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# EML1100/1200 Electromagnetic speed log


# User Manual

Part number DM-I001-1.5.2023 Preliminary

Software version 1.0.0

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# Contents

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# 2.1. S- Introduction

The EML1200 is a graphic speed through water only speed log consisting of a display, an optional electronic buffer unit, and a 60mm sensor- The sensor can be mounted in a valve (recommended for easy cleaning and maintenance), or in a tank. A number of retrofit solutions are designed allowing it to replace an older unit.

The User interface is Openbridge web based and can be called up on any terminal within the same network.

The system can be purchased as a 2 axis system (EML1200) or as a lower cost single axis system (EML1100) As the hardware is the same on both, the EML1100 can be upgraded to EML1200 at a later stage using a pay option.

# 2.2. S- EML Principle of operation

The Electromagnetic Speed log is a compact 2 axis speed through water speed log, The system introduces an electrogmnetic filed into the water just infront of the sensor, and using flemmings right hand rule, detects a current between electrodes on the front surface of the sensor.

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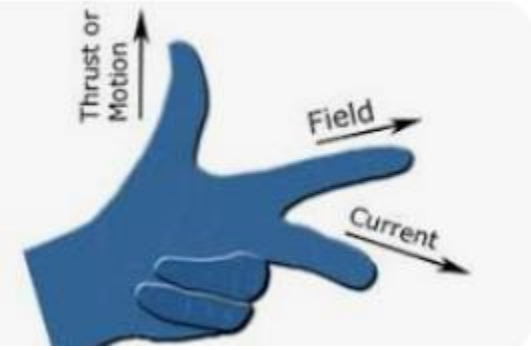


This means the system gives an accurate 2 dimensional measurement of the speed of the vessel through the water at the surface of the sensor/vessel hull. As the hull can drag some water with it, a calibration is needed to adjust for both angular mounting errors of the sensor, and speed differences between the sensor reading and the actual speed through water at different speeds.

# 2.3. Terminology

### 2.3.1. Units

| Parameter | Unit | Abbreviation |
|---|---|---|
| Distance | Nautical Miles | nm |
| Speed | Nautical miles per hour | kn |
| Pulse speed | Pulses per nautical mil | p/nm |
| Temperature | Degrees celsius | °C |

### 2.3.2. Abbreviations

| Abreviation | Meaning |
|---|---|
| STW | Speed of vessel relative to the water |
| SOG | Speed of vessel relative to the Sea bed (Ground) |
| Temp | Temperature |
| Trip | Daily trip counter (resetable) |
| Total | Total distance sailed since installation |
| LAN | Local area network |
| NMEA | serial communication standard equivilent to IEC61162-1 |
| | |

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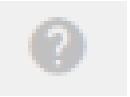
| Symbols | | | |
|---|---|---|---|
|  User admin |  Silence alarm |  Adjust parameter |  Open help information |
|  Menu |  Auxiliary information |  Open setting menu |  Set standby mode |
|  Alert information |  Expand Menu |  Sideways direction |  Fore Aft direction |

### 2.3.3. Alert Symbols

| Symbol | Status | Sound |
|---|---|---|
|  | Unrectified, ,Unacknowledged | 2 beep repeated after escalation time |
|  | Rectified, Unacknowledged | No beep |
|  | Unrectified, Acknowledged | No beep |
| | Rectified, acknowledged (Normal) | No beep |

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| | | |
|---|---|---|
|  | Silenced alert | No beep for 300 seconds |
|  | Responsibility transferred | No beep |
| | Caution | No beep |

# 2.4. C- Physical Installation

### 2.4.1. H- Installation of the screen

Packing list for this system is as follows:

| Part number | desciption | number of |
|---|---|---|
| CU-M001-ZA | 10.1” Display including plus for 5 connectors (mounted) | 1 |
| M-Kit-CU-M101 | Mounting kit containing:<br>• tapping mounting screws<br>• mounting bolts<br>• cable ties | • 6<br>• 6<br>• 6 |
| M-Kit-CU-XBEEP | Buzzer on cable with plug | 1 |
| Getting started sheet | A Sheet with QR codes to the latest manuals, and installation guides. | |

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| | | |
|---|---|---|
| Sensor in mounting | EML224SXX-SD where XX =<br><br>• G for gate valve (1,2)<br>• T for combo tank (6)<br>• DB for 100mm seavalve(3,4,5)<br>• STA for aluminium tank(7)<br><br>(number is the valve it fits in)<br><br>**Retrofit versions**<br><br>• SN for Simrad NL<br>• SNFIII for naviknot III<br>• STXM19 for XM-19 tank<br>• SV for Naviknot SRD331 or 450D<br>• SX for skipper PCSV60 valve<br>• others may follow | 1 |
| Optional extras | | |
| Sea valve or tank | one of if not retrofit:<br><br>1. SB-60-SA 60mm seavalve (recomended)<br>2. DB-60-SA 60mm double bottom seavalve<br>3. SB-100-SB 100mm seavalve<br>4. DB-100-SB 100mm double bottom seavalve<br>5. SB-100-SA 100mm gatevalve<br>6. ETNSTC Steel tank<br>7. ETNALC Aluminium Tank | optional |
| M-KIT-CU-IP56 | rear mounting kit for IP56 | optional |
| GC-202-SA | isolator for USB connections | optional |
| JB40Pow-SA | Electronic buffer unit | optional |

The Display is a 10.1” display and can be mounted from the front (IP22) or from behind (IP56).The connections can be fastened using provided cable ties. The screen should be firmly grounded to the ships chassis.

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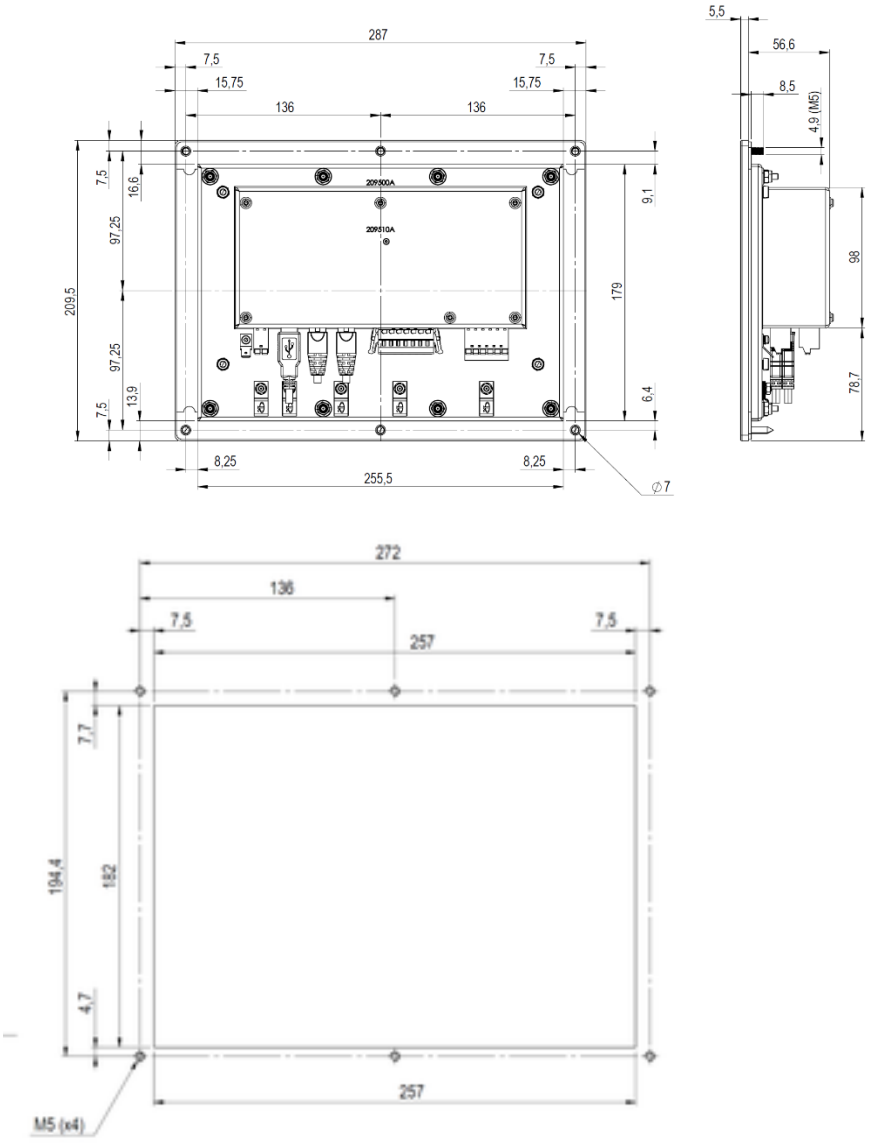


For rear mounting or if IP56 is required the display should be back mounted using CU-IP56 clips (Art number M-KIT-CU-IP56).

2 sets of screws are provided, self taping for wood (Art number XXX) for soft surfaces, and bolts for mounting to metal plate (art XXXX) as shown on the exploded view below.

If Alerts are to be signaled from this unit, and the unit is flush mounted to a console the supplied external beeper will ensure the high enough volume. If the unit is stand alone, the internal beepr is loud enough on its own.

The provided Beeper (Supplied with the display), and should be attached to a prepared, clean area on the rear of the console, with an 8mm hole, using the tape provided.

