2x 2x
200 Pulses/nm
Rated 100V DC/AC Max 100mA
TB
2x1,5
24VDC Power Supply
Stock-No:
60386 -5 to +25kts 192x192
60384 -5 to +25kts 144x144
60385 -5 to +40kts 144x144
60381 -5 to +25kts 96x96
60382 -5 to +40kts 96x96
60383 -5 to +60kts 96x96
4896 35 74532 DIMMER 3,3kΩ
1)4896-0112-01 230VAC or 24VDC/LED
2,5m
110 24V REPEATER SPEED
60387 38 24V REPEATER SPEED 25kn 1)60387-0112-01
Speed or Distance
WT 12.7kt
4891CA 1)4891-0112-03 45 74833 UNIVERSAL DIGITAL REPEATER 4891CB 1)4891-0112-04 74834
+24V DC 0V RxD RxDN TxD TxDN RxD2 (Centr.Dim) RxDN2 (Centr.Dim) Status IN Status OUT Status OUT Dimmer Ext. + - 0V
R BK BL P W Y BR/GN W/GN GN GR V W/Y GR/P R/BL BR
2,2m
Caution
= Screened cables have to be grounded through cable glands.
4x 4x 4x
TB
Not used wires have to be connected to blind terminals or isolated separately !
Remote CDU
79488 CONSOLE FRAME 0021-0112-86 1)0021-0112-02
or
5001 73506 1)5001-0112-02
or
5001AA 73507 1)5001-0112-01 NAVIKNOT 350/450
Control and Display Unit
3m
TB
2863AA 73458 PREAMPLIFIER E 1)2863-0112-02 2)2863-0115-01 93
TB1 +24V 0V Signal Output
FILTER R BL
To be grounded through cable gland
2x1,5
115/230VAC Power Supply
4040 73188 SENSOR 87 1)4040-0112-01
4120 73314 1)4120-0112-01
4726 74218 1)4726-0112-01
2829-2100 73266 SENSOR 87 1)2829-0112-01
4874 73447 1)4874-0112-01
20m
30m
Note:
If more than one Remote CDU an additional Power Supply is required !

Cables marked with ☐:
Cross Section
up to 100m length: 0,75mm²
over 100m length: 1,5mm²

115/230VAC
Power Supply

Caution

All Power Supplies must be separately fused !
All Housings must be grounded !
If screened cables are not grounded as shown, malfunction will occur !

TYPE-NO		IDENT-NO
STOCK-NO		

Mounting of console frames

For servicing, arrange the cable so that the entire console frame can be raised by approximately 1m
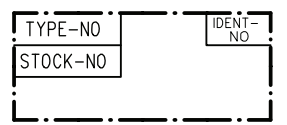
REMARKS
1) Dimension Drawing
2) Wiring Diagram
● if required
< Screened Cable
(AA) all cables marked with letters are Sperry Marine Supply of max. 3m length

General Notes:
1. All cables shipyard supplied unless otherwise specified
2. ⧓ Components Owner- or Yard-Delivery
3. ◆ Cables delivered by Sperry Marine
4. All cables to be screened, unless otherwise specified
5. All units unless otherwise specified to be directly connected to ship's earth
6. Cable diameters acc. to classification requirements unless otherwise stated
7. All cables to include a min 1/10 of unused conductors

DESCRIPTION	REV	ECO-No.	DATE	NAME
initial	A	981 900	04.04.07	Geisler

	Date	Name
DRAWN	04.04.2007	Geisler
DESIGN	04.04.2007	Dietmann
CHD ECO	21.06.2007	Steiger

5001\5001-0153-11S01

NORTHROP GRUMMAN
Sperry Marine
Hamburg Germany

TITLE
Connection Diagram
ELECTROMAGNETIC LOG
NAVIKNOT 350 E

DRAWING No.
5001-0153-11 /A

SHEET 1 SHEETS 1

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Each modification of this drawing requires the approval from NORTHROP GRUMMAN SPERRY MARINE HAMBURG in written form.