Ship Performance Monitoring
- Powered by Kyma

Kyma Shaft Power Meter
Kyma Delfini
Kyma Ship Performance
Kyma SHaPoLi

MAC14266-13A

Proven product quality, longevity and reliability

Optimise the safety, performance and cost of your vessel and fleet operations with cutting-edge Voyage Data Recorders (VDR) technology, Shaft Power Meters (KYMA), and intelligent maritime Internet of Things (IoT) solutions from Danelec Marine.

Our technology enables more than 10.000 ships worldwide to meet stringent safety and environmental regulations, and we continue to develop new ways of improving performance and efficiency through the application of data collected on board and accessed in the cloud.

Ensuring resilience and effectiveness, all Danelec solutions - since the introduction of our leading VDRs in 2001 - are designed according to our key product principles:

SOLID - SAFE - SIMPLE

Danelec's Global Presence

With offices in Denmark, Norway, Greece, Germany, Poland, Singapore, South Korea and China as well as over 600 factory-trained personnel in more than 50 countries worldwide, Danelec has a truly global presence ensuring reliable, cost-efficient and fast service and support to our customers anywhere.

Are you doing enough to meet new environmental regulations and consume less fuel?

Our Ship Performance Monitoring solutions unlock significant financial and operational advantages by enabling the optimum balance between fuel consumption, power output and ship speed, while reducing greenhouse gas emissions.

With Ship Performance Monitoring from Danelec, developed by Kyma for more than 30 years, you can be sure that you are doing everything you can to lower your bunker costs and meet guidelines for the Energy Efficient Design Index (EEDI), Energy Efficiency eXisting Ship Index (EEXI) and Carbon Intensity Indicator (CII) regulations.

Leveraging field-proven, highly reliable shaft power measurement technology and methodologies, our Ship Performance Monitoring solutions are easy to integrate and able to provide precise, understandable and actionable propulsion data so bridge and engine officers can reduce costs and improve operational sustainability under any conditions.

Our Ship Performance Monitoring Systems
- a tiered solution offering

We supply a range of solutions able to both monitor the performance and analyse the performance data of your vessel (when combined with the Kyma Online service). Several systems are available with varying levels complexity, tailored to differing customer requirements and capable of integration with each other.

	Kyma Shaft Power Meter	Kyma Delfini	Kyma Ship Performance
Shaft Power/Torque/RPM	✔	✔	✔
Thrust Measurement	✔*	✔*	✔*
Analogue/Digital Signal Output	✔*	✔*	✔*
Shaft Power Limitation	✔*	✔*	✔*
Reference Curves	Power vs RPM	✔*	✔
Number of Real Time Input	4	40	500
Real Time Data Presentation	Numerical	Numerical/Graphical	Numerical/Graphical
Reports	-	Daily/Voyage*	Daily/Voyage/Trial
Historical Data Presentation	-	✔	✔
Data Storage	-	✔	✔
Other KPIs (SFOC, +++)	-	✔	✔
Data Export	-	✔*	✔
Kyma Online/API (subscription)	-	✔*	✔*
EEOI Calculations	-	✔	✔
Long Trend Diagnostics	-	-	✔
Analysis and Advisory info	-	-	✔*

* Option

Kyma Shaft Power Meter

Kyma Shaft Power meter (KPM) is an instrument for continuous measurement of torque, thrust (option), revolutions and power on a rotating shaft, primarily designed for marine applications.

The Shaft Power Sensor measures shaft torque and thrust* using strain gauge technique. The instrument consists of an aluminum ring clamped on to the shaft, a stationary unit located next to the shaft and a terminal junction box for signal and power connection.

The shaft ring contains electronic components for signal processing and transmission, and will also serve as protection for the strain gauges, which are glued to the shaft surface.

The signals are transferred as frequency modulated signals to the stationary unit through contact free transmission. Shaft revolutions are measured by sensing of magnets on the shaft ring.

The Display Unit consists of a flat LCD screen module and a processing unit that can be flush mounted in the ECR console or installed in brackets on the top of the console.