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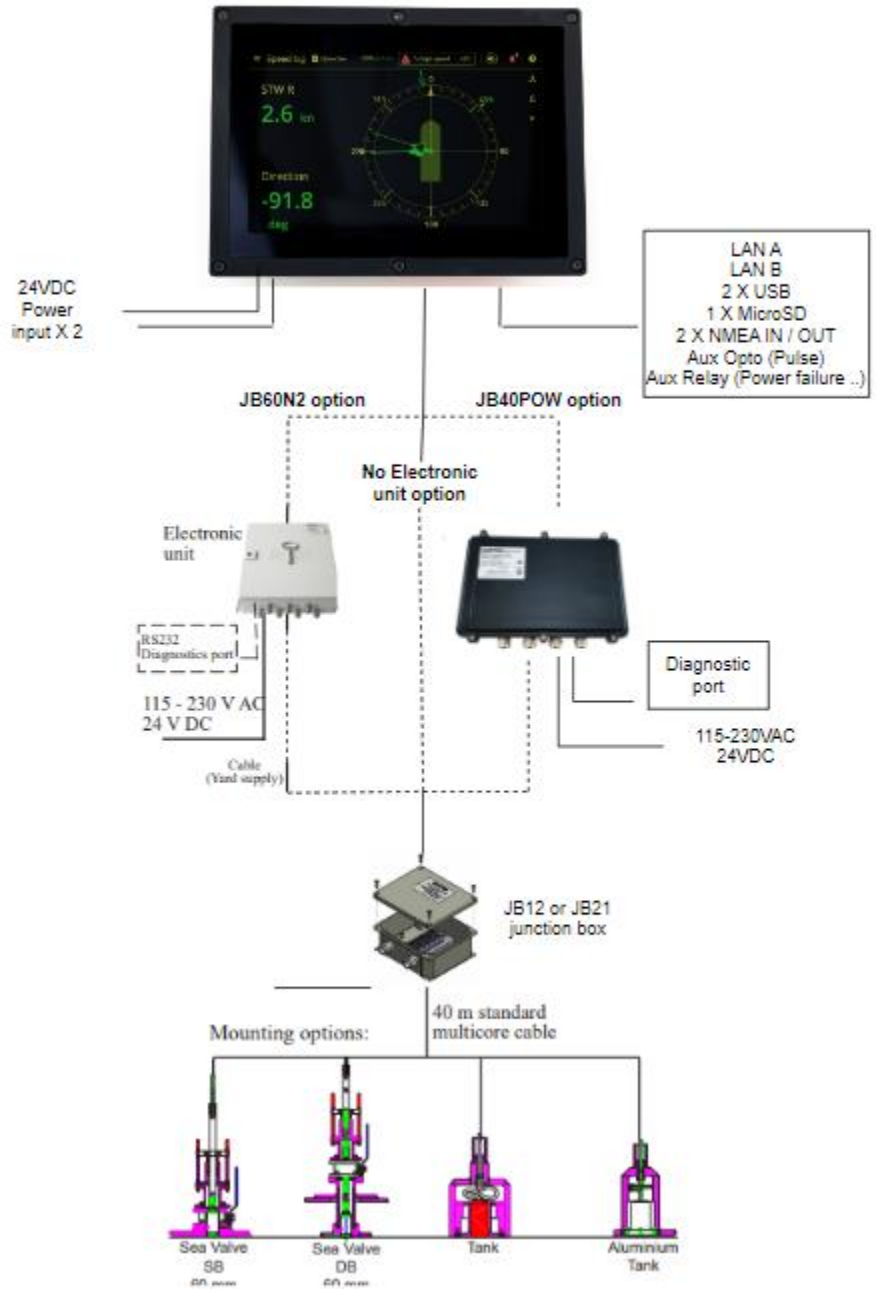
## 2.4.2. H - Connection of the system



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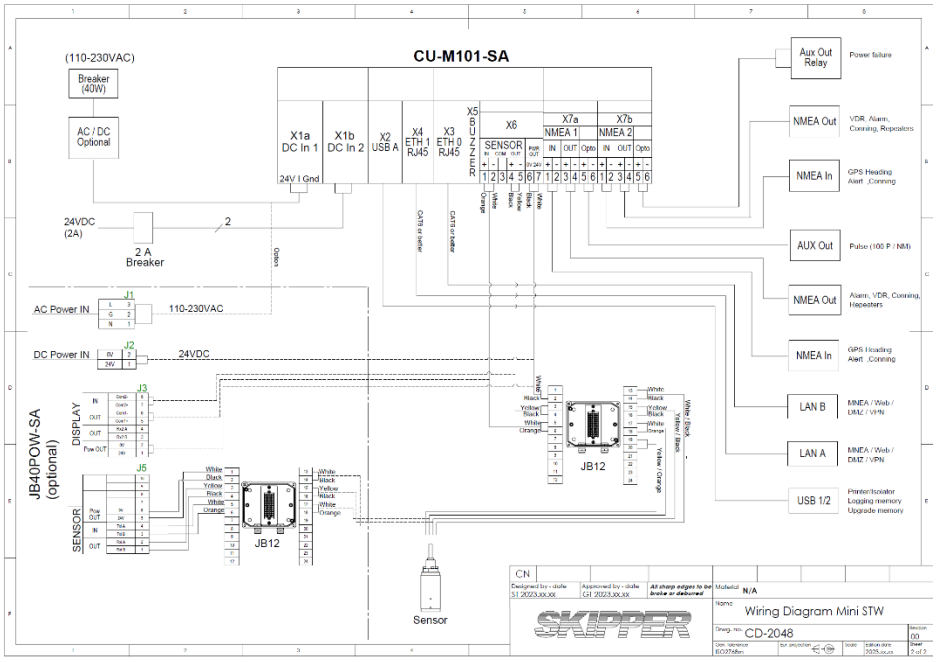


Connection can be direct to the sensor from the sensor port, or via an optional JB40 Electronic buffer unit. The JB40 unit can be mounted near the sensor or on the bridge, and provides a buffer and diagnostic port for the unit.

### 2.4.2.1. C- General Cabling

Cables between the system electronics and the rest of the vessel should use standard twisted shielded yard supply cabling, Shield of the cables should generally be connected to the grounding points.

The connectors in use on the Display unit a of type

| Connector type | Connector plug | Wire type | manufacturers part nr | picture | provided |
|---|---|---|---|---|---|
| X1a , X1b | 2 pin spring connector, for power | Screened 0.5-2.5mm² | Degson 2EDGKD-5.08-02P-14-00A(H) Part Nbr. 10020000581 |  | 2 |
| X2 | USB | All USB type A | All accepted, Note: USB memory should not have - voltage connected to chassis, for permanent fixtures use isolator Pnr. GC-202-SA |  | No |

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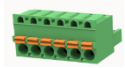
| | | | | | |
|---|---|---|---|---|---|
| X3, X4 | Ethernet RJ45 | CAT6 or above, max 100m | 8P8C connector with ANSI/TIA T568A/B pin assignment - All accepted (screened or not screened) |  | No |
| X5 | External beeper | 3.5mm mono jack | all accepted, but provided as part of M-KIT-XBEEP |  | 1 |
| X6 | 7 pin Spring connector for Sensor | 0.5 to 2.5mm² see table below | Wago MCS MIDI Classic 231-307/037-000 Part Nbr. 51117461 |  | 1 |
| X7a, X7b | 6 pin spring connector for NMEA and Aux | 0.5-2.5mm² | Degson 2EDGKD-5.08-06P-14-00A(H) (Part Nbr. 10020000585) |  | 1 |

Wires should be terminated with appropriate crimp pins cables size should be 0.2-2.5mm2 (28 to 12 AWG)

### 2.4.2.2. H- Connecting to the Aux outputs

The Display has 2 Aux outputs:

The connector X7a has an opto isolated output, used for Speed pulses, this requires a voltage on the input of at least 3.3VDC, and this will be switched up and down to provide a speed

Connector X7b has a normally closed relay, that can be used for Power failure alarm (closed circuit when no power),

Both connectors can be used for other functions defined in the AUX setup screen.

### 2.4.2.3. C- Network cables

Standard network cables can be used from the system using RJ45 connectors. we recommend Cat 6 or better cabling. Network cables should not be more than 100m in length.

### 2.4.2.4. C- Cabling to the sensor

The sensor is supplied with 40 m of cable. This should be guided to a dry area where a junction box (yard supply or SKIPPER part JB12) should be used to extend the cable to the bridge. The sensor is a smart sensor and outputs propriety NMEA messages. This standard is based on RS-422, so cable lengths should not be a problem. The cable can be cut or extended. However, power is sent down the cable and the sensor should have at least 16 V at the sensor junctions box

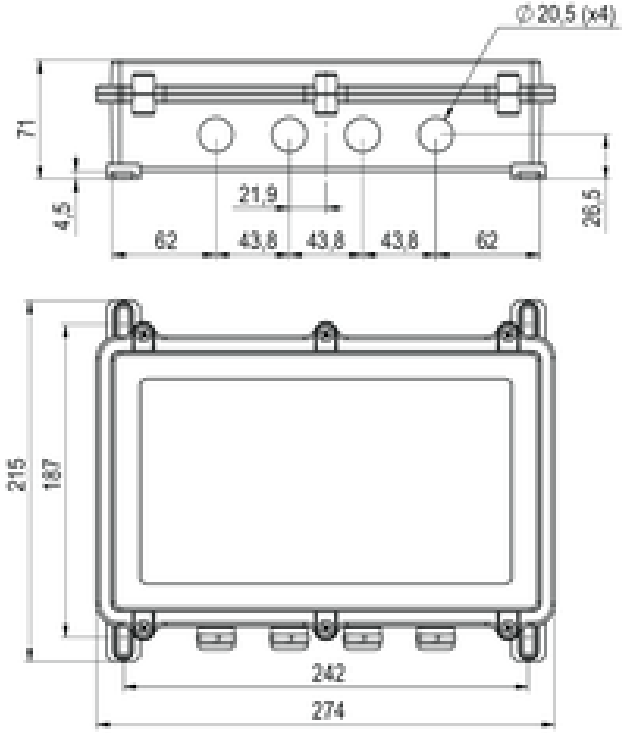
to function normally. If the voltage is low we recomend using the JB40POW unit as a buffer for both signals, but also AC can be fed to the unit to boost the sensor power.

#### 2.4.2.4.1. Cable Dimensions

| Cable length | Cable type | alternative |
|---|---|---|
| Up to 40m | Use supplied cable | |
| Up to 100m | 4 Twisted pairs min 0.5mm² | |
| Up to 200m | 4 twisted pair min 0.8mm² | |
| Up to 400m | 4 twisted pair min 1.5mm² | use 0.8mm² with JB40Pow in middle with AC power cable. |
| Upto 600m | Use 1.5mm² and JB40Pow with AC. | |

Although the signals on the cable are digital, it is recommended to avoid electrically noisy areas such as pneumatics and generators.

