

From 1D to 3D object detection: ifm vision sensors.

Automation solutions from ifm.

ifm.com/gb/vision

From selective distance measurement to industrial imaging.

Vision sensors





From 1D to 3D object detection.

As a driver of industrial digitalisation, we are committed to making outstanding technologies available to companies of all sizes. This also applies to vision sensors which, as the "eye" of Industry 4.0, play a significant role in the success of digital evolution.

Our vision: a cutting-edge technology, available to all!

No compromises! The benefits of ifm vision systems:

The application possibilities for our vision systems are wide-ranging; we can offer you:

1D vision systems

2D vision systems 3D vision systems ifm has been offering vision systems as an easy-to-use solution for industrial image processing since 2003. To this day, all our products are characterised by their ease of use. Even 3D sensors which are capable of handling complex challenges can be set up within minutes.

What else makes our products unique? The Time-of-Flight (ToF) technology of our subsidiary pmdtechnologies. As the only supplier of vision systems, we develop all components ourselves. This enables us to manufacture ToF sensors which precisely fulfil the particular system-specific requirements. In other words: Our vision systems offer ToF technology without compromise.

Let's make automation smart and simple!



1D Vision systems: precisely detect distances, levels and positions.



ifm 1D vision systems are ideal if you want to perform non-contact distance measurements or positioning tasks in factory automation. Even speed control or level measurement, collision protection for autonomous industrial transport systems or positioning tasks for industrial trucks in high-bay warehouses can be reliably implemented.



O1D distance sensor	O5D distance sensor	OID distance sensor	OGD distance sensor
8 - 12	13 - 15	16	17
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1D Vision systems: the sensors.



Distance sensor of type O1D

Reliable photoelectric distance detection with long ranges of up to 10 m.

Two switching outputs, one of them programmable as analogue output.

Scalable measuring range and adjustable window function.

Use in applications with background suppression.

Very good price/performance ratio.

The very compact distance sensor O1D with Time-of-Flight measurement based on PMD technology is characterised by a very large scanning range, reliable background suppression, a visible red laser light spot and a high functional reserve.

The sensor is resistant to extraneous light and can be used in workshops where daylight hits the sensor or target from above. And even reflective objects such as metal surfaces are reliably detected Reflective stripes on high-visibility vests reliably hidden. With the O1D, distances can also be reliably measured even if the light beam does not hit the object surface vertically. This allows flexible mounting, facilitates installation and saves costs. Due to the precise background suppression, even shiny, matt, dark or light objects are reliably detected.



Distance sensor of type O5D

Reliable background suppression and colour-independent detection Reliable detection of shiny surfaces.

Flat reflection angles to the object possible.

With display and pushbuttons for precise switching point setting.

The O5D distance sensor with Timeof-Flight measurement based on PMD technology combines the advantages of long range, reliable background suppression, visible red light and high functional reserve in a compact rectangular standard housing.

The switch point can be set to the nearest centimetre via "+/-" buttons and the display. Thanks to IO-Link, the switch point can also be set from a controller or PC. The current value can be viewed on the display at all times.

The accurate background suppression ensures that even shiny, matt, dark or light objects are safely detected. The unit allows any angle of incidence and thus any mounting position, which facilitates installation and saves costs.



Distance sensor M30 of type OID

Reliable background suppression and colour-independent detection.

Simple switch point setting by means of a rotatable, lockable setting ring.

Reliable detection of shiny surfaces.

Flat reflection angles to the object possible.

Convenient communication via IO-Link.

The OID distance sensor with Time-of-Flight measurement based on PMD technology combines the advantages of long range, reliable background suppression, visible red light and high functional reserve in a compact, robust M30 housing.

Switch point setting of the unit is easy and intuitive via a scaled setting ring (easy-turn). A scale shows the distance set. The switch point can thus be set before installation.

The accurate background suppression ensures that even shiny, matt, dark or light objects are safely detected. The unit allows any angle of incidence and thus any mounting position, which facilitates installation and saves costs.

ifm.com/gb/oid





Distance sensor M18 Cube of type OGD

Small compact design with standard M18 thread.

Laser protection class 1, e.g. for the automotive industry.

Visualisation and setting of the distance value via IO-Link and 2-colour display on the unit

Use in applications with background suppression.

Convenient 3-button operation or parameter setting via IO-Link.

Thanks to the innovative on-chip Time-of-Flight measurement system based on PMD technology, the sensor has the capabilities of an extremely precise measurement system.

The OGD Precision with an extremely small light spot and a 300 mm range is perfectly suited for the detection of very small parts. The OGD Long Range reliably measures distances up to 1.5 m.

Both detect objects independent of the colour and with laser protection class 1, which is not harmful to the eye. The excellent reflection resistance and background suppression, together with the high functional reserve, contribute to the reliable function of both sensors.



The PMD sensors from ifm use a "systemon-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 – at a fraction of the price of conventional systems.

With the extremely small laser light spot, the sensors are perfectly suited for the detection of small parts, e.g. in error-proofing applications.



Applications defined by "degree of difficulty" Set-up time Degree of difficulty Simple applications are shown with a green Less than 5 minutes bar and are standard error checking applications which require a simple parameter setting. Set-up time is less than 5 minutes. Moderate Advanced Simple Degree of difficulty Moderately difficult applications are shown Less than 10 minutes with a yellow bar and may require some com-Moderate Advanced plex parameter settings and mounting tech-Simple niques. Set-up time is less than 10 minutes. Degree of difficulty Up to 30 minutes Advanced applications are indicated with a red bar and will require advanced parameter Moderate Advanced Simple settings. Set-up time may take up to 30 minutes.