Operators can change the units of measurements between Metric and SI. The serial data output format is according NMEA0183 or Modbus.

The following propulsion data are recorded by the Shaft Power Sensor and presented on the Display Unit:

- **Power**
- **Rpm**
- **Torque**
- **Thrust (option)**
- **Total Energy Power**
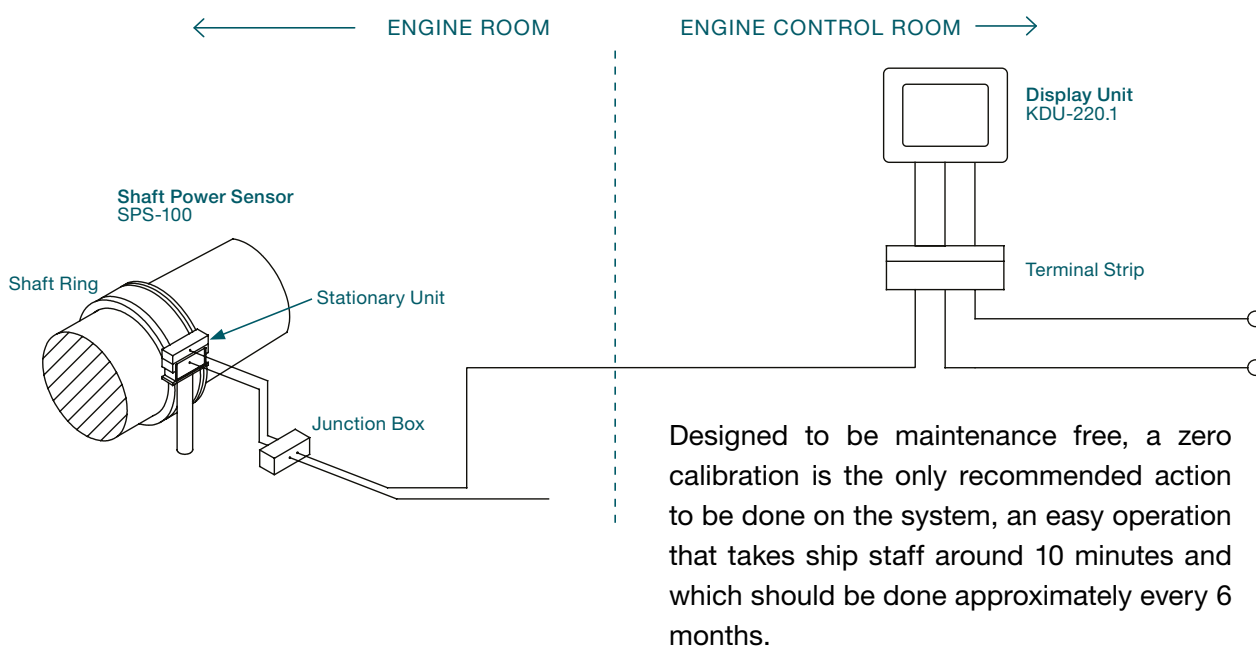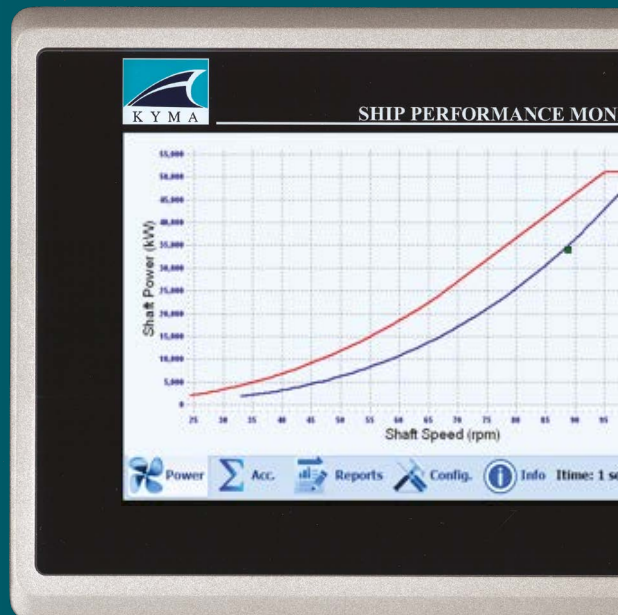- **Total revolutions**