### 2.4.2.5. Optional JB40 unit



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## 2.4.3. Power requirements:

The Display unit and sensor can be powered by 24V from the display, The JB40Pow unit can be used as a AC DC converter, so that the display is connected powered from the JB40POW, alternatively the JB40Pow can be powered from the display. Normally the power to the whole system should be from a circuit breaker near the bridge (2A rating or 50W rating)

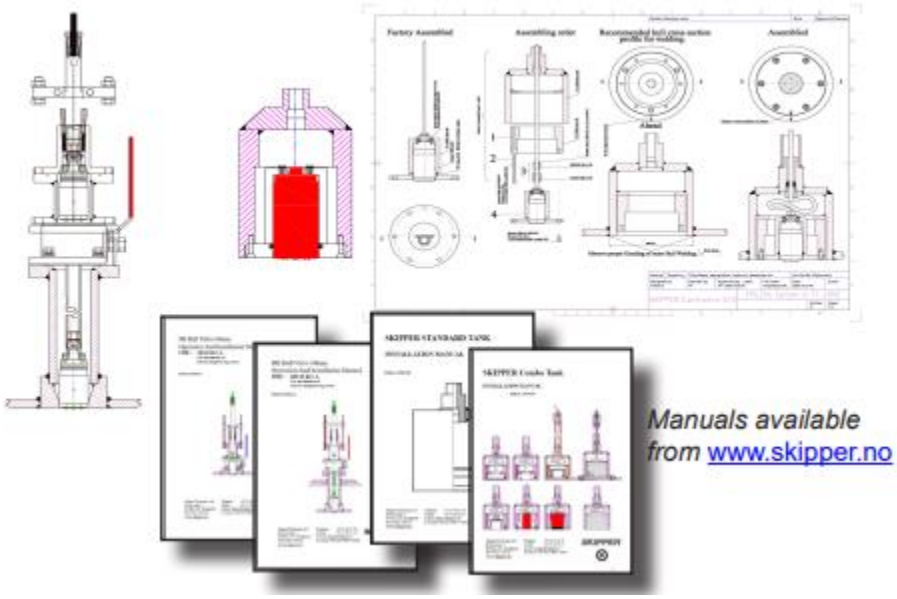
## 2.4.4. F- Installation of the sensor and metalwork

### 2.4.4.1. Mounting of the metalwork

This must happen in dock and care should be taken to mount the valve/tank such that the sensor will be flush with nothing to cause turbulence near the sensor. The sensor should be mounted forward in the vessel, preferably just behind the bulb.

**Important: Tank mountings have an orientation (an arrow that must point forward).**

The sensor is fully water tight and can be mounted in wet areas such as ballast tanks. Please see the separate mounting user guide for more details.




### 2.4.4.2. C- Sensor location.

For proper operation, the sensor should be installed close to the bulb or the bow of the ship, avoiding areas where it may be damaged by the anchor chain. It is, of course, necessary to select a part of the hull that is submerged under all load and speed conditions.

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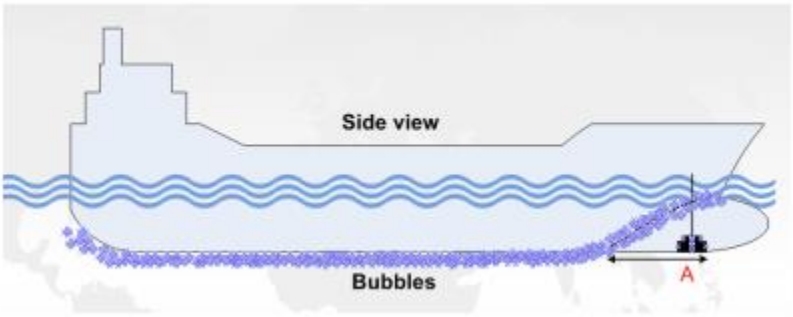
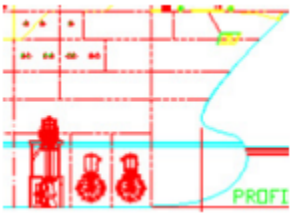



For 2 axis speed logs the transducer should be positioned as deep as possible on the hull. The transmitting surface of the transducer must be installed horizontally.




A typical recommended area for installation is fore part of the bow thruster room. The sea valve with sensor can be installed in a ballast tank, but it is not recommended. It is necessary to position the sensor on a hull section which will ensure a laminar water flow for all angles of measurement. If such a flat section is not available, the shipyard must construct a suitable bed. If the vessel is designed with a box keel, this can be used for installation of the sensor. In this case, special length hull fitting and sensor may be ordered from SKIPPER. Before hull fitting installation procedure is initiated, always check that the hull fitting valve can be properly operated and that the sensor can be removed in the selected location. See installation manual for the valve solution for more information.

### 2.4.4.3. F- Sensor mounting

Please see the installation manual for the valve. Installation may differ between the different valve solutions available.

The sensor can be mounted and powered in air and water. Briskly rubbing the face of the sensor will show changes in values in the speed. It is very important that the sensor is mounted in the correct orientation, (especially single axis units). In a tank, the arrows should point forward. On a ball valve, the flat area should point on the port side.

**Tip:** Placing a large flat straight pole on the flat area will allow accurate adjustment. Alternatively a laser level can be used to get accurate orientation on a remote bulkhead.

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Small errors in angle can be calibrated, but care should be taken to get this as accurate as possible. Each time the sensor is lifted or repositioned, the angular offset should be checked.

#### 2.4.4.4. S- Sensor maintenance

The EML sensor requires regular cleaning as growth on the front of the sensor will show slower speeds. The calibration can be adjusted to compensate.

**Do not paint or coat the front of the sensor**

# 2.5. Integration to the vessels navigation system

the EML1100/1200 are designed to simply integrate in the modern bridge. The unit supplies 2 networks, 2 NMEA input and output, an Aux-pulse and Aux-relay output. In addition 2USB's can be used for connection to memory stick or printers. USB is tightly controlled.

All settings on the system are password controlled with 4 levels of security.

- No user: view only
- User: Control operational functions
- Service: Change settings
- Admin: as service but with User configuration control.

All levels above user will default to user after 6 hours with no interaction.

### 2.5.1. C- System selection on startup

The EML1200 can be supplied fully setup, or the system type can be selected on site using a code number. If the system has not been setup a setup screen will show on startup. Here you must enter the supplied code for the system and then the system will setup. If this code is not availalble it can be downloaded from skipper website or by using the QR code that shows on the screen.

### 2.5.2. C- Connecting to the bridge network

The System is built up to meet many of the current and future cybersecurity standards, although the obligatory standard is IEC-61162-450 and IEC61162-460. The system is set up with a secure area and public area. The vessels network only has access to the public area. All data not following the -450 standard will be encrypted.

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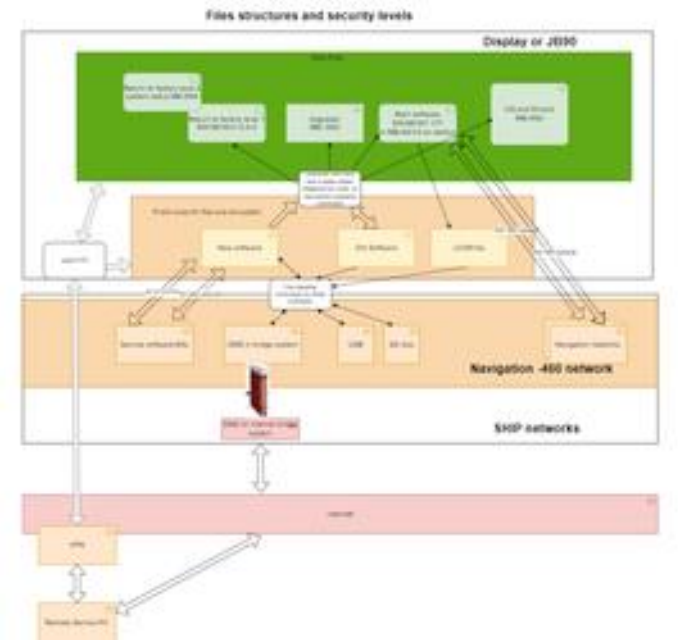


### 2.5.2.1. C- Network

The system has 2 independent network ports, both communicate with both TCP/IP and multicast (UDP) (IEC61162-450) this allows the system to be connected to the ships internal networks.

The system will exert a maximun load of of ??20??kB7s (kilobytes per second) and will tolorate a data traffic of up to ??20??Mbits per second. The system will exert/receive a maximum load of ??40?? datagrams/second.

IP Address: The IP addresses can be assigned in the communication setup pages, but are by default 172.16.1.50, and 172.16.2.51.

SFI (System Function ID): Each device has its own identifier (SFI) and the systems can then identify who they are and who they are talking to. These should be unique within a vessel and will start with an identifier of VM. Default is VM0112

The system contains a log of errors following the IEC61162-450 standard. This can be accesed by sending the following command to the systemPSKPVMPCGTERR,9*nn This will return error numbrs 70-84 with the number of occurences

| |
|---|
| $PSKPERRORTABLE,70,71,72,73,74,75,76,77,0,0,0,0,0,0,0,0,0*1E where the following 0, indicate the number of occurances |
| $PSKPERRORTABLE,78,79,80,81,82,83,84,0,0,0,0,0,0,0*23 |

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| Error number | Error type | Error number | |
|---|---|---|---|
| 70 | Too long UDP message or checksum error | 78 | Total rejected messages |
| 71 | Error missing tag or tag checksum | 79 | Header (Wrong UdPbC) |
| 72 | Error in tag format (only s:,n:,d:,g:, tag not =0000, n=4 digits) | 80 | Image Block size error |
| 73 | Tag framing errors /missing or empty tag, ,, or too long tag (>80) | 81 | Missing Datagram |
| 74 | incorrect NMEA length (overflow) | 82 | Invalid Header (RaUdP) |
| 75 | UDP datagram length (overflow) | 83 | Udp Overflow (>1460 Byte) |
| 76 | Error in msg format; no $ or !, no CRLF, ID not 5 characters (except $P) | 84 | Total Rejected |
| 77 | Bad sensor data (too low quality) | | |

#### 2.5.2.2. C- DMZ

The Ships DMZ is intended to be used for transfer of data and software upgrades. These functions are still under development . Contact SKIPPER for more details.