Reliably measure long distances.



Distance sensor of type O1D



Position check: Dashboard removal





Description:

During the gripping operation, the distance sensors measure the distance to the instrument panel.

Automotive industry

Industry:



If the distance falls below the value previously stored in the robot's program, the gripping robot reduces its speed to avoid a collision.

Degree of difficulty
Simple Moderate Advanced



Position check: Workpiece carriers in the gearbox test rig

		Description:	On the workpiece carriers, it must be detected whether the connectors have been connected in the correct positions.
		Industry:	Automotive industry
100			During the test run, the gearbox is held in place using locking bolts.
Degree of difficulty			
Position check: Mould proc	duction in the foundry		
		Description:	The casting moulds are united automatically.
		Industry:	Automotive industry
			O1D photoelectric sensors detect the casting moulds for the control system.
Degree of difficulty			
Position check: Detecting v	when the assembly platform	is free	

	Description:	The car body is assembled in a further step. The photoelectric distance sensor O1D pre- vents a collision with another car body.
	Industry:	Automotive industry
		The sensor detects whether the assembly plat- form is free. Only when no car body is present will the hanger be lowered and the car body positioned.
Degree of difficulty		

Position check: Sag control in a loop pit

Moderate Advanced

Degree of difficulty

Moderate Advanced

Simple

Simple



Position check: Controlling a straightening machine





Description:

Feeding a sheet to a straightening machine. The sheet is shaped in the next process step.

Industry:



Automotive industry

The sensor checks the presence of the sheet and starts the shaping process.



Position check: Transport to door module assembly





Description:	The doors are transported for further processing via the overhead electric monorail conveyor.
Industry:	Automotive industry
	Photoelectric distance sensors O1D take over collision protection.

Simple Moderate Advanced

Position check: Spreader steering

Moderate Advanced

P		Description:	Distance sensors are used in the port area for positioning and speed control. They can e.g protect vehicles and autonomous transport systems from collisions.
		Industry:	Port logistics
	Ŷ	The O1D distance sensor measures the distance between spreader and container. When the container is approached, this is signalled to the driver so that the speed can be adjusted accordingly. To protect against	
Degree of difficulty			impacts, cushioned assembly is required.

Position check: "Empty" detection of material carriers





Degree of difficulty Simple Moderate Advanced **Description:**

Industry:



The O1D photoelectric distance sensor uses the analogue output to detect how full the material carrier is.

Vehicle doors are temporarily stored in material carriers for subsequent assembly.

Automotive industry



Simple



Position check: Detecting the bonnet condition "open"





Description: Industry:	If the car body travels to a defined position with an open bonnet, the light beam to the assembly shop floor will be broken and clear- ance to proceed will be given. Automotive industry
	A closed bonnet is also recognised and the automatic docking to the filling station prevented.



Position check: Manufacture of ice cream





Description:	Several O1D distance sensors check from a distance whether all pneumatic grippers have actually grasped an ice cream cone.
Industry:	Food industry
	The sensors do not influence each other despite the short assembly distance.

Degree of difficulty Simple Moderate Advanced

Position check: Cane sugar mill





Description:	The level of a cane sugar silo is transferred to the plate via a rod.
Industry:	Food industry
	The O1D measures the distance to the meas- uring plate with millimetre accuracy and pro- vides precise information about the level.

Degree of difficulty Simple Moderate Advanced

Position check: Palletiser







Position check: Strip flow in blank cutting plant and coil unwinder





Description:

Industry:

Degree of difficulty
Simple Moderate Advanced

Position check: Collision avoidance in crane installations





Description:	Two or more cranes on a crane bridge pose the risk of collision.
Industry:	Steel production
	The laser distance sensor O1D is used to measure the distance between the cranes. If the distance is too short, the crane travel is stopped.

Automotive industry

The O1D PMD sensors monitor the correct running of the steel strip and coil unwinding.

Once a defined circumference has been reached, the coil changeover starts automatically.

Degree of difficulty		
Simple	Moderate	Advanced





Reliably measure long distances.



Distance sensor of type O5D



Position check: Detecting the body position





Description.	requiring a car body on an assembly line.
Industry:	Automotive industry
	O5D distance sensors reliably detect the posi- tion of the car body on the skid for controlling the subsequent processes.



Position check: Detecting the body position



Degree of difficulty

Simple

Т

Moderate Advanced



Description:	A robot grips a car body panel and positions it for the welding process.
Industry:	Automotive industry
	The O5D distance sensors reliably detect the correct position of the car body for the sub- sequent welding process using Time-of-Flight measurement.

Position check: Transporting scrap bales



 Description:
 The O5D photoelectric distance sensor detects if the conveyor belt is clear.

 Industry:
 Machine tools

 Even the coarse structure and dark colour of the scrap bales are no problem for the O5D.



Position check: Optical detection of cartons





Description:

Cartons are transported on a conveyor belt. Detection at high speeds is not a problem.

Food industry

Industry:



Polished, matt, dark or light objects of any colour: The photoelectric sensors of the PMD-Line reliably detect all objects, irrespective of the angle of incidence. This allows flexible installation positions.