Instrument accuracy

	Relative
Torque	< + 0.5%
Thrust*	< + 2.0%
Revolution	< + 0.1%
Power	< + 0.5%

Key Benefits

- Instant values and high accuracy
- Available for multi-shaft installations
- No moving parts and maintenance free
- Not affected by pollution in the engine room
- Option for Thrust measurement
- Option for PDF output of voyage reports on USB port
- Design for use in hazardous areas
- Kyma Shaft Power Meter is easy to install on newbuilds and as retrofit
- Ring is suitable for all shafts above 150mm

ENGINE ROOM   ENGINE CONTROL ROOM

Display Unit
KDU-220.1

Shaft Power Sensor
SPS-100

Shaft Ring

Stationary Unit

Terminal Strip

Junction Box

Designed to be maintenance free, a zero calibration is the only recommended action to be done on the system, an easy operation that takes ship staff around 10 minutes and which should be done approximately every 6 months.

Our performance systems are well proven with currently more than 6.000 systems sold. Many of these vessels were installed more than 30 years ago and are still in operation.

Example of optional voyage report on PDF format

Voyage information
Duration: 26 hours and 24 minutes

Accumulated values
Total Shaft Energy: 792792 SHph
Total Shaft Revolutions: 162518 revs

Average values
Shaft Power: 30030 SHp
Shaft Revolutions: 102.6 rpm
Shaft Torque: 250 Tm
Shaft Thrust: 145
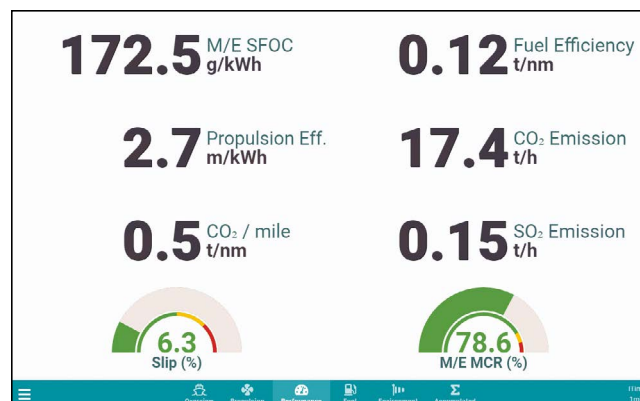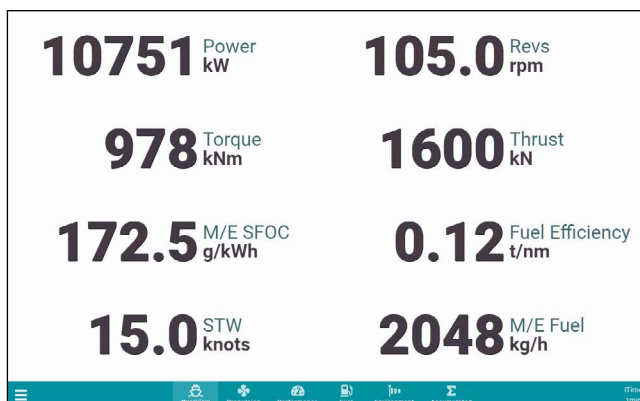
Continuous monitoring of vessel performance data

- **Shaft Power/RPM/Torque/Thrust Measurements**
- **Fuel Consumption Monitoring**
- **Emission Calculations**
- **Noon-noon & Voyage Reports**
- **KPI Monitoring**

Kyma Delfini

Kyma Delfini collects data onboard the vessel, processes the data, and presents the data in a way that is easy to interpret and understand.

The system can be adapted to all types of vessels and machinery configurations and is flexible regarding the type and number of signal inputs.

Kyma Delfini receives inputs from torque meter(s), fuel oil flowmeter(s), speed log, alarm monitoring systems, bridge instrument(s), etc., and combines these with additional inputs entered by the user. Based on the inputs, Kyma Delfini calculates additional parameters.

