EMES60
Navigational STW speed log

User manual
Introduction

EMES60 is a combined echo sounder and speed log, providing both speed and water depth from the same unit.

This manual gives the information necessary to use the Speed log system.
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1 About this Manual

1.1 Glossary

Terms used in this manual include:

DIV Division

echo sounder A device that measures the depth of water under a ship, by measuring the time between sending a sound pulse and receiving its echo from the seabed.

electromagnetic log A type of speed log that uses electromagnetic measurements to calculate the speed of a vessel through water. Compare with acoustic Doppler log, which calculates the speed through the water or relative to the seabed by detecting shifts in frequency of acoustic echoes. EMES60 uses an electromagnetic log.

HMI Human-machine interface: screen units that give readouts of speed and depth, and allow the user to control and set up the system

IMO International Maritime Organization

Interface Unit EMES60 electronic unit that connects sensor, Sensor Power Unit and ship’s power

longitudinal speed Speed in the aft-fore direction of the vessel

opto Short for “opto-isolated”

opto-isolated An electrical input that is separated electrically from the inputting device using an optical converter circuit

Sensor Power Unit EMES60 electronic unit that connects HMI units, external equipment and Interface Unit

speed log A device that measures the speed of a ship relative to the water around it and the seabed under it

TVG Time Varied Gain, signal compensation that removes transmission loss effects from echosounder data

transducer A device that converts electrical signals to sound and back again

transverse speed Speed in the port-starboard direction of the vessel
swipe technique  Touch and drag – common scrolling technique applicable to the touch screens.

1.2 Parts of the Manual

- Section 1, About this Manual, introduces this manual.
- Section 2, Introduction to EMES60, provides an overview of the system.
- Section 3, 4 and 5 Operation, describes the day-to-day operation of the system, including how to use the information and control screens.
- Section 6 provides EMES60 System Specifications.
2 Introduction to EMES60

2.1 Summary
EMES60 is a combined electromagnetic speed log and echosounder navigation system. It is a single sensor with two transducers in one housing. Both parts have been designed to meet the relevant international standards and provide all the modern and legacy input-output interfaces that are specified by the IMO standards. As required by the relevant regulations, the two parts are totally separated internally. The main advantage of this arrangement is that the system only needs one hull penetration, and one set of mounting hardware, thus increasing reliability and reducing costs of installation and maintenance. The size and weight of the sensor is significantly less than other systems on the market, which greatly facilitates installation and handling.

2.2 Highlights
- Only one hull penetration, which increases safety of navigation
- Small overall diameter of sensor, requiring small hull penetration, which minimizes the risk of mechanical damage
- Sophisticated analog and digital signal processing, which provides reliable data in any navigation conditions
- All modern and legacy input-output interfaces are supported, including IEC 61162-1
- Sound speed calibration based on temperature, which provides accurate depth measurements in different conditions without the need for manual adjustments
- Includes water temperature sensor, accurate to 1°C
- Optimized electromagnetic log operational parameters, which provides accurate speed through water measurements in different water conditions, such as sea water, river water, and brackish water
2.3 System Structure

SYSTEM STRUCTURE
EMES60 Echosounder and Speedlog Redundant HMI units

- RS422 communication cables

Dual Universal Marine Interface unit

EMES Dual power supply and junction box

EMES Dual sensor with sensor cable

Sea ballvalve for single and double hull mounting

External equipment
3 Operation, generic

3.1 HMI Touch-Screen Controls
Reading the speed and depth information from the system, and configuring the system for use, is done through the touch-screen display units, called “human-machine interface” (HMI) units. Data is also sent to external equipment using a range of standard communication protocols and data formats.
Two HMI Units are usually fitted, both of which can run both the echosounder and speed log parts of the system, but typically one is configured to run the echosounder, and the other is configured to run the speed log.
The HMI Units use touch-screen technology, so that controlling the system is done by touching the relevant part of the HMI Unit screen.
The structure and operation of both HMI units is similar. The examples below are from the echosounder, but the principles are the same for the speed log.

3.2 Structure of the operational screen

[Diagram showing the layout of the screen, including:
- GNSS and THD sensors data, ref 3.3
- Miscellaneous buttons, ref 3.5
- Main window: different for each system and each screen type
- Settings buttons: touch to change settings and Home access, screen]
The exact contents of the parts of the screen are different for each screen type; see the section for each screen for detailed information.