Degree of difficulty
Simple Moderate Advanced

Position check: Chamber filter press



Degree of difficulty
Simple Moderate Advanced

Position check: Carton folding machine

	Description:	The machine folds cardboard blanks into cartons.
	Industry:	Packaging machines
		The sensor measures the amount of blanks present and starts a refilling process when the remaining amount is low.

Degree of difficulty
Simple Moderate Advanced

Position check: Detection of interchangeable tools





Description:

Industry:

Machine tools



The O5D photoelectric sensors detect if the selected tool is present in the fixture.

Different tools are required in the processing machine for different production steps. The

tools are changed automatically.





Position check: Packaging machine





Description:	Distance sensors provide important informa- tion to logistics, for example in the packaging area, in order to avoid disruptions in the process.
Industry:	Packaging machines
	The distance sensors of the O5D family measure the fill level in the magazine using Time-of-Flight measurement. The values can be transmitted as switching signals or as con- tinuous values via IO-Link.

Degree of difficulty
Simple Moderate Advanced



Reliably measure long distances.



Position check: Transporting workpiece carriers







Description:	Components are conveyed on the conveyor line to the car manufacturing plant.
Industry:	Automotive industry
	The sensors record the exact position of the workpiece and transmit this information to a controller.



Presence verification: Photoelectric detection of yoghurt pots





Description:



Yoghurt pots are transported on a conveyor belt and checked for completeness and for lids.

Industry:

Food industry

Shiny, matt, dark or light surfaces, whatever the colour: The optical sensors of the PMDLine reliably detect even difficult objects, such as yoghurt pots in this application.

Degree of difficulty





Reliably measure long distances.



Presence verification: Cut to length with spring arm





Description:	Sheets of different thicknesses are machined and cut to size.
Industry:	Automotive industry
	The OGD determines the sheet thickness via the distance to the sheet. Depending on the sheet thickness, a different process is started.



Quality control: Two-stage conveyor belt stop function



Degree of difficulty			
Simple	Moderate	Advanced	



Description:	Background suppression is yet another advan- tage the OGD provides. The feature comes in handy when implementing a stop function at the end of a conveyor belt.
Industry:	Conveying and packaging industry
	Reflections from the metallic rollers do not affect the sensor which also reliably detects objects of different colours. The first switch point triggers a speed reduction of the belt. When the object reaches the second switch point, the belt is stopped.



Non-contact level detection of liquids and solids.



Distance sensor of type O1D



Level control: "Full" detection for swarf hoppers





Description:	Swarf is produced during the machining of metallic components and is collected in a hopper.
Industry:	Machine tools
	The O1D photoelectric sensor outputs the fill level of the swarf hopper to the analogue out- put. Both long swarf and short-chipping swarf are detected.



Level control: Chocolate in storage tank



Level control: Hopper of a vacuum filling machine

2	Description:	Checking the level when filling pasty masses such as for sausages.
	Industry:	Food industry
		The O1D photoelectric level sensor can be installed at a safe distance from the goods to be detected. It replaces manual level monitor- ing by the operators.

Simple

Degree of difficulty

Moderate Advanced



Cane sugar is delivered via a conveyor line for further processing.

The sensor reports a full container and stops the supply of further cane sugar.

Level control: Delivery of cane sugar





Description:

Industry:

Degree of difficulty			
Simple	Moderate	Advanced	

Level control: Conveyor belt cane sugar or sugar beet





Description:	Cane sugar or sugar beet is transported on a conveyor belt to the next processing step.
Industry:	Food industry
	The sensor continuously monitors whether cane sugar or sugar beet is present on the conveyor belt.

Food industry





Precisely determine the position of small parts.











Machine tools

The OGD Precision carries out an inline quality check precisely and reliably; assembly errors, such as uninserted O-ring seals from 5mm thickness, are detected.

Industry:



This error proofing process during production and before final quality checks minimises the risk of costly consequential damage such as plant downtimes or batch failures.



Error proofing: Quality assurance in fully automated production processes





Description:

Industry:



Assembly automation

In the fully automated production of electronic devices, it is essential to ensure the presence

and correct assembly of parts from different angles with precision and reliability.

Here, the OGD is used for production monitoring of white goods or electronic components such as PCBs and other electronic devices.

Degree of difficulty			
Simple	Moderate	Advanced	





Distinguish objects based on their reflectance.



of type OGD



Quality control: Verification of the correct sealing of packages





Description:

Industry:



Range registers whether ready-to-ship pack-ages have been properly sealed with adhesive tape. Conveying and packaging industry

Based on the reflectance value, the OGD Long

A signal can be output via IO-Link to feed sealed packages into the further shipping process. Even transparent adhesive tapes are reliably detected by the sensor.

Degree of difficulty Simple Moderate Advanced

Presence verification: Seals in the lids



Quality control: Production monitoring and product evaluation





Description:	In food processing applications, the OGD Long Range is used to monitor the handling technology.
Industry:	Food industry
	At the same time, it can be used for product evaluation. For example, pieces of meat have different colours and contrasts due to fat lay- ers and bones and can therefore be evaluated

in terms of quality and product size.

Degree of difficulty Simple Moderate Advanced

2D vision systems: detect surfaces, shapes, codes, texts and profiles.



Detect areas and check for completeness.



Identify objects by their shape regardless of their position.



Match the height profile of an object with the target condition.



Read 1D and 2D codes even at high speed.