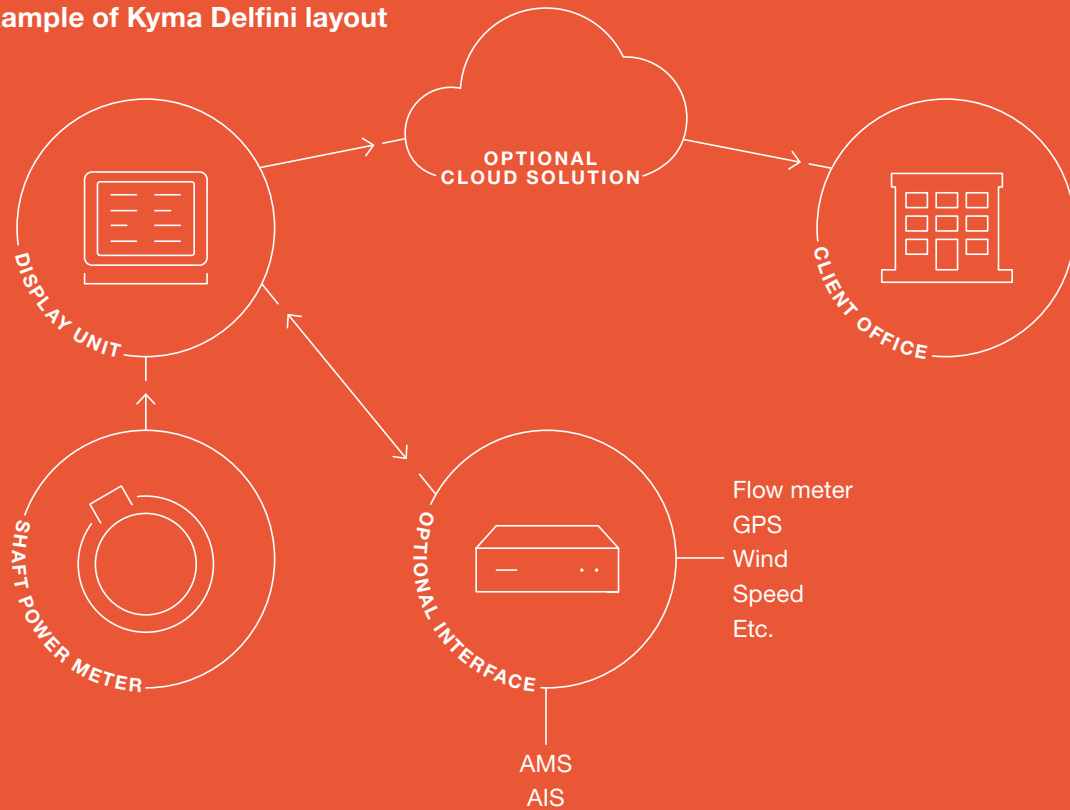|			
10751 Power kW	**105.0** Revs rpm	**172.5** M/E SFOC g/kWh	**0.12** Fuel Efficiency t/nm
978 Torque kNm	**1600** Thrust kN	**2.7** Propulsion Eff. m/kWh	**17.4** CO_2 Emission t/h
172.5 M/E SFOC g/kWh	**0.12** Fuel Efficiency t/nm	**0.5** CO_2 / mile t/nm	**0.15** SO_2 Emission t/h
15.0 STW knots	**2048** M/E Fuel kg/h	**6.3** Slip (%)	**78.6** M/E MCR (%)

Kyma Delfini interfaces with a range of signals such as analogue, digital, pulse signals and serial inputs (NMEA0183, Modbus RTU, Modbus TCP, etc). The variables are continuously logged and updated.

Kyma Delfini also provides a graphical presentation of the propeller reference curve, including over-torque limits.

Example of Kyma Delfini layout

DISPLAY UNIT

OPTIONAL CLOUD SOLUTION

CLIENT OFFICE

SHAFT POWER METER

OPTIONAL INTERFACE

Flow meter
GPS
Wind
Speed
Etc.

