Solutions to strengthen resilience in port operations

Improve availability of critical equipments and limit risks during automated operations

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Senior VP Global Sales Mobile & Outdoor industries

ifm. **At a glance**

The ifm group of companies is a global industry leader in automation and digitalisation technology.

We combine the flexibility and individuality of a family-owned company with the quality and professionalism of a corporate group.

9,120
employees
worldwide

1,47
billion euros
in sales*

1,400
patents

1969
founded
in Essen

96,8 %
product availability
on the customer's
requested date

169,000
customers
worldwide

*Total turnover according to HGB (German Commercial Code)

ifm. **Product portfolio**

More than 16,000 tried and tested automation products for all application areas


Sensors


Condition monitoring systems

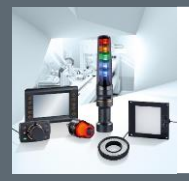

Image processing/ identification


Safety technology


Industrial communication

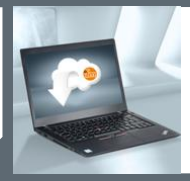

IO-Link

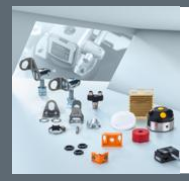

Systems for mobile machines


Display / Operate / Illuminate


Connection technology


Power supplies


IIoT software


Accessories

ifm. **Industry portfolio**

Smart ifm products for all
applications and industries

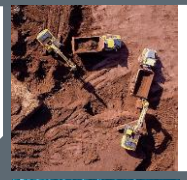

Automotive


Food & Agribusiness


Industrial &
Assembly Automation


Intralogistics &
Mobile Robotics

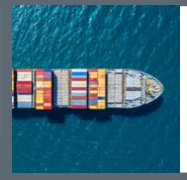

Mining


Mobile Machines


Port Automation


Renewable Energy


Semiconductor &
Solar PV


Ship Automation


Water & Wastewater


Others

ifm.

Port Automation

Port automation is the integration of advanced technologies in port operations. As maritime trade surges, ports face mounting pressure to safely and efficiently handle more cargo than ever before. ifm with more than 30 years of experiences in ports knows how to drive automation in ports and these are the benefits:

- Boost efficiency and safety
- Reduce costs and enhance asset management
- Adapt to evolving regulatory requirements
- Expand traditional security and cyber security needs
- Meet increasing customer expectations

Port Trends Overview

1 **Electrification**

Increasing usage of electrified equipment with renewable energy (RTGs, terminal tractors, straddle carriers). Deployment of On-shore Power Supply for vessels

2 **Digitalization**

Optimization of port operation with advanced technologies (e.g. IoT, digital twins). Drawback: cyber attacks

3 **Automation**

Safety increase by using autonomous vehicles (AGV‘s and trucks), including sensor fusion, AI-powered path planning & robust communication systems– challenges: extensive testing & complicated certfications, cybersecurity

4 **Safety**

Shifting from reactive incident responses to proactive safety management. E.g. spreader safety regulation, safety controllers on AGVs

ifm. **Active in port industry**

» ifm has been a member of the Port Equipment Manufacturers Association since 2010 which represents the interests of equipment and technology suppliers to educate and promote best practice within the port industry

