Op-Advance manual
Installation and operating instructions

OPDAQ 07/2017

Op - ADVANCE

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Original instructions

OpDAQ Systems

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Name and address of purchaser: _____

Date of Purchase: _____

Model of product: _____

Serial number of product: _____

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OpDAQ Systems Inc. warrants solely to the original purchaser of the Products for a period of (1) one year after the date of delivery, the Products to be free from defect in material and workmanship under normal use, and will confirm to OpDAQ Systems Inc. published specifications of the Products. Notwithstanding the foregoing, OpDAQ Systems Inc. retains its right to deviate from published specifications due to latest improvements in function and design of the Product. The foregoing warranty is subject to proper storage, transportation and use of the Products, and does not include defects due to normal wear and tear or deterioration. Upon delivery, Customer shall immediately inspect the Products for conformity and visible defects. Customer shall give OpDAQ Systems Inc. immediate written notice of any conformities or visible defects regarding the Products and contact OpDAQ Systems Inc. in writing concerning return or repair, as the case may be.

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If any defects not caped under the warranty are found, OpDAQ Systems Inc. will repair the defect after providing the Customer with an estimate.

1. ABOUT THIS MANUEL

The Op-Advance system is a versatile system that can be configured for a variety of user's specifications. Consequently, the information displayed and the menus are specific to each Customer configuration request and can vary considerably.

The Op-Advance is designed to display, log and analyse power, RPM, torque and fuel consumption from KRAL Volumeter flowmeters and Binsfeld Engineering TorqueTrak torquemeters. It also integrates data from the shipboard GPS. Op-Advance is generally designed to perform the following functions:

1. Main engine fuel consumption measurement
2. Ship service generator fuel consumption measurement
3. Propulsion shafting torsional measurement
4. Sea trial performance measurement
5. Remote monitoring and reporting

Op-Advance is specifically designed for shipboard use. It is resistant to weather, dust, dirt, moisture, oil, chemicals or other harsh contaminants.

To ensure clarity and coherence most figures presented in the manual will feature the same ship configuration: twin engines referred to as Port and Starboard. This should be considered only as an example as it does not reflect the full extent for the system's potential.

Table 1: System Targeted User

Target group	Tasks
Operator-owner	Keep these instructions available at the installation site for future reference. Ensure that employees read and observe these instructions and the associated documents. Observe additional system specific directives and regulations.
Specialist personnel, fitters	Read and observe these instructions and the associated documents.

The information contained in this manual are based on our experience and is current and complete to the best of our knowledge and ability at the time of printing. OpDAQ Systems Inc. does not accept responsibility for errors, omissions or incorrect interpretations of the contents or any information herein.

2. SYSTEM COMPONENT & OPTIONAL FEATURES

Op-Advance can be purchased with different measurement instruments and optional features. This section provides information on the different system components. For more information regarding the upgrades and the optional features, please contact OpDAQ Systems at: info@opdaq.com

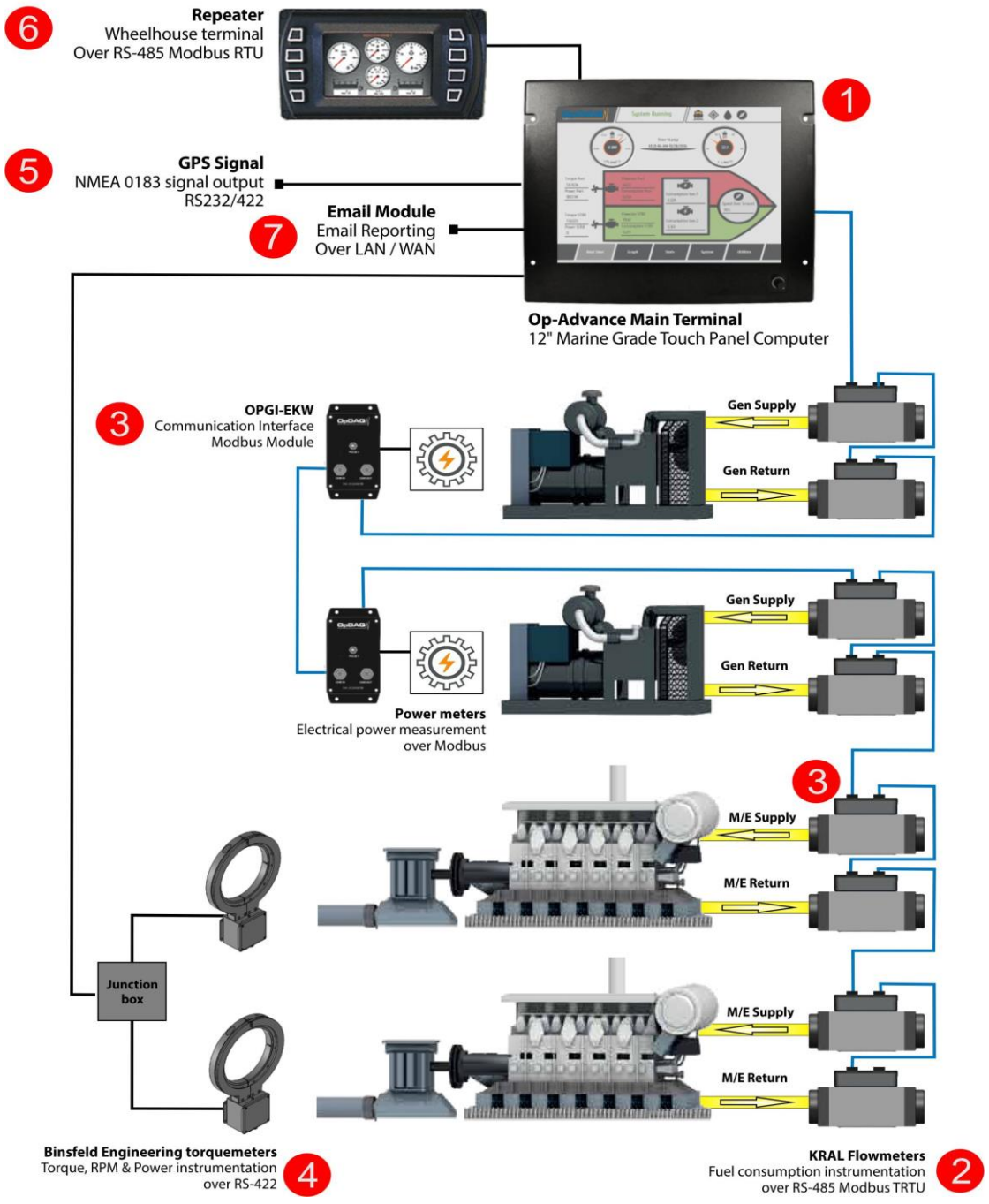


Figure 1 - System components overview

	System components	Specifications	Communication Protocol
1	Main Terminal	12.1” touch panel marine computer	---
2	Flowmeters	KRAL Volumeters	Electrical signals
3	Modbus Modules	OpGI-V Volumeter Modules	RS-485 Modbus RTU
4	Shaft torquemeters	Binsfeld Torquemeter	RS-422
5	GPS	GPS NMEA0183 output	RS-232/422
6	Wheelhouse Repeater	4.3” LCD marine display	RS-485 Mobdus RTU
7	Internet Connection	Email module	LAN/WAN

2.1 OP-ADVANCE MAIN TERMINAL OVERVIEW

Op-Advance is built around a Main Terminal, which is a 12.1” touch panel marine computer. The Main Terminal is made of a Marine Grade Panel PC equipped with a high quality 12.1” touch screen monitor. It receives the digitally converted signals from the KRAL Volumeters through the OpGI-V and OpVI Volumeter Modules. The main Terminal also receives signals from the TorqueTrak TPM2 torquemeter(s) and from the GPS. The converted signals are logged into a database and displayed in real-time on the Terminal screen.

The computer can log up to one year of data. The data can easily be downloaded on a USB drive. As an option, it can also be sent by email. The user can use the touch screen to navigate the various displays, moving between windows and applications.

Figure 2 – Main Terminal

Figure 3 – Remote USB Port

A remote USB port is supplied with the system to provide an easy way to export the data and update the system without having to access the Main Terminal. It should be installed close to the Main Terminal.

2.1.1 OP-ADVANCE MASTER SOFTWARE

Op-Advance master software is the main acquisition system. All system configuration and settings must be done on this display. Refer to section 7. SYSTEM SOFTWARE for more information on the software.

2.1.2 CONTROL PANEL ASSEMBLY (optional & sold separately)

To facilitate the installation of the Op-Advance monitoring system, OpDAQ can provide a custom-designed industrial cabinet to fit the user's needs. The control panel facilitates the display and monitoring of numerous instrumentation assemblies. The Panel PC, the Analog module and the USB port can be assembled in a single control panel as shown in the figure below.

Figure 4 – Control panel assembly for main terminal

2.2 KRAL VOLUMETER OVERVIEW (sold separately)

The KRAL volumeters are positive displacement screw type flowmeters equipped with temperature sensors to ensure temperature compensated measurements. These parts are sold separately from the Op-Advance system.

Figure 5 - KRAL Volumeter (figure shows OMG series)

2.3 OPDAQ VOLUMETER MODULES OVERVIEW (sold separately)

The OpDAQ Volumeter Module OpGI-V converts and computes the measurements of flow from the KRAL Volumeter into a Modbus output signal. The measurements can be temperature compensated.

These parts are sold separately from the Op-Advance system.

Figure 6 – Volumeter Module OpGI-V

2.4 BINSFELD TORQUETRAK TORQUEMETER OVERVIEW (sold separately)

The Binsfield TorqueTrak torquemeter is a torque and power monitoring and control system that features inductive (non-contact) power and data transfer for continuous operation. It is designed for applications that require ongoing measurement of torque and/or horsepower. These parts are sold separately from the Op-Advance system.

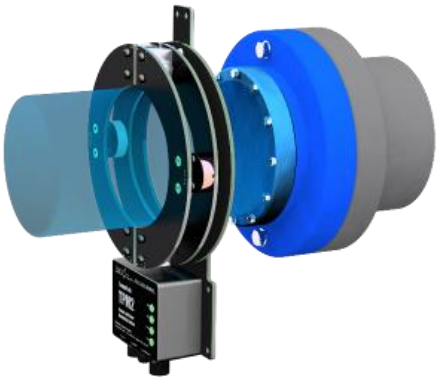


Figure 7 - Binsfeld TorqueTrak TPM2 torquemeter

2.5 SHIPBOARD GPS OVERVIEW

The acquisition system needs a NMEA0183 GPS signal from the installed shipboard GPS to operate. The communication protocol can be RS232 or RS422 (preferred for long cable run). If no GPS output is available, a GPS receiver can be sold separately.

2.6 WHEELHOUSE REPEATER OVERVIEW (optional & sold separately)

The Op-Advance Main Terminal is typically installed in the engine control room. A Repeater is used to display the acquired data in the wheelhouse or in any other convenient place. The Repeater is a multi-functional display specifically designed to meet the engine monitoring needs of the marine industry. It offers an easy to use interface with the ability to switch between Day and Night mode operations.

The system setup must always be done directly on the main terminal.

Figure 8 –Wheelhouse repeater

2.7 ANALYSIS COMPUTER OVERVIEW (optional & sold separately)

The analysis computer is typically installed in the engineer's room to duplicate the main terminal information but it can be installed anywhere. The analysis station is a standard desktop computer. If required, DataVIEW software can also be installed to enable more complex and advanced data analysis.

2.7.1 OP-ADVANCE REPEATER SOFTWARE

Op-Advance repeater software is a duplicata of the main acquisition system. All system configuration and settings must be done directly on the main terminal. Refer to section 7. SYSTEM SOFTWARE for more information on the software.

2.7.2 DATAVIEW SOFTWARE

Collected data can be analysed by our software called DataVIEW. DataVIEW is a powerful tool designed to process and analyse data provided by a wide range of instruments and sensors. DataVIEW runs on a regular PC

and gives the users a tool to produce ship performance reports over long periods of time (several months, year, between drydocks). The report format can be customized according to the client standards. The data can also be exported to Microsoft Excel in a tab separated format.

Please refer to the DataVIEW installation and operation manual for installation and operation instruction of DataVIEW.

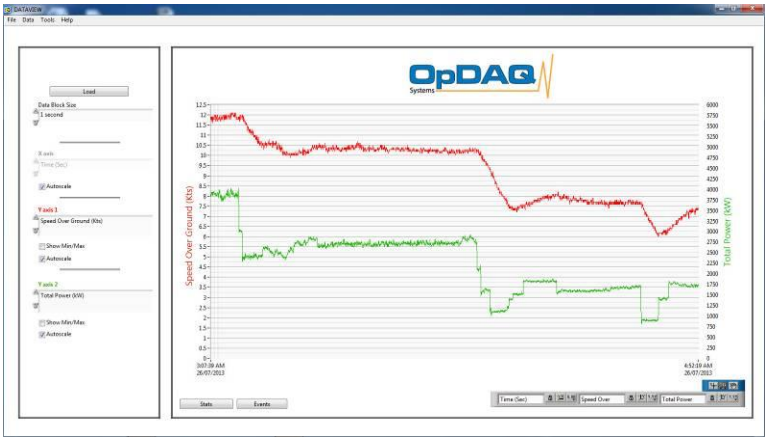


Figure 9 – OpDAQ DataView screenshot

2.8 INTERNET CONNECTION OVERVIEW (optional)

The system can be connected to an internet connection to add to enable remote supporting and send report emails.

2.8.1 EMAIL REPORT MODULE

The Email report module is designed to send periodic fuel consumption and ship performance reports via email to allow a third party (for example: the ship owner) to have access to information on a daily basis using the Daily Report module or at the end of a voyage using the Voyage Report module. The report features a compressed version of the saved data along with the list of events and error codes. The data is compiled into an excel file. Each file has a size of approximately 10 kB. Refer to Daily Report Table 30 and Voyage Report Table 34 for more information on the email module.

Access to an internet connection is necessary to use the Email report module.

2.9 ELECTRICAL POWER METER OVERVIEW (optional & sold separately)

The electrical power meter can be integrated to the Op- Advance system to monitor the electrical power on genset engines and generators.

Figure 10 – Electrical power meter

3. MECANICAL ASSEMBLY

The following section contains the mechanical system drawings including the dimensions of the different system components.

3.1 OP-ADVANCE MAIN TERMINAL TECHNICAL DRAWINGS

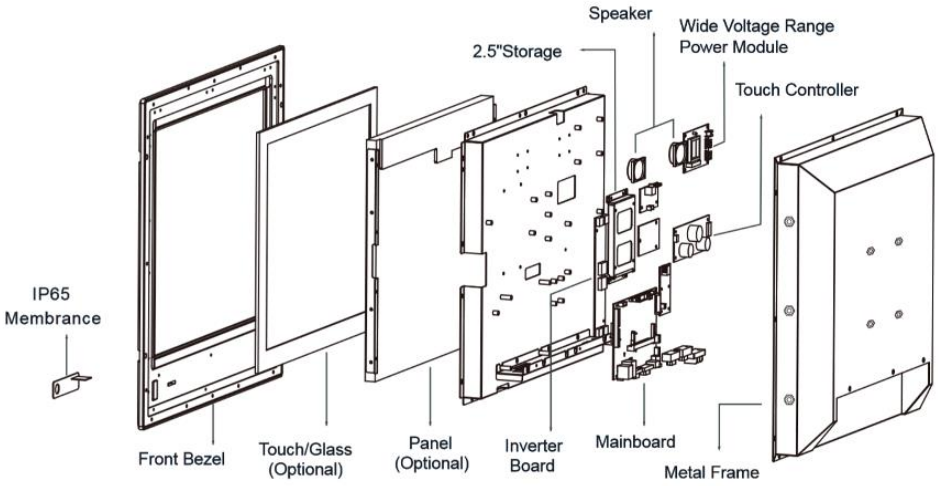


Figure 11 – Modularized Construction of the main panel computer

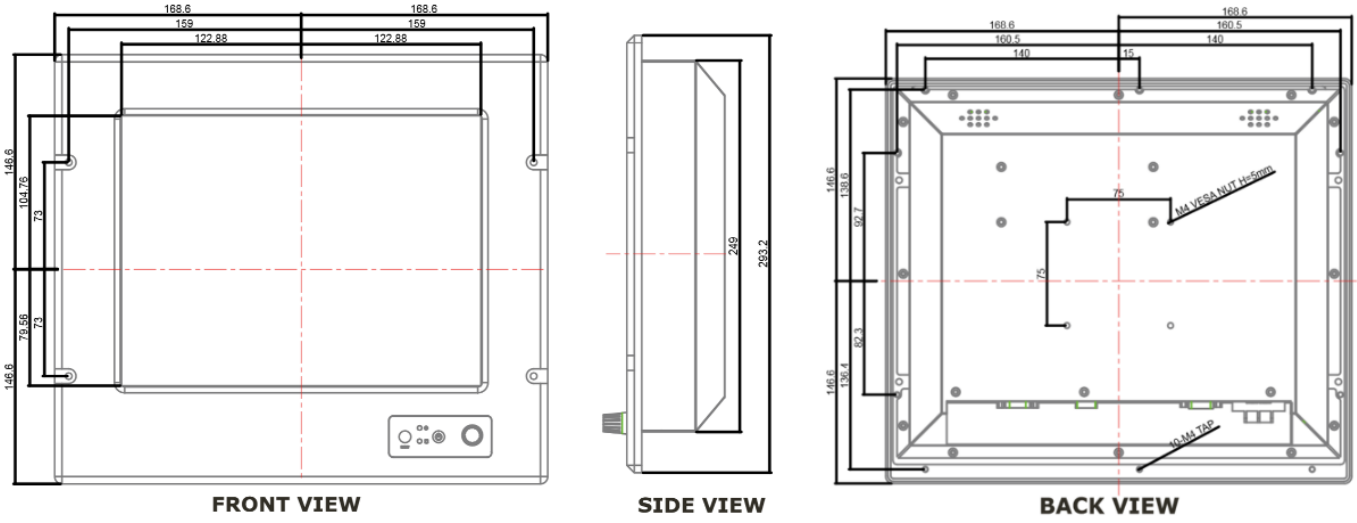


Figure 12 – Dimensions of the main panel computer [in mm]

3.1.1 REMOTE USB PORT TECHNICAL DRAWINGS

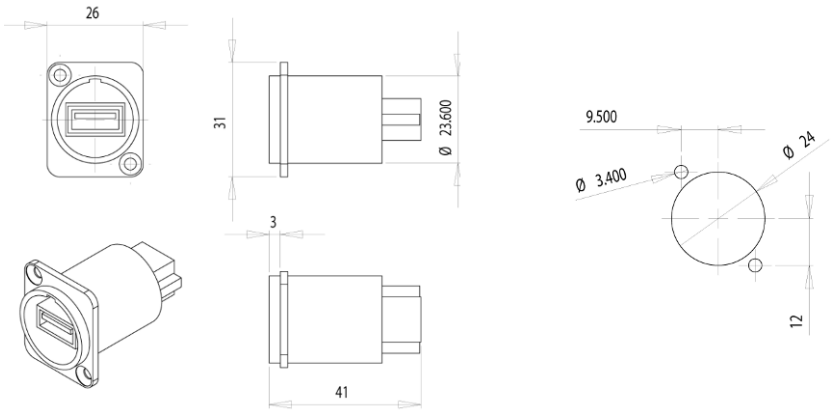


Figure 13 - Dimensions and cut out of remote USB port [in mm]

3.2 KRAL VOLUMETER TECHNICAL DRAWINGS

Refer to the KRAL volumeter documentation for technical drawing.