AMS
AIS

Generate reports

Kyma Delfini provides the capacity to generate noon-noon and voyage summary reports. These reports can be exported in Excel format. It is also possible for the shore office to receive the reports using the optional cloud solution or manually via the Display Unit.

Typical outputs

- Shaft Power/RPM/Torque/Thrust (instant and accumulated)
- Fuel consumption by fuel type for each consumer (instant and accumulated)
- Total Ship fuel consumption (instant and accumulated)
- SOG/STW
- Main Engine(s) SFOC
- Main Engine(s) % MCR
- Propulsion Efficiency
- Fuel Efficiency
- CO2 and SOx emissions
- Trim
- Propeller Slip
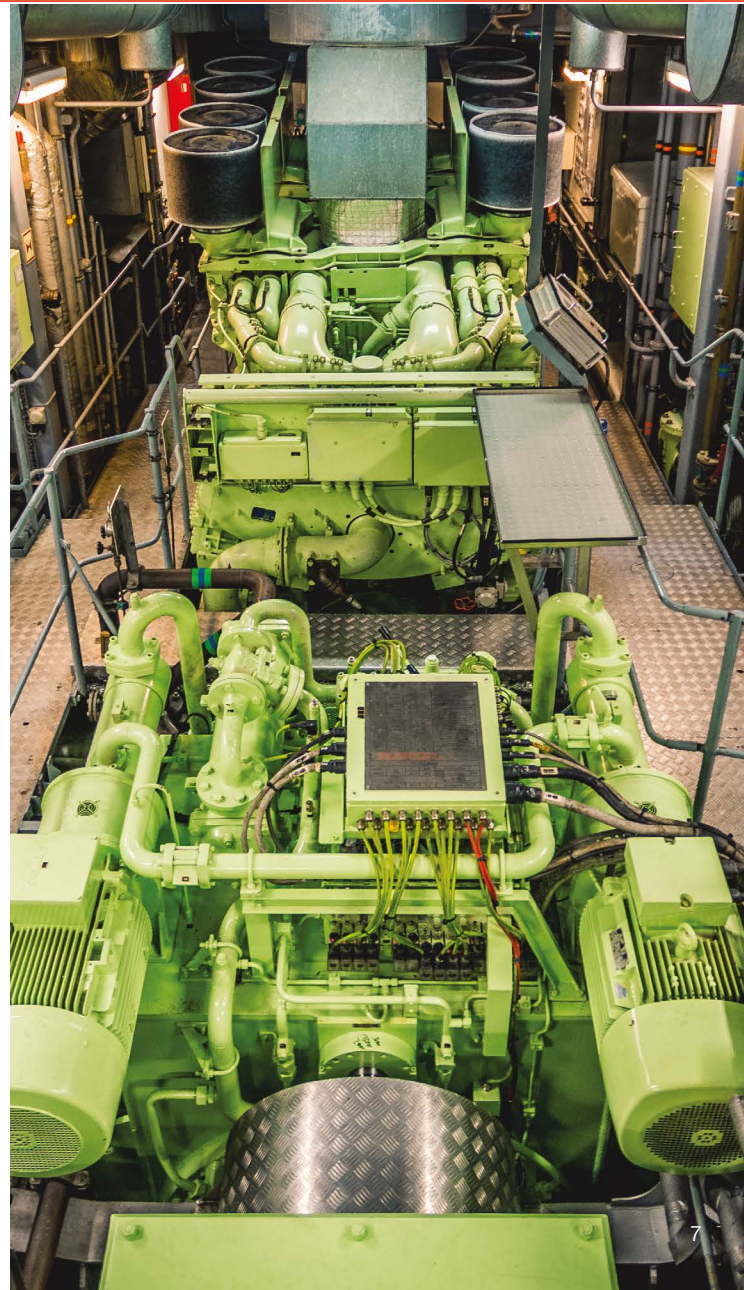
Kyma Ship Performance

Reduced fuel consumption

As fuel consumption is a major cost factor, the use of our Performance Monitoring can contribute significantly to an improved bottom line.

