



Application Note

Keywords

- Exhaust emissions
- NO_x, SO₂ and NH₃
- Emission sensors

Techniques

- Absorbance
- UV spectroscopy

Applications

- Emissions monitoring
- Exhaust gases detection

Emissions Monitoring of Seagoing Commercial Vessels

How Danfoss Helps Ship Operators Measure Exhaust Emissions



Based in Denmark, Danfoss IXA develops emission sensors for the maritime industry. At the heart of its emission sensor, which provides continuous measurements of nitrogen oxides (NO_x), sulfur dioxide (SO₂) and ammonia (NH₃), is a high-sensitivity Ocean Optics spectrometer. This system is ruggedized to withstand operation at sea and designed for simple servicing and minimal maintenance.

Recently, we caught up with Finn Haugaard, Supply Chain Manager for Danfoss IXA, for an update on how the emission monitor is faring and what measurement challenges are ahead for maritime industries.

Ocean Optics (OO): Tell us about your measurement challenge and how Danfoss decided to use spectroscopy for the application.

Finn Haugaard (FH): Danfoss identified a window of opportunity, in terms of providing the maritime industry with a solution for emission measurement that would help ship operators overcome many of the challenges related to existing solutions. The result – the Danfoss Marine Emission Sensor MES 1001 — is easy to put into operation, and hardly requires any effort to maintain. To choose spectroscopy was a rather easy choice, as the technology

had already proven to be effective in measuring, for example, sulfur, ammonia and various NOx gases.

OO: You mentioned that spectroscopy had been proven effective in measuring gases. What sort of technique does the Danfoss sensor use?

FH: The MES 1001 sensor is based on UV absorption spectroscopy. UV light is emitted into the gas and a detector – the spectrometer, in this case — measures the amount of light absorbed by the gas. The sensor's computer contains a digital library with the “fingerprints” of the supported gasses and by comparing what we “see” with the reference library, we can calculate the exact concentration of each gas.



Figure 1. The Danfoss system uses a high-sensitivity Maya2000 Pro spectrometer that's highly customized yet is reproducible in volume.

OO: How do ship operators use the emissions data?

FH: The emission data are used for either pure emission monitoring and reporting, or for controlling exhaust gas treatment systems.

OO: What have been the biggest challenges — technical or otherwise — associated with this application?

FH: The harsh environment onboard seagoing vessels was one challenge to overcome. *[Editor's note: Ocean Optics customized the spectrometer assembly to withstand the high temperatures and vibration conditions experienced on cargo ships.]*

However, the most complex issue was probably to be able to achieve high quality measurements from

exhaust gas, which contains lots of hot steam and particles.

OO: How have ship operators responded to your marine emission sensors?

FH: Customers have especially appreciated the marine sensor's handy size, the very competitive total cost of ownership, and the speedy data generation, which is close to real-time data.

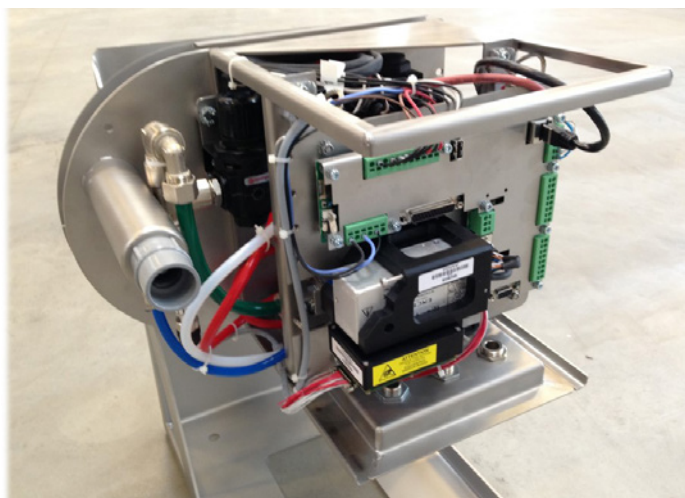


Figure 2. The spectrometer assembly, shown here inside the sensor housing, has been ruggedized for challenging conditions at sea.

OO: How much innovation in the maritime industry is driven by regulatory requirements compared with the commercial concerns of customers?

FH: Regulatory requirements are clearly one major driver forcing the industry to transform. However, commercial concerns remain important. A competitive total cost of ownership offering to the industry remains a prerequisite for marketers who want to become successful.

OO: What challenges do maritime industries face in the future, and how can optical sensing technologies such as spectroscopy help take on those challenges?

FH: As in most other industries, the need for timely and reliable data is growing in the maritime industry. This is driven by a desire to facilitate and accelerate continual improvement of safety and efficiency. Optical sensing technologies have already made their way

into many different industrial applications onshore, proving that the technology is both commercially relevant as well as technologically stable and mature. The maritime industry can easily become the next big playfield for future marketers offering solutions based on optical sensing. 🌊

Additional Resources

- Absorbance techniques at <https://oceanoptics.com/measurementtechnique/absorbance>
- Danfoss IXA at <https://www.danfoss.com/en>
- Emissions monitoring at <https://oceanoptics.com/spectroscopy-monitoring-volcanic-emissions>
- Environmental monitoring applications at <https://oceanoptics.com/applications/environmental-monitoring>

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