3.3 OPDAQ VOLUMETER MODULES TECHNICAL DRAWINGS

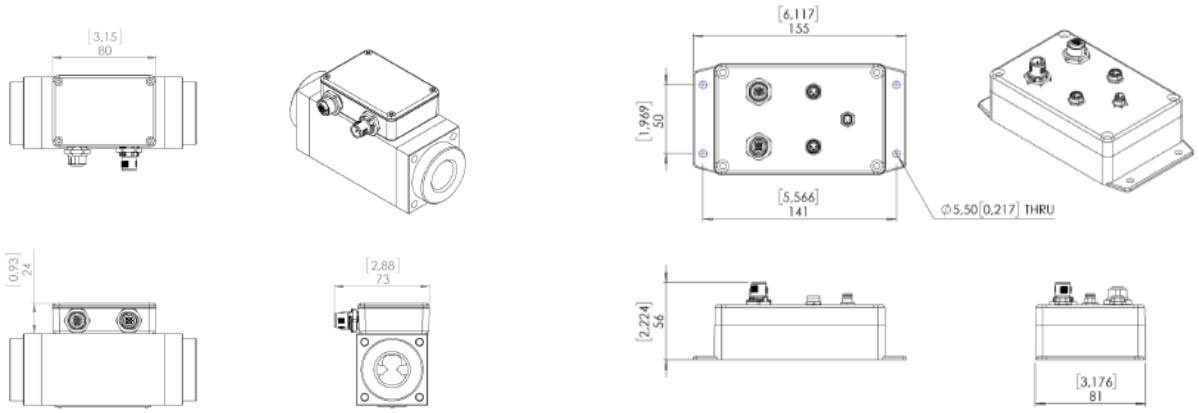


Figure 14 - External dimensions of OPVI module (left) and OPGI modules (right)

3.4 BINSFELD TORQUETRAK TORQUEMETER TECHNICAL DRAWINGS

Refer to the Binsfeld Engineering torquemeter documentation for technical drawing.

3.5 SHIPBOARD GPS TECHNICAL DRAWINGS

The system uses the onboard GPS usually located in the wheelhouse.

3.6 WHEELHOUSE REPEATER TECHNICAL DRAWINGS

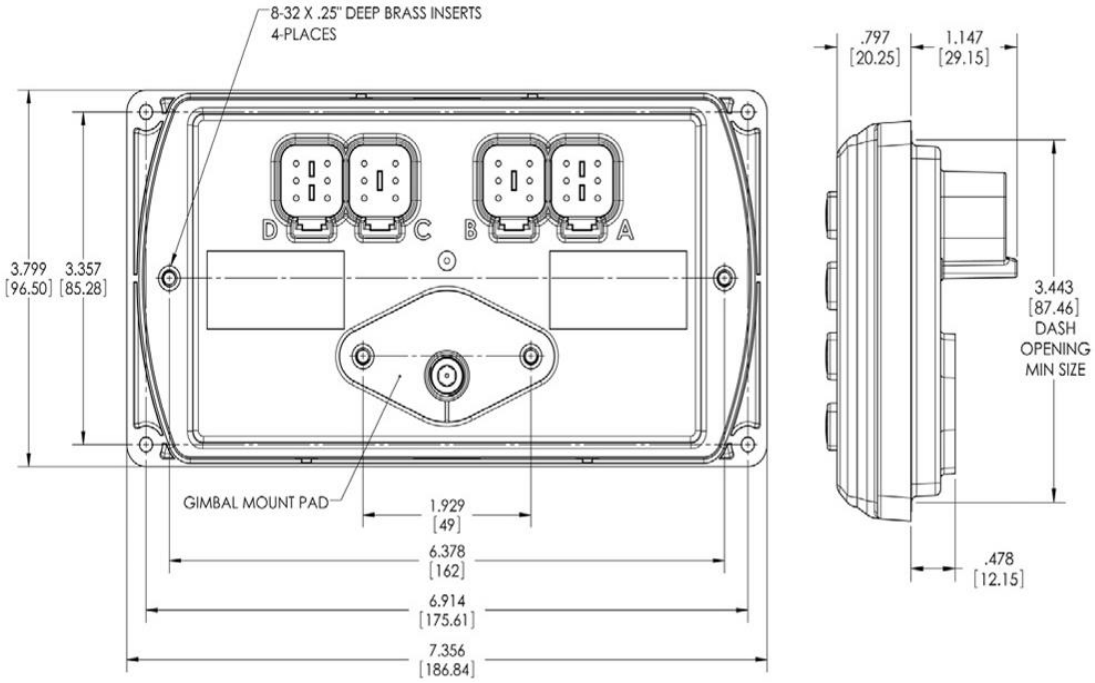


Figure 15 - Dimensions of the wheelhouse repeater [in inches & mm]

3.7 ANALYSIS COMPUTER TECHNICAL DRAWINGS

The analysis computer is selected to best fit the client needs. Usually a simple desktop computer is installed. Refer to the computer company for technical drawings.

3.8 INTERNET CONNECTION TECHNICAL DRAWINGS

The system is connected to the existing network.

4. INSTALLATION

This section is intended as a summary of the steps needed for the installation of the components of the Op-Advance system. Always follow the instructions supplied with the components.

Begin by identifying the final location of all components.

Do not connect power to the instruments during installation

The following safety instructions must be observed at all time

- ☐ Installation work may only be carried out by qualified personnel.
  - Read the operating instructions supplied with the components.
- ☐ The Op-Advance components are part of a precision measuring system
  - Ensure cleanliness and take care during installation and removal
- ☐ Do not take apart any of the Op-Advance components

4.1 OP-ADVANCE MAIN TERMINAL INSTALLATION

- ☐ Install the Main Terminal in the Engine control room.
- ☐ Ensure sufficient room is provided for bottom-exit connections.
- ☐ Access to the Main Terminal should be sufficient for daily operation.
- ☐ Use vibration absorbing devices if needed.
- ☐ The Main Terminal should be housed in an enclosure or console protected from humidity, dust or other contaminants. OpDAQ can provide a custom designed industrial enclosure.

4.1.1 REMOTE USB PORT INSTALLATION

- ☐ The remote USB port should be installed in a convenient location close to the Main Terminal.
- ☐ Prepare the required cut-out in the console.
- ☐ Insert the Remote USB Port into the cut-out and screw the USB port position.

4.2 KRAL VOLUMETERS INSTALLATION

- ☐ Install the KRAL Volumeters flowmeters as instructed in the KRAL manual supplied with the flowmeters.

4.3 OPDAQ VOLUMETER MODULES INSTALLATION

- ☐ The Volumeter modules OpGI-V should be installed in the engine room near the flowmeters.
- ☐ Connect the Pulse sensors #1 and #2.
- ☐ Connect the Temperature sensors.
- ☐ The Volumeters are daisy-chained to the Main Terminal using Modbus over RS-485. Proper communication cable should be used.

4.4 BINSFELD TORQUETRAK TORQUEMETERS INSTALLATION

- ☐ Install the TorqueTrak torquemeters as instructed in the manual supplied with the components.
- ☐ The Torquemeters are connected to the Main Terminal using differential serial over RS-422. Proper communication cable should be used.

4.5 SHIPBOARD GPS INSTALLATION

- ☐ Locate the shipboard GPS.
- ☐ Locate an available NMEA0183 RS-422 or RS-232 output port on the GPS.
- ☐ The GPS is connected to the Main Terminal using differential serial over RS-422 or serial over RS-323. Proper communication cable should be used.

4.6 WHEELHOUSE REPEATER INSTALLATION

- ☐ The repeater should be installed in the wheelhouse or in any other convenient location to monitor the Op- Advance data.
- ☐ The Repeater is connected to the Main Terminal using Modbus over RS-485. Proper communication cable should be used.

4.7 ANALYSIS COMPUTER INSTALLATION

- ☐ The Analysis Computer should be installed in the Engineer's Room or in any other convenient location to monitor the Op- Advance data.
- ☐ The Analysis Computer is connected to the Main Terminal using Ethernet over UDP. Proper communication cable should be used.

4.8 INTERNET CONNECTION INSTALLATION

- ☐ Measure and cut the amount of cable needed to connect the main Terminal to the ship network. The total length of wire should not exceed 100 m (328 ft) for 100BASE-TX or 300 m (976 ft) for 10BASE-T.

Notice: It is much easier to attach the RJ-45 connectors on the cable ends after the cable has been run, especially through holes.

Do not deform, do not bend, do not stretch, do not staple, do not run parallel with power cables, and do not run Ethernet cables near noise inducing components.

5. WIRING AND CONNECTIONS

This section is intended as a summary of the steps needed for the installation and connections of the components of the Op- Advance system. Always follow the instructions supplied with the components.

The following safety instructions must be observed:

- ☐ The following qualifications are required for the electrical connection:
  - Practical electrotechnical knowledge
  - Knowledge of the safety guidelines at the workplace
  - Knowledge of the electrotechnical safety guidelines
- ☐ Use shielded communication cable for RS485 connections.
- ☐ Ensure that the DC supply voltage is correct (24 V DC).
- ☐ Ensure that the AC supply voltage is correct (100-250 V AC).

Do not connect power to the instrument when running cables

5.1 RECOMMENDED WIRING

All power supply need to be of good quality to protect the instruments. It is recommended to supply power through a dedicated circuit protected by a fast acting fuse. The use of an uninterrupted power supply will help avoid data logging gaps.

Table 2: Communication Cables Overview

From	To	Signal	Cable	Length
Flowmeters	Volumeter Modules	5V Pulses, RTD	3 x 3 conductors cables	Up to 50m
Volumeter Modules	Main Terminal	Modbus RTU RS485	2 power wire + twisted pair + GND	Up to 1000 m
Torquemeter	Main Terminal	RS-422	2 twisted pairs + GND	Up to 600 m
GPS	Main Terminal	RS232/422	1 Twisted pair + GND	Up to 1000 m
Main Terminal	Wheelhouse Repeater	Modbus RTU RS485	1 Twisted pair + GND	Up to 1000 m
Main Terminal	Analysis Computer	Ethernet	4 Twisted pairs	Up to 300 m
Main Terminal	Internet	Ethernet	4 Twisted pairs	Up to 300 m

Table 3: Power Cables Overview

Module	Operating Voltage Range	Cable
Main Terminal	12 VDC or 24 VDC	3 conductors power cable
OpDAQ Volumeter Module	24 VDC (Powered from Main Terminal)	Delivered by data cable
Binsfeld Torquemeter	10 - 30 VDC	3 conductors power cable
Repeater	6 - 32 VDC	2 conductors power cable
Analysis Computer	Typically 120VAC (may differ depending on model)	---

5.2 OP-ADVANCE MAIN TERMINAL CONNECTIONS

The Op-Advance Main terminal is the point where all the data cables should be run from. All the instruments are connected to this terminal. The following figure describes the different ports on the main terminal and specifies how the data cables should be connected.

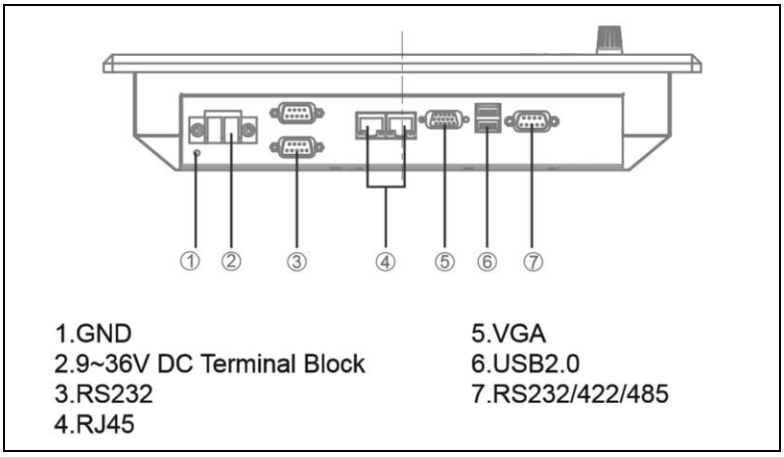


Figure 16 - Connection panel of the Main Terminal

Table 4: Detailed Connection on Main Terminal

	PORT	Cable type	Destination
1	GND (Chassis)	Braided ground wire	Ship chassis
2	12-24 VDC	Power cable	Shipboard Power
3 (top)	COM 4	RS-422 Serial cable	GPS
3 (bottom)	COM 3	RS-485 Serial cable	Wheelhouse Repeater
4	LAN	Ethernet cable	Analysis Computer
4	LAN	Ethernet cable	Shipboard Network (Email module/remote access)
6	USB	USB cable	Remote USB Port
6	USB	RS-422 Serial cable	TorqueTrak TPM2
6	USB	RS-485 Serial cable	Electrical power meter
7	COM 1	RS-485 Serial cable	OpGI-V and OpVI Volumeter Modules

5.3 KRAL VOLUMETER CONNECTIONS

Each OpDAQ Volumeter Module must be connected to the Pick-up and Temperature sensors from the corresponding Volumeter. For more details on the Volumeter Modules OpGI-V refer to the OpGI-V Operation and Installation manual.

Note that each OpGI-V module contains the calibration information for a specific KRAL volumeter. Failure to assign the module OpGI-V to the right KRAL volumeter will result in high measurement error. Each module OpGI-V is labelled with the serial number of the corresponding KRAL volumeter.

Table 5: Pick Up 1 and 2 Pinout

Kral Volumeter Pick Up Sensor 1 or 2	OpGI-V Pulse 1 or Pulse 2 Connector
Vin	Pin 1 : Pulse voltage (12VDC)
0 V	Pin 3 : 0 V
Encoder Pulse OUT	Pin 4 : Encoder Pulse IN

Table 6: Temperature Sensor Pinout

Kral Volumeter Temperature Sensor	OpGI-V Pulse 2 Connector
Signal	Pin 1 : Pulse voltage (12VDC)
GD2	Pin 3 : GD2
GD1	Pin 4 : GD1

5.4 OPDAQ VOLUMETER MODULES CONNECTIONS

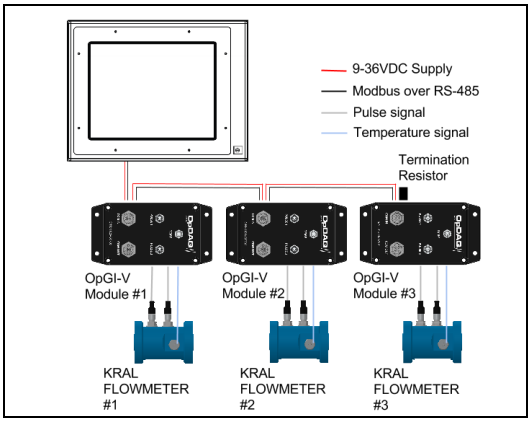


Figure 17 – OpGI-V Connection example

The Volumeter Module (OpGI-V) receives communication and power over a M12 bus cable connected to the Op-Advance main Terminal module serial COM port #1. If multiple Modules are used, they are connected in chain and their Mobdus addresses have to be indexed. It is recommended to use cable designed for RS-485 communication with 120 ohm impedance. The maximum cable length between the Main Terminal and a Volumeter module is 1000 meters.

Table 7: OpDAQ Volumeter Module Communication Modbus Pinout

Main Terminal TR-485 Port COM 1	OpGI-V Modbus IN Connector
Pin 1: A (DATA-)	Pin 4: A
Pin 2: B (DATA+)	Pin 5: B
Pin 5: GND	Pin 3: GND
24 VDC	Pin 2: Vin
GND (Chassis)	Pin 1: Shield

5.5 BINSFELD TORQUETRAK TORQUEMETER CONNECTIONS

The Binsfeld torquemeter requires two cables: a shielded serial data cable and a power cable. It is recommended to use shielded serial data cable to ensure quality signal transmission. The maximum data cable length between the Main Terminal and the TorqueTrak TPM2 is 600 meters (2000 feet). The power must be delivered to the torquemeter using a 3-conductors power cable.

Table 8: Torquemeter Communication Cable Pinout

Main Terminal USB to RS-422	TPM2	TPM2 Communication connector pin #
TDA(-)	RDA(-)	2
TDB(+)	RDB(+)	1
RDA(-)	TDA(-)	6
RDB(+)	TDB(+)	7
GND	GND	4

Table 9: Torquemeter Power Cable Pinout

TPM2 PIN #	Wire color	Signal description
1	RED	+24VDC (10 to 30VDC is acceptable), 15 watt max, 10 watt typical
2	BLK	Power Supply common
3	CLR	TPM2 chassis (connected to aluminum enclosure)

5.6 SHIPBOARD GPS CONNECTIONS

A serial cable is used to connect the GPS NMEA signal to the Main Terminal using the Serial port #4. It is recommended to use shielded serial cable to ensure quality signal transmission. The maximum cable length between the Main Terminal and the shipboard GPS is 150 meters. For longer cable run, RS-422 converters may be used to increase cable length to 1000 meters.

Table 10: GPS RS-232 Communication Cable Pinout

Main Terminal Serial Port COM 4	GPS NMEA 0183 COM Port
Pin 2: Rx	Tx
Pin 5: GND.	GND

Table 11: GPS RS-422 Communication Cable Pinout

Main Terminal Serial Port COM 4	RS-422 Converter In	RS-422 Converter Out	GPS NMEA 0183 COM Port
Pin 2: Rx	RS-232 TD	RS-422 RD A(-)	Tx(-)
		RS-422 RD B(+)	Tx(+)
Pin 5: GND.	RS-232 GND	RS-422 GND	GND

5.7 WHEELHOUSE REPEATER CONNECTIONS

The Wheelhouse Repeater is connected to the Main terminal using a serial cable using the Serial port #3. A RS-485 converter needs to be installed on port #3 to convert RS-232 signal to RS-485. It is recommended to use cable designed for RS-485 communication with 120 ohm impedance. The maximum cable length between the Main Terminal and the Wheelhouse Repeater is 1000 meters. The power must be delivered to the repeater using a 2-conductors power cable.