Hull fouling and propeller roughness indication

Kyma Ship Performance makes it possible to evaluate the economic impact of reduced propeller efficiency and increased hull resistance. It can show the effect of any action taken to improve hull or propeller smoothness.

Overload protection

Early warning signals provide a further benefit for the continuous monitoring of propulsion components. These can indicate the overload stress of components and thus prevent unexpected breakdown.

Performance evaluation

Contracts for new buildings are based on performance estimates from model tank testing. Performance Monitoring can confirm precisely to the contract performance parameters or to any specified deviations.

Environmental information

Emission calculation of CO2 and SO2 is included in Ship Performance and EEOI will be continuously calculated. Additional reporting in compliance with EU-MRV is an available feature on the Kyma Online service.

Trim optimization module

KSP Trim is an optional software module that can be integrated with the standard KSP system. The purpose of the KSP Trim module is to provide the vessel operator with a practical tool for establishing the optimum trim for the vessel at any load and draft condition.

Diagnostic toolbox

An optional trend analysis toolbox is available for detailed statistic alanalysis of speed loss and performance information.

Kyma Online

Web-based optional management tool for evaluating fleet performance with easy and secure access from any internet connected PC or Tablet.

Key Features

- Instant performance information
- Fuel reporting
- Speed loss and performance analysis
- Sea trial reports
- Daily and voyage reports
- Possibility for automatic export of data, trends and reports to Kyma Online/onshore
- EEOI calculation
- Trim Optimization
- Statistical analysis of historical data

Instant values

A wide range of output information is available from the system computer.
All output may be presented in SI or metric units as required.

Numerical

All logged and calculated parameters can be output to computer monitor and printer.
Typical updating time is 15 sec.

Available real-time values:

- Revolutions - rpm
- Shaft Torque - kNm
- Shaft Thrust - kN
- Shaft Power - kW
- Ship speed by log - knots
- Ship speed by GPS - knots
- M/E specific fuel consumption - g/kWhr
- Propulsion efficiency - m/kWhr
- Ship overall efficiency - kg/nm
- M/E fuel consumption - kg/hr
- G/E's fuel consumption kg/hr
- Aux. Boiler's fuel consumption - kg/hr
- Type of F.O. in use (HFO or MDO)
- Fuel Temperature at flow meters - C °
- HFO density at 15°C - kg/l
- MDO density at 15°C - kg/l

- HFO low calorific value (LCV) - kJ/kg
- MDO low calorific value (LCV) - kJ/kg
- CO_2 emissions - ton/ day
- Energy Efficiency Operational Index, EEOI (CO_2 Index) - g CO_2 /ton, nm
- SO_2 emissions - ton/day
- Wind speed, rel. - knots
- Wind speed, true - knots
- Wind direction, rel. - Deg
- GPS position, latitude - Deg.Min.Sec
- GPS position, longitude - Deg.Min.Sec
- GPS, ship course - Deg
- Draft fwd/aft - m
- Draft MS, port /starboard - m
- Trim/List - m

Graphic mode

Presentation of performance curves where the actual condition is indicated as a plot in the graph with numerical indication and deviation from the performance curve.

Performance curves are derived from model tank data or sea trial data.

- Shaft Power versus Revolutions
- Shaft Power versus Ship Speed
- Daily Fuel Consumption versus Ship Speed
- Specific Fuel Rate versus Shaft Power

Trend curves:

- Long-term trend capability over the life of the vessel of selected vessel performance data subject to change over time, such as speed loss due to hull fouling and increase of main engine specific fuel rate.

- Short-term trending of any five selectable parameters on a selectable time basis of up to 14 days. Resolution is 1 sample per 15 sec.

Web-based Management Tools

Kyma Online

Kyma Online and Kyma Online Plus are powerful web-based management tools for evaluating fleet performance. They allow the onshore technical team to follow each individual vessel or a complete fleet with easy and secure access from any connected device.

Documents
Users can upload documents such as user manuals, final documents, bunker certificates, etc, for each vessel.