### 3.3 GNSS and THD sensors data

All the screens show GNSS and THD sensor data received by the system in the top row of the screen.

![ GNSS and THD Sensor Data Display ]

This section can be enabled or disabled using the GPS Display on/off button at the top of the Home screen.

### 3.4 Using the on-screen keyboard to enter data

On-screen keyboard is used to change some of the user adjustable settings. The upper line contains the name of the edited parameter. The operator should enter the desired value and press the “enter” button. Backspace button can be used to delete the characters to the left from the cursor. In order to cancel operation without saving the changes – press the Esc button or touch any area outside the keyboard frame.
3.5 Miscellaneous buttons
The second row has a set of buttons, which provide numerical outputs as well as controls for the system. Each screen type is slightly different, but a typical one is as follows.

![Image of buttons]

3.6 Administrator mode
EMES60 has two input modes: “Normal User” and “Administrator”.

Some operational parameters could prevent correct operation of EMES60 if they are set incorrectly. These parameters cannot be set in Normal User mode, and the operator must change to Administrator mode in order to get access to the setup screens.
All setup, calibration and troubleshooting screens are accessible only in Administrator mode.
The system starts in Normal User mode. To change to Administrator mode, go to the Home Screen (ref 3.7), and enter the Administrator password in the “Password” section. The administrator password is 1963.
The current input mode is shown at the bottom of the screen.

3.7 Home screen
Touch the button in the bottom-right of most screens to access the Home screen.
3.7.1 Home screen layout

The Home screens of the Echosounder and Speed Log interfaces are similar, but a different selection of screens is available for each.

**Home screen Upper line**

**Home screen Control buttons**

**Home screen Second line**

**Screen selection**: touch to select an operational screen

**Screens navigation**

3.7.2 Home screen upper line

08-06-17

Interface
SW v.01.00.10
emesl-1645008

Sensor
SW v.01.00.10
emesS-1645003

Display
SW v.01.01.18
emesD-1607002

**Date**: touch to change

**SW version and serial number of Interface Unit**: Touch to upgrade software

**SW version and serial number of Sensor Unit**: Touch to upgrade software

**SW version and serial number of HMI(Display) Unit**: Touch to upgrade software
3.7.3 **Home screen second line**

![Image of Home screen controls]

3.7.4 **Home screen Control buttons**

**Day/Night** mode: touch to toggle between Day and Night display modes. The button shows the current mode. In night mode, the display is shown in darker colors, to preserve the night vision of the user. A sun icon is shown in Day mode, and a moon in Night mode.

**Defaults:** sets the system settings to default values.

You are then presented with the option of restoring to either the ship’s defaults (see below) or factory defaults.

An “Are You Sure” screen appears when the tick button is touched. Touch “OK” to return all the settings of the system to the selected set of settings.

**Store ship’s default settings:** stores the current settings of EMES60. This function is recommended after the required setup is performed. Then it will be easy to restore the original settings in case of accidental loss of the settings. Also see Saving Files to USB, section 7.1.

**Return to Screen:** returns the display to the previous operational screen.
Standby: turns the system in Standby mode. An “Are You Sure” screen appears when this button is touched. Touch “OK” to turn the system in Standby mode.

3.8 Alerts

3.8.1 Alerts basics
If a value goes over a minimum or maximum limit, or functional failure occurs, an alert will be triggered. This causes the following things to happen:

- A flashing text indicator is shown in a prominent position on the screen
- The alert state is logged to an alert list, with the time stamp of the alert status change
- The potential free relays in the Interface Unit can be activated (depending on the settings of each relay function, ref section 6.6.4). These can be used to trigger audible alerts or set alerts in other systems.

To acknowledge an alert, causing the on-screen warning to disappear, touch the flashing warning box. More than one alert condition could be in place at the same time, so it may be necessary to repeat this procedure to acknowledge the other alerts.

The alert parameters are adjusted, controlled and monitored using the Alert screens, ref sections 4.4 and 5.4

The “loudspeaker” button is on provided in the second line of each screen. The color of the button depends on the existing alarm conditions. If any alarm condition exists – the button is red, otherwise - grey.

Touch the “loudspeaker” button and the active alarms list will appear.