PEMA

» Exhibiting at TOC Europe and TOC Asia every year with port focused products

TOC EUROPE

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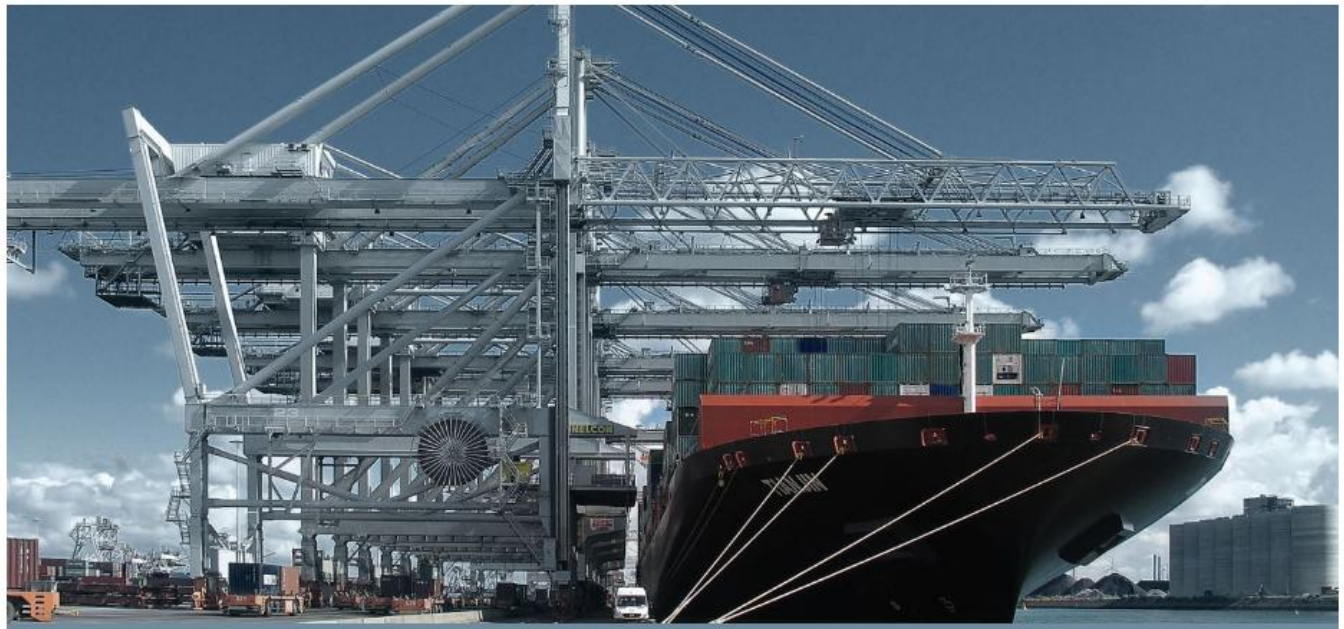


Port automation: Increasing the efficiency of port operations

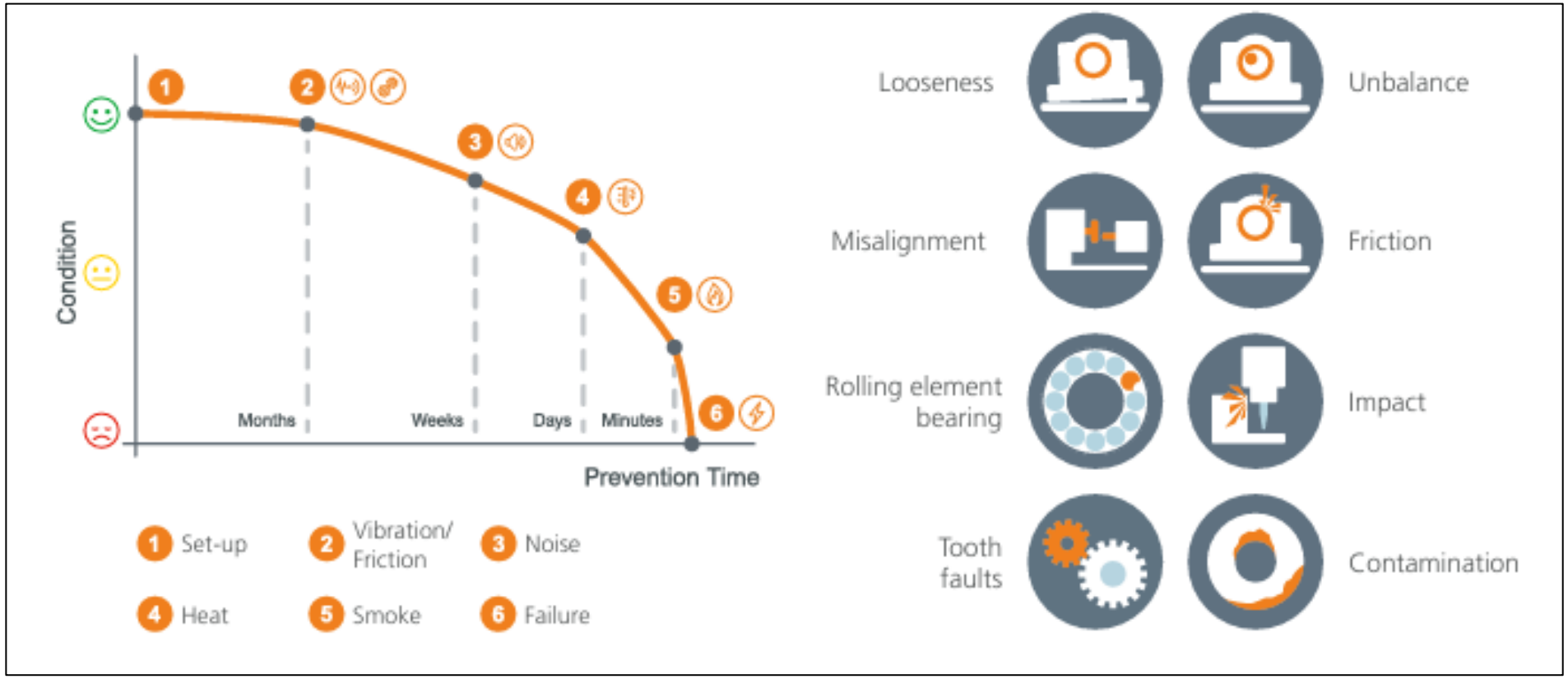
Discover our system solutions based on smart sensors for optimised port operations.

