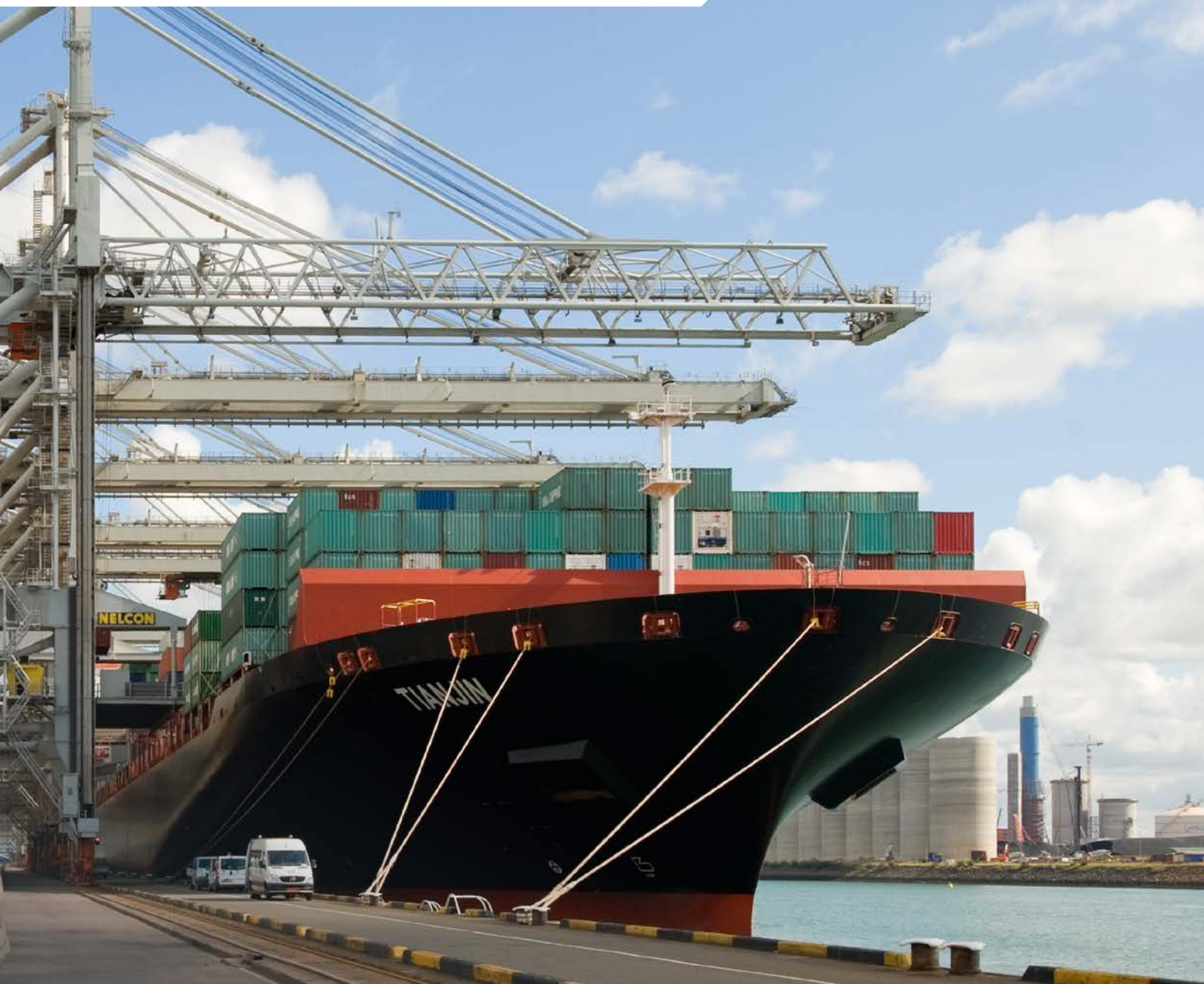
Distance and collision avoidance systems for the port industry



Safety is priority in port terminals

Sophisticated collision avoidance technology improves safety and efficiency across various port equipment applications by detecting, classifying and preventing potential collisions. This reduces the risk of collisions, minimises damage and ensures the safety of both operators and bystanders.

