Distance and anti-collision solutions for ports

System introduction and application references

Version 1.0 January 2024 by Frank Spitzer

Distance and anti-collision solutions for ports

Safe as needed vs safe as possible

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, minimizes damage, and ensures the safety of both operators and bystanders.

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

Object classification: Detect dangerous objects, classify them, and predict their behavior. 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 immediate, the system will reduce vehicle speed or adjust the trajectory.

However, limitations by the physical principles of the automation solution can limit the performance or will need another redundant automation solution. The risk assessment and needed solution is in the responsibility of the enduser but different manufacturers offer consulting services by certified experts on this.

As safety has it’s price, not always customer decide for the best solution but still decide to make their port “safer” with a more economical solution

Distance and anti-collision solutions for ports

System overview

Technology	3D	Ethernet	2D	Radar	Ultrasonic
Principle	Measure distance and shape of objects using laser or infrared light	Leverage standard communication protocols to digitize and packetize image data	Capture visual information using light-sensitive sensors	Emit radio waves and detect reflections to determine object position and speed	Emit high-frequency sound waves and measure the time taken for the echo to return to determine distance
Accuracy	+++	++	++	+++	+
Range	+++	++	++	+++	+
Field of View (FoV)	Wide	Wide	Wide	Wide	Narrow
Weather resistance (fog, rain)	++	×	×	+++	+++
Depth perception	✓	×	!	✓	✓
Object recognition	✓	×	×	×	×
Speed detection	×	×	×	✓	×
Cost	$$ $$	$$	$$	$$$	$
Learn more	3D ▶	Ethernet ▶	2D ▶	Radar ▶	Ultrasonic ▶

Key: ✓ : Available × : Unavailable ! : Limited + : Low +++ : High

Distance and anti-collision solutions for ports

pmd 1D sensors

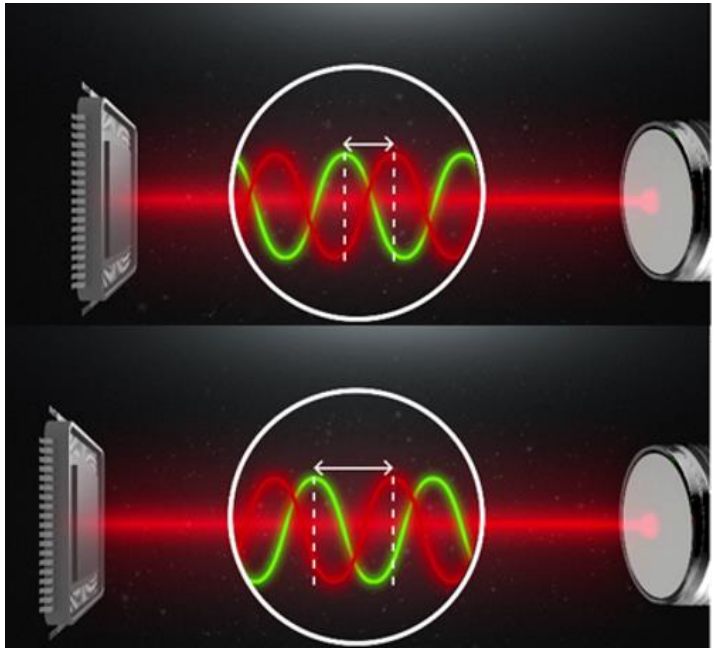
Product

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**. **Even ambient light sources up to 100klx, reflective, oil film wetted surfaces or very 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 1 which is uncritical to the eye. 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 3-button handling or alternatively via IO-Link. It also allows provision of the current distance value.



When the distance to the object increases, the distance between the waves becomes longer. This allows to determine the distance to the object.