Our 2D vision sensors and 2D vision cameras check, for example, whether the contour, the surface, the geometry or the rotational position of an object matches the predefined specification. But they also offer solutions for automated process and product control as well as for sorting tasks.

國			

2D vision sensor O2D	Code reader O2I	Profile sensor OPD	
26 - 32			
33 - 44			
		45 - 52	
	53 - 55		

2D vision systems: the sensors.



2D vision sensor Dualis type O2D

Combinable 2D inspection of surfaces and contours for maximum quality assurance

User-friendly software simplifies set-up of the inspection tasks.

Powerful algorithms can handle even the most demanding requirements.

Reliable functioning in changing light conditions

Maladjustment monitoring ensures reliable quality control

Missing retaining clips, threads that have not been milled properly, too much adhesive or incorrectly shaped components: The new Dualis detects all this with ease – as well as any other deviation of an object from the specified target conditions. Surface areas, contours, omissions or object rotation can be checked and evaluated individually as well as in combination. Thanks to the integrated daylight filter, the Dualis is extremely resistant to extraneous light. The version with integrated polarisation filter is ideal for applications with particularly highly reflective objects.

The new Dualis is set up with the user-friendly ifm Vision Assistant software. Even complex tasks are quickly defined. Real-time maintenance options ensure reliable quality assurance. For example, changes in the continuously checked image sharpness and the image brightness indicate an unintentional maladjustment. In this case, the sensor can automatically issue a warning. A contour presence verification wizard supports you in solving simple contour



presence checks. Even inexperienced users can set up the application within 2 minutes.

Using the blob presence verification wizard, you can easily set up an application to analyse blobs. Blobs are contiguous



pixels that form an area. These areas can be checked for their size, shape or other properties.



Code reader 1D/2D of type O2I

Orientation-independent reading of 1D and 2D codes.

Detection of more than 20 different types of code.

Integrated code comparator system in the sensor.

Adjustable by means of integrated laser pointer.

Segmentable lighting for applications with problematic surfaces.

Application areas of the 1D/2D code reader range from product tracking and product control to product identification.

The sensor can read 1D and 2D codes regardless of their position. Even if up to 25% of the code information becomes damaged or soiled, it is still read correctly. The reader can also be used for optical character recognition (OCR), e.g. in order to identify products based on type labels or serial numbers.

ifm.com/gb/dualis

ifm.com/gb/o2i



0²⁰ 0²⁰ 0²¹ 0²⁰



Profile sensor of type OPD

Inline quality control checks to ensure correct assembly of parts

Quick set-up without software in just a few steps

Distance-independent measurement for high tolerance on object positioning

External light immunity - no shielding or external lighting required.

Optional profile visualisation possible with software.

In assembly and handling technology, the profiler not only checks the presence of an object, but also determines whether the intended component was actually used and correctly attached.

For this purpose, the profile of the inspected object is compared with the target profile taught beforehand at the touch of a button using the light-sectioning method. The photoelectronic line scanner reliably detects tiny differences between nearly identical components. Since the distance is not relevant, the PMD profiler does not require complicated positioning as is the case with 1D sensors.

With its user-friendly colour display and intuitive setting with only 3 pushbuttons, the sensor is ready for use within a few minutes without requiring any software. It is possible to either transmit information on the reject rate or the detected object profiles via IO-Link.

sensors?			Blob Press	enceverific	neverification Code reader Profile sensor C
	Pattern recognition		\checkmark		\checkmark
	Shape detection		\checkmark		\checkmark
	Orientation	\checkmark	\checkmark		
	Object position	\checkmark	\checkmark		\checkmark
1 2	Number of objects	\checkmark	\checkmark		
A C	Sorting tasks	\checkmark	\checkmark		\checkmark
1	Object area	\checkmark			
\bigcirc	Inner / outer radius	\checkmark			
	<i>Object width / height</i>	\checkmark			\checkmark
	Roundness / rectangularity	\checkmark			\checkmark
•	Number of holes	\checkmark			\checkmark
	Object contrast	\checkmark			
	1D/2D codes			\checkmark	
S.					

Which tasks are suitable for 2D

Object profile

ifm.com/gb/profiler





Detect areas and check for completeness.



2D vision sensor Dualis type O2D

Examination Blob presence verification



Check: Presence monitoring of threads



Correct part





Incorrect part

Description:

Industry:

The 2D vision sensor detects inconsistencies on the thread surface so that faulty parts can be sorted out before assembly.

Missing threads in metal parts can cause oil leaks and ultimately engine failure.

Metal casting



Check: Verify the correct nut assembly



Correct weld nut

Simple

Degree of difficulty		
Simple	Moderate	Advanced



Incorrect weld nut

Description:	Detecting that the correct weld nut is installed on the proper assembly is essential to the automotive assembly process. The weld nuts have either a green or a white thread seal.
Industry:	Automotive industry
-	A diffuse sensor was used to detect the colour sealant but movement would lead to inaccu- rate results. The Dualis can easily distinguish between green and white seals based on the different contrasts.