Reports
All available reports such as daily reports, voyage reports as well as trial reports can be downloaded as pdf files. Choose the type of report and select a date. Trial reports are available if the crew carried out a sea trial.

History logging
Choose any parameter/value available (up to 10 each time or groups of 10 values) to plot graphs with high frequency data of a chosen time period. Values can be combined on the same graph and the data downloaded in CSV format.

Diagnostic Toolbox
The Diagnostic Toolbox is a module that is activated onboard the vessel within the KSP software (as well as Kyma Delfini in the future) which can be activated even if the customer chooses not to have Kyma Online.

Diagnostic (requiring Diagnostic Toolbox to be activated onboard the vessel)
The Diagnostics page shows, in detail as a curve with values, the data used to calculate the performance status. The page with long trend analysis is shown as trend curves of the power/speed, power/rpm, and SFR in a colour-coded diagram with a performance value for each day. It also shows detailed information about the performance, benchmark levels, efficiency loss, and fuel impact.
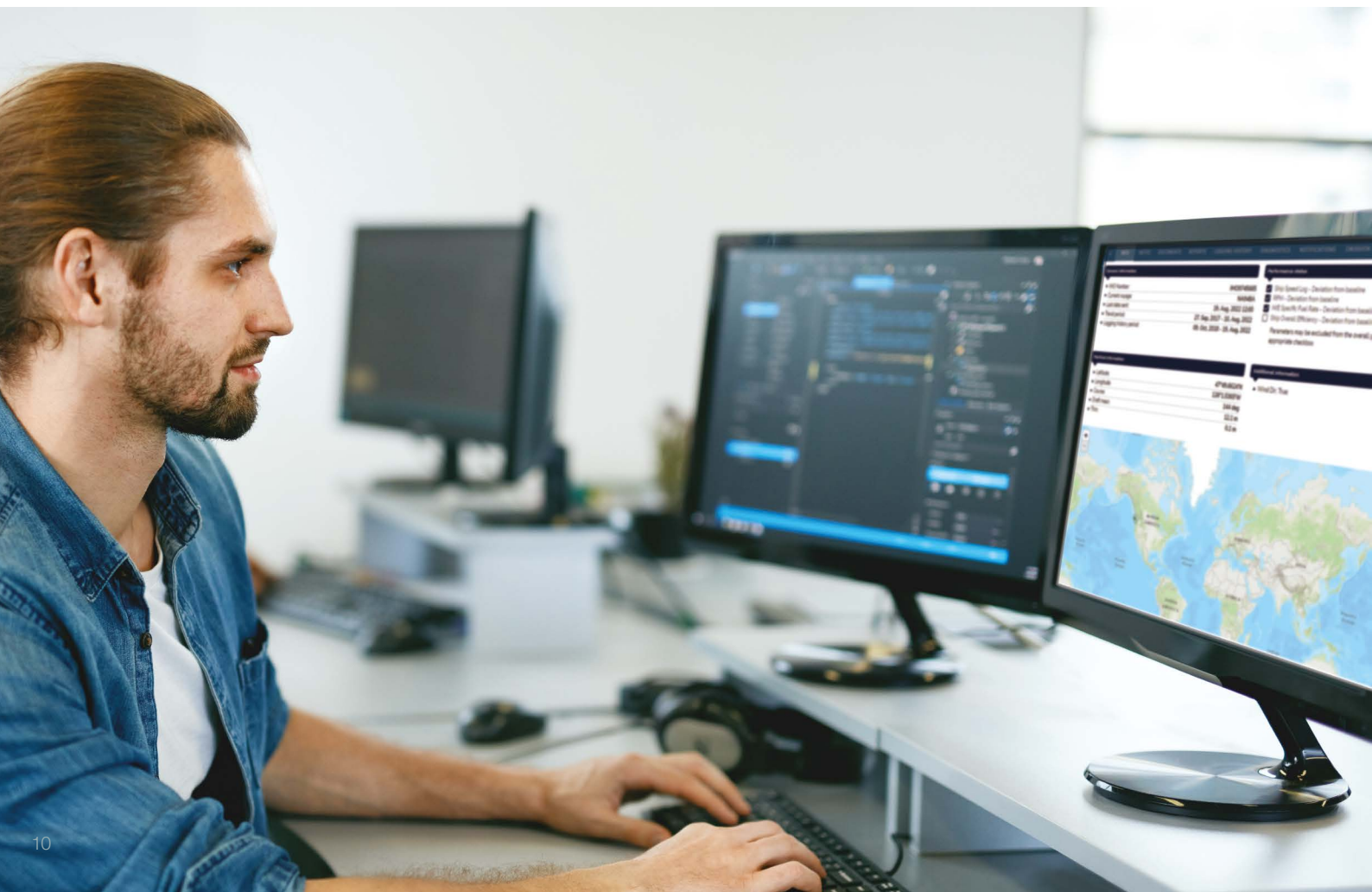
Kyma Online Plus