Alarm status can be “Active” or “Inactive”

Acknowledge status can be “A” (Acknowledged) or “N” (Not acknowledged)

This way it is always possible to check the alarms status after they has been acknowledged.

3.8.2 Generic alert conditions
There are several alert types, which are common for both echosounder and speed log systems.
These are:

| Void | Void | void |

The alert types which are specific to one of the systems are explained in 4.4 and 5.4.

### 3.8.3 Setting alert limits

The values at which alert is triggered are shown in Alert Buttons at the bottom of the screen. There are two buttons, one for the alert when the value gets too low, and one for when it gets too high.

To change these values, touch one of the Alert buttons.
A digital keyboard appears on the screen; Enter the desired value in the edit line and press “Enter” button.
The value in the Alert button changes to show the new selection.

![Alert buttons](image)

### 3.9 Screens navigation

Use the Screens Navigation part of the screen to go directly to a different screen: touch the dot for the required screen.

Alternatively, “swipe” to left or right to move to an adjacent screen. The current screen is shown as a filled dot.

**IMPORTANT NOTE:** Entire set of screens is available only in admin mode, ref 3.6. In the user mode there are only basic screens (which are needed for a daily use) can be selected.
3.10 Brightness control
Double-tap in any screen area, and a brightness control slider is shown. Slide it up and down to increase and decrease the brightness of the HMI screen.

If the brightness is set so low that the screen picture is not visible under the present ambient light conditions – touch any part of the screen and keep touched for ca. 3 seconds. The brightness will change to a value so the elements of the screen are visible in all light conditions.

3.11 Hardware interface setup

3.11.1 Screen layout
This screen is used to program the Interface Unit according to the specific requirements of the installation. This screen can be accessed from both speed log and echosounder modes.

The default settings can be restored when necessary
The following outputs are available:

### 3.11.2 Relay outputs
These are controlled from the Alerts screen (ref 4.4 and 5.4) Ref 6.5.25 for connections details.

### 3.11.3 Opto outputs
Two opto output channels are provided. Touch the box next to each opto channel to assign the function to this channel. Select “Not Used” if no action is needed on that channel. The functionality is different for speed log and echosounder systems. Ref 4.6.7 and 5.6.7 for further details. Factory default: Not used.
3.11.4 Pulse inputs
A signal received from an external system can be selected to cause an action in the EMES60 system. Two pulse input channels are provided. The functionality is different for speed log and echosounder systems. Ref 4.6.5 and 5.6.4 for further details. Ref 8.2.6 for input connection details. Factory default: Not used

3.11.5 Analog outputs
Analog outputs can be configured to provide a varying voltage output in response to a measured value in the EMES60 system. Two analog output channels are provided. Touch the first box next to the channel number to switch between 0 to 10 V voltage output and 4 to 20 mA current output. The functionality is different for speed log and echosounder systems. Ref 4.6.8 and 5.6.8 for further details. Factory default: Not used

3.11.6 Screen copy and printing
Controls what happens when the Print Screen button at the top of most windows is touched. Touch Printer to send screen copy images to a printer, and File to send them to a file, stored in the HMI memory.

Touch this box to select the printer from a list of available system printers.

3.12 Demo and Simulation modes
EMES60 can be put into special modes, to help with training and testing.
Demo and simulation modes are set in the Home screens; touch the mode button and select the required mode.

**Warning:** ensure that the mode is set to Normal when EMES60 is used for navigation.

The available modes are:

- **Normal**: the information shown in the screens and the outputs from the external interfaces are driven by the measurements made by the speed log and echo sounder sensors.
- **Demo**: the screens are driven by artificial speed log and echo sounder data, which is computed inside the EMES60 software. This mode is supposed to be used for presentations.
- **Simul**: simulation mode; in this mode, the screens and outputs are also driven by data computed by the EMES60 software, but the operator can program the parameters of the data that is shown and output. This is useful for training and checking the connections to the external equipment, when real data from the sensor head is not available.

To set the simulation parameters: select simulation mode, then go back to screen 1. Click in the area of the digital depth (or digital speed) indicator – to change the simulated data.

Note that when either demo or simulator mode is activated the large character S is indicated in the upper right part of all screens.

### 3.13 Printing and screen snapshots

Touch the Print Screen button to send data from the screen to a printer or to the file screen for debug and maintenance purposes.