Brochures: Port Automation

SMM 2026

On-line condition monitoring of RTG / RMG/STS critical parts

Benefits of on-line condition monitoring of critical parts on port equipments

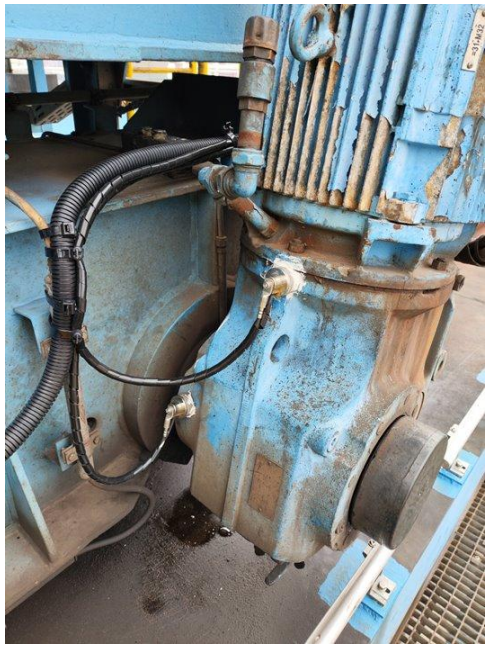


Give feedback to operators of the condition of cranes (especially in case of remote control of the cranes) and improve reactivity in case of anomaly detection

Applications of on-line condition monitoring

Cranes transmission motors and gear reducers

Machine faults at cranes which are not known can create lots of losses in terms of efficiency. A way to foresee such faults will help to avoid such incidents. Some machine faults are bearing unbalance, looseness or overall condition.



Cranes hoist motor and gearbox

The crane gearbox is a critical equipment and downtime can be very expensive. This is a variable speed and load application: crane speed changes from top speed to zero reverses and cycle time is less than a minute The load also varies as per direction of movement; also, same crane can carry 20 feet/40 feet container. In this case there are 8 bearings in total to be monitored

Solutions for on-line condition monitoring

Vibration monitoring systems

Condition monitoring sensor with CANopen type VMB
Real-time condition monitoring with triaxial precision – seamlessly connected to your mobile control network via CANopen.

Acceleration sensors type VSA, VSP & VSM
High-accuracy, real-time acceleration measurement – available in a wide variety of housing designs.

Diagnostic electronics type VSE
4-channel diagnostic system for evaluating dynamic signals, with additional analogue support variables such as speed and load.

Condition monitoring sensor with IO-Link type VVB
Enables real-time monitoring of reliable condition indicators: impact, fatigue, friction and temperature.