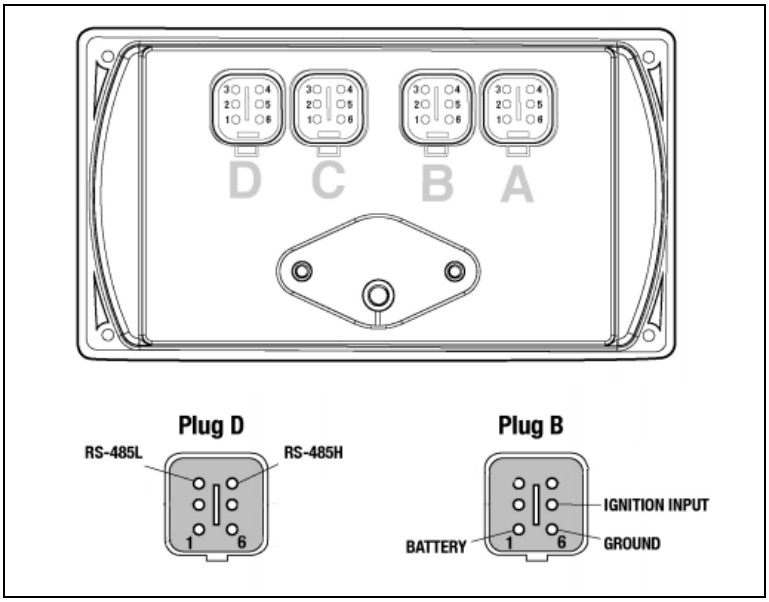


Figure 18 - Connection panel of the repeater

Table 12: Wheelhouse Repeater Communication Cable Pinout

Main Terminal Serial Port COM 3	RS-485 Converter In	RS-485 Converter Out	Repeater Plug "D"
Pin 2: Rx	RS-232 Rx	RS-485 (-)	3 (RS-485L)
Pin 2: Tx	RS-232 Tx	RS-485 (+)	4 (RS-485H)
Pin 5: GND.	RS-232 GND		

Table 13: Wheelhouse Repeater Power Cable Pinout

Repeater Plug "B"	Wire color	Signal description
1 (Battery)	RED	+24VDC (6 to 32VDC is acceptable), 10 watt max
5 (Ignition Input)	RED	+24VDC (6 to 32VDC is acceptable), 10 watt max
6 (Ground)	BLK	Power Supply common

5.8 ANALYSIS COMPUTER CONNECTIONS

The Analysis Computer is connected to the Main Terminal using an Ethernet cable. When the main terminal is directly connected to the analysis computer, the crossover pinout in Figure 19 must be respected. If the main terminal and the analysis computer are connected to the ship's network, then the patch pinout in Figure 20 must be used.

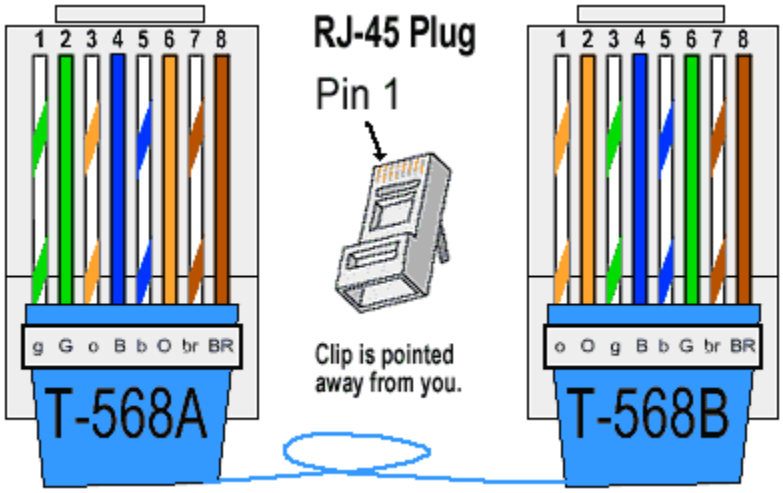


Figure 19– Ethernet crossover cable connectors pinout

RJ-45 cable assembly instructions:

- ☐ Carefully strip the outer sheath insulation back 1" to 2" using a stripper or a knife. Be careful not to nick the wires. Roll back the foil shield insulation and wrap the drain wire around the foil. Do not remove any insulation from the conductors.
- ☐ Spread and untwist the pairs to within 1/8" of the jacket. Cut off the core and discard.

- ☐ Straighten the twisted pairs. Arrange the untwisted wires in a row, placing them into the position, running from right to left, in which they will go into the RJ-45 connector. See figure below.
- ☐ Trim the untwisted wires in a straight line leaving no more than 1/2" of wire exposed otherwise it will be susceptible to crosstalk.
- ☐ Insert the wires into the RJ-45 connector, making sure that they stay aligned and each color goes into its appropriate channel. Make sure that each wire goes all the way to the top of the RJ-45 connector.
- ☐ Insert the plug into a crimp tool. Carefully holding the wires in position. Crip and recrimp the cable once more to ensure proper connection.
- ☐ Test the cable using a cable tester to check for shorts, opens or miswires.

5.9 INTERNET CONNECTION

When an internet connection is required for the main terminal, an Ethernet patch cable in Figure 20 can be run to connect the terminal to the ship's network. Follow the instructions listed above to assemble the RJ-45 connectors.

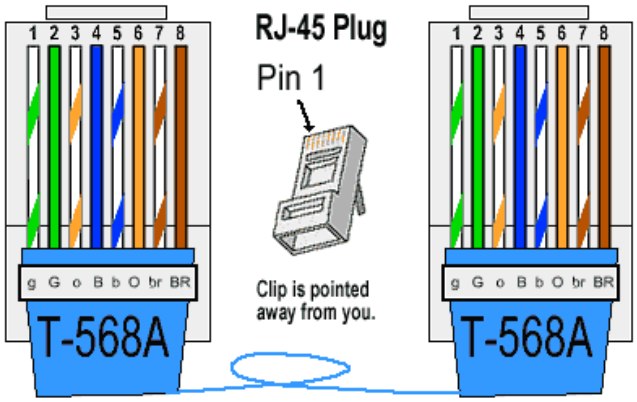


Figure 20 – Ethernet patch cable connectors pinout

6. COMMISSIONING

The following safety instructions must be observed at all time

- ☐ The following qualifications are required
  - Practical electrotechnical knowledge
  - Knowledge of the safety guidelines at the workplace
  - Knowledge of the electrotechnical safety guidelines

6.1 INSTALLATION VALIDATION CHECKLIST

Installation

- ☐ Check that the Main Terminal is installed correctly

Electrical installation

- ☐ Check the connection of the output signal cables from the Volumeter Modules
- ☐ Check the connection between Volumeter Modules and the Main Terminal COM port #1.
- ☐ Check the connection between Torquemeter and Main Terminal.
- ☐ Check the connection between the Wheelhouse Repeater and the Main Terminal COM port #3.
- ☐ Check the connection of the serial cable from the GPS and the Main Terminal COM port #4.
- ☐ Check the connection between the Analysis Computer and the Main Terminal.
- ☐ Check the internet connection of the Main Terminal.

Power supply

- ☐ Ensure that the power supplies are disconnected.
- ☐ Check that the power supply on the Main Terminal is connected firmly.
- ☐ Check the Torquemeter connection to the power supply.
- ☐ Check the Wheelhouse Repeater connection to the power supply.
- ☐ Check the Analysis Computer connection to the power supply.

Function test

- ☐ Switch on the power supply.
  - The system screen will appear on the touch screen monitor.
- ☐ Make sure no error appears on the main terminal. Refer to section 9. TROUBLESHOOTING to isolate error causes.

7. SYSTEM SOFTWARE

Op-Advance is a powerful tool specifically designed to collect, store, analyse and display sensor data. This software can also generate smart reports and do much more. Press the Power button to power up the Main terminal. The default Home screen may take up to 30 seconds to appear.

7.1 RESTARTING THE SYSTEM

To restart and reboot the system, press the Power button on the Main Terminal.

7.2 SYSTEM OVERVIEW

There are three (3) main control areas to navigate the system: the Notification area, the top contextual menu and the bottom Main menu.

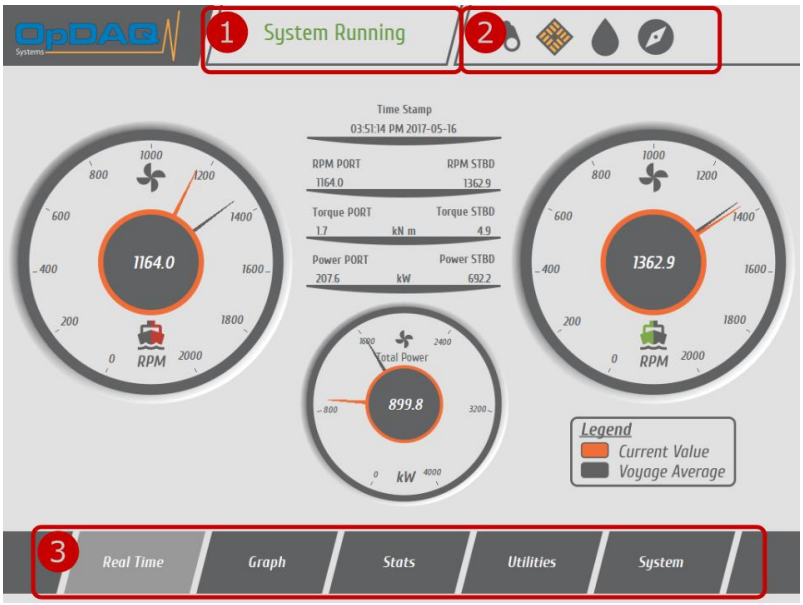


Figure 21 – System Overview

Table 14: General Navigation Tool Description

	Navigation tool	Description
1	***Notification Area***	System status and alarm notifications are always displayed at the top. This area indicates if the system is working properly or if errors occurred. The user may click on the notification area to display errors detail.
2	***Contextual Menu***	The contextual menu enables a more complex display. The contextual menu is found in the top right corner of the screen. Repeatedly pressing a Main menu button will also cycle between the different contextual screens of that main screen.
3	***Main Menu***	The Op-Advance monitoring system is arranged into five main screens accessible through 5 buttons in the lower part of the screen. This menu never changes unlike the contextual menu.

7.2.1 NOTIFICATION SYSTEM

The notification area can display various notifications. The notification area is directly linked to the event subscreen (Figure 40) but will only display a single notification. When more than one notification needs to be displayed to the user, only the highest priority notification will be displayed. A green still notification indicates everything is running properly. A red blanking notification indicates an error or a warning about the system state. The user should always attest notifications before and take the appropriate action before clearing them.

Table 15: Notification List

Type	Priority	Notification	Description
System	*1 (highest)*	*System Running*	System is running properly without any notification.
System	*1 (highest)*	*System Error*	System is running with error(s). Errors need to be fixed for this notification to be cleared.
System	*1 (highest)*	*System Warning*	Error(s) occurred but system was able to clear them and keep running without error. Make sure to attest the errors and and take the appropriate action to make sure the system keeps running without errors.
Automatic Input	*2*	*Input Warning*	*Automatic input overshoot was detected.*

7.3 REAL TIME SCREEN

The REAL TIME screen is used for the real-time display of the measured data from the system instrumentation (torquemeter, flowmeter, GPS, electrical power, etc). The REAL TIME screen displays all measured data including the following:

- Fuel consumption
- Distance travelled
- GPS speed
- Specific fuel consumption
- Shaft torque “Power and Revolution”

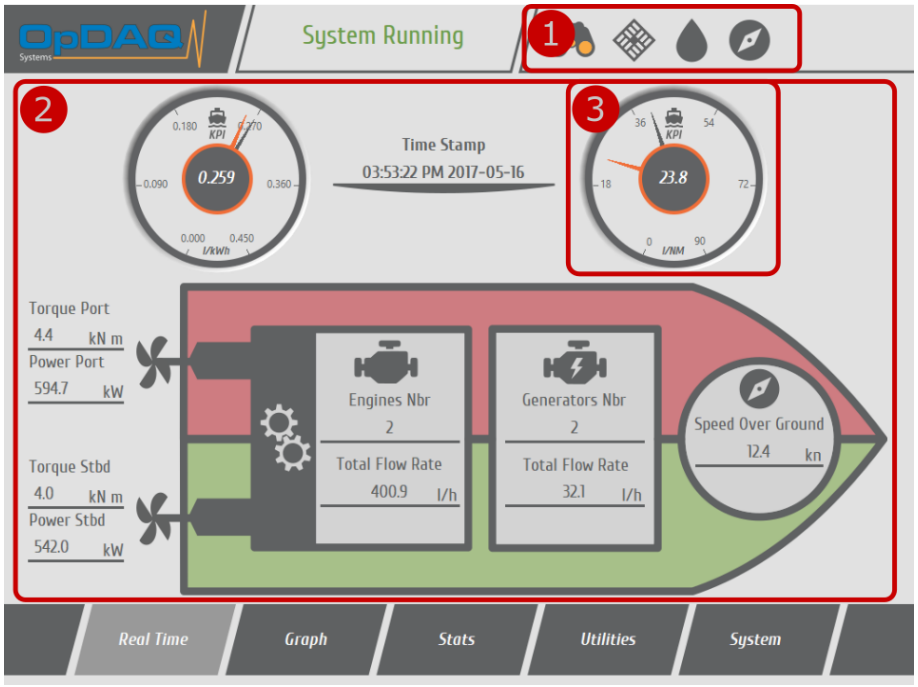


Figure 22 – Real Time screen example

Table 16: Real Time Screen Element Description

	Navigation tool	Description
1	***Real Time Contextual Menu***	The *Real Time* contextual menu is automatically built to include the ship overview followed by the installed instrument displays.
2	***Real Time Instrument Values***	The *Real Time* screens display the actual values read from the sensors. Different gauges, bars and images may be used to display the data.
3	***Real Time Gauges & Graphical Element***	On all graphical elements, orange colored needles show the actual value and gray colored needle shows the voyage average.

7.3.1 RESETTING AVERAGES & TOTALIZERS

Average and totalizer values are computed from current voyage data. To reset averages, you must restart a new voyage. Refer to Table 31 for the procedure to save and start a new voyage.

7.4 GRAPH SCREEN

Two different graph modes are available to analyze data over time or to compare actual values with previous vessel values. The graph mode can be selected from the contextual menu in the top part of the GRAPH screen.

7.4.1 TIME GRAPH

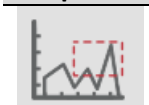
The TIME GRAPH screen is used for displaying last-minute or last hour data on a graph. The user can display up to two sets of data simultaneously to help compare PORT and STBD data or any other useful data. The displayed data is user-selectable from a list of options and a set of graphical tools is provided for further analysis.

Figure 23 – Time Graph screen

Table 17: Time Graph Screen Element Description

	Navigation tool	Description
1	***Time Graph Mode***	The top part of the GRAPH screen features a contextual menu for a quick access between Time mode and Baseline mode.
2	***Graph Parameters***	The data displayed on the GRAPH screen can be selected using the Parameter dropdown menus. Two sets of data can be displayed simultaneously on the x-axis (time interval) for comparison purposes. The graphs are color coded. Their respective scales (on the y-axis) are displayed on the left and right of the graph.
3	***Zoom tools***	A set of four (4) graphical tools is provided for zooming on specific parts of the graph.

Table 18: Graph Tool Description

Graph tool	Axis	Description
	Zoom to box	With this option, click a point on the display you want rectangle of the zoom area to start from and drag until the rectangle covers the area of interest.
	X-zoom	Use this option to zoom in an area of the graph along the x-axis.
	Y-zoom	Use this option to zoom in an area of the graph along the y-axis.
	Zoom to fit	Use this option to autoscale all x-and y- scales on the graph. Pressing the ZOOM TO FIT button will also zoom back to the original display.

Notice: When using the graphical tools on a touch screen computer, it is required to maintain sufficient pressure on the touch screen to ensure proper selection of graph zone.

7.4.2 BASELINE GRAPH

The Baseline Graph is a very useful tool to monitor vessel deterioration and performance over its lifetime. It can also be helpful to assist the officers and help follow the company guideline. To set the baseline data, refer to Table 41: Baseline Configuration Procedure.

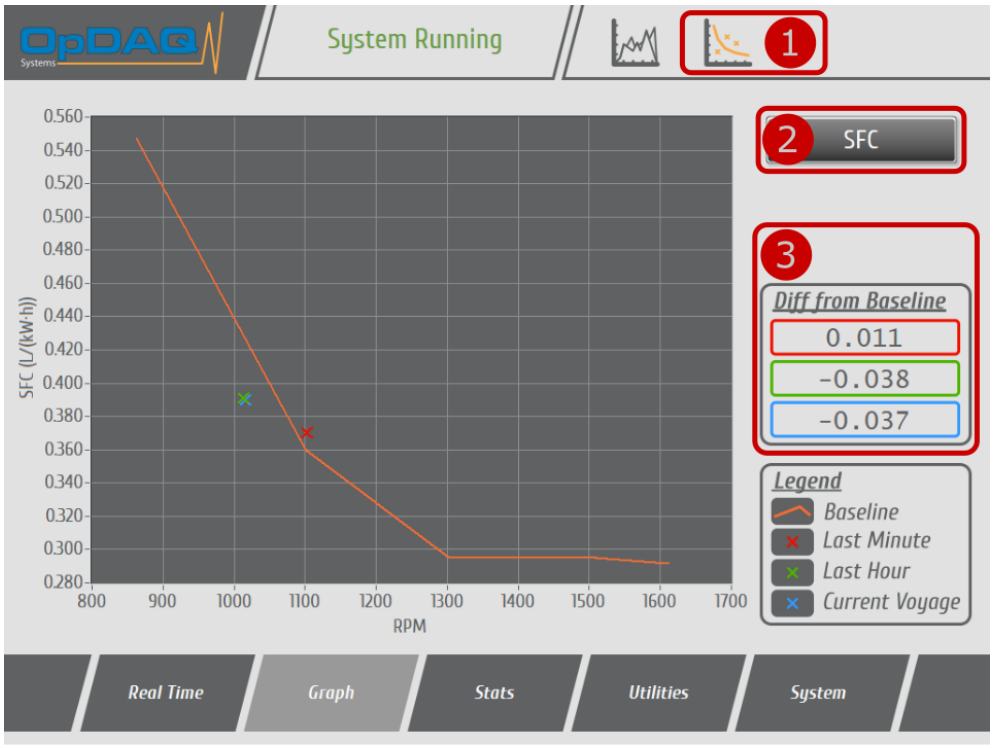


Figure 24 – Baseline Graph screen

Table 19: Baseline Graph Screen Element Description

	Navigation tool	Description
1	***Baseline Graph Mode***	The top part of the GRAPH screen features a contextual menu for a quick access between Time mode and Baseline mode.
2	***Baseline Type***	Dropdown list to select Baseline type from these five performance indicator: ▪ Fuel Consumption/Hour ▪ Engine Power ▪ Specific Fuel Consumption (SFC) ▪ Specific Fuel Consumption/Speed ▪ Fuel Consumption/NM
3	***Difference Display***	Displays the difference of each point from the baseline interpolated point.