In Echosounder mode, keep this button touched for 3 seconds and this will start a continuous printout of the echogram and the GPS position data.

The function of this button is controlled by the selection of the Screen copy alternatives in the Hardware Interface Selection screen (ref 3.11.6).
3.14 Setting the time and date

Touch the time display box to open the time-setting menu. Click on the hours, minutes or seconds, and use the up and down arrows to change them. Then touch the “tick box” to set the new time.

Go to screen Home and touch the date button. Use the date control dialog to select the required date. Then touch the “tick box” to set the new date.
4 Operation, Speed log

The speed log measures the speed of the vessel through the water.

4.1 Speed log Home Screen

This screen is used to go to the desired operational screens, and for general controls.

See section 3.7 for detailed description of all screen elements. See 3.7.4 for use of the Control buttons.
4.2 Speed log main operational screen (screen 1)

This screen is the one that is shown in normal use of the speed log. It shows the vessel speed through the water in forward and sideways directions, and the total distance travelled.

Touch the speed and distance display boxes to set the units of measurement. GPS information is indicated in the upper line. Time and water temperature are indicated in the second line.

**Speed, Heading, GPS position**

- **Alarm Status**: touch to display the list, Print screen; time; water temperature: touch to

**Transverse speed**: sideways speed, as a number and a bar indicator

**Longitudinal speed**: forward speed, as a number and a bar indicator

**Total distance travelled**: touch to change units

**Distance travelled in this trip**: touch to reset

**Speed through water**

- 5.6kn
- 355.0°

**GPS position**

- N059°48.4136' E010°42.8997'

**Time and Water Temperature**

- 12:13:05
- 12.7°C
4.3 Speed log single axis indicator (screen 2)

This screen shows the resultant speed (the vector sum of forward and lateral speeds) as a dial and a number.

It also shows the total distance travelled and the distance in the current trip.
4.4 Speed log alerts screen (screen 3)

Note that this screen is only available with Administration privileges, ref 3.6

4.4.1 Screen layout

When a value that is measured by the system goes out of limits or failure mode occurs, an alert is issued. This screen allows setting the individual alert ID’s for different alert events, and assigns the relay (totally 2 relays) to the particular alert event.

4.4.2 Alert list

Generic alert list – ref 3.8.2

List of the alerts specific for the speed log

<table>
<thead>
<tr>
<th>Alert Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low speed limit</td>
<td>Present speed value is less than the low speed limit</td>
</tr>
<tr>
<td>High speed limit</td>
<td>Present speed value is greater than the high speed limit</td>
</tr>
<tr>
<td>Lost speed alarm</td>
<td>Speed log cannot measure speed</td>
</tr>
</tbody>
</table>
4.4.3 Alert ID setup

Each alert event can be associated with an ID number. Such ID is used in the NMEA alarm messages, ref sections 8.5.15 and 8.5.16 for details.

To set an alert ID, touch the value box next to the alert type text. This opens a numeric touch keyboard. Enter the ID number and touch the “Return” key. Touch “Esc” to leave the value unchanged.

To reset the ID value - enter the empty string. In this case such alert type will not be presented in the output stream (ALR message)

4.4.4 Alert Relays setup

When an alert event is changing the state, it is possible to change the state of a relay in the Interface Unit, which can be used to trigger audible alarms or signal alert to other systems. Touch the “Relay Num” button next to the relevant alert type, and select the number of the relay to trigger, or “Not Used” to disable relay operation for that alert type. Ref 6.5.25 for relay connections details.

4.4.5 Scrolling freeze

A scrolling history of alerts is shown in the bottom half of the display. Freeze the monitoring window and use swipe technic - to study the alert history.

Touch the Freeze button to stop new messages being shown in the window. The button changes the shape and the scroll bar appears.

The easiest way to scroll through the alarm history is to use the swipe technique inside the monitoring window.
4.4.6 Alert depth limits setup

The shallow and deep alarm depths are shown in the Alert buttons at the bottom of the screen. If the depth is shallower than the shallow alert depth, or deeper than the deep alert depth, an alert is triggered. Touch the Alert button to change the shallow or deep alert depths. Enter the desired value from the on-screen keyboard and press enter. The new value will be indicated on the corresponding button. Note that shallow alert has alarm classification, while deep alert is just a caution.