Oil quality monitoring systems

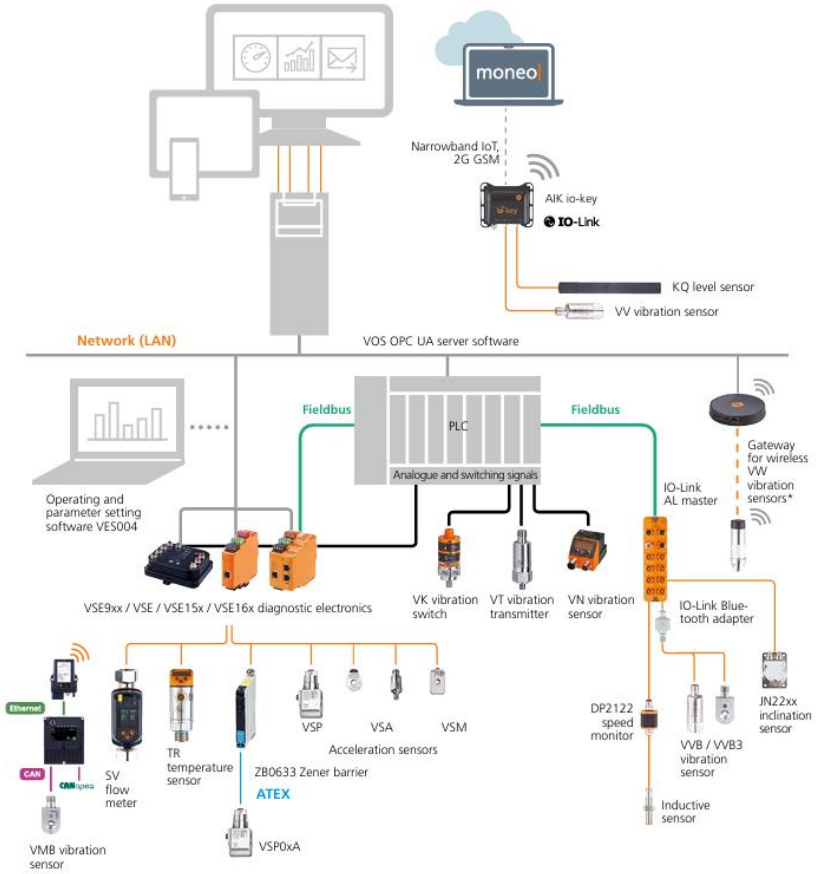
Optical oil particle monitor type LDP
Monitoring the level of contamination in hydraulic oils such as mineral, ester and biodegradable oils. The integrated data memory enables data recording over extended periods. The LCD display indicates cleanliness levels according to ISO 4406:99 or SAE AS4059E as range numbers. The device features a CANopen interface and a sequential analogue output.

Oil humidity sensor type LDH
Water is generally undesirable in hydraulic fluids and lubricants. High concentrations of water can seriously impair operation or even cause damage. The oil moisture sensor of the LDH series measures the relative moisture content in oil within a range of 0...100% using a capacitive measuring element. In addition to relative humidity, the sensor also outputs the medium temperature as an analogue signal.