Object detection
Identify nearby objects and issue early warnings based on their risk level, determined by their size and shape.

Object classification
Detect dangerous objects, classify them and predict their behaviour. Enhanced situational awareness for operators is achieved through warnings or interventions based on the system's adaptive responses.

Accident prevention
When a collision is imminent, the system can automatically apply the brakes. If the collision is less imminent, the system will reduce vehicle speed or adjust the trajectory.

However, limitations due to the physical principles of the automation solution may limit performance or require another redundant automation solution. The risk assessment and required solution are in the responsibilities of the end user, but different manufacturers offer consulting services by certified experts on this.

Because safety comes at a price, customers may not always choose the best solution, but they may still choose to make their port "safer" with a less expensive solution.

ifm has more than 50 years of experience in manufacturing sensors and systems for automation technology.

We offer an extremely wide product range, which provides sufficient flexibility to meet customer requirements in the port industry.

5 YEARS Warranty on **ifm products**

Find more information
ifm.com/cnt/port-automation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GOTTWALD

Comparison of the technologies

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

O1D laser distance sensors
for positioning and distance control

O1D photoelectric distance sensor

What makes PMD technology suitable for use in ports
The PMD sensors from ifm use a "system-on-chip" design: Both sensor element and electronics for signal evaluation are integrated on a single silicon chip called a Photonic Mixer Device (PMD).

Advantage
This innovative ifm design offers high measurement accuracy in a compact, industrially compatible housing.

What is particularly special about the PMD technology
The PMD sensors measure the distance irrespective of the surface colour (corrosion of port equipment happens over time). Even ambient light sources up to 100 klx, reflective and dark objects are no problem. The impact angle of the object may be up to 20 degrees.

PMD sensors detect objects with laser protection class 2. The excellent reflection resistance and background suppression, together with a high excess gain, enable reliable operation. The switch point is set easily and within a millimetre by means of user-friendly 2-button handling or alternatively via IO-Link. It also allows provision of the current distance value.

O1D

Features
- Reliable photoelectric distance detection with long ranges of up to 10 m diffuse and 75 or 100 m with reflector
- Resistant to extraneous light up to 100 klx
- Can be used in applications that require background suppression of up to 600 m and offers flexible installation positions
- Scalable detection range with window function
- Suitable for positioning and speed control in port areas
- Good price/performance ratio

Applications
Anti-collision of ship-to-shore cranes, RTG and RMG cranes (with reflector) as well as straddle carriers, soft landing of spreaders and at the gate for truck detection (diffuse)

Selected O1D types
O1D105, O1D106, O1D209

Learn more about the O1D
ifm.com

O2M camera systems
reliable area monitoring

O2M analogue camera for mobile machines

Heavy-duty universal cameras

Work area and rear area monitoring are becoming more and more important for mobile machines. The O2M camera system with analogue video output (PAL) is designed for particularly difficult conditions and excels thanks to its pressure-resistant housing and a light sensitivity of < 0.05 lux.

The new O2M camera system can, for instance, be directly connected to the graphic PDM360 dialogue modules with colour display and analogue interface. This makes it possible to use the dialogue module not only to display machine information but also images of up to two cameras. Consequently, no separate monitor is needed.