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pmd 1D sensors

Application

- Twin twenty feet container detection below the spreader

- Height indication/soft landing of spreaders and automatic landing/supported landing of the spreader (customer specific solution for straddle carriers)

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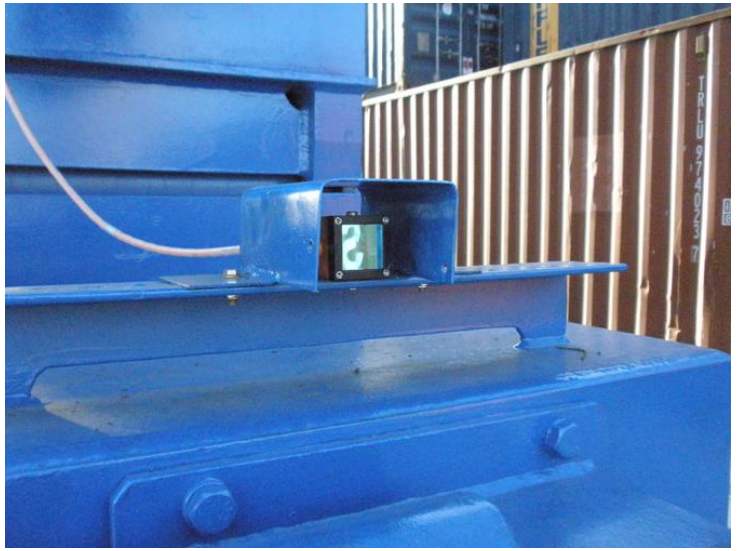
pmd 1D sensors

Application

- e-RTG for anti-collision with the AC bus bar

- Anti-collision between STS/RTG/RMG/ASC (reflector needed for distances up to 60 mtr or more)



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3D time of flight camera (based on pmd technology)

Product

Long sensing range

Each pixel on the PMD chip determines the distances to the scene from the phase shift between the transmitted and the received signal. The range of up to **35 m in typical environments and up to 50 m on reflective objects**, e.g. safety vests, ensures universal use

Extraneous light suppression

The integrated, active suppression of background illumination almost completely prevents saturation of the image sensor by extraneous light. That means that the PMD 3D sensor can be operated in **bright sunlight up to 120 klx**

Integrated diagnostics

Interfaces such as CAN with J1939 or CANopen or fast Ethernet are integrated as standard. Self-diagnostic functions from the sensor to the IR system illumination unit continually monitor the system status

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3D time of flight camera

Applications

Collision warning system and area surveillance

- Detects and warns the driver of obstacles on the path of STS/RTG/RMG cranes
- Avoidance of collision of an AGV, reachstacker, straddle carrier or others to an object in the blind spot, e.g. when driving reverse
- Area surveillance below a STS crane to avoid collision of spreader or container with people or vehicles

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Ethernet camera

Product

The new Ethernet cameras feature a fast Ethernet interface for communication. Unlike analog camera systems, the camera image can be displayed on any number of displays via an Ethernet switch. Additionally, multiple cameras can be connected to a single display or industrial PC using this method. Voltage can be directly supplied by the vehicle battery, as the camera is protected against both overvoltage and undervoltage.

Features:

- Enapsulated, weatherproof housing with protection rating IP67 and IP69k
- High shock and vibration resistance
- Opening angle up to 180° H x 130° V
- HD resolution up to 1280 x 960 pixels
- Individual settings for resolution, image zone, frame rate and bit rate
- Mirror function for reversing can be enabled

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Analogue camera O2M

Product

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.

Features:

- Encapsulated, fully potted housing with IP 67 / IP 69K protection
- High shock and vibration resistance
- Temperature-controlled lens heating for -40° to +85°C ambient temperature
- Automatic brightness adjustment
- Angle of aperture up to 170° x 117° (max. field of view 16,6 mtr x 9,8 mtr)

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Analogue camera O2M

Application

Frontview, side view, rear view, 360° view on:

Empty container handlers

Heavy forklift trucks

Reachstacker

Straddle Carrier

Other applications:

STS cranes (winches)

Spreader (twistlocks, only in yards)