7.5 STATS SCREEN

The STATS screen gives access to calculated statistics for the last minute, last hour or current voyage. The system presents the Average, Total and Peak values. The STATS screen displays the following:

- Total average fuel consumption
- Total distance travelled
- Peak and average speed
- Average specific fuel consumption
- Average shaft torque “power and revolution”

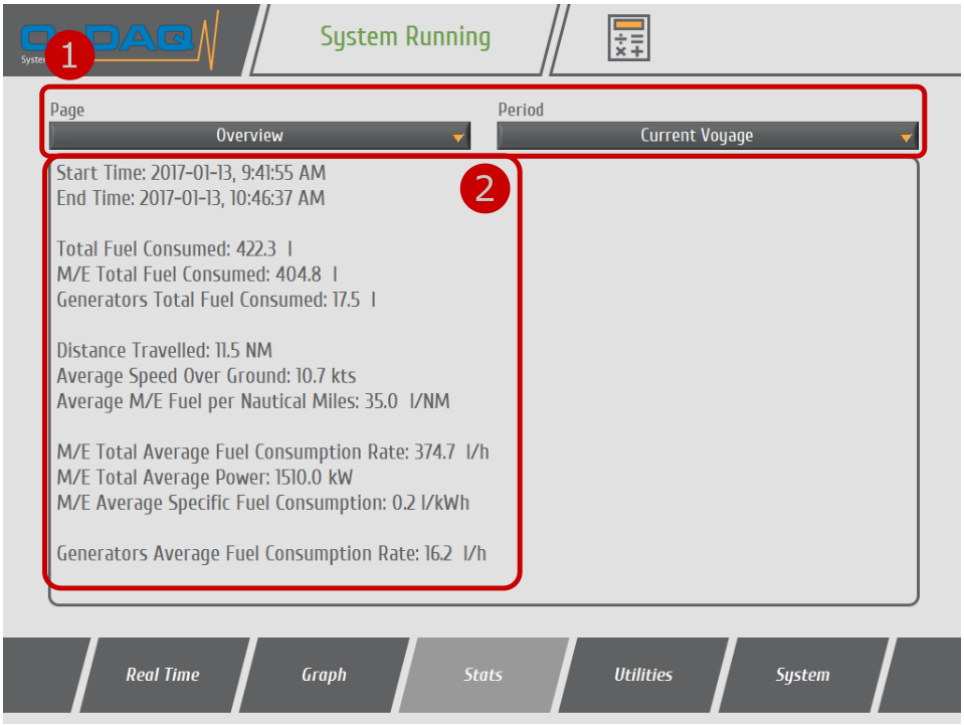


Figure 25 – Stat screen

Table 20: Stats Screen Element Description

	Navigation tool	Description
1	***Statistics parameters***	For any configuration of two or more engines, each shaft data may be displayed at the same time (Overview) or separately.
2	***Statistics***	Statistics are computed using the template from the stats.txt file. Typically, statistics are shown for specific engine as well as for the overall configuration.

Table 21: Example of Available Statistics

Engine choice	Displayed statistics	
Overall	Start time Last recorded time Total fuel consumed Average flow Average power	Total distance Average FpNM Average SFC Average speed over ground Peak speed over ground
Specific engine	Total fuel consumed Average flow Peak flow Peak/Average shaft power Peak/Average shaft torque Peak/Average shaft revolution	

7.6 UTILITIES SCREEN

The Utilities screen is designed to meet the user's specific needs. Add-ons, User Specific modules and Utilities are found on this screen. Any custom user requested utilities will be found on this screen.

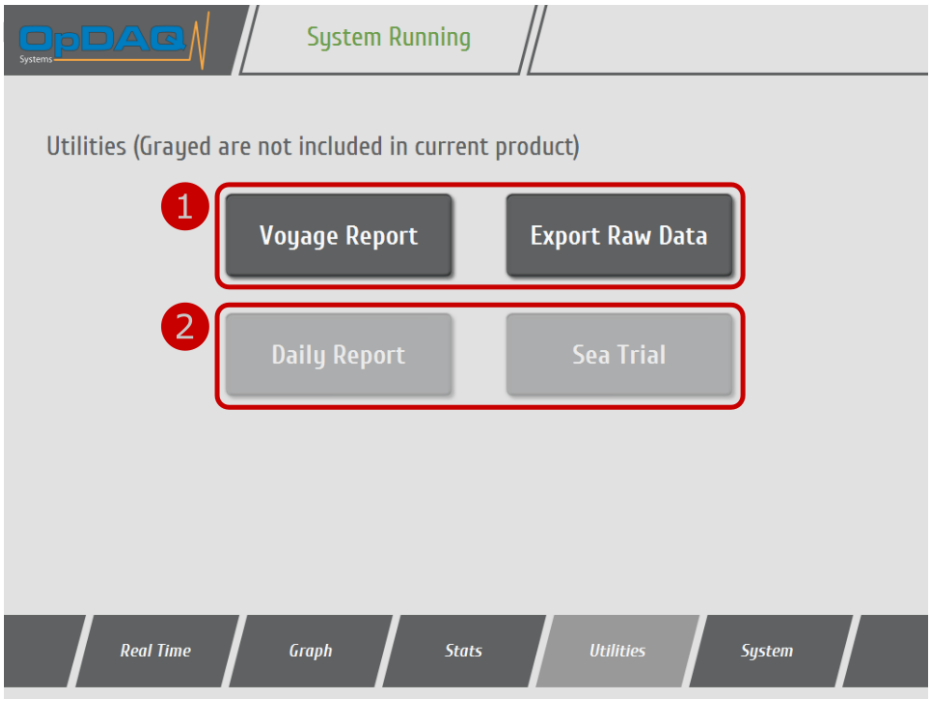


Figure 26 – Utilities screen

Table 22: Utilities Screen Element Description

	Utility Availability	Description
1	***Included***	Utilities enabled and included in current user version of Op-Advance system.
2	***Available upon purchase***	Utilities not included in current user version are grayed out and disabled.

Please contact our customer service to know more about the packages available and to share your specific needs for the application.

7.6.1 USB EXPORT

Op-Advance acquired data may be exported on a USB memory stick. Two data types are available: Raw for further analysis with the DataVIEW software and Excel for any Microsoft Excel version.

When exporting to Excel, some data may be periodically discarded to speed up compute time and reduce file size. The following rule is applied to reduce file size: if data element is larger than 8640, the program will periodically discard data so that the remaining data fit in 8640.

Example: A system acquires data every 1 second for an entire day, the exporter will keep 1 sample and discard 9 every 10 seconds of acquisition. The excel file will then displays the entire day of data with a period of 10 seconds between each sample.

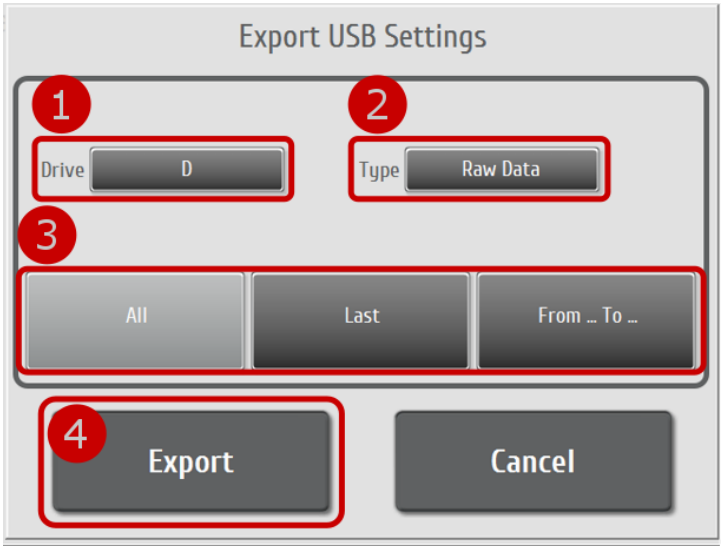


Figure 27 – Export status screen

Table 23 : USB Data Exportation Procedure

	Connect the USB memory stick to the remote USB port.
	Open the USB Export utilities located in “Utilities".
1	Select USB Drive to export data to.
2	Choose file type (Data or Excel).
3	Choose the days to be exported (EXPORT ALL; EXPORT LAST or EXPORT From… To…). If EXPORT From… To… is selected, choose dates to export.
4	Click “Export” to start exportation process.
	Remove the USB memory stick from the USB connection.
	Use DataVIEW or Excel 2007 (or newer) to analyse the exported files exported on the USB drive.

7.6.2 SEA TRIAL

The Sea Trial Module is a helpful and powerful add-on to measure, compare and benchmark vessel performance and efficiency. This module allows the user to record laps and automatically computes the data. This gives precious information on engine performance for each lap. To use this module, a keyboard is required to enter name tag.

7.6.2.1 SEA TRIAL MODULE OVERVIEW

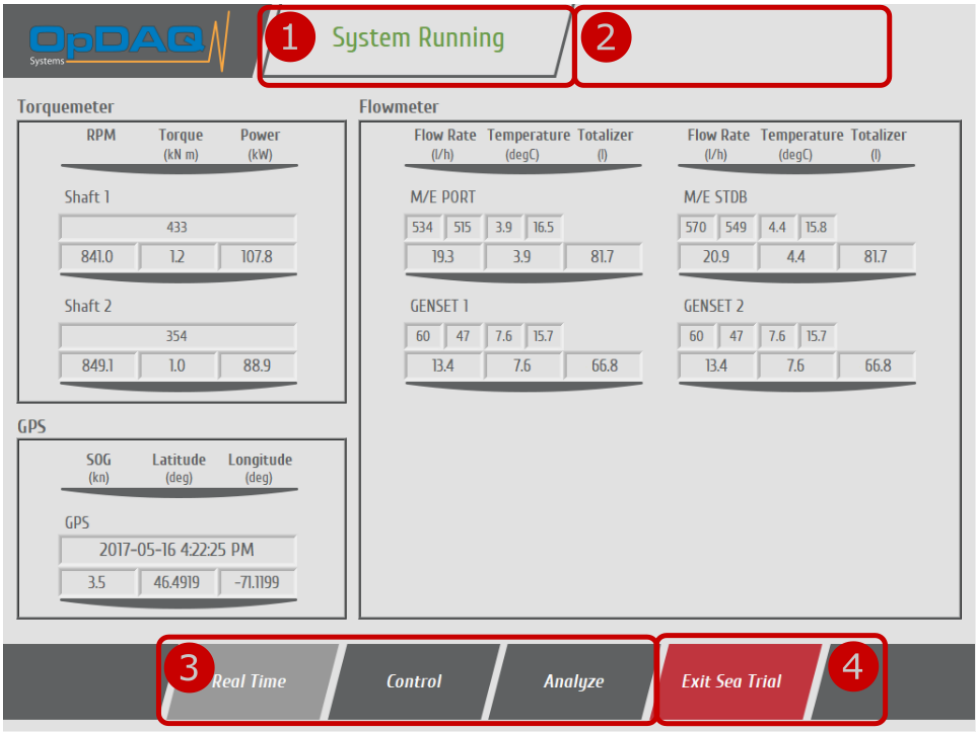


Figure 28 – Sea trial Main screen

Table 24: Sea Trial General Navigation Tool Description

	Navigation tool	Description
1	***Notification Area***	System alarm notification is always displayed at the top. This area indicates if the system is working properly during sea trials. The user must leave Sea Trial mode to display errors detail.
2	***Contextual Menu***	The *Analyze* screen holds a contextual menu to display each sensor details. Repeatedly press a main button will also cycle between the different contextual screens.
3	***Main Menu***	The Sea Trial module is arranged into three main screens. This menu does not change unlike the contextual menu.
4	***Exit***	To exit Sea Trial Mode and return to Op-Advance monitoring system screens, press the Exit Sea Trial button.

7.6.2.2 RUN A NEW SEA TRIAL

The Sea Trial module is designed to record lap data as easily as recording time with a chronometer.

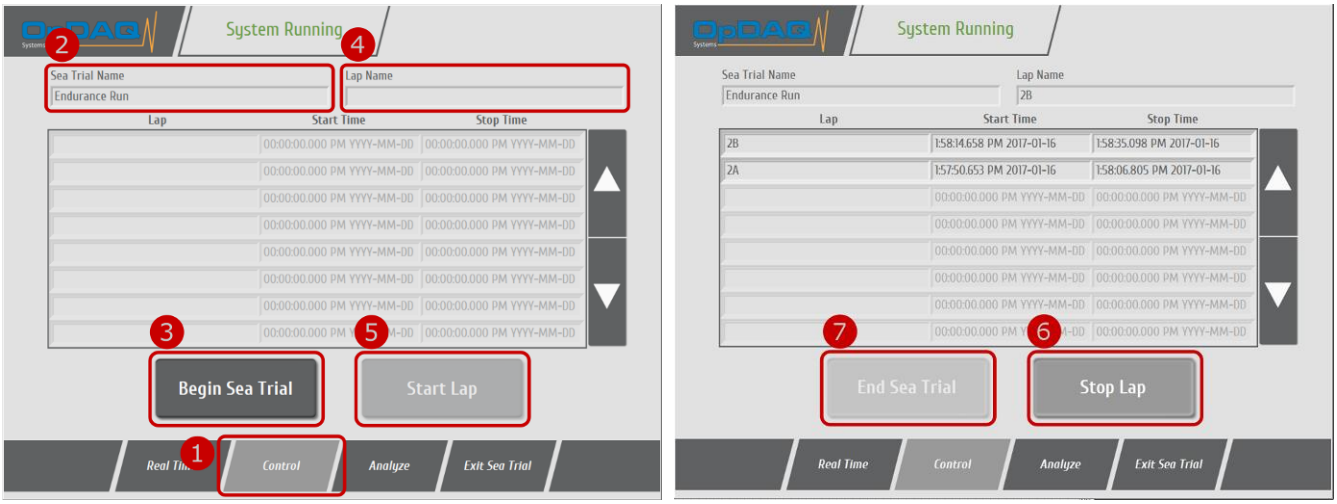


Figure 29 – Sea trial Control screen

Table 25: Record a New Sea Trial Procedure

1	Select the control screen.
2	Enter new sea trial name. (If no sea trial name is entered, the date/time will be used.)
3	Press “Begin Sea Trial” to create new sea trial data.
4	Enter new lap name. (If no lap name is specified, an incrementing number will be used)
5	Press “Start Lap” when ready to record lap data.
6	Press “Stop Lap” to end recording of lap data. ▪ To record a new lap, redo step 4 to 6
7	Press “End Sea Trial” to close current sea trial.

7.6.2.3 COMPUTE SEA TRIAL DATA

Once Sea Trial data has been recorded, the user may compute past Sea Trial using the compute function. Any previous Sea Trial data may be computed by selecting date to compute.

Figure 30 – Sea trial Analyze screen – Compute

Table 26: Computing Recorded Sea Trial Data Procedure

1	Select the Analyze screen.
2	Select date to fetch data (default is current day).
3	Press “Compute” to start compute process
4	Select Sea Trial to display.
5	Analyze data.

7.6.2.4 EXPORT SEA TRIAL DATA

Sea Trial computed data may be exported to a USB flash drive. The data tables will be exported in a simple html file that can be read on any computer using the default web browser.

Figure 31 – Sea trial Analyze screen – Export

Table 27: Exporting Sea Trial Data Procedure

	Plug the USB flash drive to the terminal.
1	Select the analyze screen.
2	Select date to fetch data (default is current day).
3	Press “Compute” to start compute process.
4	Select USB drive to export data.
5	Press “Export Report” to copy report on USB memory stick.

7.6.3 DAILY REPORT

The Daily Report module, once enabled, automatically generate report at the end of every day. The generated report displays the ship overview including key performance indices (Specific Fuel Consumption, Fuel per Nautical Mile, etc.) Detailed engines, shaft and GPS information are also included in every generated report. Daily Reports are a simple tool to get a quick overview of the ship performance over time as well as monitor the ship daily usage. For convenience and remote monitoring, Daily Report can also be automatically sent by Email once generated.

7.6.3.1 DISPLAY PREVIOUS DAILY REPORT

The Daily Report module will back up every day report on the hard drive. Previous day report can be loaded by selecting the date to look for an archived report.

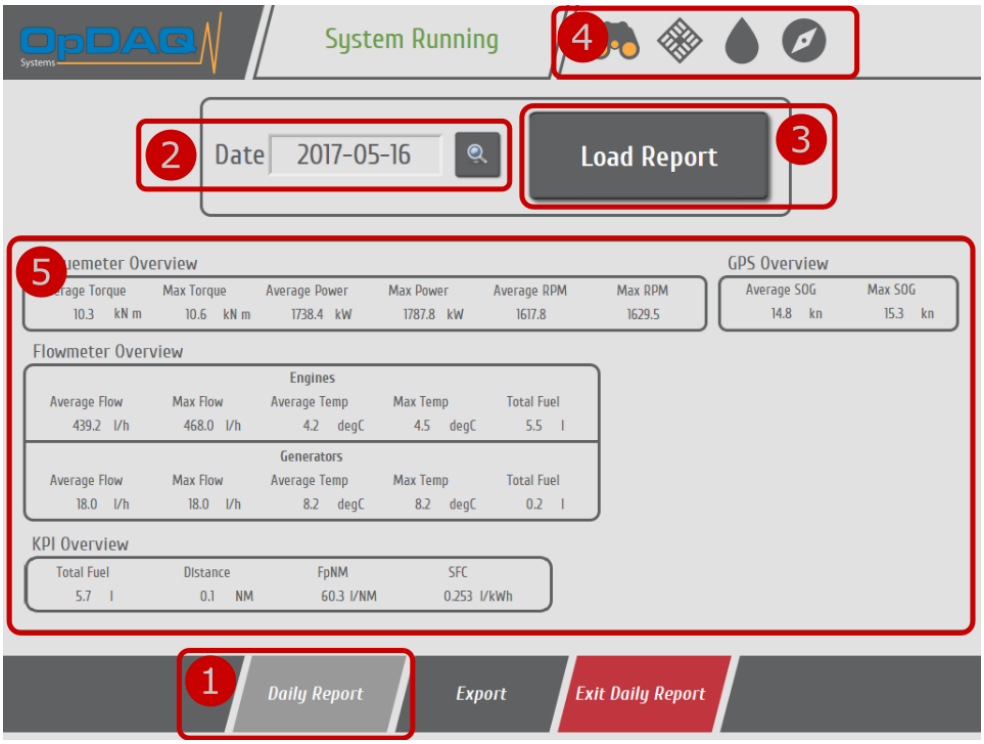


Figure 32 – Daily Report main screen

Table 28: Loading Previous Daily Report Procedure

	Open Daily Report module in OP5 Utilities menu.
1	Select the Daily Report screen.
2	Select a valid date to fetch report (default is yesterday) (valid date are orange in calendar display).
3	Press “Load Report” to load selected daily report.
4	Select information to display. (Select the binoculars to display ship overview)
5	Analyze the data.

