



## Bunker Management System

Coriolis mass flow measurement that ensures accurate bunkering

**MARINE**



# Get the amount of bunker fuel you pay for



*Insatech – taking the guesswork out of it!*

*Get an overview of your bunker operation and improve it.  
Don't use guess work when you can – act on knowledge*



The Bunker Management System measures and logs, mass flow, temperature and density, thereby detecting manipulation attempts. Short-deliveries of 3 to 4 % are not uncommon and they are an unnecessary extra cost for operators. The systems greatest documented short-delivery had the value of USD 31,980.



### Introduction

As focus on fuel consumption and trade has risen over the last decade, so has the incentive for bunker delivery services to attempt to actively affect the properties of the fuel delivered. Our Bunker Management System is developed to act as a safeguard against short-deliveries and manipulation of bunkered marine fuel oil.

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### How It Works

The system consists of a mass flow meter, a control cabinet with all the electronics and an operator display. It evolves around direct measurement of temperature and mass, it is therefore not affected by increases in temperature or air entrained in the oil. This ensures you get the bunker fuel you have paid for!

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### Operation

The operator interface is easy to use and requires only a one-time setup to be ready for bunkering. The interface lets the operator swiftly enter the necessary information, after which the system can be started. The system generates a Bunker Report after each bunkering operation.

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### Installation

The system installation can be handled by your ships' crew, installing instruments and transmitters on deck in a hazardous zone, and the cabinet and operator interface in a safe zone. Once installed our marine technicians will complete the wiring, commissioning and testing to ensure the system works from the first operation.

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### Service and Support

The system requires a minimum of maintenance, as it contains a limited amount of moving parts. Under normal conditions the maintenance of the bunker line on board will suffice. If a problem occurs our skilled marine technicians are able to service and troubleshoot at your preferred location – or provide remote support.

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### Contacts World Wide

Insatech Marine has a broad and international agent network, spanning from Finland to India. We want to serve you the best possible way, and our agents are ready to receive your inquiries and questions. Find your local representative to learn more about our solutions or go to [www.insatechmarine.com](http://www.insatechmarine.com)

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# Introduction



Insatech Marine's Bunker Management System is developed, designed and built to act as a safeguard against manipulation of bunkered marine fuel oil as well as counteracting it. By using equipment and methods that deliver high accuracy inline and real-time measurement during bunker operations, any attempt by the bunker supplier to gain an economic advantage is detected. This ensures you have the upper hand in the following disputes.

**Temperature and air manipulation is detected**

As the focus on bunker consumption has risen over the last decade, so has the incentive for bunker delivery services to attempt to actively affect the properties of the delivered fuel. The properties typically manipulated are temperature and air content. By raising the temperature of the marine fuel oil

during bunkering, the bunker supplier can increase the volume of the oil, and thereby give the impression of delivering a larger quantity, than what is actually delivered.

**The uncertainty of volume-based measurements**

It is common practice to determine the amount of bunkered fuel oil by

sounding both vessel and barge bunker tanks before and after bunkering and then converting the volume into mass using conversion tables. Measuring bunkered fuel oil in volume but settling in weight causes some uncertainty due to the table based conversion.

If air is introduced into the Heavy Fuel





*Our system is installed on more than 50 vessels worldwide and has been proven in practice during the last seven years. It detects the entraining of air so you can avoid unnecessary bunker fuel costs.*

Oil (HFO) bunker stream the volume will also appear to be larger than what is actually delivered. The air can enter the HFO during bunkering through several – intended or unintended – entry points. The most common source is stripping during the change-over from one source tank to another. As long as it has been agreed how long stripping is allowed it is normally not an issue. However, if the bunker fuel supplier intentionally uses the stripping period to increase the volume of the delivered marine fuel oil, it is clearly a manipulation that must be addressed and dealt with.

**“The Cappuccino effect”**

Letting air seep into the bunker line

and thereby continuously manipulating the volume is known as “the cappuccino effect”. It causes tiny air bubbles to form that are barely visible and therefore very hard to detect during for example sounding.

Common for both stripping and the cappuccino effect is that the fuel oil will stay aerated for several days or even weeks. This means the manipulation is not detected in time and disputing is not an option, as claims should normally be made within 48 hours after the first bunkering.

**Measure mass directly – and get the amount of bunker you pay for**

The clear advantage of the Bunker

Management System is that it utilizes a mass flow meter instead of a volumetric flow meter. This means the mass flow is measured directly, and is therefore not influenced by air entrained in the oil. Furthermore, the system takes the differential pressure over the flow meter and media temperature into account, ensuring entrained air detection automatically, bunker operation stability and logging.