Notification Centre

This feature notifies the user by email (and during login to Kyma Online Plus) of irregularities with onboard sensors, missing data and/or performance issues.

Emission reports

It is a module which makes it possible to generate MRV/IMO reports. It is certified by Verifavia in compliance with the EU regulation 2015/757, set in force by January 2018. The Kyma system is certified for fuel monitoring methods A, B and C. *NOTE: Can also be made available for non-KSP customers, for all manual input, only.*

Charter Party module

Using this tool, the performance data collected can be used for detailed analysis and evaluation of how the vessel performs relative to any specific Charter Party contract, or other benchmark conditions. It is also designed for customers operating in the spot market.

Data analysis

An optional feature which allows users to perform any data analysis evaluating the relation between two parameters logged in the Kyma Ship performance system onboard. It allows to set any filter and evaluate a specific period, giving graphs and numerical results. In addition, the module offers the possibility of checking the prediction of the behavior of the parameters under analysis, based on historical data available and filtering applied.

API

The API gives the owners the possibility to extract the Kyma data at the frequency desired and display the Kyma data in their BI/ERP system with the format and layout that they prefer. The Kyma data can be combined with data from other data sources (maintenance, operational, financial etc.) within the customer's own BI/ERP data system, which is then owner's own responsibility.

Kyma SHaPoLi Solution

The Energy Efficiency Existing Ship Index (EEXI) and the Carbon Intensity Indicator (CII) will come into force in January 2023. Our solution, powered by Kyma technology, enables shipowners to quickly and easily implement the mitigating measures required on vessels to stay compliant with the new emission reduction regulations.

- Standardized and cost-effective
- Easy and fast to upgrade
- Compliance with IACS proposed SHaPoLi solution
- Type approved components (DNV system approval expected September/October 2022)
- Full engine power is always available
- Tamper-proof logging functionality
- Prepared for optional upgrade to Ship Performance
- Preparing optional shore-based monitoring
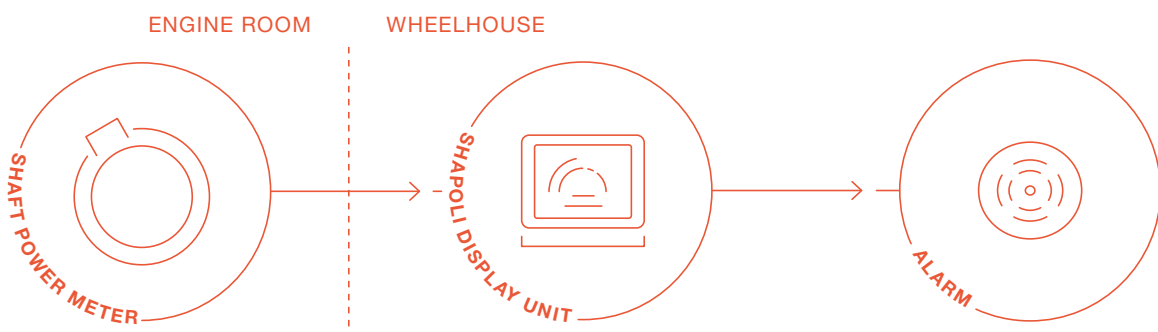
Class type approved components (DNV, CCS, ABS, etc...)

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