7.6.3.2 EXPORT PREVIOUS DAILY REPORT

Daily Report can be exported at any time on a USB drive in Excel format.

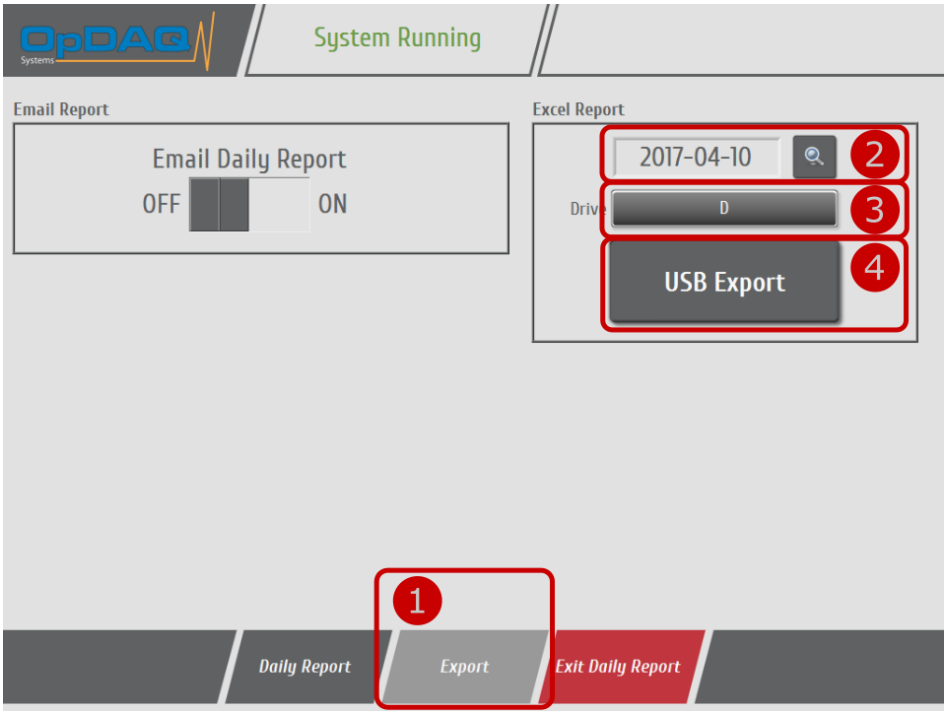


Figure 33 – Daily Report export screen

Table 29: Exporting Previous Daily Report Procedure

	Export previous report procedure
	Open Daily Report module in OP5 Utilities menu.
1	Select the Export screen.
2	Select a valid date to fetch report (default is yesterday) (valid date are orange in calendar display).
3	Select USB drive to export report to.
4	Press “USB Export” to load selected daily report and export it to the USB drive. Exported report data are formatted inside an Excel file.

7.6.3.3 CONFIGURE EMAIL

When daily report data is computed at the end of a day, the excel report can be automatically sent to as many email addresses as necessary. To do so, an internet connection must be available to the system. To make sure not to overload the internet connection (often limited) only the current report is sent including computed averages and values and excluding raw data. This way, the email size is kept to a minimum (about 10kB).

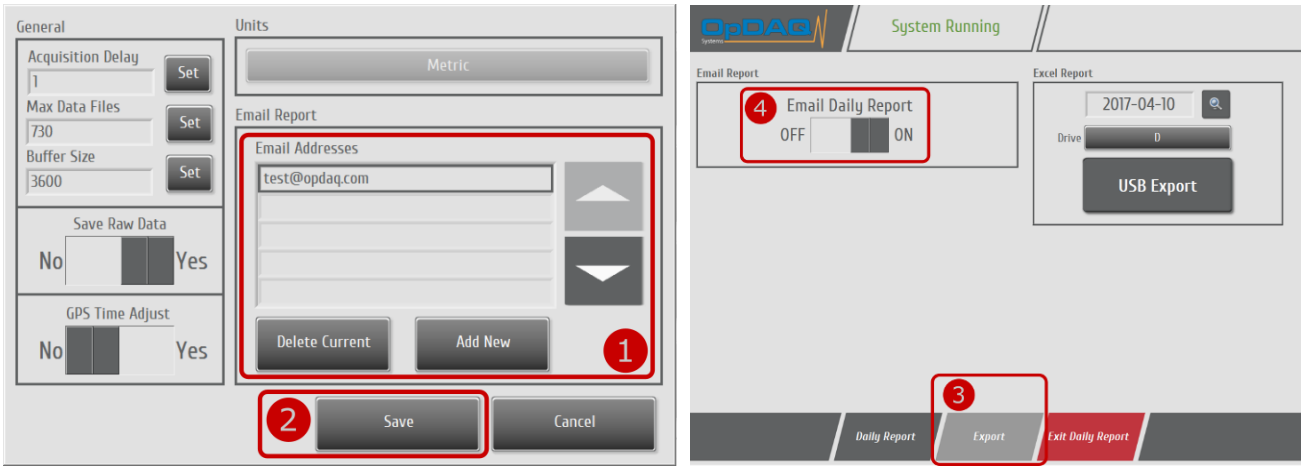


Figure 34 – Daily Report email configuration

Table 30: Enabling and Configuring Daily Report Email Procedure

	Open General Configuration in system settings.
1	Enter list of email addresses to send report to. (The same list is also used for Voyage Report)
2	Save configuration.
	Open Daily Report module in OP5 Utilities menu.
3	Select the Export screen.
4	Activate Daily Report Email functionality.

7.6.4 VOYAGE REPORT

The Voyage Report module allows the user to generate a report for any time period larger than a single day. This module can be useful to monitor and compare ship voyage performance. The generated voyage report displays the same data as the daily report but over a user controlled time period. Just like the daily report module, generated voyage report can be send by email and all previous voyage reports are archived on computer hard drive.

7.6.4.1 START & SAVE VOYAGE

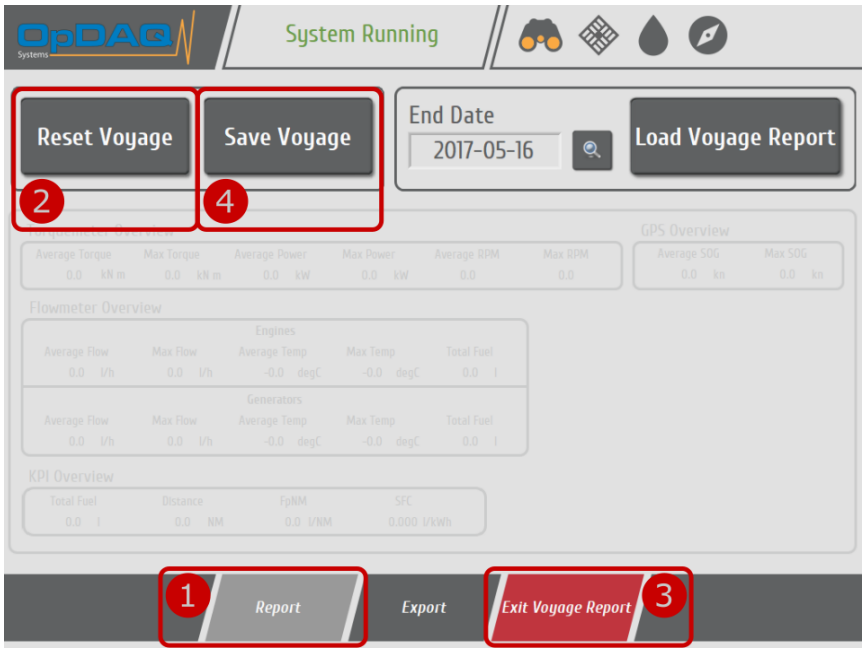


Figure 35 – Create and Save Voyage Report

Table 31: Creating a New Voyage Report Procedure

	Starting a new voyage procedure
	Open Voyage Report module in OP5 Utilities menu.
1	Select the Report screen.
2	Reset statistics to start recording voyage data. Warning: All unsaved statistics will be lost. Make sur to save current voyage first.
3	Exit Voyage Report and continue using the system as needed.
	Saving current voyage procedure
	Open back Voyage Report module in OP5 Utilities menu.
1	Select the Report screen.
4	Press “Save Voyage” to compute statistics and archive report.

7.6.4.2 DISPLAY PREVIOUS VOYAGE REPORT

The Voyage Report module will back up every saved report on the hard drive. Previous voyage report can be loaded by selecting the end of voyage date.

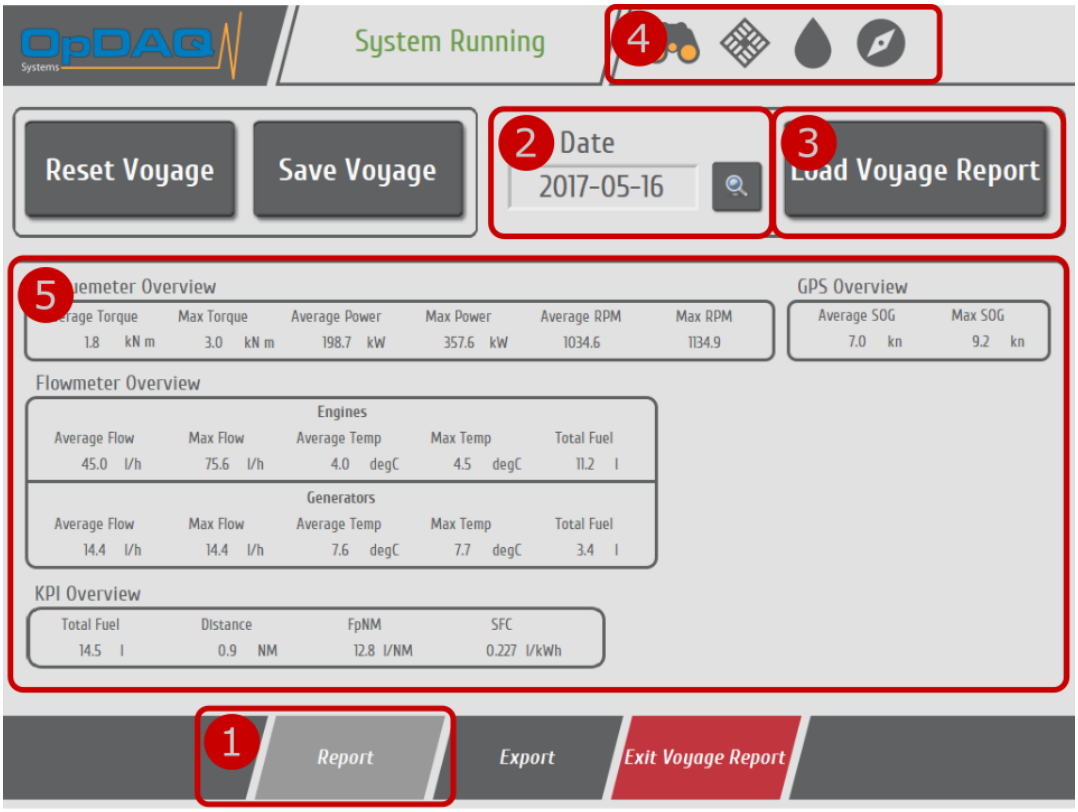


Figure 36 – Voyage Report main screen

Table 32: Loading Previous Voyage Report Procedure

	Open Voyage Report module in OP5 Utilities menu.
1	Select the Report screen.
2	Select a valid end of voyage date to fetch report (valid dates are colored orange in calendar display).
3	Press “Load Voyage Report” to load selected voyage report.
4	Select information to display. (Select the binoculars to display ship overview)
5	Analyze the data.

7.6.4.3 EXPORT PREVIOUS VOYAGE REPORT

Voyage Report can be exported at any time on a USB drive in Excel format.

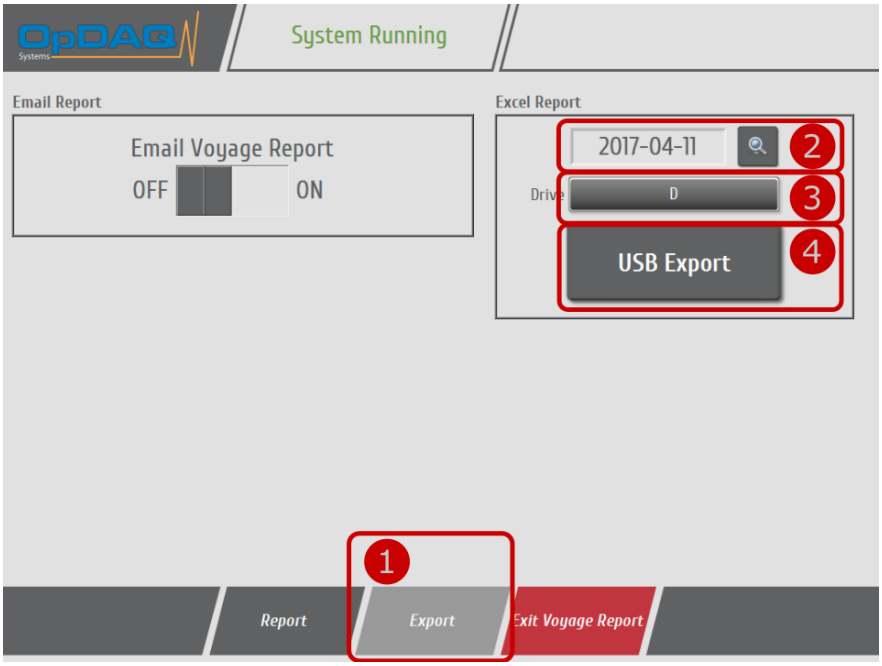


Figure 37 – Voyage Report export screen

Table 33: Exporting Voyage Report Procedure

	Open Voyage Report module in OP5 Utilities menu.
1	Select the Export screen.
2	Select a valid end of voyage date to fetch report (valid dates are colored orange in calendar display).
3	Select USB drive to export report to.
4	Press “USB Export” to load selected voyage report and export it to the USB drive. Exported report data are formatted inside an Excel file.

7.6.4.4 CONFIGURE EMAIL

When voyage report data is computed when the user request to save current voyage, the excel report can be automatically sent to as many email addresses as necessary. To do so, an internet connection must be available to the system. To make sure not to overload the internet connection (often limited) only the current report is sent including computed values and excluding raw data. This way, the email size is kept to a minimum (about 10kB).

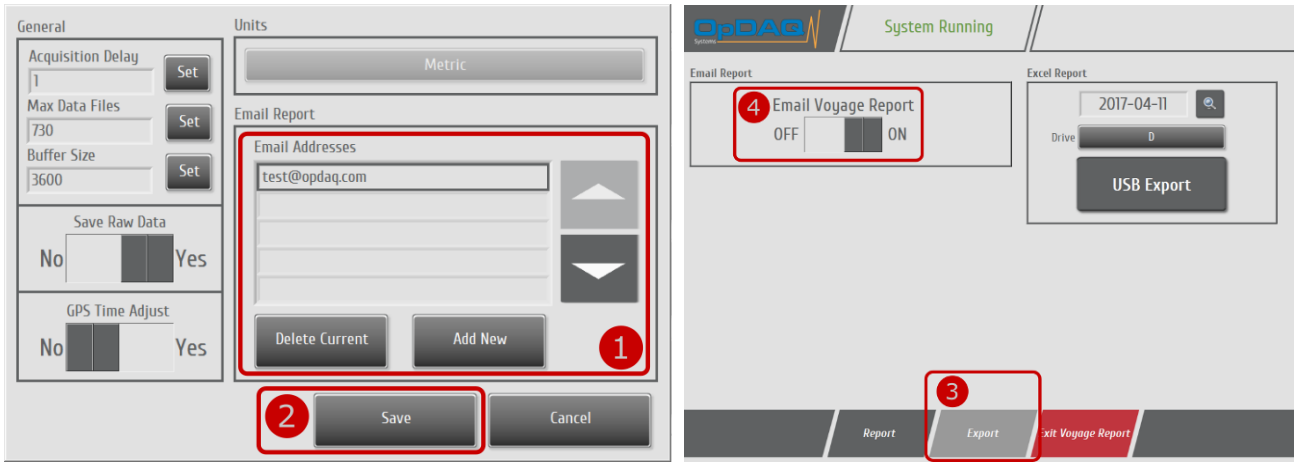


Figure 38 – Voyage Report email configuration

Table 34: Enabling and Configuring Voyage Report Email Procedure

	Open General Configuration in system settings.
1	Enter list of email addresses to send report to. (The same list is also used for Daily Report)
2	Save configuration.
	Open Voyage Report module in OP5 Utilities menu.
3	Select the Export screen.
4	Activate Voyage Report Email functionality.

7.7 SYSTEM SCREEN

The SYSTEM contextual menu holds HOME, SETTINGS, EVENT, ABOUT subscreen buttons. It also holds the button to Switch between night and day mode.

7.7.1 HOME SUBSCREEN

The Home subscreen is the default screen at system start up.

It holds the System Status to quickly identify erroneous connections and error signals from the connected instruments. This screen is helpful for troubleshooting during installation and system usage.