# 2.6. C- Setup of users and options

## 2.6.1. C- Setup of Users

The system is supplied with 2 users Admin with password Admin Service with password Service and User with password User. These should be changed.

The default is NoUser , and clicking on the user icon will allow a password and username to be entered / changed.

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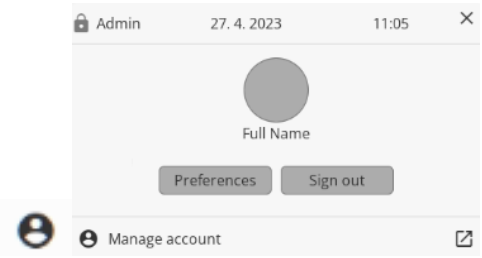


The Admin user on entering manage account option will be allowed to administrate users and add options. Other user levels will have be able to change their passwords.

Passwords can be changed from a central system using encrypted commands.

### 2.6.2. C- Setup of the system options

System options are selected from the Admin manage account page. Adding the correct code within the password/code field will enable or disable the options. On enabling, the features of these options will become available within the setup screens and can be individually activated or disabled.

#### 2.6.2.1. S- Available Options

##### 2.6.2.1.1. S- Option EML1200

If the system is setup to EML1100 (single axis) then using a pay code, the second axis can be activated. Part number ??EML1200-opt??

##### 2.6.2.1.2. C- Option Reverse

if selected the system is installed on a vessel that can sail at full speed in both directions. This switch turns the bow and stern, and rotates the Axis of the system, it is triggered by NMEA message ‘EPV’, (or AUX input if available).

The command to reverse the vessels direction (when the option is activated) is

$--EPV,R,VM,121,50,Y*nn for rotated direction and $--EPV,R,VM,121,50,N*nn for Normal direction

## 2.7. C- Setup screens and configuration of the system

### 2.7.1. C- Set up of the network, serial and other communications (Communication setup)

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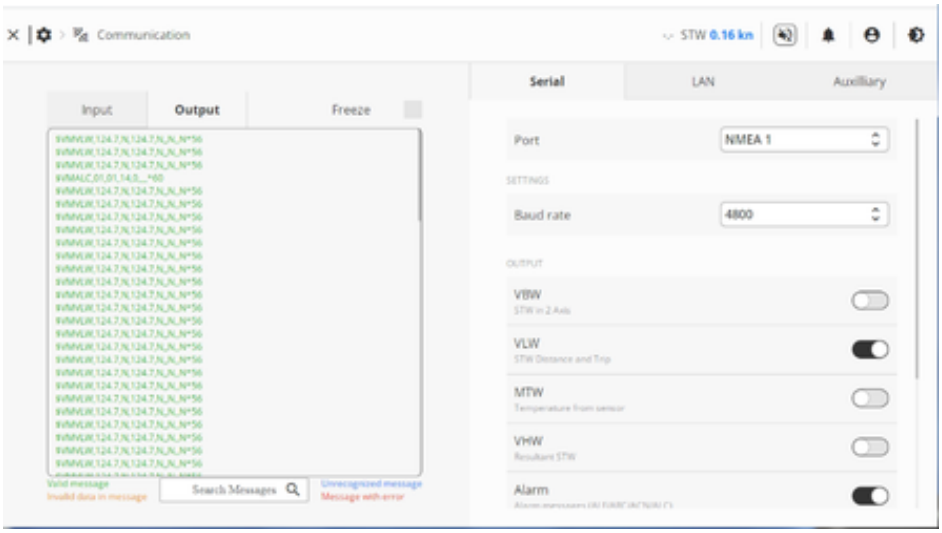
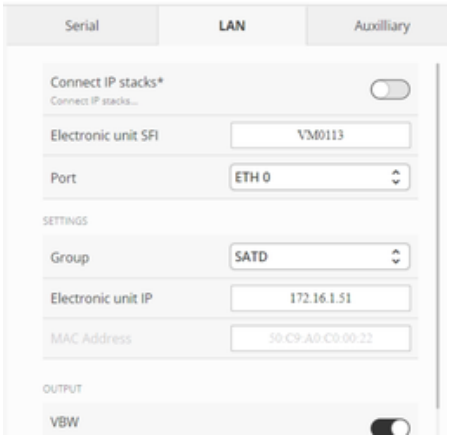



The left side of the display shows a terminal emulator of the information arriving or leaving the system. The user can change from output to input, freeze the screen or filter for a particular message. The colour code of the messages will show their validity.

The Right side has 3 tabs, one for each Communication form.

Serial allows you to choose the Port number, the baud rate (same baudrate for input and output) and select the sentences to be sent. The standard communications the NMEA outputs are 4800, 8 data bits, 1 stop bit.




The LAN settings allow System function ID (SFI to be set (the same on both LAN ports), the transmission Group and the IP to be set. The 2 IP addresses cannot be within the same domain defaults are 172.16.1.50 and 172.16.2.51.

If the user is using only 1 network, then the 2 connectors can be connected so that they share the same IP address as ETH0.

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### 2.7.2. S- Output formats

All serial outputs can transmit the following IEC61162-1 (NMEA 0183) outputs:

| Sentence | contents | Format example and explaniation |
|---|---|---|
| VBW | Dual speed forward and aft<br><br>ID VM indicates at sensor<br><br>Id II indicates calculated at bow or CCRP (see option in Runtime screens - General | $VMVBW,X,Y,A/V,,,V,Z,A/V,,V*nn<br><br>• X is Longitudinal water speed<br>• Y is Forward Transversal water speed<br>• Z is Aft Transversal water speed (if Heading/ROT is avialble<br><br>**$VMVBW,10.1,0.5,A,,,V,,V,,C*58** |
| VLW | Water Trip and total | $VMVLW,Trip,N,Total.N,,N,,N*nn<br><br>• Trip - Daily trip through water - resettable on menu<br>• Total - Total distance run through water - non resettable<br>• N indicates Unit Nautical Miles<br><br>**$VMVLW,1208.9,N,1210.N,,N,,N*56** |
| MTW | Water temperature | $VMMTW,XX.X,C*nn<br><br>• XX.X is the temperature<br>• C indicates °Celsuis<br><br>**$VMMTW,13.8.C*02** |
| VHW | Resultant water speed | $VMVHW,,T,,M,XX.X,N,YY.Y,K*nn<br><br>• XX.X Speed in Knots<br>• YY.Y Speed in km/h<br><br>**$VMVHW,,T,,M,10.8,N,20.0,K*45** |
| Alarm | Alert outputs (ALF, ARC,ALC) | |

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| | | |
|---|---|---|
| DDC output | Dimming output | |
| Combined VBW | make a single combined output using this sensor and external SOG sensor | $IIVBW,X,Y,A/V,D,E,V,Z,A/V,F,V*n<br><br>As normal VBW, but a received VBW, for an external Ground speed log (information D,E,F) will be inserted. In this way a combined message can be sent. |
| Combined VLW | | $VMVLW,Trip,N,Total.N,Ground trip,N,Ground Total,N*nn<br><br>A received VLW message containing ground trip and total will be included. |

### 2.7.3. C-Accepted inputs

The following inputs are accepted by the system

| Sentence | contents | Format |
|---|---|---|
| VBW | SOG part of this sentence | To follow |
| ACN | Alarm acknowledge | |
| ZDA | Clock date and offset<br><br>(Recommended) | |
| GLL | Position and time | |
| RMC | position speed and time | |
| GGA | position and time | |
| VTG | Speed SOG/COG | |
| XDR | Direction (For reverse) | |
| MWD | wind direction | |
| MWT | wind true | |
| MWV wind velocity | | |
| | | |

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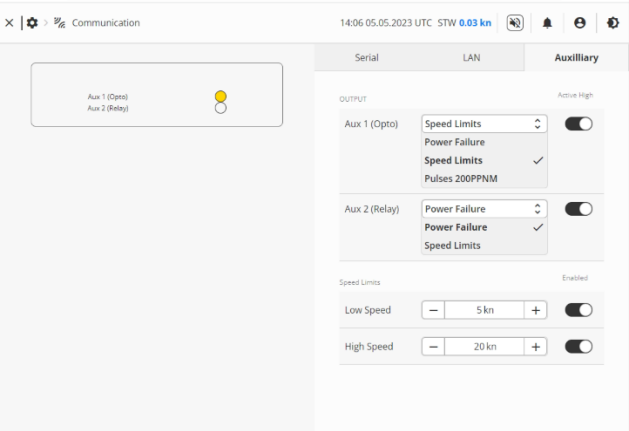
## 2.7.4. S- Auxilliary outputs

The system has 2 auxilliary outputs

- Aux 1 on connector X7A is an opto-isolated output that can be set to Pulse speed output, Power failure or Speed limit output
- Aux 2 is a relay output that is limited in use to Power failure or Speed limit

The speed limit allows the user to indicate as the vessel passes through a speed. This is commonly used for stabilisers or rudder limiters.




### 2.7.4.1. C- Speed limits output

THe speed limit output allows the system to indicate by TTL level when the vessel rises above, or falls below a set speed. There is a high and low, allowing a speed zone to be set, these can also be enabled/disabled if only one speed needs detecting. Although similar to the speed alerts, this function does not generate an alert.