O2M

Features

- Encapsulated, fully potted housing with IP67 / IP69K
- High shock and vibration resistance
- Temperature-controlled lens heating for ambient temperatures from -40° to +85°C
- Automatic brightness adjustment
- Angle of aperture of up to 170° x 117° (max. field of view 16.6 mtr x 9.8 mtr)

Applications

360° view on empty container handlers, heavy forklift trucks, reach stackers, straddle carriers, winches of ship-to shore cranes, spreader's twistlocks of reach stackers and empty container handlers

Selected O2M types

O2M202, O2M210

Learn more about the O2M
ifm.com/cnt/o2m


eco container
bamboo flooring

O3M camera systems
3D PMD sensor for object detection

O3M - 3D sensor for mobile applications

O3M - AI-supported 2D/3D camera

O3M	O3M with AI & person detection
Features • Compact and robust housing with very long ranges of up to 35 m • Automatic vehicle tracking with collision warning • Reliable detection thanks to automatic suppression of background illumination (full sunlight at 120 klx) • Display of the camera image in real time when obstacles are detected	**Features** • Reliable person and obstacle detection, optimised for off-highway applications • Integrated person and object detection, based on ifm deep learning • 2D/3D sensor fusion and plausibility check to avoid false alarms • Robust functionality even in bright sunlight or twilight
Applications AGVs and autonomous trucks, spreaders, ship-to-shore cranes, ASC, RTG and RMG cranes, straddle carriers, reach stackers	**Applications** AGVs and autonomous trucks, spreaders, ship-to-shore cranes, ASC, RTG and RMG cranes, straddle carriers, reach stackers
Selected O3M types O3M151, O3M161, O3M171, O3M251, O3M261, O3M271	**Selected O3M types** O3M372

Learn more about the O3M
ifm.com/cnt/collision-warning-mobile-machines

Learn more about the O3M AI
ifm.com/cnt/o3m-ai

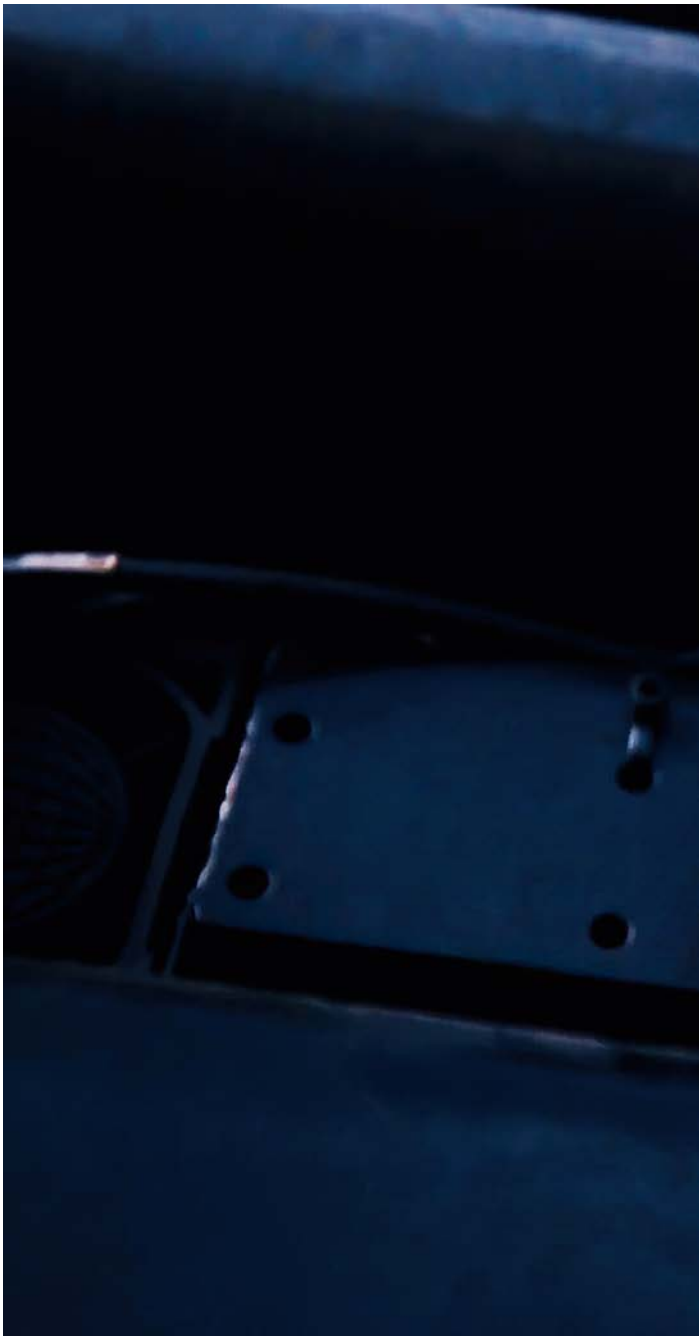
Ethernet cameras
with HD resolution & real-time output

Ethernet cameras are essential for difficult-to-maneuver vehicles, enhancing visual detection of vehicle surroundings, especially on highly frequented construction sites where small monitors with poor resolution fall short.