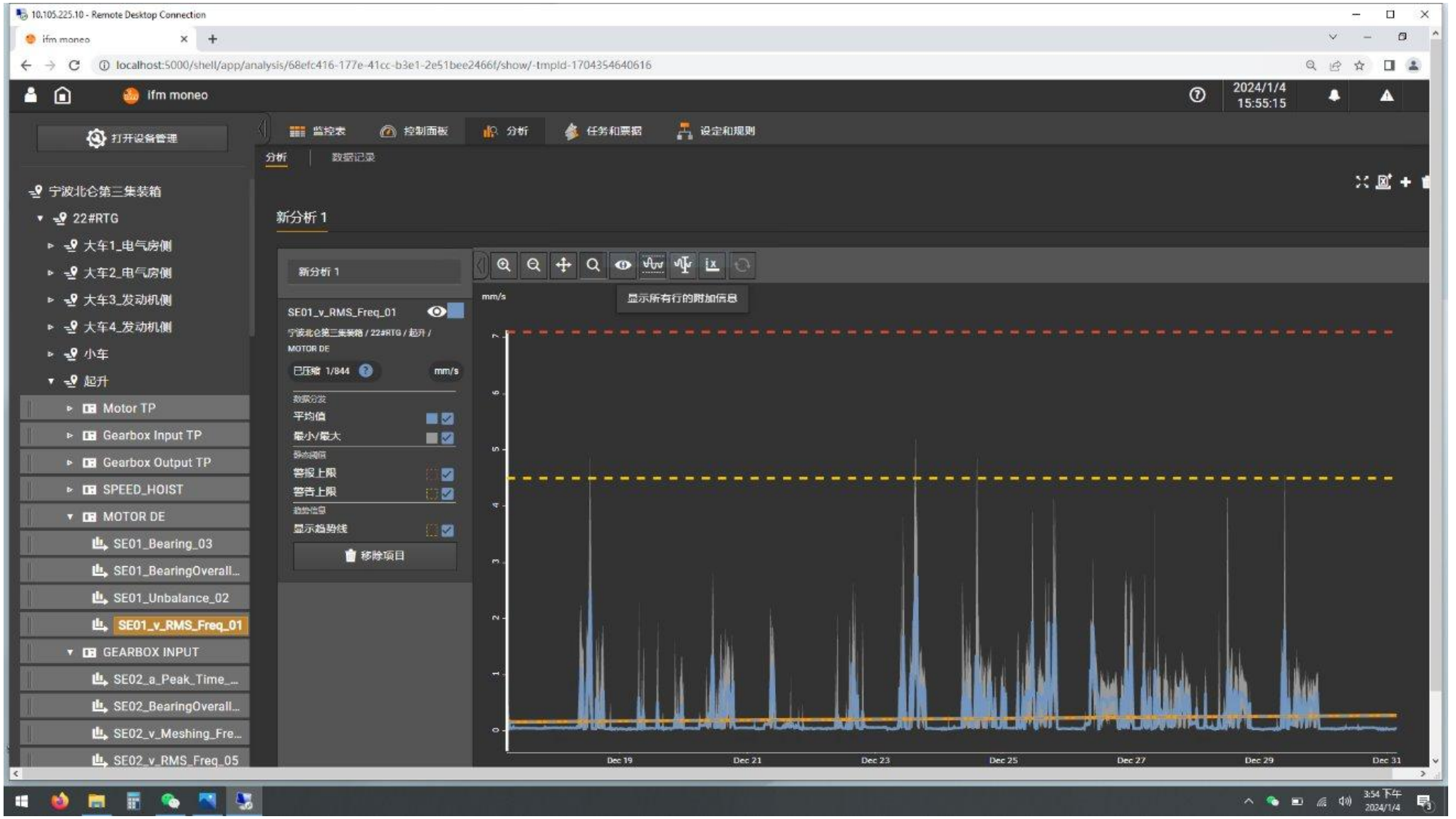
Temperature monitoring

Temperature sensor for mobile use type TA
The hermetically sealed stainless steel housing withstands harsh environmental conditions such as high shock and vibration. It is suitable for multiple applications in tanks or pipes, especially in hydraulic or pneumatic systems. This robust and accurate sensor is ideal for long-lasting and reliable temperature measurement, helping to reduce downtime and save maintenance costs.

Vibration monitoring system overview



Proven results of on-line condition monitoring



Collision prevention between cranes, crane and vessel, crane and prime movers

Technologies in scope for distance and collision avoidance

Technology	1D	2D	3D	Ethernet	Radar	Ultrasonic
Principle	Use laser distance measurement based on time-of-flight technology	Capture visual information using light-sensitive sensors	Measure distance and shape of objects using laser or infrared light	Use standard communication protocols to digitise and packetise image data	Emit radio waves and detect reflections to determine object position and speed	Emit high-frequency sound waves and measure the time it takes for the echo to return to determine the distance
Accuracy	++	++	+++	++	+++	++
Range	++(+)*	++	+++	++	+++	+
Field of view	Narrow	Wide	Wide	Wide	Wide	Medium
Weather resistance	+(+)**	Unavailable	++	Unavailable	+++	+++
Depth perception	Unavailable	Limited	✓	Limited	✓	✓
Object recognition	Unavailable	Unavailable	✓	Unavailable	Unavailable	Unavailable
Speed detection	Unavailable	Unavailable	Unavailable	Unavailable	✓	Unavailable
Costs	+	++	++++	++	+++	+