## 2.7.5. C- Setup of the System parameters

The system requires some information about the vessel it is mounted on. This menu allows you to adjust the following

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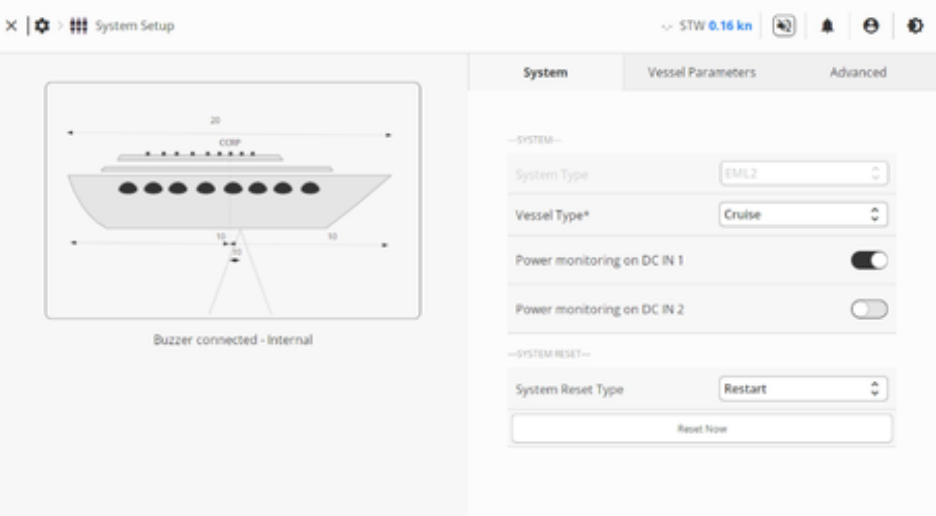


The vessel on the left shows the vessel and the mounting position of the sensor, also the selected buazzer configuration

| Tab - System | Function | Extra information |
|---|---|---|
| System Type | | |
| Vessel Type | | |
| Power monitoring 1 | | |
| Power monitoring 2 | | |
| system reset dropdown | Restart<br><br>All except calibration/IO<br><br>Factory | a selection of the type of reset to be performed. Once selected Reset now button triggers the reset. A hardware reset feature is also available (in diagnostics section) |
| Reset Now | Perform the reset now. | |

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| Tab - Vessel parameters | Function | Extra information |
|---|---|---|
| Max Speed | The Max speed to be displayed on graphical elements | |
| Sensor to CCRP | Distance from the sensor to steering position | |
| Bow to CCRP | Position of steering position relative to the Bow | |
| Stern to CCRP | Position of steering position relative to the Bow | |
| Vessel tonnage | Deadweight of the vessel | Used for filter adjustment |
| Sensor mounting | Mounting type | Used to allow simpler service or sensor replacement at a later stage. |

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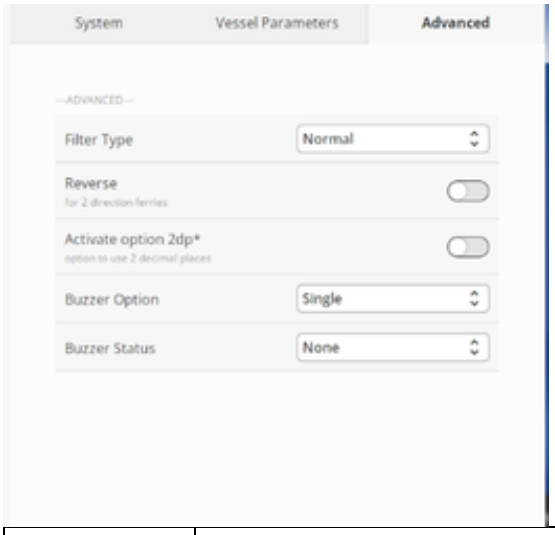


| Tab - Advanced | Function | Extra information |
|---|---|---|
| Filter type | The Max speed to be displayed on graphical elements | |
| Reverse | | |
| Activate 2dp | | |
| Buzzer option | Disable the internal buzzer | requires an option code*, can be disabled if an external BAM system is in use |
| Buzzer status | None, interna,l externa,l both, | giving dofferent sound levels (requirement is 75 to 85 dBA) which is correct if the external buzzer is used. |

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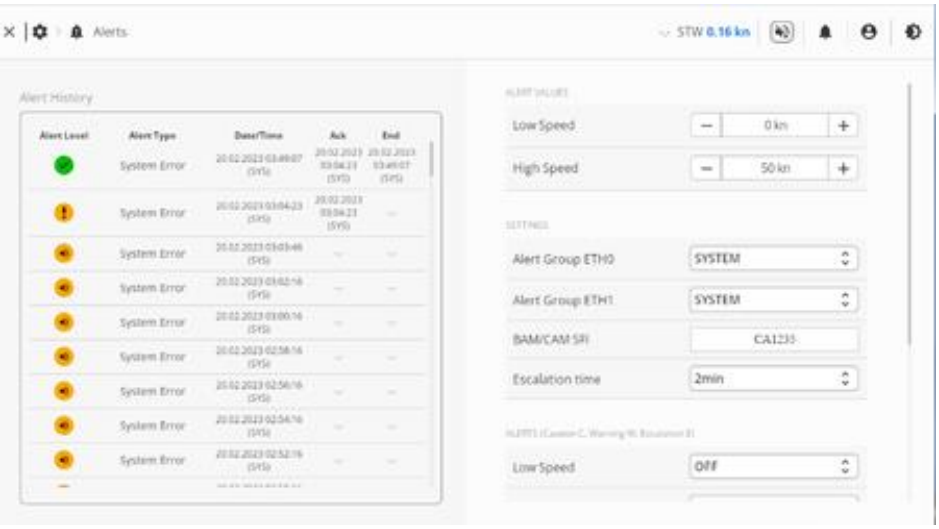
## 2.7.6. C-Setup of Alerts




The Alert screen shows on the left a history of the alert situations for the last 500 entries

On the right the alerts to be indicated can be configured.

The speedlog system has 2 function alerts, speed hi and speed low. These can be set to a particular speed and as the vessel passes this speedthe alert will sound. The level of these alerts can be set. And the values can be set here or on the main menu setting. and can be shown on the runscreen information.

This system does not support aggregation

| Function | options | description | Text | secondary text |
|---|---|---|---|---|
| Low speed | value in 0.5kn steps | send alert when speed sinks below the set limit | SPEED LOW | SPEED < XX KN |
| High speed | value in 0.5kn steps | send alert when speed rises above the set limit | SPEED HIGH | SPEED > XX KN |
| Settings | | | | |

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| | | | | |
|---|---|---|---|---|
| Alert group ETH0 | SYSTEM, BAM1,BAM2,CAM1,CAM2 | Group to be used for alert messages | | |
| Alert group ETH1 | SYSTEM, BAM1,BAM2,CAM1,CAM2 | | | |
| BAM/CAM SFI | CAXXXX | SFI of the BAM system | | |
| Escalation time | 0:30 to 5:00 in 30 second steps | | | |
| categories | | | | |
| Low speed | Off, W(3032) W+E(3032/1) | Value out of set limits | SPEED LOW | SPEED < XX KN |
| Highspeed | Off, C(3033) | Value out of set limits | SPEED HIGH | SPEED > XX KN |
| System Error | Off, W(3015) W+E(3015/4) C(3016) | Error causing system to stop measuring | SYSTEM ERROR | SENSOR COMMUNICATIONS |
| Internal error | Off, W(3062), C(3063) | Non critical error* | INTERNAL ERROR | SETTING DISRUPTING SYSTEM |
| Power Failure | Off, W(3022) | A power supply has lost power (see also relay) | POWER FAIL DC | VOLTAGE TOO LOW < 12V<br><br>VOLTAGE TOO HIGH >24V |
| Power Reduction | Off, W(3032) | Power supply out of design limits | POWER REDUCTION | |
| unsynchronised clock | Off, W(3119) | external clock input missing | UNSYNC CLOCK | NO EXTERNAL CLOCK INPUT |

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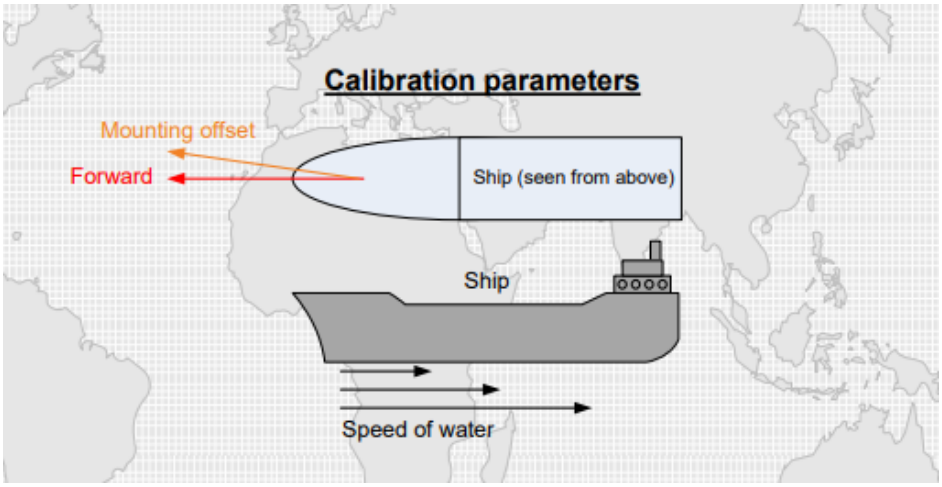
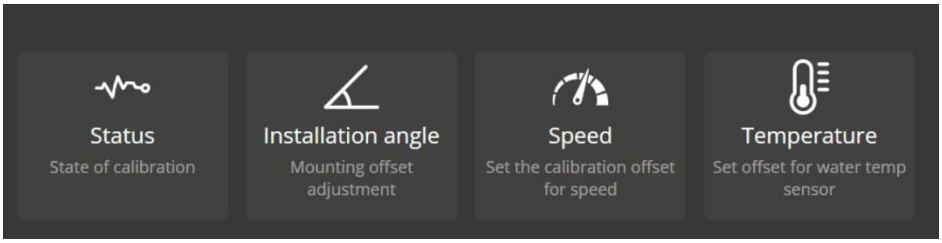
Non critical errors could be , cannot connect to sensor, the error type is shown in the diagnostic screen

## 2.8. S- Calibration

The calibration setup is split into installation offset, speed, and auxiliary calibrations.