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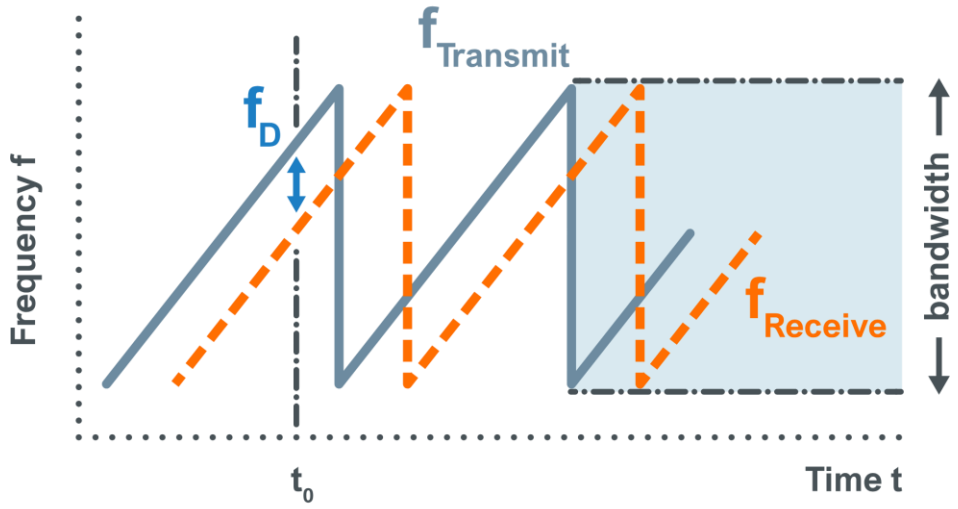
Radar sensors

Product

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.



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Radar sensors

Product

- Long ranges up to 50 mtr and a wide temperature range from -40°C to 80°C
- Simultaneous detection of distance and speed
- Reliable measurements even in precipitation, fog, dust and dirt
- High protection rating IP67/IP69k
- Shock and vibration resistance
- Adaptable to specific applications thanks to various operating modes

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Radar sensors

Applications

Vehicle positioning
Detection of vehicles at the gate or during docking operations at loading and unloading ramps

Distance control and height measurement
Reliable detection of distances from the ground or objects even in dusty environments

Monitoring of surroundings and collision avoidance
Early detection of obstacles in the surroundings of a moving crane or vehicle and assistance to the operator/driver in monitoring poorly visible areas

Smart access control
Automatic opening and closing of gates and barriers with cross traffic masking

Conveyor monitoring in bulk terminals
Non-contact, simultaneous detection of the loading height and speed of a conveyor belt

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Ultrasonic sensors

Product

Ultrasonic sensors are based on the time-of-flight principle. The sensors calculate the time between sending and receiving a reflected sound signal. One advantage of this type of distance measurement is that the measurement result is unaffected by the material properties of the detected target. Even with shiny, coloured or textured surfaces or optically transparent objects, reliable detection is guaranteed.

Independent of colour
Reliable detection of coloured and even transparent objects

Independent of material
Reliable detection, whether solid or liquid, shiny or matt

Wide detection range and long ranges up to 8 mtr
Enable reliable detection of even irregular targets such as mesh boxes

Detection to the nearest millimetre
Continuous and precise output of the distance value.

Stable signal output thanks to integrated temperature compensation

Extraneous light immunity

Attention: wind has influence on the performance, therefor a sound tube is recommended for outdoor applications

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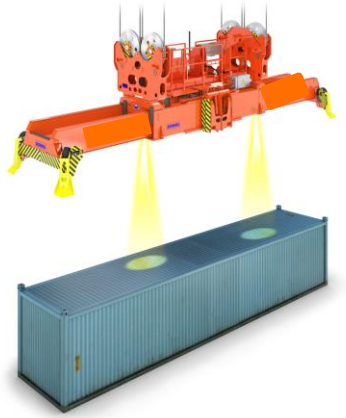
Ultrasonic sensors

Application

- **Height Indication System** (HIS) to measure the distance between the spreader and the container, sending signals to the crane to decelerate or help the crane operator to **avoid hard landings on containers**. Typically M30 or M18 sensors are used.



- **Anti-collision** devices, typically M30 sensors due to higher sensing range, using one Digital Output to slowdown the machine (when an obstacle is detected in around 8m range) and another Digital Output to stop when the obstacle is inside of 5m range.

Thank you