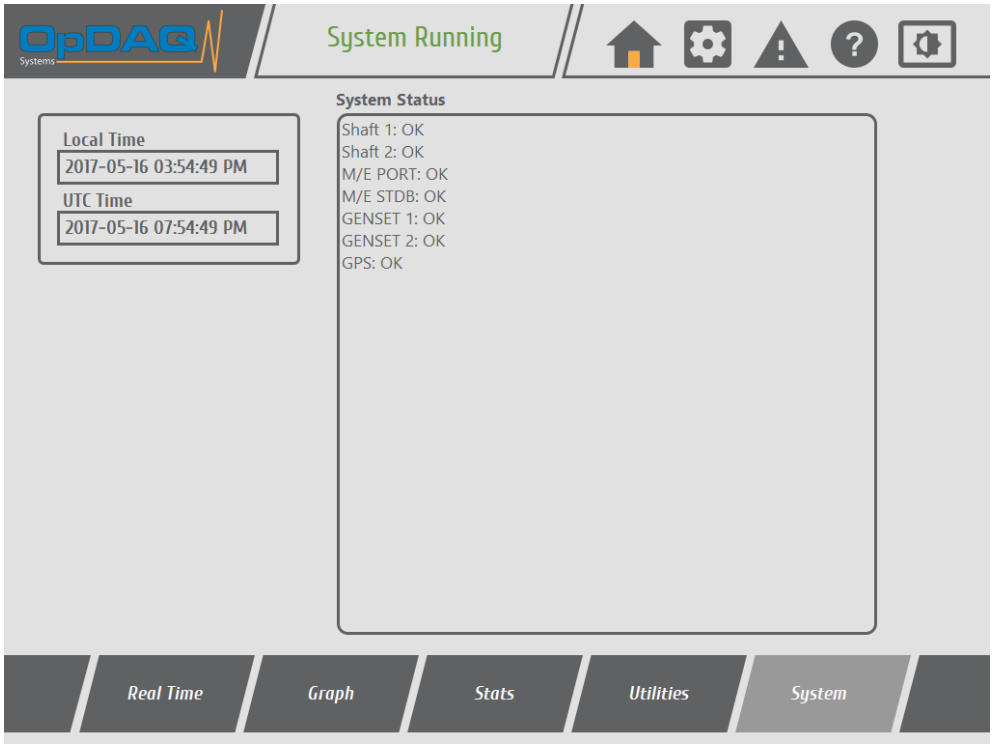


Figure 39 – System status screen

7.7.2 CONFIG SUBSCREEN

This screen is locked to the normal everyday user. To unlock it and configure the system, refer to chapter 8.

7.7.3 EVENTS SUBSCREEN

The EVENTS button will show the information recorded at a specific date/time. These events can be system warnings, user automatic inputs and instrument errors. This screen is helpful for troubleshooting.

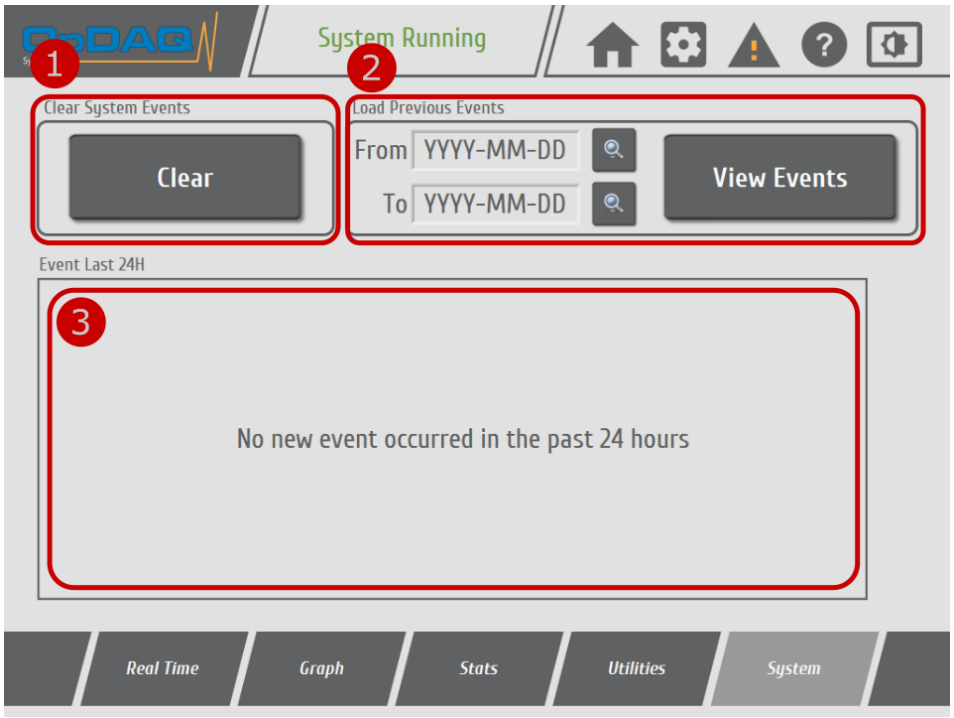


Figure 40 – Events subscreen

Table 35: System Event Screen Element Description

	Navigation tool	Description
1	***Clear System Events***	This button clears all events from the Last 24H list. All un-fixed error event and valid user automatic events will show back on this list as soon as it is cleared.
2	***Load Previous Events***	This area allows the user to view all past errors, warnings and events. To view a single day, enter the same date in the “From” and “To” selectors.
3	***Event Last 24H***	This box shows a list of all the events that occurred last 24 hours.

7.7.4 ABOUT SUBSCREEN

This subscreen shows the system version and the contact information.

7.7.5 SWITCH DAY/NIGHT MODE

To switch between day and night mode, press the day/night mode button in System.

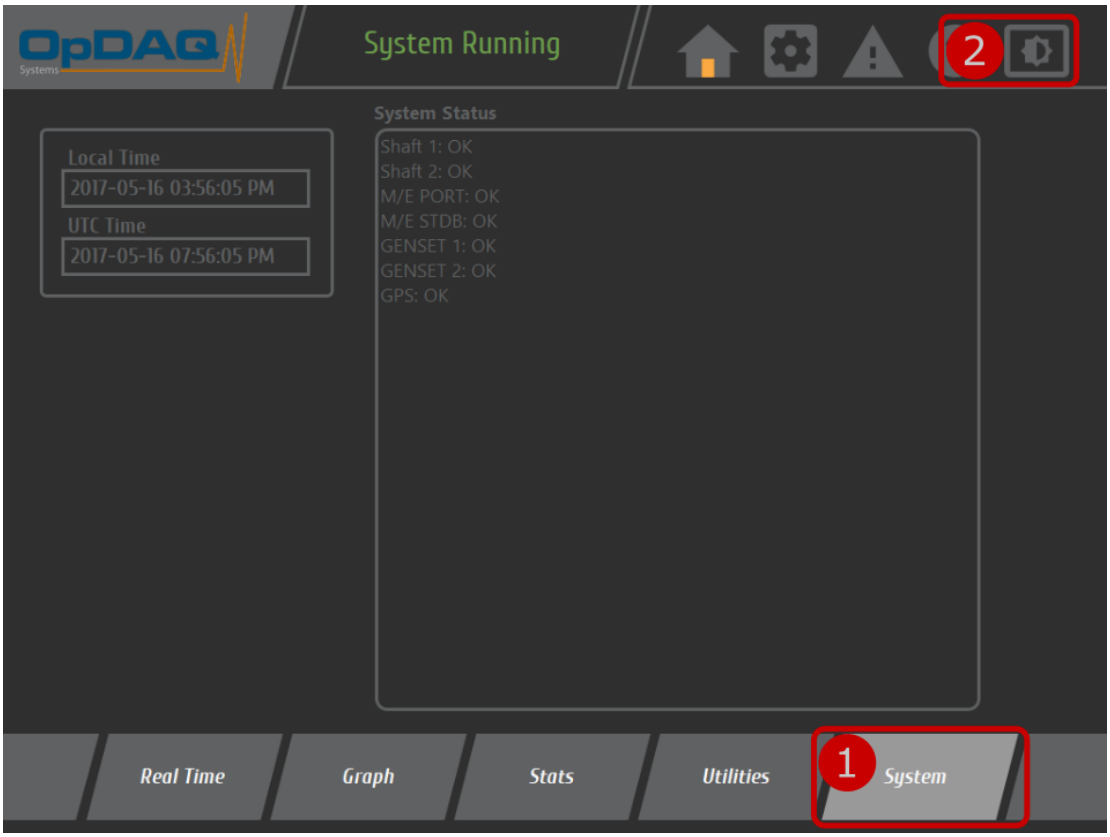


Figure 41 – Night screen

8. SOFTWARE CONFIGURATION

8.1 SYSTEM FIRST START-UP

At first system start-up, the user will have to set software initial configuration and enter provided activation code. Those entries will be saved and will not be needed afterward on system start-up.

8.1.1 SOFTWARE INITIALIZATION

The initialization screen presented bellow will appear at first system start-up. All paths are automatically populated if found on system. The system can still be re-initialized by technician request later on. To do so, go to system settings and press “Reset”.

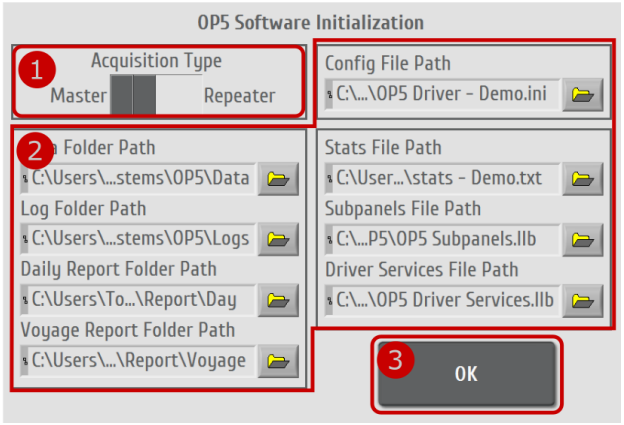


Figure 42 – Initialization screen

Table 36: Software Initialization Procedure

1	***Acquisition type***	Select “Acquisition Type”. (Master is main terminal and Repeater is a UDP terminal)
2	***File path***	Ensure all paths are found.
3	***OK Button***	Press OK to apply initial configuration and start system.

Table 37: Software Initialization Parameter Description

Parameter	Description	File Type
Config Path	Master system config file. This file describes the vessel configuration.	.ini
UDP Port	Repeater UDP port to connect to master system.	---
Data Folder Path	Folder to store acquisition data files.	---
Log Folder Path	Folder to store system logs files.	---
Daily Report Folder Path	Folder to store daily report data file.	---
Voyage Report Folder Path	Folder to store voyage report data file.	---
Stats File Path	Template file for stats display.	.txt
Subpanels File Path	Subpanels library for specific Real-Time displays.	.llb
Driver Services File Path	Service library to read instruments status and values.	.llb

8.1.2 SYSTEM ACTIVATION

The first time the system is started, the provided activation code must be entered to unlock the system. If, no activation code was provided, follow the procedure detailed in the following figure.

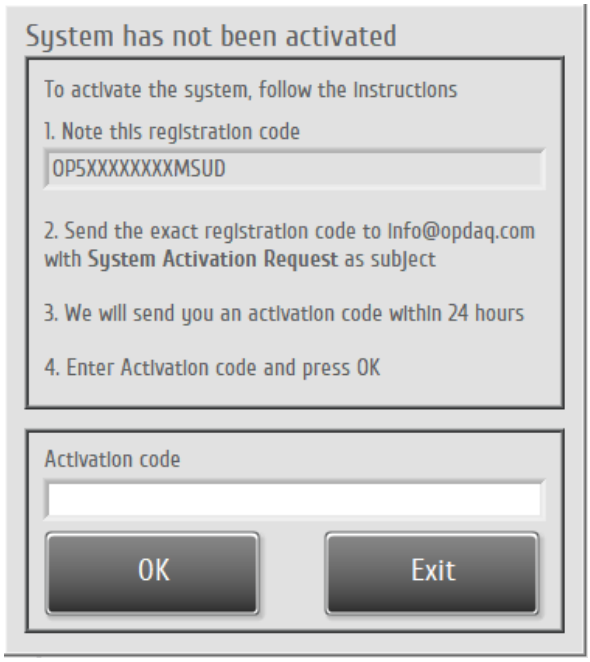


Figure 43 – System activation screen

8.2 SYSTEM SETTINGS

To enter setup mode, press the button on the system page. When prompted enter the password « 1487 » using the numerical pad and press OK.

Once the password is entered, the setup screen divided in 2 parts will appear: "*Instrument Setup*" and "*System Setup*". The Instruments setup reflects the user's acquisition instrument package. The System setup is used to set general configuration and update the system version. The configuration interface will go back to locked state after 15 minutes without changes or at technician request using the "Lock Settings" button.

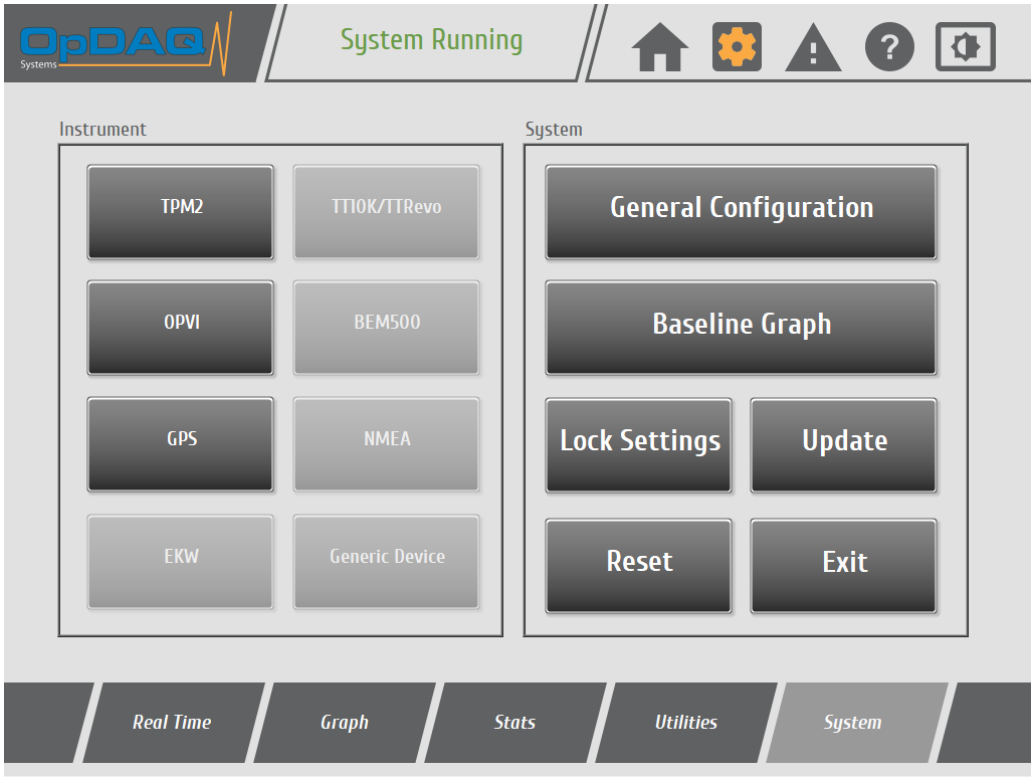


Figure 44 – Configuration Interface

8.2.1 UPDATING THE SYSTEM

The Op-Advance system is continuously being improved. Clients may be offered updates free of charge for a one years period following purchase. Updates are sent on a USB memory stick containing update data. The following procedure has to be followed to update the Op- Advance system.

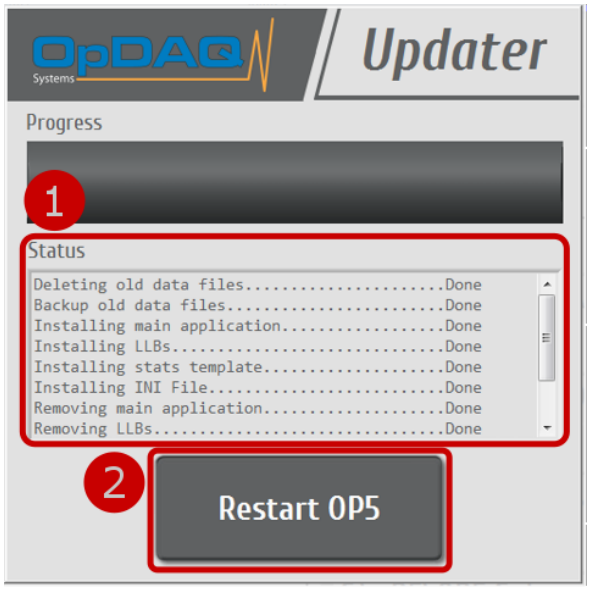


Figure 45 – Updater screen

Table 38: Update Procedure

	Obtain the update	An update can be downloaded online or shipped on a USB flash drive. When downloaded, the updater must be unzipped on the root of any USB flash drive.
1	***Lauch the updater***	Connect the USB memory stick into the USB connector on the Main Terminal. In System Settings, press the Update button to launch the updater. A dialog box will appear to confirm the user want to perform a software update. The program will shut down and the updater will launch. The updater will display your activation code. Make sure to note it since it will be needed once the updated system is launched.
2	***Restart OP5***	Make sure no error occurred before restarting the system. Remove the USB drive.

8.2.3 GENERAL CONFIGURATION

This menu displays the general system configuration.

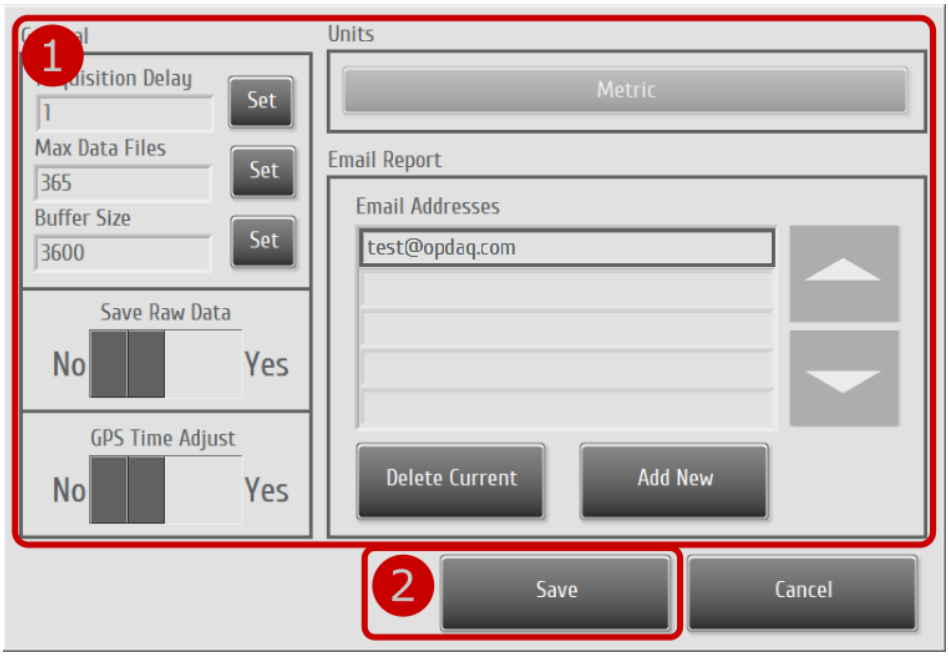


Figure 46 - General configuration screen.

Table 39 : General Configuration Procedure

	Press the general configuration button in main system setup screen.
1	Configure the system.
2	Press the save button (the save button will appear once a parameter is changed).