4.4.7 Disabling audio alert

In case the audio alarms are not desirable, it is possible to disable by touching the speaker button.
4.5 Speedlog communication screen (screen 4)

This screen is used to verify the incoming and outgoing data through the system communication lines (NMEA serial and Light Weight Ethernet). All data can be logged to a file on disk. It is also used to setup the communication line parameters (UART setting for NMEA0183, IP address for Light Weight Ethernet).

- **Message display controls**
- **Input messages**: data messages sent to the system
- **Output messages**: data messages sent from the system
- **Horizontal scroll**: touch and drag to see long messages
- **Communications port controls**
This screen is used to program the Interface Unit according to the specific requirements of the installation. Note that this screen is only available with Administration privileges, ref 3.6

4.6.1 Screen layout

**Alarm Status:** touch to display the list, Print screen; time; water temperature

**Opto outputs:** touch to select the functions that drive the Opto output channels

**Pulse inputs:** touch to select what happens when a pulse is received on a pulse input channel

**Analog outputs:** touch to select the signals and range that drive the Analog output channels

**COM outputs:** check/uncheck the boxes to select the messages that are provided on the serial data output channels

**Screen copy:** touch to select where screen copy (print screen) is sent. Touch the printer name to select the alternative

Interface Unit COM output setup

<table>
<thead>
<tr>
<th></th>
<th>1 @ 4800</th>
<th>2 @ 4800</th>
<th>3 @ 4800</th>
</tr>
</thead>
<tbody>
<tr>
<td>VB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VLW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VLV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Epson Stylus D88 Series (M)
4.6.2 Double ferry mode

Default setting is OFF
The double ferry mode activation/deactivation button.

If the function is active:

- The “Double ferry mode” text indicator appears on Screen 1
- In order to work properly in both directions of vessel’s movement, one of the Pulse inputs must be configured as the Direction selector, ref 5.6.4
  Ref 8.2.6 for hardware connections of the direction control voltage-free switch
- The VBW speed values on NMEA output ch1 are the same as values measured by the sensor.
- The VBW speed values on NMEA output ch3 are opposite to the values, which are measured by the sensor.
- The VBW speed values on NMEA output ch2 depend on the voltage level on the Pulse Input, which is configured as Direction selector
  If level is low, the VBW speed values are the same as measured by the sensor.
  If the value is high (reverse direction), the VBW speed values are opposite to the values measured by the sensor. “Reversed” indicator appears on the main screen 1

4.6.3 Reset to default settings

The default settings of the Interface Unit can be restored to factory default values when necessary
NMEA 0183 messages can be output on three serial ports; use the tick-boxes to select which messages are sent out on which serial port. Each serial port can output any number of the available messages. See section 8.4 for a description of the supported output NMEA 0183 messages.

Touch the frame with indicated baud rate value – to change the baud rate. Select one out of: 2400; 4800; 9600; 19200; 38400; 57600; 115200
The following inputs are available:

### 4.6.5 Pulse inputs

Factory default value is NOT USED

A signal received from an external system can be selected to cause an action in the EMES60 system. Each of two available pulse input channels can be used as:
- External dimming
- Alarm acknowledge
- Direction selector (in case the double ferry function is active).

Touch in the area of current setting of pulse inputs at ch1 or ch2 and select the new desired function.

Note that if both channels are set to Dimming pulses, ch1 will act as brightness increase and ch2 will act as brightness reduce. If only one channel is assigned to dimming function, the brightness will be changing in cycles: middle->max->middle->min-middle->max..etc.

If any of the Pulse input channels is set as Direction selector, the high level on the input selects inverse direction (if double ferry mode has been activated).

If Alarm reset is selected as the Pulse input function, the pulse on the input results in alarm acknowledge.

Ref [8.2.6](#) for hardware connections of the direction control voltage-free switch.

---

The following outputs are available:

### 4.6.6 Relays

Relays are controlled from the Alerts screen, ref [5.4.4](#).
4.6.7 Opto outputs

Factory default value is NOT USED

Opto-isolated outputs can be set up to switch when an event occurs in the EMES60 system. Two opto output channels are provided. Touch the box next to each opto channel to set the event that causes it to trigger. Select “Not Used” if no action is needed on that channel. Two functions are selectable:

- **Pulses per NM** – set number of pulses is generated per each nautical mile
- **Speed direction** – if speed is positive, the optocoupler is open, if speed is negative, the optocoupler is closed.