By understanding the bunker operation and the factors that influence it, as well as applying precise, trustworthy instrumentation and equipment, you will put yourself in the optimum position when bunkering!



# How it works

The bunker management system is based on reliable and tested instrumentation to ensure efficient detection of non compliant bunker operations whether intentional or unintentional. The system is made to aid your crew when bunkering, via the reporting feature the information is stored, and the system ensures headquarters have all the data.

## Direct mass measurement

The main component of the Bunker Management System is the mass flow meter, based on the Coriolis principle. The flow meter directly measures the mass of the fluid that passes through it, and is unaffected by air in the marine fuel oil.

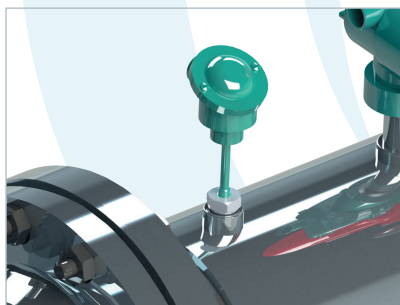
## Pressure transmitters ensure heightened precision

Pressure transmitters are placed before and after the flow meter, and will in the advanced system aid in the regulation of line pressure and flow rate, by controlling a valve placed downstream of the flow meter. The valve is also used for slow start-up, enabling venting of bunker hose and pipes. Furthermore, the two pressure transmitters are needed for detection of air in the bunkered marine fuel oil. A temperature transmitter is also included in the setup to heighten precision.

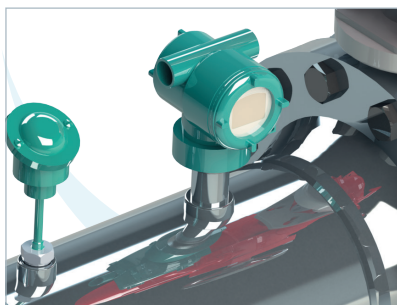
All signals that are drawn from the mentioned instruments are received, stored and processed within the control cabinet containing the electronics. All communication is handled and administrated from this cabinet as well.

## Bunker report

Insatech Marine's Bunker Management System is very useful during bunkering as well as in the event of a bunker dispute. Data collected from the sensors, will automatically generate a bunker report including all necessary information, such as bunkering time, average density, temperature, flow rate and viscosity. If the advanced system is installed, the report will also include a value for the stability index of the complete bunkering operation. This report will be stored in the system and can be recalled at any time you require.



Temperature transmitter

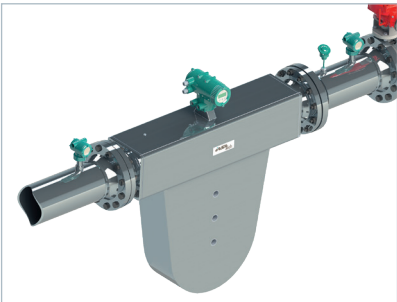


Pressure transmitter



Valve





Coriolis mass flow meter



Operator touch screen



# Operation

Insatech Marine has developed and designed the operator interface and focused on its functionality and easy operation. We know it is vital to have an easy to use system in order to get benefits from it, as it will be handled by different crews, with different nationalities and experience. The system eases the processes related to raising protests and claims towards bunker suppliers.

## A simple system to operate

The simple operation of the Bunker Management System is achieved by a clean and minimalistic design, that eliminates confusing elements and unnecessary information, while in depth and full data is still readily available to any user. It is done without compromising the compatibility and integrity of the system.

## One-time setup

When the system has been installed and is ready to use, some basic set-up information is needed. Merely enter the ship's name, IMO number and other obligatory data once, and the

system will continuously use these for Bunker Reports and displays.

## User experience

When using the Insatech Marine Bunker Management System all information is readily available within one touch of the screen. All information needed during bunkering operations is presented in the overview display, including intuitive illustrations of current status within the different stages of the system.

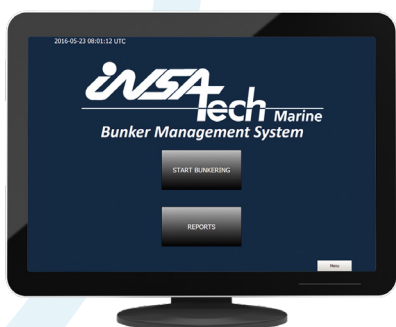
The "Start Bunkering" display will swiftly let the operator enter the necessary input and ready the Bunker

Management System for the task at hand. Once the data has been entered, the operation is ready to begin, and by the press of one button the system is activated. During the operation the operator will be able to see information such as flow, density, viscosity and trends.