Sensor calibration can vary at different speeds of the vessel due to drag of the water, or bubble / Turbulance formation, so the system has possibility to calibrate the sensor at 5 different speed zones. Each can be adjusted manually, using a sea test of 2 legs, or automatically using inputs from other approved systems.




### 2.8.1. C- Status

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The Status screen shows the status of the calibrations on the left and shows the current speed graphs 5 points. This graph usiually shows a reasnobly straight line with a slight increase in the gradient of the curve at faster speeds. THe 5 points on the right allow the user to select between the use of Default values (calculated by using the other points) , Sea test ,calculated during a sea test (see below) Manual used by manually adjusting or using the GPS value at that time, or Auto* using historical data from the sensor and GPS.

Normal useage is to set a manual value on first sailing, perform a sea test when possible and then switch to auto* after some months of sailing.

in most cases one sea test at the highest speed will be enough to get the system within its accuracy requirements, more calibrations will improve this.

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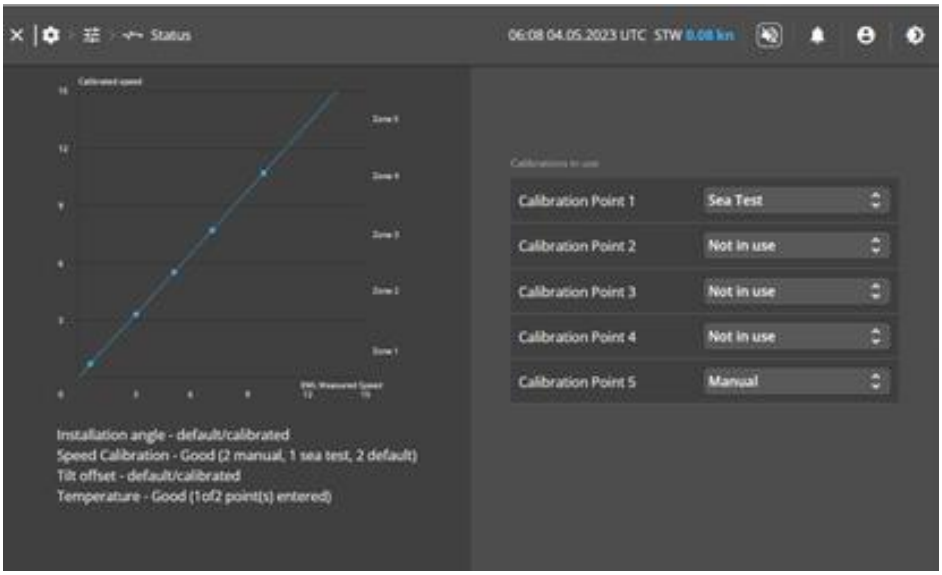
## 2.8.2. -S Installation angle




Offset adjustment adjusts any angular mounting variations relative to the ship. The adjustment can be up to +-180 degrees, however some sensors do not have as good resolution at higher adjustment angles so installation should aim to be as close to zero as possible.

5 zones are selectable here, speed through water sensors may experience water is dragged at slightly different angles at different speeds, but generally a single value is enough.

Sea tests will measure the installation offset, for the speed zone calibrated.

### 2.8.2.1. S- Speed Calibration

The relationship of the Real speed of the vessel, relative to the measured speed from the sensor can vary with the speed of the vessel or the mounting angle of the sensor. Speed through water (STW) measurement tend to vary much more with speed than Speed over ground (SOG). This variation can change with time as the hull or sensor gets growth and water drag is changed. When the hull or sensor is cleaned, the calibration will change again. EML systems which measure at the sensor surface are more sensitive to this than Doppler sensors which measure remotely

#### 2.8.2.1.1. S- Manual / GPS speed calibration

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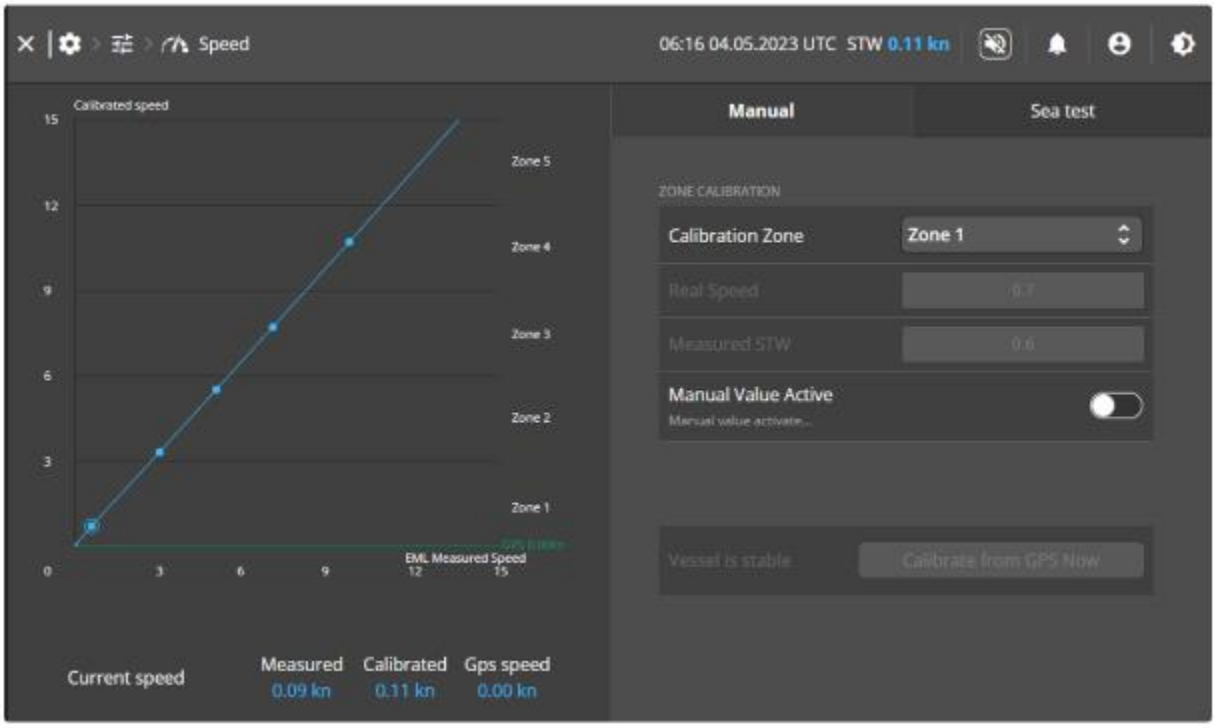
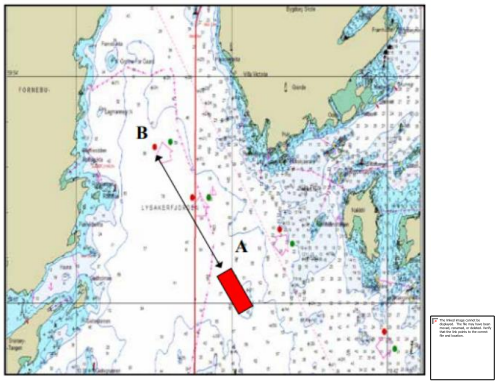



If you wish to adjust an individual speed offset The right side of the screen shows the current values, these are either previously adjusted manual settings, default or generated by the sea test. if not active, these can be adjusted by activating the desired speed zone, and adjusting the real speed (from GPS) and the measured speed from the sensor.

The simplest way to do this is to adjust the speed when the vessel is sailing at that speed. in this case, when the vessel is sailing in a stable speed and heading the ‘Calibrate from GPS Now’ button will show and when pressed , will replace the values in the selected zone with those measured now.

This assumes no current. if there is a detectable current, then the sea test should be used.

#### 2.8.2.1.2. s- Sea test speed calibration



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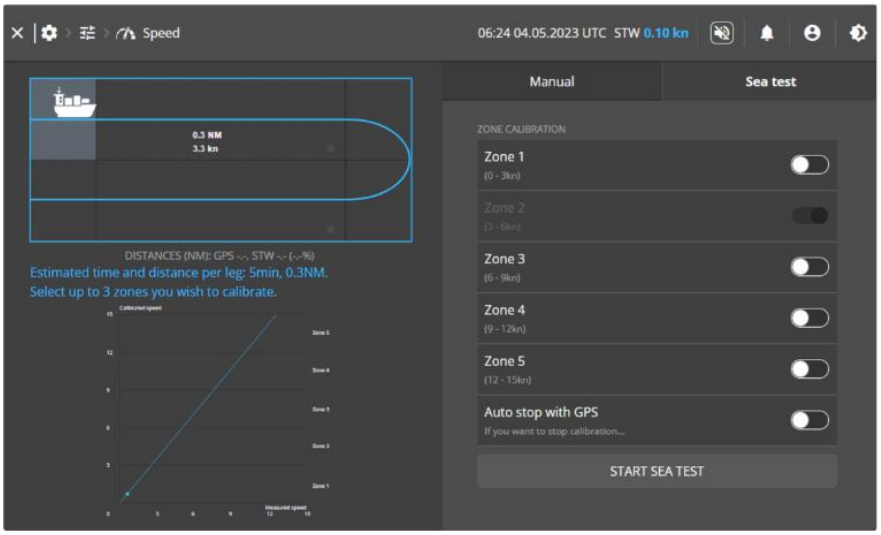
To get the most accurate calibration , the ystem needs to compensate for current within the sea. The simplest way to do this without having a reference system is to sail the vessel in opposite directions within the same part of the sea so that the vessel measure s the current in opposite directions and cancels it.

Turning the vessel can be a big and expensive procedure. To minimise this the system allows up to 3 calibration speeds to be performed within the same leg.