If **Pulses per NM** function is selected - touch the next field - to enter number of pulses, which will be generated on the output per 1 nautical mile.

4.6.8 Analog outputs

Factory default value is NOT USED

Analog outputs can be configured to provide a varying voltage output in response to a measured value in the EMES60 system. Touch the first box to switch between 0 to 10 V voltage output and 4 to 20 mA current output. Touch the next button to select the value output. The example shows a selection between longitudinal speed, transverse speed, and the resultant (vector sum) of the two speeds.
Touch the next box to enter the value that corresponds to the lowest analogue output. For example, if ‘0.0’ is entered from the touch screen keyboard, then the lowest analogue output (0V or 4mA) is given for speed of 0.0 knots. Touch the next box for the highest value. For example, if ‘20.0’ is entered, then the highest analogue output value (10V or 20mA) corresponds to speed of 20 knots or greater.

### 4.6.9 Screen copy setup

Screen copy: this controls what happens when the Print Screen button at the top of most windows is touched. Touch **Printer** to send screen copy images to a printer, and **File** to send them to a file, stored in the HMI memory.

Touch this box to select the printer from a list of available system printers.
4.7 Speed log history screen (screen 6)

EMES60 is recording speed and all important navigational data during 30 days. Each day is recorded into the separate file. After 30 days of recording the oldest file will be overwritten. To change the day that is shown, touch the top-left button. All information can be replayed directly on the HMI unit, and also all history files can be downloaded to the external flash disk, see section 7.1. The history screen window provides a graph of speed data against time. Touch at a point in the graph to show the data at that time; a vertical line appears at the selected time, and the time box in the second row down shows the selected time. The longitudinal and transversal speed, important system settings and navigational data related to the selected point of time is displayed in the lower part of the screen.

Use the arrows at the bottom of the screen navigate in the record. The single arrows below the display area move the cursor left and right, and the double arrows move the entire screen left and right when it is zoomed. The speed scale can be changed by touching in the area of the range scale lines. Touching in the lower area changes the lower scale range. Touching in the upper area changes the upper scale range.
Navigational data recorded in history (GPS speed, heading, northing, and easting at the cursor position)

Recordings date: Touch to select the date of recordings

Time scale

Range

Speed history graph: touch anywhere in the window to move the cursor.

Cursor line: controls point of time from which all data is displayed

Navigation: single arrows move cursor, double arrows move display area when zoomed in

Speed and miscellaneous history navigational data and settings at cursor position

ZOOM reset, ZOOM in, ZOOM out and Home buttons

Use slider to scroll the history horizontally
4.8 Speedlog oscilloscope screen (screen 7)

Note that this screen is only available with Administration privileges, ref 3.6. This screen is used for speedlog sensor troubleshooting and processing setup. The processing setup is accessible in the Service mode only. Three frames indicate the digitized receiver signal either in frequency domain or vs time, which greatly facilitates troubleshooting. GPS information is indicated in the upper line.

Alert indicator Screen Dump, Time and water temperature
Transceiver setup (service function), Stop update, toggle frequency/time domain

Digitized longitudinal signal, in frequency or time domain

Digitized transversal signal, in frequency or time domain

Vertical scale in AD counts: touch to change

Digitized transmitter signal, in frequency or time domain

4.9 Speedlog test and troubleshooting screen (screen 8)

Note that this screen is only available with Administration privileges, ref 3.6.
This screen shows the results of the self-test functions built in to EMES60. All important parameters are collected and displayed on this screen. The status of all units is checked every 10 seconds and displayed in the monitoring window every 10 seconds. In case of abnormal operation, the data is displayed immediately and the malfunction alarm is given.

**Self-test measurement results:**

**Troubleshooting output log:**
Press to freeze and scroll up/down to see more results
4.10 Speedlog calibration screen (screen 9)

Ref section 5 for speed calibration procedure details.
5 Calibration

5.1 Calibration

5.1.1 Speed log Calibration

The electromagnetic speed log can be affected by magnetic materials near to the sensor. It is therefore necessary to calibrate the sensor after it has been installed. This is done by running the vessel back and forth over the same line on the seabed several times, and entering the data from these calibration “trips” into a calibration table. EMES60 uses the data in the calibration table to correct the speeds measured by the speed log.