This new generation of Ethernet cameras features easy parameter setting via the ifm Vision Assistant. They are compatible with dialogue modules with graphics capabilities and common industrial PCs, making them an essential upgrade for safety and efficiency in demanding environments.

Benefits

- Cameras offer several presets by allowing individual adjustments
- Featuring a fast Ethernet interface for communication
- Camera image can be displayed on any number of displays
- Multiple cameras can be connected to a single display
- Camera is protected against both overvoltage and undervoltage
- Thanks to its robust housing, it is suitable for use in harsh environments



Ethernet camera for mobile machines

Ethernet camera

Features

- Angle of aperture up to 180 degrees
- HD resolution up to 1280 x 960 pixels
- Pin-sharp images with high depth of field
- Low latency, video stream transmission via H.264 or MJPEG
- Encapsulated, weather-proof housing with IP 67 / IP 69K rating
- High shock and vibration resistance

Applications

Reach stackers, forklift trucks

Selected Ethernet camera types

ZB0863, ZB0864

Learn more about the Ethernet camera
ifm.com

Radar sensors
robust & reliable for collision avoidance

Radar sensor for harsh environmental and all-weather conditions

Advanced radar technology enables reliable object detection under harsh environmental conditions. FMCW radar technology enables the sensor to detect the distance, position, speed and direction of movement of multiple objects.

The robustness of radar technology, the wide range of operating temperature and the high protection rating make the sensors perfect for outdoor applications.

Radar sensor

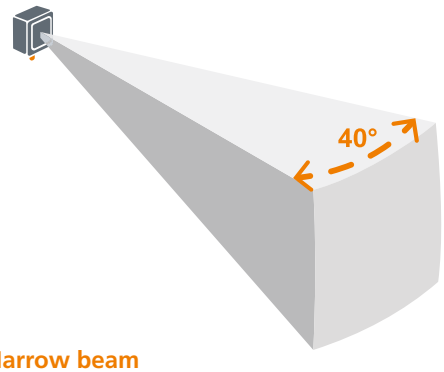
Radar technology – what makes it reliable?

Radar sensors emit electromagnetic waves, whose frequency ranges stretch from approx. 30 MHz to approx. 300 GHz, with the echoes reflected by objects or media serving as active transmission and reception method to calculate their distance to the sensor.

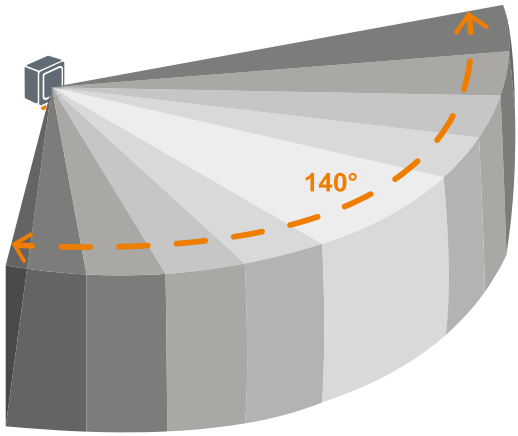
ifm radar sensors utilise the Frequency Modulated Continuous Wave (FMCW) method. They emit high-frequency electromagnetic waves with a periodically changing frequency. These waves are reflected by objects, detected by the sensor's receiving antenna and evaluated. Based on the time offset between the transmitted and reflected signal, information on distance, speed, direction and position can be precisely determined.