Sea calibrations should be made at max speed and normal operational speeds. Select the desired speed zones to be calibrated, and then follow the onscreen instructions. The calibration should take place in an area with low current or stable current. and the opposing legs should be in the same area, preferably not in the wake of a previous leg.

The system will give the user an estimate of the time and distance to make this calibration

The use of a GPS input is advised to help the user make the legs the correct length (activate Auto stop with GPS) . If GPS is not available, the system will require the user to use the chart to find the correct position to start and stop the calibration.

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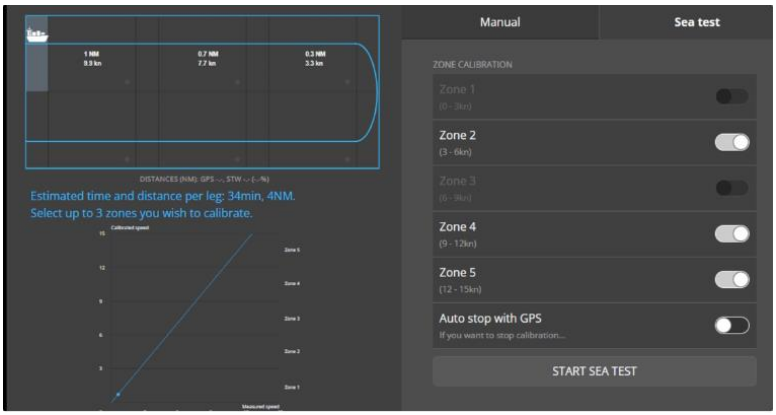
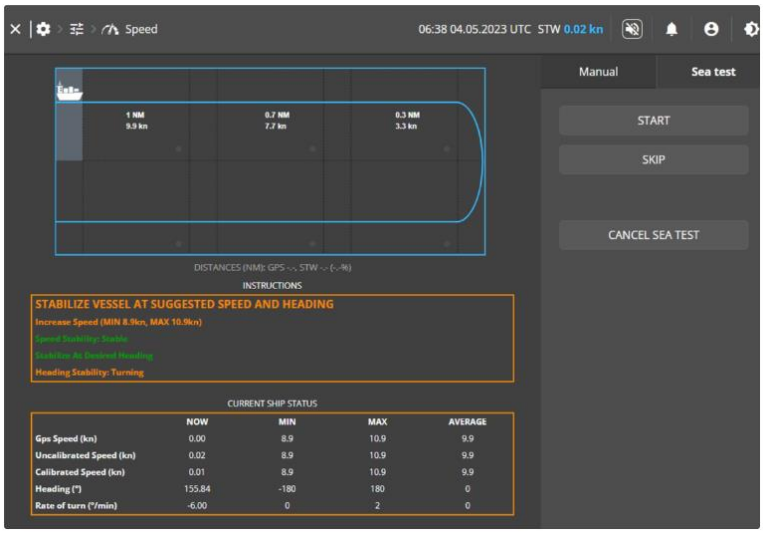



once selected, the vessel should move into position for the start of the leg and accelerate to the correct speed .

on start the vessel will show the following screen




The status ibn the middle field will turn green when the desired stability is achieved. Once green you are ready for the first leg. Press start.

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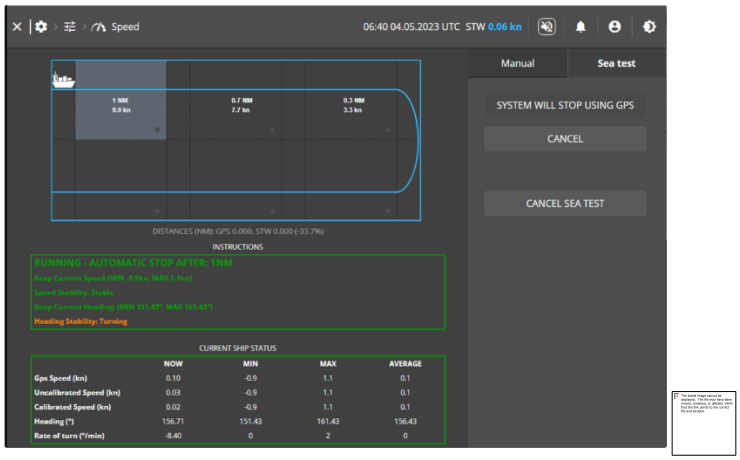
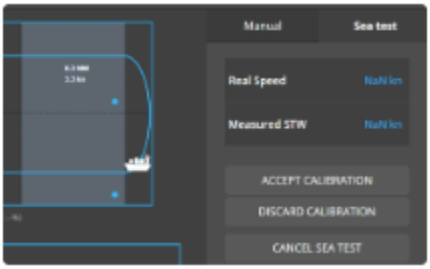



The vessel sails at the same **Heading**, until the correct distance is reached. It will then stop (or be manually stopped by the crew if GPS is not available)

The vessel then accelerates/decelerates to the next speed and repeats. After all speeds in the leg are performed the vessel should turn 180 degrees and sail in the opposing heading. repeateing the legs in the opposite direction. After each leg the user will be asked if they accept the calibration or not. At this stage the data will be transferred to the calibration tables




After the calibrations in the second leg are performed the system will show a summary of before and after

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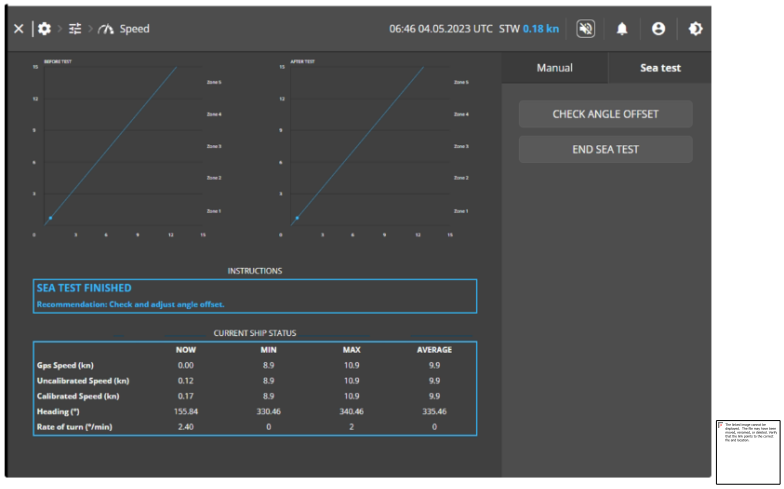
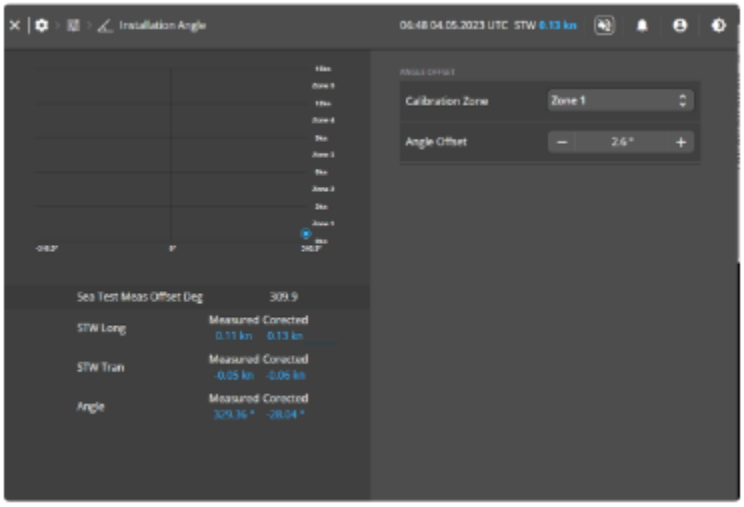



The user can then decide to check the installation angles measured during this sea test. if these seem wrong, they can be ignored and manually adjusted to a more appropriate value




## 2.8.3. C- Temperature offset

Temperature adjustment screen shows the last 5 hours measurement and allows the user to ad an offset by adding the actual water temperature using a reference device on reading from the coolent intake device.

## 2.8.4. C- Auto calibration

this is not yet available

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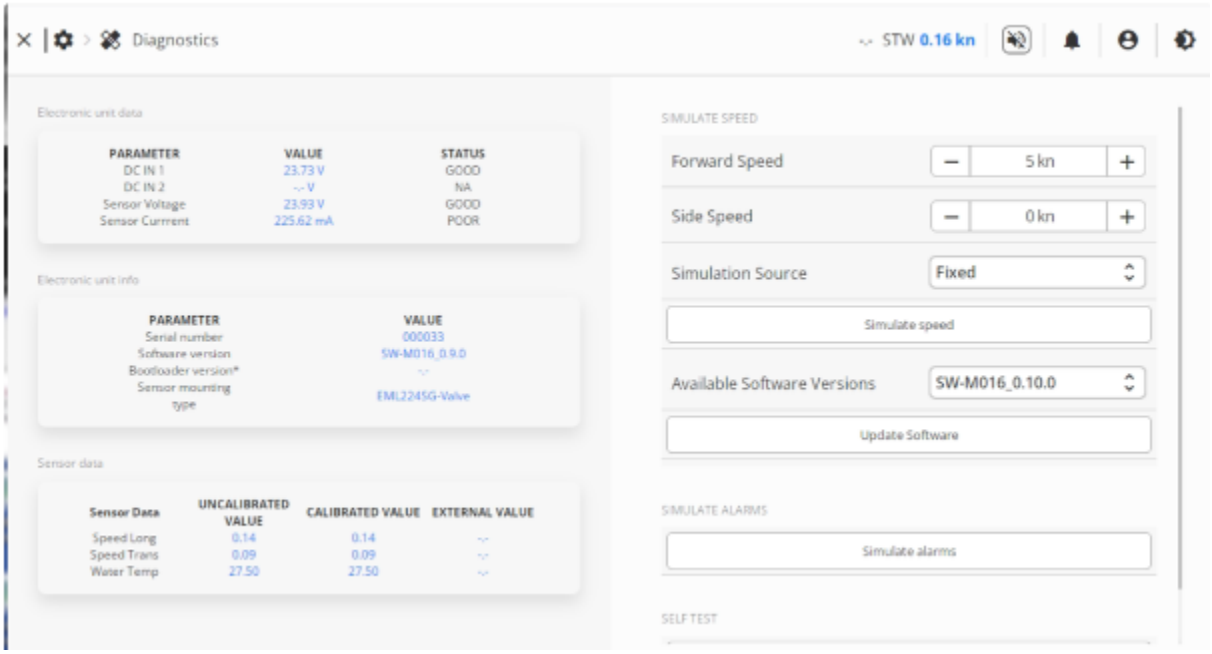
# 2.9. S-Verifying, Supporting and Maintenance of your system

## 2.9.1. S- Diagnostic screen




The Diagnostic screen has a number of useful functions to help diagnose problems. If serious problems occur, this can be indicated in the alerts page as caution or warning. The left side of the page shows the running status of the system, showing internal measurements such as voltages and currents with their advised limits.