Check: Detect marks used to identify parts



Check: Verify the correct amount of glue

Moderate Advanced

24224		Description:	In wood assembly, the right amount of glue must be applied to a joint. Too much glue causes bleeding out of the joint and too little causes improper bonding.
		Industry:	Wood industry
Glue detected	Glue missing	<u> </u>	The Dualis is able to count the white pixels generated by the glue to determine the amount of glue on the joint.
Degree of difficulty			
Simple Moderate Advanced			

Check: Detect contrast in assembly processes requiring long ranges



Black seat frame

Degree of difficulty
Simple Moderate Advanced



Silver seat frame



Industry:

Automotive industry



It is recommended to use the 2D vision sensor

The goal is to separate a black seat frame from a silver seat frame. A standard contrast sensor would solve this application, but typically lacks the sensing range required to detect the seat frame. In this application it can

easily detect the silver seat frame.

when a long range contrast sensor is required.

Check: Verify the accurate shape of injection moulded parts



Complete moulding





Incomplete moulding



imperative that the plastic being injected into the mould reaches all portions of the mould to produce a complete product before shipping. In this example, the mould has produced a "short shot" on the tip of the handle. The 2D vision sensor is able to count the number of pixels at the tip and to determine whether enough material is present.

In the plastic injection moulding process, it is

Industry:

Description:



As faulty moulds do not produce reproducible shapes and contours, the Dualis is the ideal solution for this application.

Plastic injection moulding

Check: Count number of holes in a rotor

		Description:	A rotor can be machined incorrectly with irreg- ular holes or holes with incorrect diameters. The vision sensor detects the different hole sizes and shapes and can precisely determine the number of holes present.
		Industry:	Automotive industry
Correct holes	Irregular holes		Due to the variable hole sizes and shapes, the 2D vision sensor from ifm is the correct choice.
Degree of difficulty			
Simple Moderate Advanced			

Check: Correct moulding of a metal insert



Check: Confirm grippers have not caused damage to honeycomb



Moderate Advanced

Correct outside diameter

Simple



Simple Moderate Advanced



Damaged outside diameter



Industry:

When robots grab and place the honeycomb, the grippers can cause damage to the outside diameter, resulting in insufficient emission control. The Dualis can reliably detect the irregularities marked by dark pixels and issue an alarm in case of a damaged honeycomb.

General machinery

If the outer surface is damaged, open, irregular areas create additional dark pixels which are detected by the sensor.



Check: Ensure that correct material has been placed inside of a filter



Correct filter material

Degree of difficulty		
Simple	Moderate	Advanced



Incorrect filter material

Description:

Industry:



Description:

Industry:

In this application, a customer uses media with two different colours for filters. It must be verified that the correct material is in the filter.

Automotive industry

The contrast between the two materials differs greatly; the Dualis 2D sensor can distinguish between colour gradations.

A short shot part can result in loose electrical assemblies in automotive parts causing short

The short shots are unpredictable due to a wide range of acceptable parts. The 2D vision

sensor is the correct choice in this example,

as it checks the area of the hook for improper

circuits and electrical failures.

Plastic injection moulding

moulding.

Automotive industry

Automotive industry

Check: Short shot can result in loose electrical assemblies in automotive parts

Incorrectly moulded part



Correctly moulded part

Degree of difficulty			
Simple	Moderate	Advanced	

Check: Brake pad



Copper paste present





Copper paste missing



Description:

The applied copper paste never creates the same shaped glob. The absence of the paste results in rattling brakes.

The Dualis 2D sensor can detect the copper paste despite irregular contours.

Check: Double sheet detection



Correct number of sheets





Incorrect number of sheets



if two sheets of metal were selected instead of one.

A stamping press could be seriously damaged

ry:



The reflectivity of the sheets creates irregular shapes which can be easily detected by a 2D vision sensor.

Description:
Industry:

Check: Checking the presence and amount of mastic



Mastic present

Degree of difficulty		
Simple	Moderate	Advanced

Mastic missing



Description:

In this application, it must be verified that mastic is present and that the correct amount has been applied. By analysing the surface, the sensor can detect the absence of epoxy resin.

Automotive industry

face of the flute.

Metal stamping and forming

The Dualis 2D vision sensor offers the perfect solution as the shape of the epoxy resin may vary.

Check: Detect difference between polished and non-polished flute



Non-polished flute

Description:

Industry:



As reflections prevent repeatability of the shape or contour, the vision sensor offers the ideal solution.

In a stamping application, the difference between a polished and an unpolished flute is detected. The sensor analyses the entire sur-

Degree of difficulty

Simple Moderate Advanced

Check: Mark



Mark present

Simple



Mark missing

Industry:



. ..

A mark is used to identify parts that have been through a completed process. Without the mark, the parts are rejected.

Assembly automation

The ifm vision sensor can detect whether the mark is present, regardless of shape or size.

Check: Detect that a nut has been inserted and is seated correctly

Nut missing



Degree of difficulty

Moderate Advanced

Nut inserted correctly



10 Metric	Description:	In the assembly process, small components must be seated correctly. If a nut is not seated correctly, a higher number of white pixels is indicated. Using the rectangularity tool, it is determined that the shape of a part is more rectangular when not seated correctly.
and a	Industry:	Assembly automation



The 2D vision sensor provides tools for check-ing the rectangularity of the component and the number of pixels.

Simple Moderate Advanced



Presence verification: Alignment of battery housings



Tab found

Degree of difficulty			
Simple	Moderate	Advanced	



Tab missing

Description:



Industry:

Assembly automation The Dualis 2D vision sensor is used to determine the position of the battery housing before the contacts are mounted.

tration of white pixels.