See section 5.10 for instructions on using the speed log calibration screen.

Speed log calibration is typically done during vessel sea trials. A typical calibration sequence is as follows.

1. Choose a sea area to run the calibration trips. This needs to be in open water, where the vessel can run between two defined points, one nautical mile apart, at a range of speeds up to 75% of the vessel’s maximum speed. The effects of wind and tidal currents should be minimized.
2. On the Speed log HMI, open the Speed log Calibration Screen.
3. Select two points (which we will call point A and point B for the purpose of this description). The points should be exactly 1 nautical mile apart (although other separations can be selected if required: touch the distance indicator at the top of the calibration screen to enter a new trip distance).
   Most users enter these points on the ship’s GPS plotter, although it is perfectly possible to set up points using transits by aligning landmarks from a paper chart, and measuring the distance from the chart.
4. Line up the vessel on a straight course from point A travelling at approximately 25% of the ship’s maximum speed. When point A is reached, press the trip start button.
5. The progress along the first leg of the trip is shown as a progress bar above the distance indicator. This progress is derived by integrating the speed log speed, so it might not be exactly correct yet.
6. When the GPS plotter (or selected external navigation tool) indicates that point B, the end of the calibration trip, has been reached, touch the trip stop button.
7. The trip start button will now be flashing, waiting for the return leg of the trip. Turn the ship around, head back down the same calibration line at the same speed. Press the trip start button at point B, and the trip stop button when point A is reached.
8. The software now gives the prompt message: “Set results in calibration table?”
9. If you are confident that the results are good, select Ok, then use the drop-down list to select a column number in the Calibration table. The
Calibration table is shown at the bottom of the Calibration screen. You can either write to an empty column, or over-write the data that is already in a column.

10. Alternatively, you can postpone the entry of the calibration trip data by pressing **Cancel**, and then check the trip data before using it. This method is recommended at least for the first time that the speed log calibration is done. Look at the data from the latest trip, which will be shown highlighted in the Calibration trips table. Look at the following values, and check that they are within the limits of what you would expect:

   a. **Trip time** and **Trip date**, which should match the time that the trip was run
   
   b. **Ref. Leg1** shows the speed of the first leg of the trip (from A to B) calculated from the distance that was entered in step 2 above and the time taken to run the leg.
   
   c. **Log Leg1** shows the speed of the first leg of the trip as measured by the speed log.
   
   d. **Ref. Leg2** and **Log Leg2** show the same information for the second leg of the calibration trip.
   
   e. **Ref. Aver** and **Log Aver** show the reference and speed log speeds, averaged between the two legs of the trip.
   
   f. **Dist Leg1, Dist Leg2, and Dist Aver** show the distances for the two legs, and the average, as computed from the speed log speed.
   
   g. **Drift** shows the angle between the forward and sideways velocity, again for the two legs and the average between them.

11. If these values all seem to be acceptable, touch the column to select it, and touch the Calibration Trip Use button.

12. You will be given the prompt message: “**Set results in calibration table?**”, just as in step 8 above. As described in step 9 above, you can put the values into a selected column of the Calibration table.

13. Check that the values in the calibration table match what you expect for the calibration trip:

   a. **Ref.** shows the reference speed for the trip, computed from time and distance
   
   b. **Log** shows the speed from the trip as measured by the speed log before calibration.
   
   c. **Drift** shows the angle between forward and sideways speed components for the trip.

14. Repeat the process, from steps 4 to 13, A to B and back again, this time at 50% of the ship’s maximum speed, and again for 75% of the maximum speed. Enter all of the values into the Calibration table. The table has five columns, allowing you to run two more lines at different speeds if you wish.

The Calibration table shows un-calibrated forward and sideways speeds on the left of “Calibration table” and the calibrated results on the right, so that you can see what the effect of the table is at any time during the process.

If one of the calibration trips doesn’t work well, select it by touching it, and press the Delete button to remove it from the table.
If one of the columns in the Calibration table is bad, you can:

- Over-write it from one of the columns in the Calibration trips table (see step 9 above), or
- Stop is being used in calibration calculations by selecting any one (or all) of the values in the column by touching it, using the “backspace” key to delete the value. Columns with any one of the three values blank are not used; or
- Touch a value in a table to edit it (see below to see how this might be used).