Table 40: General Configuration Parameter Description

Parameter	Description
Acquisition Delay	Delay between each data acquisition. (in seconds)
Max Data Files	Maximum data files to save on hard drive. (one data file is produced each day)
Buffer Size	Buffer size for graph and real-time statistics. (By default, this should be set to one hour of data (3600/Acquisition Delay))
Save Raw Data	Save instrument raw data to data file. (This option should only be used for non-permanent system since it will double data file size)
GPS Time Adjust	Use GPS UTC time to update local system time. Displayed time uses configured Windows timezone.

<table>
<tr><td>Units</td><td>Select the preferred unit type between Metric and English.

<table>
<tr><th>FlowMeter</th><th>English</th><th>Metric (default)</th></tr>
<tr><td>Flowrate</td><td>gal/h</td><td>l/h</td></tr>
<tr><td>Temperature</td><td>degF</td><td>degC</td></tr>
<tr><td>Totalizer</td><td>gal</td><td>l</td></tr>
</table>

<table>
<tr><th>TorqueMeter</th><th>English</th><th>Metric (default)</th></tr>
<tr><td>Torque</td><td>ft.lbf</td><td>kN.m</td></tr>
<tr><td>Power</td><td>hp</td><td>kW</td></tr>
</table>

<table>
<tr><th>GPS</th><th>English</th><th>Metric (default)</th></tr>
<tr><td>Speed Over Ground</td><td>kn</td><td>kn</td></tr>
</table>
</td></tr>
</table>

Email Addresses	List of Email addresses to send Daily report and Voyage report.

8.2.4 BASELINE GRAPH CONFIGURATION

Two options are available to set the baseline: enter furnished baseline data or run a sea trial to compute current vessel baseline. Since the ship performance baseline is often unknown, the Sea Trial module can be used to run a sea trial and compute baseline data. During the sea trial, it is primordial to record reciprocal laps (1 lap downstream and 1 lap upstream). To get a baseline, you must do reciprocal laps at different speed (typically idle, 25%, 50%, 75% and 100% of engine RPM). Refer to the Sea Trial Figure 29 – Sea trial Control screen for more information on the module operation procedures.

Once a Sea Trial has been recorded, the following procedure must be followed to compute and set the graph's baseline.

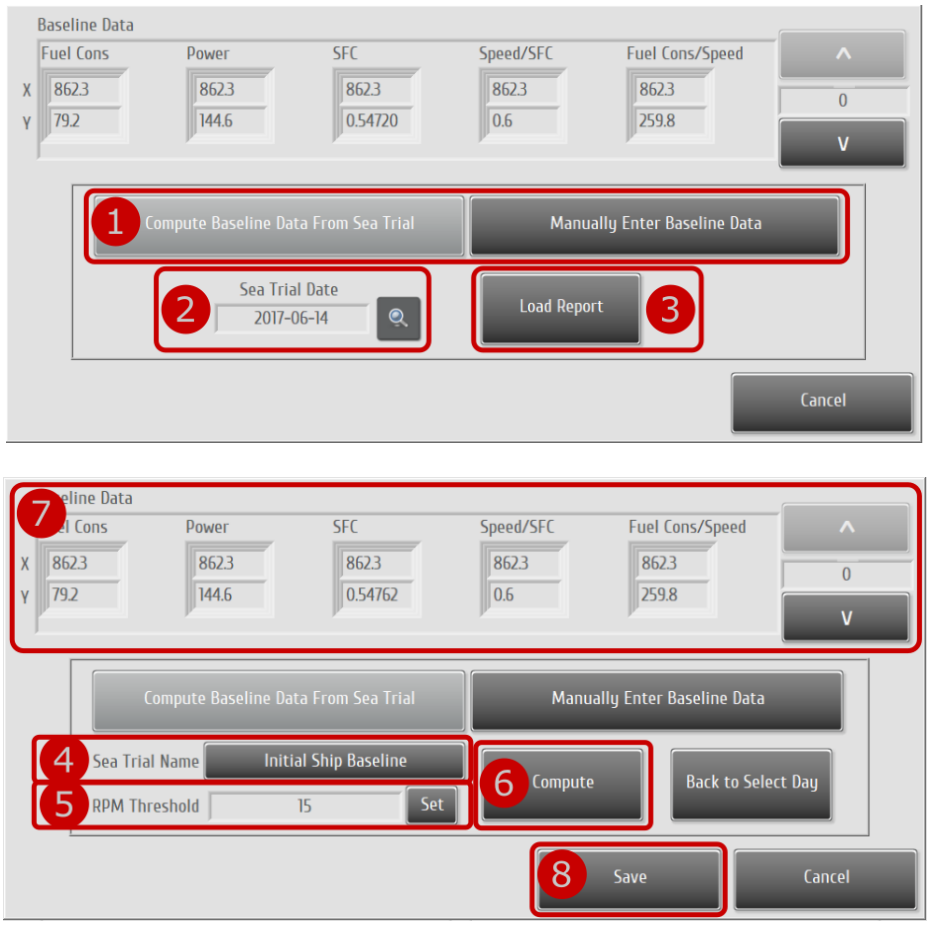


Figure 47 - Baseline configuration screen.

Table 41: Baseline Configuration Procedure

	Press the baseline graph button in main system setup screen.
1	Select “Compute Baseline Data From Sea Trial”. Alternatively, you may select “Manually Enter Baseline Date”, enter the data yourself and jump to step 8.
2	Select to Sea Trial date to fetch the data.
3	Press “Load Report”
4	Select the desired Sea Trial name from the dropdown list.
5	Select the RPM threshold to detect reciprocal laps. Example: 15 means the autocompute process will group all RPM data that are inside ±15RPM to compute a baseline point.
6	Press “Compute” to start compute process.
7	Verify the computed data integrity and make sure all laps where properly grouped. (If you ran 5 reciprocal laps, you should get 5 baseline points. More than 5 baseline points means the RPM threshold was too restrictive and data could not be bundled together or the Sea Trial was executed incorrectly.)
8	Press the save button (the save button will appear once a parameter is changed).

8.3 INSTRUMENT SETTINGS

8.3.1 SETTING THE OPVI/OPGI-V VOLUMETER MODULE

This menu displays the OpGI-V volumeter module configuration for each flow meter. For more details about the specific volumeter module Configuration, refer to the OpGI-V volumeter module Manual.

Figure 48 - Typical OpGI-V volumeter module instrument setup screen.

Table 42: OPVI/OPGI-V Configuration Procedure

	Press the OpGI-V / OpVI volumeter module button in main system setup screen.	
1	Config	Instrument configuration.
	Parameter	Name tag and gauge range configuration.
	Signals	Real-time instrument signals. (useful for debug)
2	Select communication bus. This is the Modbus communication bus on which the module you desire to configure is connected.	
3	Select the Fuel Consumption instrument.	
4	When the instrument is in differential mode, select Supply or Return.	
5	Configure the flowmeter.	
6	Press the save button (the save button will appear once a parameter is changed).	

Table 43: OPVI/OPGI-V Configuration Parameter Description

Config Tab	Description
Temperature At	The Temperature At is the reference temperature used to compensate the thermal dilatation of the fluid. For fuel, the reference temperature is normally 15°C. If the Volume Mode parameter is set to 0, the Temperature At parameter is unused.
Flowrate Max	This parameter is used to control when Alarm 29 is displayed. If the actual flow rate is over the Maximum_Flow_Rate parameter, Alarm 29 is triggered.
Flowrate Threshold	This parameter is used to ignore very small flow variations. Any flow rate below this threshold is ignored.
AVG Nb Samples	To attenuate the flowrate variations, the Volumeter module performs averaging. While the averaging reduces the amplitude of the random variations, it also reduces the response time. Typical value: 200 (20 seconds response time)
Volume Mode	Volume At X: Volume corrected at temperature X Volume: Uncorrected volume Mass: Volume corrected at temperature X and converted to mass
Density Table Mode	Manual Density Table – Automatic Manual Density Table – Table 1 Manual Density Table – Table 2 Computed Density Table – Automatic Computed Density Table – Table 1 Computed Density Table – Table 2
Temperature Switch	If the actual temperature is lower than Temperature Switch, Density Table 1 is selected. If the actual temperature is higher than Temperature Switch, Density Table 2 is selected.
Frequency	Frequency from flowmeter calibration table.
K-Factor	K-Factor from flowmeter calibration table.
Temperature 1	Density Table 1
Density 1	Density Table 1
Temperature 2	Density Table 2
Density 2	Density Table 2
Temperature Overshoot	Trigger a warning when temperature is higher than Overshoot value. (0 to disable) (in degC)
Flowrate Overshoot	Trigger a warning when Flowrate is higher than Overshoot value. (0 to disable) (in l/h)

Total Overshoot	Trigger a warning when Total is higher than Overshoot value. (0 to disable) (in l)
Baud Rate	Modbus baud rate. Keep this value to the maximum and lower it when communication error occurs.

Parameter Tab	Description
Instrument Name	Instrument tag to display.
Flow Rate Name	Flow Rate parameter tag to display.
Totalizer Name	Totalizer parameter tag to display.
Temperature Name	Temperature parameter tag to display.
Flow Rate Max	Maximum flow rate value used to build gauges increment and maximum value. (in l/h)
Totalizer Max	Maximum totalizer value used to build gauges increment and maximum value. (in l)
Temperature Max	Maximum temperature value used to build gauges increment and maximum value. (in degC)

Signals Tab	Description
TEMPERATURE	Current temperature read from flowmeter. (in degC)
AVG_FLOW_RATE	Current flow rate read from flowmeter. (in l/h)
TOTAL	Current total read from flowmeter. This total is user resettable. (in l)
PROTECTED_TOTAL	Current total read from flowmeter since beginning of operation. (in l)
FLOW_DIR_CHANGE	Number of flow direction change.
ALARMS	Current OpVI alarms.
OpVI Serial #	Current OpVI serial number.
Flowmeter Serial #	Flowmeter serial number associated with current OpVI.
Software Version	Current OpVI software version.

8.3.2 SETTING THE VOLUMETER MODULE BEM500

This menu displays the Volumeter BEM500 module Configuration for each flow meter. For more details about the specific Volumeter module Configuration, refer to the BEM500 Manual.

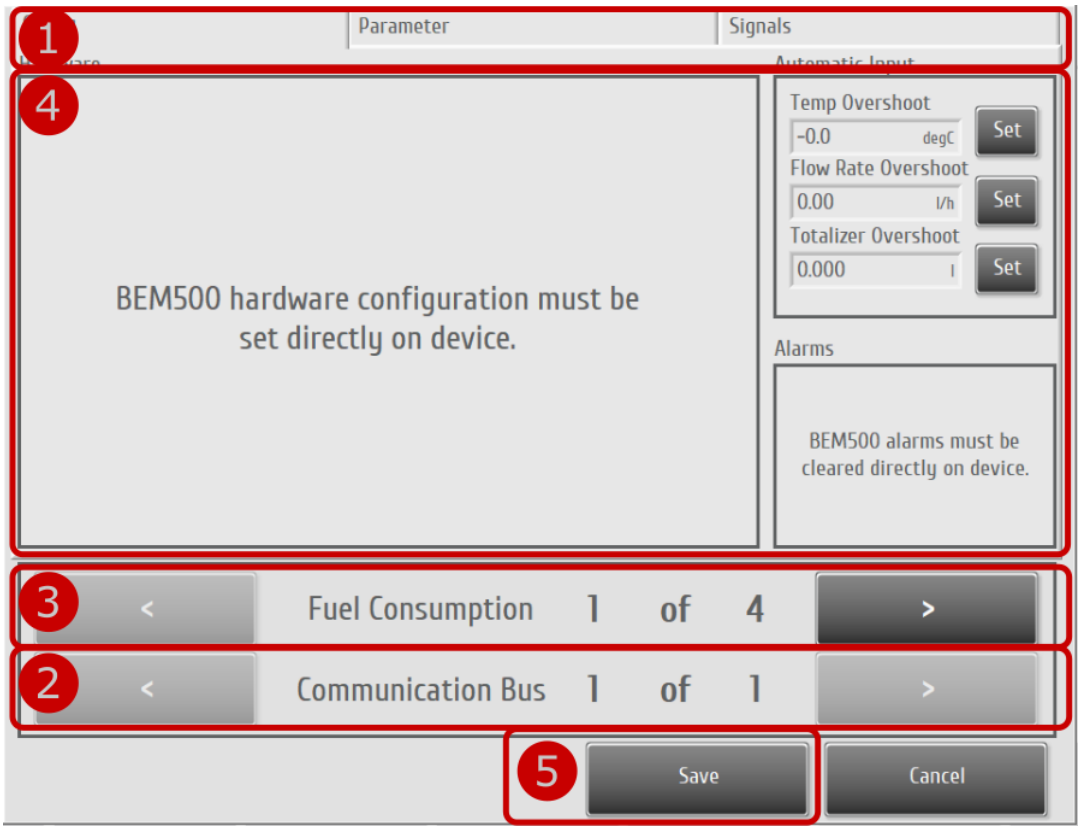


Figure 49 - Typical BEM500 volumeter module instrument setup screen.

Table 44: BEM500 Configuration Procedure

	Press the volumeter module BEM500 button in main system setup screen.	
1	Config	Instrument configuration.
	Parameter	Name tag and gauge range configuration.
	Signals	Real-time instrument signals. (useful for debug)
2	Select communication bus. This is the Modbus communication bus on which the module you desire to configure is connected.	
3	Select the Fuel Consumption instrument.	
4	Configure the flowmeter. (Hardware configuration must be set directly on BEM500)	
5	Press the save button (the save button will appear once a parameter is changed).	

Table 45: BEM500 Configuration Parameter Description

Config Tab	Description
Temperature Overshoot	Trigger a warning when temperature is higher than Overshoot value. (0 to disable) (in degC)
Flowrate Overshoot	Trigger a warning when Flowrate is higher than Overshoot value. (0 to disable) (in l/h)
Total Overshoot	Trigger a warning when Total is higher than Overshoot value. (0 to disable) (in l)

Parameter Tab	Description
Instrument Name	Instrument tag to display.
Flow Rate Name	Flow Rate parameter tag to display.
Totalizer Name	Totalizer parameter tag to display.
Temperature Name	Temperature parameter tag to display.
Flow Rate Max	Maximum flow rate value used to build gauges increment and maximum value. (in l/h)
Totalizer Max	Maximum totalizer value used to build gauges increment and maximum value. (in l)
Temperature Max	Maximum temperature value used to build gauges increment and maximum value. (in degC)

Signals Tab	Description
TEMPERATURE	Current temperature read from flowmeter. (in degC)
AVG_FLOW_RATE	Current flow rate read from flowmeter. (in l/h)
TOTAL	Current total read from flowmeter. This total is user resettable. (in l)
Serial Number	Current BEM500 serial number.
Hardware Version	Current BEM500 hardware version.
Software Version	Current BEM500 software version.

8.3.3 SETTING THE TORQUEMETER TORQUETRAK TPM2

This menu displays the Torquemeter Configuration for each torquemeter. For more details about the specific TorqueTrak TPM2 Configuration, refer to the Torquemeter Manual.

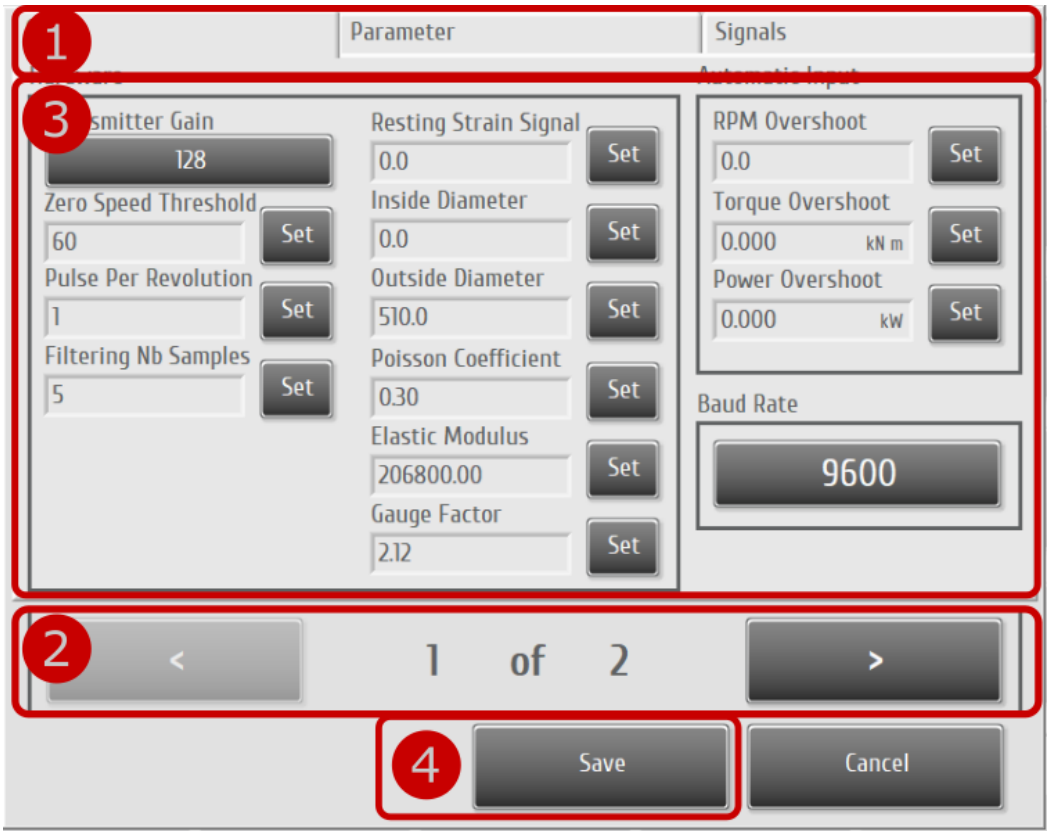


Figure 50 - Typical TPM2 instrument setup screen

Table 46: TPM2 Configuration Procedure

	Press the torquemeter TPM2 button in main system setup screen.	
1	Config	Instrument configuration.
	Parameter	Name tag and gauge range configuration.
	Signals	Real-time instrument signals. (useful for debug)
2	Select a torquemeter	
3	Enter the torquemeter calibration values.	
4	Press the save button (the save button will appear once a parameter is changed).	