* Some O1D laser distance sensor types require a reflector to achieve long sensing ranges

** Depending on the position of the O1D's front lens

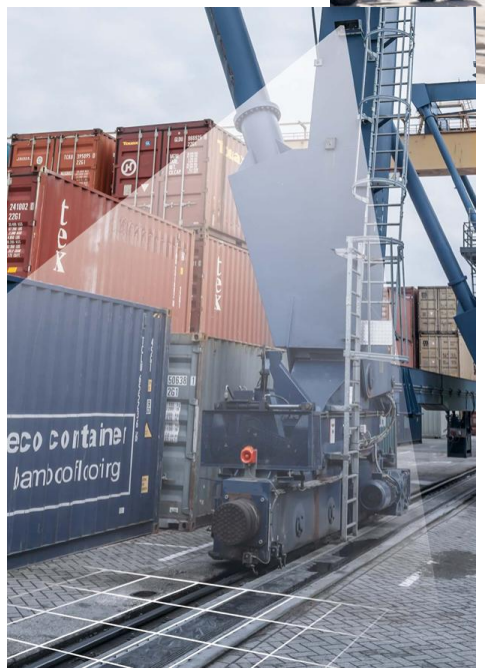
Applications of collision avoidance

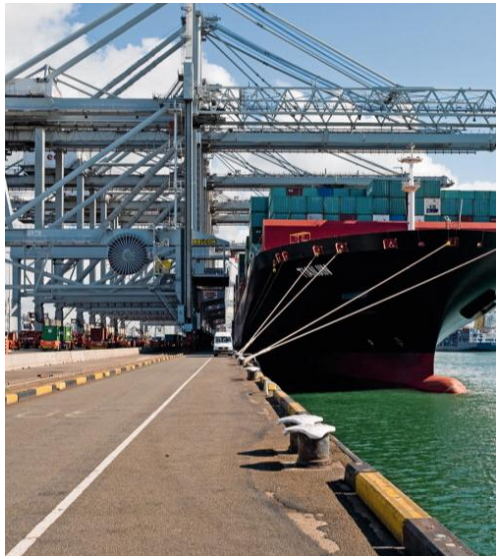
Collision avoidance of straddle carriers:

During operation in a container terminal, collisions occur repeatedly, and also when using straddle carriers. The O3M sensor system are used for collision warning. An algorithm from the automotive industry does not only detect the surface areas but also calculates the probability of collision. Different parameters such as own speed, presumed path, as well as speed and direction values of up to 20 approaching vehicles or objects are taken into account. A highly precise probability of collision is calculated from all this in a split second.

Collision avoidance between crane and upper part of the vessel:

It often happens that the boom of a quay crane collides with the vessel's bridge, mast or antennae. The damage caused by this collision can be very expensive. The photoelectric sensor O1DXXX with 100 m sensing range and 600 m background suppression and reflector is suitable for 100 klx ambient light to solve this issue. The distance between the crane boom and the sensor needs to be adjusted properly and when the vessel's part reaches the sensing range, the sensor gives a signal to stop. Another solution will be the O3M camera based on the PMD Time-of-Flight technology by providing collision prediction to the crane driver, signaling that obstacles are in the path. The O3M camera also offers the possibility to see the obstacle visually.





Solutions for collision avoidance

O1D laser distance sensors
for positioning and distance control

O1D photoelectric distance sensor

Ultrasonic sensors
position detection and precise continuous distance measurement

UIT ultrasonic sensor

Radar sensors
robust & reliable for collision avoidance

Radar sensor

O2M camera systems
reliable area monitoring

O2M analogue camera for mobile machines

Ethernet camera for mobile machines

O3M camera systems
3D PMD sensor for object detection

O3M - 3D sensor for mobile applications

O3M - AI-supported 2D/3D camera

Thank You!