After the operation all details regarding the bunkering will be saved in a Bunker Transfer Report (PDF file), which can then be printed or sent to another destination via email.







### Main Menu

When the Bunker Management System is powered up, the first screen is the main menu. Here you can choose to start a new bunkering operation or go through previous operations.

Should you wish to go through previous operations a window will open where you can browse through all Bunker Transfer Reports that have been generated by the system. The navigation is similar to that of a PC.



### Bunker Operation

Enter the "Start Bunkering" and the operation screen is presented – from where you can enter the necessary parameters, monitor current measurement values of the bunker operation, see the development over time, go through alarms (if present), and start/stop the operation.

During bunkering, trend lines provide you with an overview of the operation. You can easily choose which parameters you wish to see, as well as scale the timeline to fit your needs.



# Installation setups



In the bunker industry short-deliveries of 3-4% are not uncommon, therefore the system measures and logs, mass flow, temperature and density, thereby detecting manipulation attempts. The systems greatest documented short-delivery of bunker fuel had a value of USD 31,980.

Mass flow meter RCCS39IR

Pressure	MGO	HFO 180 cSt	HFO 380 cSt	HFO 500 cSt
2 bar	290 t/h	200 t/h	159 t/h	140 t/h
4 bar	300 t/h	271 t/h	225 t/h	203 t/h
6 bar	300 t/h	300 t/h	280 t/h	257 t/h

Mass flow meter RCCS39XR

Pressure	MGO	HFO 180 cSt	HFO 380 cSt	HFO 500 cSt
2 bar	600 t/h	432 t/h	336 t/h	342 t/h
4 bar	600 t/h	585 t/h	501 t/h	470 t/h
6 bar	600 t/h	600 t/h	600 t/h	579 t/h





### Choose for your needs

Depending on what your needs are and how you wish to use the Bunker Management System, there is a configuration that will fit. The system is made in two setups Standard and Advanced. Both includes a cabinet for signal processing and a touch screen for operation.

**Standard setup** consists of a mass flow meter, a temperature transmitter for more accurate readings and better compensation as well as two pressure transmitters, which are used to compensate for viscosity. The system requires manual input of viscosity and temperature from the BDN (Bunker Delivery Note). The system is mainly used for MGO (Marine Gas Oil).

**Advanced setup** includes a control valve enabling air detection, slow start feature and critical operation shut-down. The Automated setup will act upon changes in the bunker flow, give alarms on predefined set-points and can be programmed to close to a 15% flow automatically in case the delivery does not comply with expected quality. This system is intended for high viscosity fuels such as HFO (Heavy Fuel Oil).

Feature	Standard	Advanced
Control cabinet with touch screen	✓	✓
Flow measurement	✓	✓
Density measurement	✓	✓
Temperature measurement	✓	✓
Pressure Measurement	✓	✓
Automatic viscosity compensation	✓	✓
Flow and backpressure control		✓
Slow start capability		✓
Air detection		✓
Stability index (air content)		✓
Density alarm		✓
Critical operation shut-down		✓

### Mass flow meter 2 x RCCS39XR

Pressure	MGO	HFO 180 cSt	HFO 380 cSt	HFO 500 cSt
2 bar	1200 t/h	864 t/h	672 t/h	684 t/h
4 bar	1200 t/h	1170 t/h	1002 t/h	990 t/h
6 bar	1200 t/h	1200 t/h	1200 t/h	1158 t/h

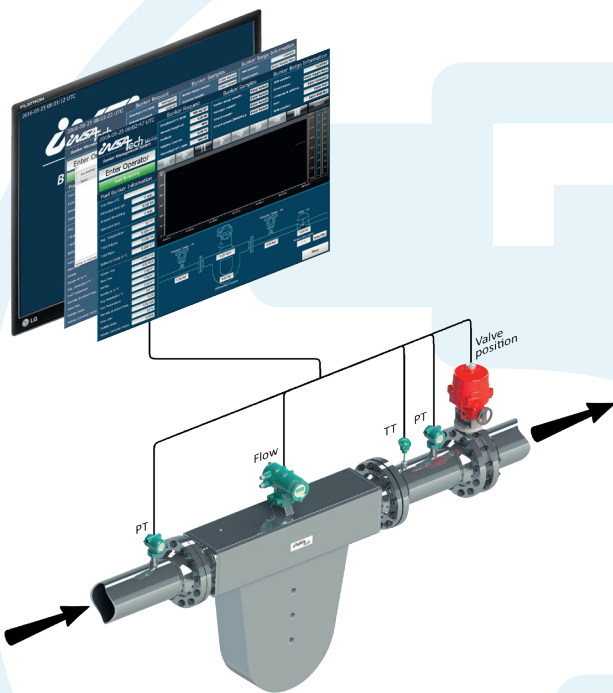
◀ These figures are guidelines for flow rates with a fluid temperature of 50°C. Special pipe designs for bunker piping can have influence on actual figures.