Learn more about the Radar sensors
ifm.com/cnt/r2d

Radar distance sensor	Radar area sensor
Features • Long ranges and a wide temperature range from -40°C to 80°C (CAN versions -40°C to 85°C) • Reliable measurements even in precipitation, fog, dust and dirt • High protection rating IP67/IP69K • Simultaneous detection of distance and speed • Operating modes can be set in accordance with the specific application • Intuitive set-up and visualisation of the measured data using the ifm Vision Assistant software	**Features** • Large angle of aperture enables area monitoring • Long ranges and a wide temperature range from -40°C to 80°C (CAN versions -40°C to 85°C) • Freely adjustable 3D detection field (horizontal and vertical) • Angular resolution for precise output of position coordinates • Reliable measurements even in precipitation, fog, dust and dirt • High protection rating IP67/IP69K • Various operating modes allow long ranges or precise resolution in the millimetre range • Simultaneous detection of distance and speed • Intuitive set-up and visualisation of the measured data using the ifm Vision Assistant software
Applications Conveyor belt monitoring at bulk terminals, barrier automation at port terminals	**Applications** Ship-to-shore cranes, yard cranes, horizontal transport equipment
Selected radar sensor types R1D100, R1D101, R1D102, R1D200, R1D201	**Selected radar sensor types** R2D100, R2D101, R2D110, R2D200, R2D201, R2D210



Narrow beam
Small opening angle



Wide beam
Large opening angle

Ultrasonic sensors
position detection and precise continuous distance measurement

Many strengths, few limits: how ultrasound technology works
Ultrasonic sensors detect all sound-reflecting objects. To calculate the distance, they measure the time between sending and receiving a reflected sound signal. The target's colour, transparency and surface reflectivity are irrelevant.

UIT ultrasonic sensor

Learn more about the UIT ultrasonic sensors
ifm.com/cnt/ultrasonic-long-ranges

UIT series

Features
- Very large detection range of up to 8 m in M30 design
- Intuitive setting of the detection range via pushbutton or IO-Link
- Clearly visible LED for indicating switching status and echo
- Protection IP67 (full metal versions IP65, IP67, IP68, IP69K)
- Output function normally open / normally closed programmable
- Non-contact detection independent of colour, transparency or surface characteristics of the object
- Width of the sound beam adjustable via IO-Link

Applications
Soft-landing of spreaders

Selected UIT sensor types
UIT500, UIT501, UIT502, UIT503, UIT504, UIT505, UIT506, UIT507, UIT508

Note: Since wind can affect the performance, a sound tube is recommended for outdoor applications (sound tube order no. E23007)

UGT ultrasonic sensor

Learn more about the UGT ultrasonic sensors
ifm.com/cnt/ultrasonic-small-blind-zone

UGT series

Features

- Very large detection range of up to 2.2 m in M18 design
- Intuitive setting of the detection range via pushbutton or IO-Link
- Protection IP67
- Clearly visible LED for indicating switching status and echo
- With programmable switching output and scalable analogue output
- Non-contact detection independent of colour, transparency or surface characteristics of the object

Applications

Soft-landing of spreaders

Selected UGT sensor types

UGT206, UGT207

Note: Since wind can affect the performance, a sound tube is recommended for outdoor applications (sound tube order no. E23000)

Ultrasonic full-metal sensor

Learn more about the Ultrasonic full-metal sensors
ifm.com/cnt/ultrasonic-full-metal

Ultrasonic full-metal sensors

Features

- Continuous non-contact level measurement and object detection regardless of environmental conditions
- Long ranges of up to 2.5 m
- Digital or analogue measured value output
- Easy parameter setting, measured value transmission and diagnostic information via IO-Link
- Available in M30 and M18 design
- Protection IP65; IP67; IP68; IP69K