When the calibration process is complete, if there is a printer fitted to the system, use the Print button to make a print-out of the calibration data as a record of the process.

It is strongly recommended that the full calibration process is followed as described above. However, alternative methods are possible:

- One-way trips: if it is certain that there is no effect on water speed from wind or tide, you can use the results from one direction only:
  - At the end of the first run (A to B) touch the end run button as usual, and then use the Trip Use button to use the data from the run so far.
  - The Start button will now be flashing, waiting for you to do the return (B to A) trip. You can clear this flashing as follows: touch it, to start a “dummy” trip, then touch the End button, and select “Cancel” from the “Set results in calibration table?” prompt.
- Use GPS speed data; this is ground speed, so only matches the true water speed if there is no tidal current. But if this is the case, then you could create a column in the Calibration table as follows:
  - Touch the Ref. field and use the keypad to enter the GPS speed that is shown in the top-left of the window.
  - Touch the Log field and enter the raw value from the speed log: this is shown to the left of the Calibration table header.
  - Enter zero (or a true value if known) into the Drift field. Blanks in any of the fields cause the column to be ignored in the calibration calculations.
## 6 Specifications

### Performance

<table>
<thead>
<tr>
<th>Echosounder</th>
<th>Speed log</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy</strong></td>
<td>0.05m or 0.5% of depth, whatever is greater</td>
</tr>
<tr>
<td>Resolution digital out</td>
<td>0.01m</td>
</tr>
<tr>
<td>Resolution screen presentation</td>
<td>Depth &lt; 100m : 0.1m Depth &gt;=100m : 1.0m</td>
</tr>
<tr>
<td>Range of measured values</td>
<td>0.7m-400m</td>
</tr>
<tr>
<td>Temperature Accuracy</td>
<td>Temperature sensor accurate to 1°C</td>
</tr>
</tbody>
</table>

### Display Unit (separate unit for each sub-system)

| Resolution | 800x480, 7” WVGA |
| Operator interface | Touch screen, tap & swipe operation |
| Communication line | RS422, Optional RS232 |
| Day/Night modes | Full range of backlight adjustment day/night color themes selection. |
| Software upgrade means | USB line, USB flash device, Ethemet |
| Supported languages | English, Norwegian, German, French, Spanish, Russian, Chinese |
| Calendar, clock | Real time clock support or GPS time reference. |

### Environmental

| Cutout dimensions | 137x185mm, depth 36mm |
| Operating °T | -15 - +55°C (storage -20 - +60°C ) |
| Weight | 0.7kg |

### Compass safe distance

| Standard : 65 cm, Steering 40cm |

### Interface Unit (separate PCB for each sub-system)

| External communication line | NMEA0183 rev4, IEC 61162-1/2 inputs/3 outputs |
| Analog | 1 output, 10Vpp or 4-20mA, fully programmable |
| Alarm relays | 2 Mechanical relays, one dedicated system power failure alarm |
| General purpose Input | 2 digital inputs (for synchronization, slave mode), fully programmable |
| General purpose Output | 2 optocoupler outputs, fully programmable |
| Software upgrade means | USB line, USB flash device, Ethemet |
| Environmental | IP55 |
| Operating °T | -15 - +60° |
| Dimensions, mm | 150x300x120 |
| Weight | 4kg |
| Compass safe distance | Standard : 130 cm, Steering 80cm |

### Dual Sensor with Cable

| Cable length | 40m (optional 40m) |
| Communication link | IEC 61162-1/2 |
| Environmental | IP68, 6 bar continuous immersion in water |
| Operating °T | -5 - +60° |
| Sensor Dimensions | H = 124mm, D = 60.2mm |
| Weight (with cable) | 7kg |

### Hull fitting unit (ball valve)

| Hull type | Single and double |
| Body material | Stainless steel |
| Pressure rating | 10 bar |
| Operating °T | -5 - +60° |
| Weight | 18kg |

### System Power Requirement

| Mains | Nominal 115V to 230V/103.5V to 242V, 47.5Hz to 63Hz |
| DC | Nominal 24V: 21.5V to 31V |
Power: 6 W, speed log: 6 W, HMI units: 12.8 W maximum each