# Installation setup

## The bunker operation

The marine fuel oil flow is measured by the Coriolis Mass Flow Meter installed with the Bunker Management System. Pressure and temperature transmitters enhance the precision and functionality of the system, and an automatic control valve will help ensure that there is always sufficient back pressure, as well as provide the ability of an automatic and controlled partial shutdown, if the delivered bunker fuel is not acceptable.



Date: 2016-05-23

Bunker Transfer Report			
<b>INSATECH</b> Marine			
Vessel No.:		Bunker Transfer Report No.:	
Vessel 1		42	
Alpha 113		Operator	
4302 Vordingborg		Enter Operator	
Denmark			
IMO No. 1234567			
Bunker Barge:		Bunker Company:	
Name: Enter Supply Name		Enter Company	
Harbour: Enter Port			
IMO No.: 1234567			
<b>Product Supplied</b>			
Commenced:	23-05-2016 08:14	Total Oper. Time:	4 min.
Completed:	23-05-2016 08:18	BDN no.:	Enter BDN No.
<b>Samples</b>			
Vessel:	Enter Sample No.	Bunker Barge:	Enter Sample No.
Vessel (IMARQC):	Enter Sample No.	Surveyor:	Enter Sample No.
<b>Product</b>			
Product Name:	HFO	Average Temp.:	49.5 °C
Density at 15°C 1:	920.0 kg/m <sup>3</sup>	Viscosity at 50°C:	380 cSt
Sulphur Content 2:	0.0 %	Stability Index:	100.0
Quantity required:	333 mt		
Quantity delivered:	10.130 mt		
Generic Standard Volume @ 15 °C:	11.828 mt <sup>3</sup>		
Remarks:			
We hereby declare that the bunker fuel supplied conforms with the specifications listed in the Bunker Receipt and LRU Reference (IATA Annex 18).		We hereby acknowledge receipt of the above product and confirm that the measurements were carried out by the relevant ship operator at the vessel's discretion, under full supervision.	
Company Stamp	Tanker's Stamp	Vessel's Stamp	
Bunker Tanker Signature		Vessel Signature	
Powered by <b>INSATECH</b> <small>Marine</small> Page 1 / 2			

## Bunker reporting

A Bunker Transfer Report will be generated automatically after each operation and stored in the system. The Bunker Report will contain information such as average density, temperature, air content and flow rate. Naturally, fuel type and logistical information will also be stated.

## Report access – from ship or shore

The data collected from the bunker operation can be accessed at all times and can be transmitted via the ship's own internet connection as soon as the operation is completed. This means both ship and shore have access to reports, current and historical. At Headquarters the use is primarily for statistical and financial purposes.

## Action enabler via alarms – also from shore

The system can be set up to signal an alarm in case of faulty deliveries or quality inconsistencies. Critical alarms that might require action or assistance from land based operations can be sent directly to Headquarters to ensure timely action is taken. Since dispute claims often have to be made within 48 hours of bunkering, taking action in due time is critical.









# Installation

The system installation does not generate unnecessary costs, it will not alter your schedule or put your vessel out of service. Our experienced technicians install and commission the system while your vessel is in service, whether at sea, in port or dry dock. We are ready to move out at your preferred destination and time.

## Do it yourself – or let us install

The system is programmed, calibrated and has been initially setup by our technicians to minimize installation time onboard. The crew on board will in some cases be able to install the equipment under the guidance of Insatech Marine's technicians, to ensure correct placement and

electrical installation. This minimizes cost and required man-hours, while ensuring maximum benefit of the system during use. However, we are also able to provide installation with commissioning, tests and training of the crew. We can complete the installation at sea, in port or dry dock at your preference.