The middle field shows the installation parameters with software and firmware versions, and installation selections

The bottom filed shows the runtime status of the sensor, indicating the measured values, the values after calibration , and the equivilent values from tha auxiliary inputs (if available) Note this system measured Speed through water, which is similar but not the same as Speed over ground given by the reference system.

This page gives a good summary of the system, and a photo of this page will be great help if requesting help from a service center.

#### 2.9.1.1. C- Simulate speed

The System can simulate a speed to the outputs The REquired speed can be entered and the type of variation of the speed can be selected

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| Simulation source | Description |
|---|---|
| Fixed | send the speeds as defined in forward and side speed |
| From GPS | send the GPS SOG value as forward speed |
| From file* ND-807 ND-779 | send data from a simulation file called Simulate.enc , as a software upgrade from the service software. |

#### 2.9.1.2. C-Software upgrade

Software upgrade is performed using files that can be downloaded from the skipper website. These files contain software and firmware required within the system and are compressed and encrypted to meet modern cybersecurity standards. The Files can be placed straight into the unit using a LAN connection by the skipper service software, alternatively the service software can be used to make a file on a USB memory stick. This can be safely inserted into the unit, and the user can trigger this software to be loaded onto the unit by selecting the USB on the diagnostic page under upgrade. In this case the files will be verified and copied onto the public part of the system and the user can trigger an upgrade.

In some cases the upgrade can be triggered remotely, in this case the service software will require the service or admin level username and password.

The system will keep an copy of the replaced software and configurations. This can be retrieved by service software or SFTP, for diagnostics. It can also be re-installed in the system by the user if required.

#### 2.9.1.3. C- Simulate alarm

This function activates one of each selected alert, warning, caution, to allow a BAM system to tackle those alert cases

#### 2.9.1.4. S- Self test

Self test will runs some diagnostic tests within the unit to check everything is functioning correctly the following tests are performed:

| test | Result | expected result |
|---|---|---|
| Sensor communication - a message is passed to and received from the sensor | Pass/fail | Pass |
| CPU load - The load on the CPU is measured to be within limits | Pass fail (number %) | Pass <60% |

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| | | |
|---|---|---|
| memory useage | Pass fail | pass <80% used |
| voltages within specification | Pass fail | |
| LAN traffic? | | |

## 2.9.2. C- Hardware Reset button

The System has a hidden button accessable with a pin on the back of the unit. Pressing this will downgrade the software and configs to earlier safe versions

### 2.9.2.1. C- 5 second press

A press of 5-30 seconds will install an older safe software and firmware version. THe unit should then work and can be upgraded again. Settings for IP, SFI are kept

### 2.9.2.2. C- 30 second press

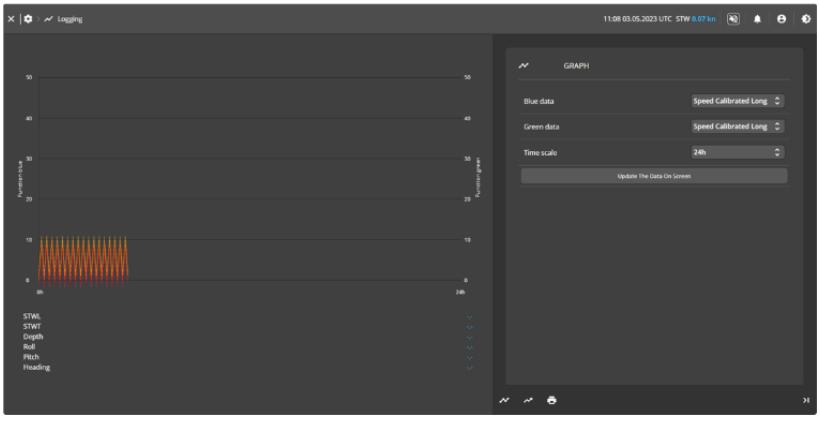
If all else fails a press of over 30 seconds will return the unit to it pre-system selection state. In this case the option number for the system must be entered, and IO configuration. Software must also be enetered after this reset.

## 2.9.3. S- Calibration check

Calibration

C- Data control

## 2.9.4. C- Logging screen




### 2.9.4.1. C- The graph

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The graph can show data from the last 24 hours. The graph lines can be selected on the right, showing either all 24 hours, or a single hour, this can be offset to show a particular time. After adjusting the settings pressing the update button will load that data.

The user can then press on a particular point to see the data values and the associated aux values (in the table below) at that point

The graph can be maximised by minimising the sidemenu.

#### 2.9.4.2. C- Logging options

Unles specifically told not to, in the advanced system settings, the system will continually log data it is receiving and generating. This data is logged for as long as there is designated memory space available. The user can select whether to log for a period and then stop , keeping only the latest file. Or whether to get rid of the oldest files and overwrite with new.


In addition, a USD or microSD disk can be used to log. in this case the old files can be dumped onto the disk, and then new files are written directly.

Saving Options:

- External logging - Selection of media to write to (USB, SD, None)
- Information - Logging of Sensor and auxiliary, Sensor and diagnostic files, Sensor , diagnostic and Raw data

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- Save ‘Loop continuously’, or run ‘to the end’ of the memory, but keep the last file updated.

Logs can be copied to USB , or collected directly using the skipper service software windows software

#### 2.9.4.3. C- Printing data

This setting is not yet implemented

- **Printer type** (connected printer to the USB port (using isolator GC-202-SA)
- **Print period**, how often to print
- **Data to print:** Sensor + aux data selection

### 2.9.5. S- Periodical maintenance of the system

The EML sensor has metal (Monel) sensors of the front. As the vessel gets growth these pins can be covered and the speed will show lower. THis can be calibrated away, but if the calibration factor is more than 2x times we recommend cleaning the sensor. This time can vary from 6 months to 2 years depending on the water temperature wand time spent alongside.

We recommend changing valve 'o' rings every 5 to 10 years, and occasionally moving the valve lever to keep it from seizing

## 2.10. C- Runtime displays and setup

The runtime display is intuitive with the following features

### 2.10.1. C- Runtime screens

3 screens are available Open sea, Coastal and Docking. These can be set up to show optimal data in these three operational modes. The modes can be changed using NMEA command*. The screens all have the following elements

#### 2.10.1.1. C- topbar

Showing the page being shown, the system type, the time and date, the primary data of this system, silence alerts button, alert dropdown, user management, and dimming options

#### 2.10.1.2. C- Dimming

The dimming menu allows adjustment of the pallet bright, day, twilight, night, this can also be adjusted remotely using the DDC dimming command,

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on the display itself the brightness can be changed, on remote displays, dimming is local to the display. Adjustment of the default backlight setting for each pallete can be adjusted using advanced settings in this menu.

#### 2.10.1.3. C- User setup

Here the user can login. if no user is logged in, the data can be viewed, but settings cannot be changed. at User level only function settings can be changed.

Service and Admin level allows other settings to be changed

Admin level allows more users to be added.

#### 2.10.1.4. C- Alert panel

When an alert is present it can be viewed and handled from this drop down menu

#### 2.10.1.5. C- sidebar

The sidebar allows can be minimised or shown, and can show parameters selected in the runtime setup.

#### 2.10.1.6. C- Menu

The Hamburger menu symbol, shows a drop down, and in this menu the function alert parameters can be changed and daily trip can be reset. You also have access to settings, the manual and standby mode

### 2.10.2. The Runtime setup

in this menu you may setup the 3 operational mode displays by selecting the appropriate tab on the right. The screen on the left shows the display format as selected. n the left you may select the graphic type, text data, the parameters to be shown on the sidebar, whether to show the function alert settings, and if available some changable configuration parameters can be shown

In addition the Viewing distance (font size) can be changed, and the shown position of the data can be selected . This can show data from the sensor itself, the CCRP (steering reference point) or from bow and stern. Default viewing distance is 0.5m for the information/ config text, and selectable 1m, 3m, 5m for the main data text.

# 3. Retrofitting to an older system

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| 1 - author | | PC | 4 May 23 |

Retrofitting to an older EML224 system

in this case, only the Display must be replaced. The Valve, sensor and JB60 unit can be used. Wiring from the Display to the JB60 will be as shown below

# 4. Getting started guide

Links to useful documentation. The manual is also available in the display software

| Document | link | QR code |
|---|---|---|
| Manual | | |
| Option codes for this unit (serial number required) | | |
| Software upgrade - Use service software (serial number required) | | |
| Valve / tank approval certificate (serial number required) | | |
| Certificate of conformity | | |
| Type approval | | |

## 4.1. Getting started:

| | link in manual | QR code |
|---|---|---|
| Weld the tank or valve | | |
| Mount the sensor, (take care with alignment) | | |
| mount the display(s) | | |
| Cable the system | | |
| Start/configure the system | | |
| upgrade the software | | |
| Perform calibration | | |
| verify calibrations | | |

## 4.2. User quick start:

### 4.2.1. Vessel speed

| Document status | Link to Spec | owner | Last edit |
|---|---|---|---|
| 1 - author | | PC | 4 May 23 |