A negative terminal must be assembled on the seam side of the battery housing. The light reflection from a metal tab creates a concen-



C		Description:	In this application, identifying that a piece is missing in an O-ring is imperative. The sensor is programmed to check the completeness of the O-ring regardless of the size and position of the missing part.
		Industry:	Assembly automation
Complete O-ring	Incomplete O-ring		The ifm vision sensor is perfect for solving this application because the position and size of the mission object may vary
Degree of difficulty			the missing object may vary.
Simple Moderate Advanced			

Presence verification: Clamps in vehicle production



Degree of difficulty

Part found

Simple

Part missing

Part missing



Presence verification: Plastic rivets

Moderate Advanced



Correct part

Degree of difficulty		
Simple	Moderate	Advanced



Incorrect part

Description:	Rivets are good as long as there is plastic pres- ent to show proof of weld. The area is ana- lysed to determine that all rivets are present.
Industry:	Automotive industry
	The contour fluctuations of the rivets caused by ultrasonic welding make the vision sensor from ifm an ideal solution.

Presence verification: Packs of chewing gum on a packaging line



Pack present

Degree of difficulty			
Simple	Moderate	Advanced	



Pack missing

Description:

Industry:

Packaging industry

exposed.

The Dualis 2D vision sensor is used to detect the white inner wall of the chewing gum box.

In a gum packaging line, there is a possibility that a pack of gum in a layer could be miss-

ing. The sensor detects the white wall if a pack of chewing gum is missing. When the packs fill the box, no white background is

Presence verification: Empty plastic bags





Poly bag found

Degree of difficulty			
Simple	Moderate	Advanced	

Poly bag missing



Due to the changing shape, the Dualis is the ideal solution for this application.





Identify objects by their shape regardless of their position.





2D vision sensor Dualis type **O2D**



Check: Verify correct position of a punch-out on a steel rod



Correct part



Incorrect part





Description:

Description:

Verifying the correct punch-out position is imperative to the process. If left undetected, an improper crimp or punch-out position on a steel rod would lead to scrap metal.

Metal stamping and forming

By detecting the steel bar's outer contour, which is used by the 2D sensor as a reference point for the circular punch-out, reliable results are provided.

A powder scoop must be placed correctly in the container of powder or it will cause a puncture in the foil seal. By ensuring the

Degree of difficulty		
Simple	Moderate	Advanced

Check: Verify correct position of scoop



Correct position

Degree of difficulty			
Simple	Moderate	Advanced	



Incorrect position



can be packaged correctly. Food industry The 2D sensor compares the contour of the

scoop with the taught contour to determine the correct position. If the scoop is not set completely flat onto the lid, the contour is changed and the sensor gives a signal of incorrect placement.

Check: Verify that the correct profile has been loaded



Correct profile





Incorrect profile



Description:

In this example, 15 different vinyl window profiles can be loaded into the machine. The sensor is used to check whether the correct profile has been loaded.

Window manufacturing

Each vinyl window profile has a unique shape and contour which can be taught using the contour sensor.

Check: Alignment of a car body panel and a windscreen



Correct placement

Degree of difficulty		
Simple	Moderate	Advanced



Incorrect placement

Description:

Industry:



Automotive industry

To verify that a car panel and windshield header are aligned correctly before welding, the placement contour is detected. If misaligned, the whole car must be scrapped.

When the panel is aligned correctly, the distances between the contours are correct. Any misalignment will result in a different distance or orientation of the contours. The 2D vision sensor offers the best choice here.

Check: Correct installation depth of an air sensor

		Description:	An air sensor assembly used on an automotive AC unit must be inserted to a specific depth to prevent failure of the component. The correct installation depth of the air sensor is detected in the field of view of the 2D vision sensor.
		Industry:	Automotive industry
Correct placement	Incorrect placement		By teaching the contour of the base and upper part of the object, the correct depth can be maintained.
Degree of dimiculty			

Check: Detect position of a key in a valve engine

Moderate Advanced

Simple



Check: Verify correct installation of dental scrubber



Correct part





Incorrect part

Description:	In this application, the correct assembly of dental devices is checked. A non-matching contour indicates incorrect placement.
Industry:	Assembly automation
	A correctly installed scrubber results in a defined shape and contour. If the scrubber is incorrectly installed, the shape of the object is different.



Check: Correct sequence of shaft washers on a gear shaft



Correct placement

Degree of difficulty			
Simple	Moderate	Advanced	





Incorrect placement

Incorrect part

Description:

Industry:



To verify that the correct order of washers is placed on a gear shaft, the unique features of the washer order are compared. Automotive industry

The width of the upper washer is always thicker than the bottom washer. By teaching the edges of the washers, the Dualis 2D vision sensor can check the correct sequence.

When the cap is fully seated, the gap is small. By teaching the correctly seated position, the

2D sensor determines incorrectly seated caps

Description:	Proper seating of a part is essential to the assembly process. If a cap is not properly seated, the rest of the assembly process will be adversely affected. The sensor can check that a cap is correctly seated by detecting the unique position features.
Industry:	Assembly automation

based on the gap deviation.

. . .

Degree of difficulty Moderate Advanced Simple

Correct part

Check: Verify correct alignment of part



Correct alignment





Incorrect alignment

Description:	Prior to the welding process, components must be aligned properly. The 2D sensor can detect the correct rotational position by con- tour matching.
Industry:	Automotive industry
	Teaching the inner and outer edges of the components enables the sensor to check for correct alignment.