At sea



In port



In dry dock



*Turnkey solutions and installations;  
at sea, in port or dry dock at your preference.*





# Service maintenance and support



*Our technicians are ready for service on board your vessel at all times.*

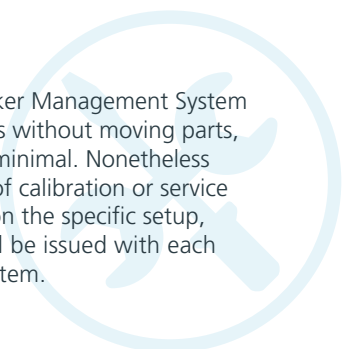
If you require a service agreement as part of the system our skilled technicians are ready to service your vessel at all times. While the system requires minimal maintenance an occasional calibration of equipment is recommended.

**Service and support is readily available**

To constantly get highly accurate measurements, your marine equipment must function optimally. This means it must be calibrated according to the purpose, and therefore we provide service options, should the need arise. This is why we have our own technicians ready for service on board your vessel at all times, whether it is a planned service visit or a pressing and acute matter that needs immediate attention.

**Minimal maintenance required**

As the equipment used for the Bunker Management System is mostly constituted by components without moving parts, the need for active maintenance is minimal. Nonetheless there might be equipment in need of calibration or service from time to time, and depending on the specific setup, a service and maintenance plan will be issued with each individual Bunker Management System.





# What we do



Contact us at  
[marine@insatech.com](mailto:marine@insatech.com)  
or +45 5537 2095

Below is a short recap of our different solutions. We provide a performance concept consisting of four solutions, which tackles the optimization of fuel consumption, performance and management at vessel and fleet level. We can also help you with ODME. All systems can be delivered as turnkey solutions.

## Fuel Consumption System

In addition to real-time fuel consumption the system enables logging of fuel consumption data. Historical views and over time developed trend lines provide you with a better analysis of performance and the effect of new initiatives. Furthermore, the system is ready for upgrade to a Performance Monitoring System and/ or addition of an on board database synchronizing with another at headquarters.

## Performance Monitoring System

The system provides an overview of the ship's performance based on direct on-line measurements. It is versatile and can be customized according to any measurements that you would like to monitor. Fuel consumption is measured with high accuracy mass flow meters, together with propeller shaft torque and rpm. For generators a power meter will be installed, and motion sensors are used to indicate weather conditions. This gives not only valuable information about fuel consumption, but also KPI values (Key Performance Indicator) such as g/kWh & g/Nm.

## Performance Management System

When fully developed it will become an upgraded version of the Performance Monitoring System and complete the on board management layer of the performance concept.

It is decision making oriented and an open input based concept, where more factors are taken into account when evaluating the ships performance. All factors taken into the system are converted into KPIs. The crew will experience a tool that effectively allows them to contribute to a more cost effective operation.

## Fleet Viewer

When fully developed it will become a system for visualizing and creating overviews of fleet performance. It enables comparisons, voyage statistics, KPI generation via consumption, performance and maintenance planning. As such it is a tool for headquarters to plan, optimize and manage the fleet. The system is built on top of the Performance Monitoring System.

## ODME Systems/15 PPM Bilge alarm

By regulations under MARPOL, all vessels must be equipped with a system for Bilge Water Discharge Monitoring as well as Oil Discharge Monitoring and Control Equipment (ODME). Both systems monitor the oil content of over board discharged ballast water and control the discharge allowance based on whether the level of oil content is below the set limits.



# A trustworthy and competent partner

Insatech Marine offers field-tested and proven solutions that meet international rules and regulations as well as helping you save money. We provide comprehensive installation, commissioning, training, service and maintenance to ensure you as little downtime as possible.

Insatech was established in 1989, and has since then grown to +70 employees. With more than 25 years of experience in the field of automation and instrumentation we are a strong partner for both our customers and suppliers. As a result of our longstanding partnerships with some of the world's leading manufacturers within instrumentation and automation, we are able to provide you with global service.

Our system users include:





# Our international agent network

In order to provide the best possible customer support Insatech Marine works closely together with selected agents. This network of dedicated agents will help to ensure your positive experience with our systems and support functions. The agent network will be developed continuously to serve you locally wherever you may operate.

## Croatia

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nenad@oreco.hr  
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## Estonia

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[www.r-automation.ee](http://www.r-automation.ee)

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[www.marinemarketingservices.co.uk](http://www.marinemarketingservices.co.uk)

## United Arab Emirates

Technology Ventures  
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## USA

Rainier Trading dba Rainier Marine  
oakley@rainier-marine.com







*Customer support at your preferred destination.*





*Increase your competitive advantage  
by reducing costs via  
performance and efficiency  
improvements on your vessels.*

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