Table 47: TPM2 Configuration Parameter Description

Config Tab	Description
Transmitter Gain	The SYSTEM GAIN button is a drop down menu used to configure the torquemeter system gain. See TorqueTrak TPM2 manual for gain setting instructions.
Zero Speed Threshold	Zero speed RPM threshold value (0 to 250).
Pulse Per Revolution	Pulse per revolution. Typically 1 pulse per revolution is received from TPM2. (0 disable speed input)
Filtering Nb Samples	Number of samples for filtering. Each sample is the average of the data received during 0.53 second.
Resting Strain Signal	The torque signal generated by the TorqueTrak TPM2 ranges from -16384 to +16384. The Resting Strain Signal is used to eliminate the offset that is present after the strain gage installation.
Inside Diameter	Shaft Inside Diameter (in mm) (0 = Solid Shaft)
Outside Diameter	Shaft Outside Diameter (in mm)
Poisson Coefficient	Poisson Coefficient value (0.3 for steel)
Elastic Modulus	Elastic Modulus Value (in N/mm^2) (206800 for steel)
Gauge Factor	The gauge factor is the specific gauge calibration factor.
RPM Overshoot	Trigger a warning when RPM is higher than Overshoot value. (0 to disable)
Torque Overshoot	Trigger a warning when Torque is higher than Overshoot value. (0 to disable) (in kN m)
Power Overshoot	Trigger a warning when Power is higher than Overshoot value. (0 to disable) (in kW)
Baud Rate	Serial baud rate. The sampling rate will always be set to the maximum supported value by the baud rate.

Parameter Tab	Description
Instrument Name	Instrument tag to display.
Strain Signal Name	Strain signal tag to display.
RPM Name	RPM tag to display.
Torque Name	Torque tag to display.
Power Name	Power tag to display.
Strain Signal Max	Maximum strain signal value used to build gauges increment and maximum value.
RPM Max	Maximum RPM value used to build gauges increment and maximum value.
Torque Max	Maximum torque value used to build gauges increment and maximum value. (in kN m)
Power Max	Maximum power value used to build gauges increment and maximum value. (in kW)

Signals Tab	Description
Strain Signal	Current computed strain signal value.
RPM	Current computed RPM value.
Torque	Current computed torque value. (in kN m)
Power	Current computed power value. (in kW)
Strain Gage	Current raw strain gage value from TPM2.
Shaft Speed	Current raw speed value from TPM2.
Status Byte 0	Current status byte 0 value from TPM2. See TorqueTrak TPM2 manual for detailed status byte 0 meaning.
Status Byte 1	Current status byte 1 value from TPM2. See TorqueTrak TPM2 manual for detailed status byte 1 meaning.
Status Byte 2	Current status byte 2 value from TPM2. See TorqueTrak TPM2 manual for detailed status byte 2 meaning.
Shunt Control 1	Enable TPM2 shunt 1. Shunts will be disabled outside the TPM2 configuration interface.
Shunt Control 2	Enable TPM2 shunt 2. Shunts will be disabled outside the TPM2 configuration interface.
Auto Set Zero Strain	Automatically compute Resting Strain Signal.

8.3.4 SETTING THE TORQUEMETER TORQUETRAK REVOLUTION & 10K

This menu displays the Torquemeter Configuration for each torquemeter. For more details about the specific TorqueTrak 10K or TorqueTrak Revolution Configuration, refer to the Torquemeter Manual.

Figure 51 - Typical TT10K instrument setup screen

Table 48: TT10K/TTRevo Configuration Procedure

	Press the torquemeter TT10K/TTRevo button in main system setup screen.	
1	Config	Instrument configuration.
	Parameter	Name tag and gauge range configuration.
	Signals	Real-time instrument signals. (useful for debug)
2	Select a communication port. (1 OpACQ per COM port)	
3	Select a torquemeter. (Up to 2 torquemeter per OpACQ)	
4	Enter the torquemeter calibration values.	
5	Press the save button (the save button will appear once a parameter is changed).	

Table 49: TT10K/TTRevo Configuration Parameter Description

Config Tab		Description
TT10K	**Transmitter Gain**	The SYSTEM GAIN button is a drop down menu used to configure the torquemeter system gain. See TorqueTrak TPM2 manual for gain setting instructions.
	Filtering Nb Samples	Number of samples for filtering. Each sample is the average of the data received during 0.53 second.
	Resting Strain Signal	The torque signal generated by the TorqueTrak TPM2 ranges from -16384 to +16384. The Resting Strain Signal is used to eliminate the offset that is present after the strain gage installation.
TTRevo	**Torque Min Signal**	Minimum torque signal. (in mA)
	Torque Max Signal	Maximum torque signal. (in mA)
	Torque Calibration	OpACQ torque calibration.
	Power Min Signal	Minimum power signal. (in mA)
	Power Max Signal	Maximum power signal. (in mA)
	Power Calibration	OpACQ power calibration.
	RPM Factor	Power scaling (RPM Factor) value.
Inner Diameter		Shaft Inside Diameter (in mm) (0 = Solid Shaft)
Outside Diameter		Shaft Outside Diameter (in mm)
Poisson Coefficient		Poisson Coefficient value (0.3 for steel)
Elastic Modulus		Elastic Modulus Value (in N/mm²) (206800 for steel)
Gauge Factor		The gauge factor is the specific gauge calibration factor.
RPM Overshoot		Trigger a warning when RPM is higher than Overshoot value. (0 to disable)
Torque Overshoot		Trigger a warning when Torque is higher than Overshoot value. (0 to disable) (in kN m)
Power Overshoot		Trigger a warning when Power is higher than Overshoot value. (0 to disable) (in kW)

Parameter Tab	Description
Instrument Name	Instrument tag to display.
Strain Signal Name	Strain signal tag to display.
RPM Name	RPM tag to display.
Torque Name	Torque tag to display.
Power Name	Power tag to display.

Strain Signal Max	Maximum strain signal value used to build gauges increment and maximum value.
RPM Max	Maximum RPM value used to build gauges increment and maximum value.
Torque Max	Maximum torque value used to build gauges increment and maximum value. (in kN m)
Power Max	Maximum power value used to build gauges increment and maximum value. (in kW)

Signals Tab		**Description**
RPM		Current computed RPM value.
Torque		Current computed torque value. (in kN m)
Power		Current computed power value. (in kW)
TT10K	**Strain Signal**	Current raw strain signal value from TT10K. (12000 = error)
TTRevo	**Torque Signal**	Current raw torque signal from TTRevo. (in mA)
	Power Signal	Current raw power signal from TTRevo. (in mA)

8.3.5 SETTING THE GPS

The NMEA GPS use GPRMC sentence at 4800 baud. This is the most frequent NMEA signal. Some GPS don't have NMEA Out enabled by default. Also, there is no standard wire color for the NMEA Out on a GPS. Refer to the manufacturer manual for proper pin-out. The GPS driver looks for GPRMC sentence to fetch coordinates, time and speed. If GPRMC sentences are not available in the GPS NMEA0183 output, GPZDA, GPGLL and GPVTG sentences will be used.

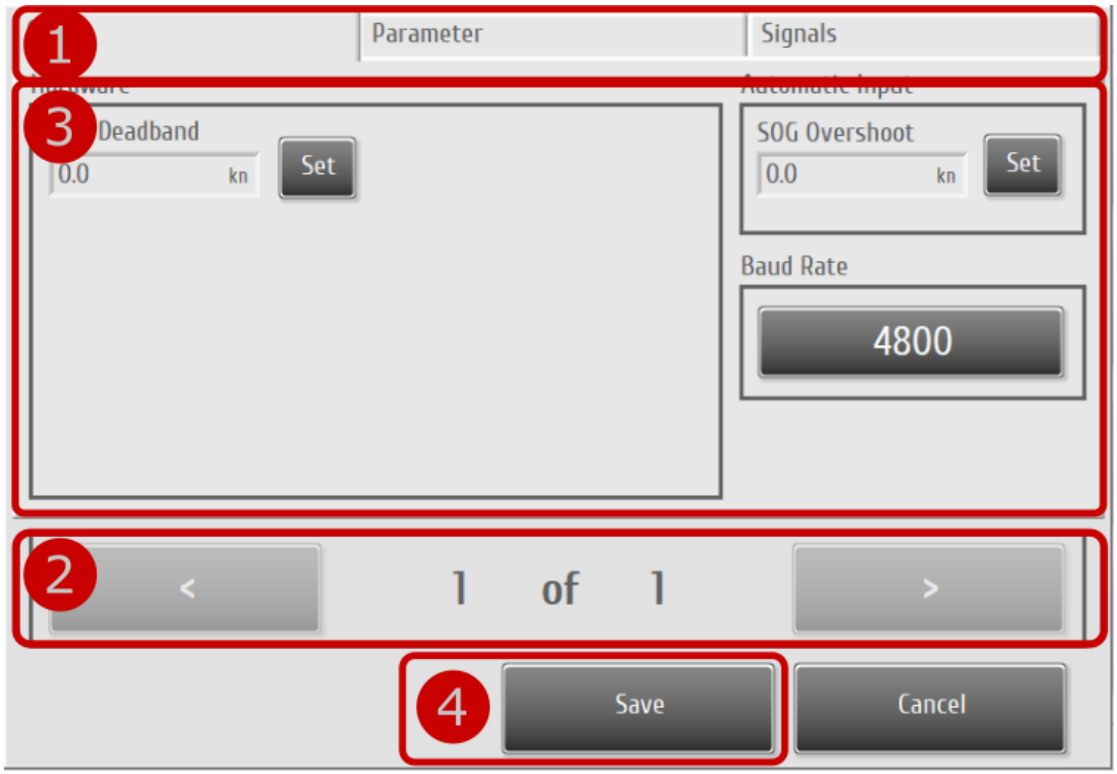


Figure 52 – Typical GPS set up screen

Table 50: GPS Configuration Procedure

	General procedure	
	Press the GPS button in main system setup screen.	
1	Config	Instrument configuration.
	Parameter	Name tag and gauge range configuration.
	Signals	Real-time instrument signals. (useful for debug)
2	Select GPS to configure. (Typically, a single GPS is connected)	
3	Edit GPS configuration.	
4	Press SAVE to save the data and return to the Setup screen).	

Table 51: GPS Configuration Parameter Description

Config Tab	Description
SOG Deadband	Set threshold under which speed is converted to “0”.
SOG Overshoot	Trigger a warning when RPM is higher than Overshoot value. (0 to disable) (in kn)
Baud Rate	GPS serial baud rate. (Most NMEA 0183 GPS use 4800 baud)

Parameter Tab	Description
Instrument Name	Instrument tag to display.
Speed Over Ground Name	Speed over ground tag to display.
Speed Over Ground Max	Maximum speed over ground value used to build gauges increment and maximum value. (in kn)

Signals Tab	Description
Satellite Fix Valid?	Light is ON when the satellite fix is valid.
Number of Satellites	Number of discovered satellites.
GPS Sentence	Raw received sentence from GPS.

9. TROUBLESHOOTING

9.1 SYSTEM STATUS

The System Home window indicates the status of all measurement instruments and repeaters. When no faults are present, all instrument names are followed by “OK”. In the case of a fault, a short description of the error appears and a notification will appear in the notification area. To get detailed system errors, click on the blinking notification or go to  system status.

9.1.1 PREVIOUS SYSTEM ERROR AND NOTIFICATION

All system errors, events and notifications are saved to a log file. Previous log may be displayed by selecting dates to display and pressing “View Events”. The event can then be filtered by event type to facilitate browsing. See Figure 40 – Events subscreen for more details.

9.2 SYSTEM ERROR CODE

Table 52: System Error Code Description

Error Code	Description	Possible Causes
5000-5999	**Software Module Error**	**See error description below.**
5100	Daily Report Generic Error	See error description in Op-Advance software.
5102	Daily Report: Unable to save daily report	▪ Make sure a R/W folder was specified in the initial configuration. ▪ Make sure specified folder path exist.
5103	Daily Report: Unable to send daily report email	▪ Make sure system is connected to the internet. ▪ Make sure specified email addresses are valid.
5104	Daily Report: Unable to export daily report	▪ Lose USB connection
5105	Daily Report: Unable to load daily report	▪ Corrupted daily report file. ▪ No daily report on selected date.
5200	Voyage Report Generic Error	See error description in Op-Advance software.
5201	Voyage Report: Unable to reset voyage	See error description in Op-Advance software.
5202	Voyage Report: Unable to save voyage report	▪ Make sure a R/W folder was specified in the initial configuration. ▪ Make sure specified folder path exist.
5203	Voyage Report: Unable to send voyage report email	▪ Make sure system is connected to the internet. ▪ Make sure specified email addresses are valid.
5204	Voyage Report: Unable to export voyage report	▪ Lose USB connection
5205	Voyage Report: Unable to load voyage report.	▪ Corrupted voyage report file. ▪ No voyage report on selected date.
5300	Sea Trial Generic Error	See error description in Op-Advance software.

5304	Sea Trial: Unable to export sea trial report	▪ Lose USB connection
6000-6999	**Software Driver Error**	**See error description below.**
6100	TPM2 Generic Error	See error description in Op-Advance software.
6110	TPM2 Service Generic Error	See error description in Op-Advance software.
6111	TPM2 Service: Checksum is invalid	▪ Interference on data line ▪ Lose connection
6112	TPM2 Service: Unable to align data	▪ Interference on data line ▪ Lose connection
6113	TPM2 Service: Session was lost	▪ USB Cable disconnected
6114	TPM2 Service: Communication timed out	▪ Cable not connected ▪ Check pinout and cable continuity. ▪ No power on TPM2 (Check power LED)
6120	TPM2 Hardware Generic Error	See error description in Op-Advance software.
6121	TPM2 Hardware: Stator error	▪ TPM2 stator unaligned or too far from rotor ▪ TPM2 communication error with rotor (reboot TPM2) ▪ Stator power is too high or too low ▪ Temperature is too high
6122	TPM2 Hardware: Rotor error	▪ Strain gage value is too high ▪ Rotor power is too low ▪ Rotor is too far from stator
6200	OpVI Driver Generic Error	See error description in Op-Advance software.
6210	OpVI Hardware Generic Error	See error description in Op-Advance software.
6211	OpVI Hardware: OpVI are not using same volume mode for differential calculation	▪ Configure return and supply of volumeter module OpGI-V with same volume mode
6212	OpVI Hardware: Communication timed out	▪ Modbus cable not connected. ▪ Check pinout and cable continuity. ▪ No power on OpVI. (Verify power LED)
6213	OpVI Hardware: Unable to set baudrate	▪ Autobaud failed (Lower baudrate and restart Op-Advance)
6250-6270	OpVI Alarm Specific Code	▪ Alarm present on volumeter module OpGI-V (See alarm code in module manual). Error condition needs to be fixed for error to be cleared.
6300	GPS Driver Generic Error	See error description in Op-Advance software.
6310	GPS Service Generic Error	See error description in Op-Advance software.
6311	GPS Service: Session was lost	▪ USB Cable disconnected
6312	GPS Service: Communication timed out	▪ Cable not connected. ▪ Check pinout and cable continuity. ▪ No power on GPS. ▪ Wrong serial communication on GPS (RS232, 4800bps, 8 data bits, no parity, 1 stop bit)
6320	GPS Hardware Generic Error	See error description in Op-Advance software.
6321	GPS Hardware: No GPRMC sentence found	▪ Strings GPRMC or GPGLL+GPVTG+GPZDA not present in data stream. (Make sure GPS

		broadcast GPRMC and/or GPGLL+GPVTG+GPZDA)
6600	TT10K/TTRevo Generic Error	See error description in Op-Advance software.
6610	TT10K Service Generic Error	See error description in Op-Advance software.
6611	TT10K Service: Invalid SOF/EOF	▪ Interference on data line ▪ Lose connection
6612	TT10K Service: Unable to align data	▪ Interference on data line ▪ Lose connection
6613	TT10K Service: Session was lost	▪ USB Cable disconnected
6614	TT10K Service: Communication timed out	▪ Cable not connected ▪ Check pinout and cable continuity. ▪ No power on TT10K (Check power LED)
6620	TT10K/TTRevo OpACQ Hardware Generic Error	See error description in Op-Advance software.
6621	TT10K/TTRevo OpACQ Hardware: Invalid SOF/EOF	▪ Interference on data line ▪ Lose connection
6622	TT10K/TTRevo OpACQ Hardware: Communication timed out.	▪ Cable not connected ▪ Check pinout and cable continuity. ▪ No power on OpACQ (Check power LED)
6700	BEM500 Driver Generic Error	See error description in Op-Advance software.
6710	BEM500 Hardware Generic Error	See error description in Op-Advance software.
6711	BEM500 Hardware: Communication timed out	▪ Modbus cable not connected. ▪ Check pinout and cable continuity. ▪ No power on BEM500. (Verify LCD)
6712	BEM500 Hardware: Unexpected unit type.	▪ Unable to write configuration at initialization.
6750-6770	BEM500 Alarm Specific Code	▪ Alarm present on volumeter module BEM500 (See alarm code in module manual) Once an alarm occurs, it must be cleared directly on BEM500 module.
6910	Repeater Murphy Driver Generic Error	See error description in Op-Advance software.
6911	Repeater Murphy Driver: Too many flowmeters	▪ Configuration defines more flowmeters than supported by Murphy.
6912	Repeater Murphy Driver: Too many torquemeters	▪ Configuration defines more torquemeters than supported by Murphy.
6913	Repeater Murphy Driver: Communication timed out	▪ Modbus cable not connected. ▪ Check pinout and cable continuity. ▪ No power on Murphy. (Verify LCD screen)
6920	Repeater UDP Driver Generic Error	See error description in Op-Advance software.
6921	Repeater UDP Driver: Communication timed out	▪ Main terminal not powered. ▪ Check pinout and Ethernet cable continuity.

9.3 SYSTEM CRITICAL SOFTWARE ERROR

System critical error will be displayed in a pop-up screen as soon as the system encounters a major error. This should never occur during the system setup and normal usage. This type of error often means a software package is missing or low-level configuration is erroneous.

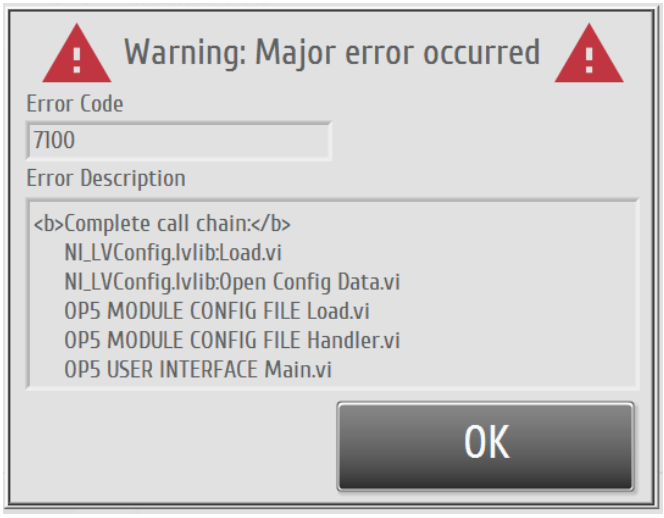


Figure 53 – Major system error screen

NOTES / CALCULATIONS