Check: Placing a label



Correct placement





Incorrect placement



In this packaging application, a correct label position is essential. Verifying that a label is applied to a wine bottle is easily achieved by matching the contour of the label.

Industry:



Packaging industry



By teaching the contour, the vision sensor offers an ideal solution for checking correct placement.

Check: Correct orientation of an engine head



Correct alignment

Simple

Simple

Degree of difficulty			
Simple	Moderate	Advanced	



Incorrect alignment

Description:

Industry:



If an engine head is not oriented correctly, it will cause a tool crash in a down-the-line process. To verify the correct orientation, the unique features of an engine head are matched.

Automotive industry

The unique features of a cylinder head in correct alignment can be taught using a 2D vision sensor.

Check: Verify that a date code is printed on an object

BEST BY: MAY2011 93081083 0624L02		Description:	A legible date code is required on certain products. If the code is missing on one prod- uct, the whole container must be shipped back. The vision sensor can detect and match the contours of characters.
	Select zone 1	Industry:	Food industry
Code found	Code not found		The Dualis is a good choice here because the date code contains a specific number
Degree of difficulty			sequence.
Simple Moderate Advanced			

Check: Detect broken speaker tab after moulding process

		Description:	In this application, laser sensors were used to detect broken speaker tabs after the moulding process. Any slight movement in the speaker fixtures would cause false evaluations. Alter- natively, the 2D vision sensor offers increased reliability.
		Industry:	Automotive industry
Correct part	Incorrect part		
			The sensor from ifm can be parameterised in
Degree of difficulty			such a way that position shirts are tolerated.

Check: Verify the alignment or absence of a contact lens bottle



Degree of difficulty Simple Moderate Advanced

Moderate Advanced

The Dualis 2D vision sensor allows position detection even with the smallest tolerances.




Check: Presence of a continuous thread



Correct part



Check: Bottle screw cap



Correct placement





Incorrect part

Description:	Quality control for thread detection on the part is essential to the process. The completeness of a thread can be checked by a 2D sensor.
Industry:	Automotive industry
	This unique shape allows the sensor to verify that the part is fully threaded.



Incorrect placement

Description:	Using the contour of a bottle cap, the correct placement of a bottle cap is verified.
Industry:	Food industry
	When the cap is incorrectly placed, the con- tour changes.

Check: Count number of seeds on a hamburger bun



Correct number

```
Degree of difficulty
Simple Moderate Advanced
```



Incorrect number

Description: Counting the number of sesame seeds on a fast food bun can be achieved by creating three zones. Below a certain tolerance, the bun will be rejected. Industry: Food industry The sesame seeds produce unique contours that can be used to count the respective amounts of seeds on a bun.

Position: Proper orientation of washer fluid cap



Correct alignment





Incorrect alignment



Description:

The cap of a windscreen washer system must be correctly aligned. Automotive industry

By adjusting the letter and symbol contour, the 2D sensor can detect the smallest changes in rotational position.

Position: Correct alignment of an inner bearing



Correct alignment

Deg	ree of diffic	ulty
Simple	Moderate	Advanced



Incorrect alignment

Description:

Industry:

ndustry:

The correct orientation of the inner bearing is critical to the process. Misalignment of the inner bearing will result in engine damage.

Automotive industry

By detecting the bearing pattern, the rotational position can be easily detected by means of a 2D vision sensor.

Position: Detect correct orientation of steering gear



Correct alignment

Deg	ree of diffic	ulty
Simple	Moderate	Advanced



Incorrect alignment

Description:	The correct orientation of the steering gear is critical to the assembly process. By matching the side contour of the gear, the proper orientation is confirmed.
Industry:	Automotive industry
	The 2D sensor detects the correct alignment of an object based on the taught outer edge of the steering knuckle.

Position: Identify the correct orientation of a symbol



Degree of difficulty

Moderate Advanced

Correct position

Simple





Position: Verify correct orientation of a cap



Correct alignment





Incorrect alignment

Description:	To determine the correct orientation of a housing cap, its circular contour is matched with the reference object. If the cap is installed upside down, it can damage the next installed component.
Industry:	Assembly automation
	If the cap is installed with the wrong orienta- tion, the tabs are missing. The 2D vision sen- sor detects the correct alignment of the tabs.



Position: Correct orientation of a part



Correct position

Deg	ree of diffic	ulty
Simple	Moderate	Advanced



Incorrect position

Description:

Industry:



Description:

Industry:

If a part is not correctly positioned, the assembly process will be affected. By detecting that the part is within the sensor's field of view, the correct orientation is confirmed.

Assembly automation

The correct orientation of the part produces a repeatable contour.

In this application, connectors are sorted by knurled nut or hex nut. The 2D sensor can distinguish between the connectors based on the

The reflection from the hex nut is repeatable

Sorting: Connectors according to knurled nuts and hex nuts





Hex nut

Degree of difficulty Moderate Advanced Simple

Sorting: Pipe clamps with screws



Degree of difficulty

Moderate Advanced

Type A

Simple



Туре В

Description:	In this application, different types of clamps with screws must be sorted.
Industry:	Automotive industry
	The 2D vision sensor from ifm sorts the com- ponents in a simple way by detecting the con- tour of the screw.

hexagonal contour.

Assembly automation

in shape.

Sorting: Piston rods



Correct part 1





Good part 2



Description:

Automotive industry



Each connecting rod has a specific shape that is unique.