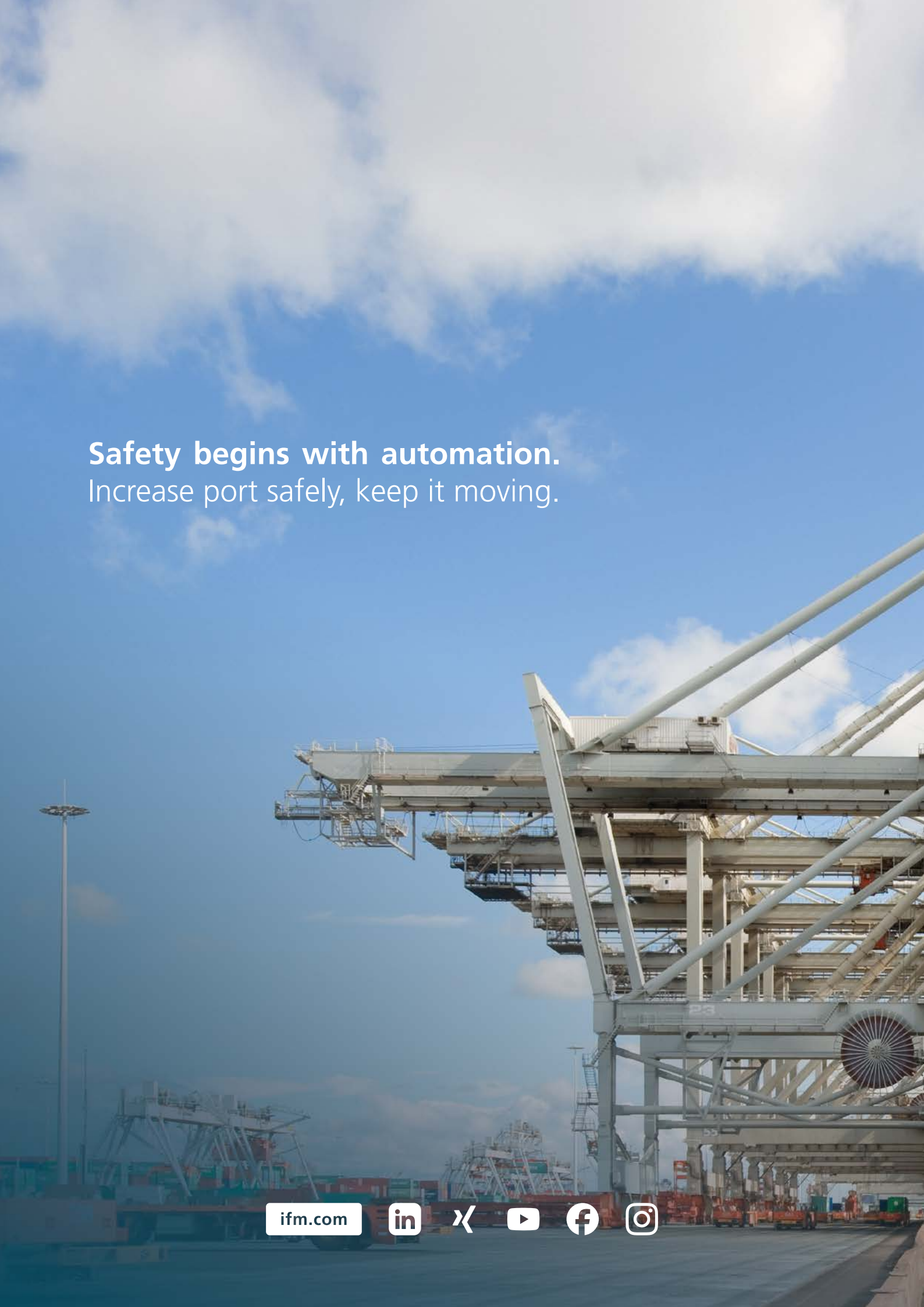
Applications

Soft-landing of spreaders

Selected ultrasonic full-metal sensor types

UGT303, UGT304, UGT305, UIT300, UIT301, UIT302

Note: No sound tube is required. The size of the sound beam is adjusted via IO-Link.


Safety begins with automation.
Increase port safely, keep it moving.
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