Two connecting rods can be distinguished by

programming two contour types in the sensor.

Sorting: Gears according to tooth spacing and number of teeth

Part 2



Part 1

Degree of difficulty		
Simple	Moderate	Advanced

Sorting: Golf balls by brand name



Description:

Industry:

Presence verification: Cap on a spray can

Moderate Advanced



Part found

Simple

Deg	ree of diffic	ulty	
مام	Madarata	م مار به م م ما	

Part missing

Industry: Food industry rectly applied caps.

process.

Automotive industry

the correct seat of a cap on top of a spray can is carried out. By teaching the upper part of the can contour, the vision sensor can detect missing or incor-

In this application checking the presence or

The 2D sensor enables sorting according to 24-pitch gears with 16 teeth and 32-pitch

Different pitch and number of gears produce

gears with 20 teeth.

Assembly automation

different contours.

Simple Moderate Advanced

Presence verification: Identify weld nuts and studs on a truck panel



Studs found





Weld nuts found

Description:

Description:

Industry:



Reflections in the recesses allow the 2D vision

Detecting the presence of weld nuts and studs

on a truck panel is important to the assembly

sensor to detect the presence of weld nuts.



Presence verification: Identify welded washer on a part



Part found

Deg	ree of diffic	ulty
Simple	Moderate	Advanced

Presence verification: Two O-rings



Part found

Part missing



Part missing

Description:

Industry:

In this application, the contour of a circular washer is detected on a part. When the circular contour is not detected, the part is determined missing.

Automotive industry

As an existing circular washer generates a recurring contour, the Dualis 2D vision sensor is the correct choice here.

Description:	Two O-rings are required on a brake line.
Industry:	Automotive industry
	The O-ring provides a repeatable edge for reli- able detection.

Degree of difficulty Moderate Advanced Simple

Presence verification: Washer on a gear shaft



Degree of difficulty

Part found

Simple



Part missing

Description:	The sensor detects a washer present on a gear shaft. The circular contour is detected in the sensor's field of view.
Industry:	Automotive industry
2	The reflection from the washer provides a reli- able and consistent contour.

Presence verification: Washers on pins

Moderate Advanced



Correct part

Degree of difficulty Simple Moderate Advanced



Incorrect part



Industry:

Assembly automation



Teaching the contours of the washer and pin enables the vision sensor to verify presence.

To determine if washers are correctly installed on the pins, the washer and pin contours are matched.

Presence verification: Detecting clips on a panel



Part found

Degree of difficulty		
Simple	Moderate	Advanced





Part found

Degree of difficulty		
imple	Moderate	Advanced





Description:

Industry:



In this application, three body clips are posi-tioned on a panel. By monitoring the contour of multiple clips, the presence of parts is determined.

Assembly automation

Body clips, when installed, produce repeatable contours for verifying presence.

Description:	The goal of this application is to determine the correct placement of an E-clip on the shaft of a metal pin. The E-clip's unique features are verified and the correct placement is con- firmed.
Industry:	Assembly automation
	The vision sensor learns the unique shape which the E-clip generates when it is in the correct position on the metal pin.

Presence verification: Detect the correct number of rollers in a needle bearing

Part missing



Presence verification: Identify seal in a shock absorber



Correct part





Incorrect part

Description:	By matching the contour, the presence of the seal within a shock absorber is confirmed.
Industry:	Automotive industry
	The constant, shiny surface and position of



the object generate a recurring reflection suitable for the sensor.

42



Presence verification: Detection of copper bolts on a truck body panel



Part found

Degree of difficulty		
Simple	Moderate	Advanced





Part found





Part missing



Industry:



The vision sensor is used to detect the presence of copper bolts on a truck body panel.



Copper studs provide uniquely shaped contours that can be detected.



Part missing



Automotive industry

Measurement: Measure needle length



Degree of difficulty

Moderate Advanced

Correct length

Simple



Incorrect length

Description:	In this application, the needle length is com- pared to maintain quality control. The correct needle length is detected in the sensor's field of view.	
Industry:	Pharmaceuticals	
	By teaching the contour of the base and the tip, the x coordinate can be provided to determine the length of the needle.	

Measurement: Measure width of test tubes



Correct width





To distinguish between 13 mm and 16 mm test tubes, the 2D sensor detects two unique features of a tube.

Industry:





By subtracting the x coordinates, the width of the test tube can be determined.

Degree of difficulty Simple Moderate Advanced Operating distance / field of view / pixel sizes vision sensor O2D



Interface	Horizontal x vertical opening angle [°]	I	Description	Order no.
	36 x 27		wide-angle lens (A)	O2D502
Ethernet 8-pole A-coded	18 x 14	RGB-W, polarisation filter	standard lens (B)	O2D500
	12 x 9	integrated	telephoto lens (C)	O2D504
	36 x 27	infrared	wide-angle lens (A)	O2D522
Ethernet 8-pole A-coded	18 x 14		standard lens (B)	O2D520
	12 x 9		telephoto lens (C)	O2D524
PROFINET 5-pole L-coded	36 x 27	RGB-W, polarisation filter integrated	wide-angle lens (A)	O2D512
	18 x 14		standard lens (B)	O2D510
	12 x 9		telephoto lens (C)	O2D514
PROFINET 5-pole L-coded	36 x 27	infrared	wide-angle lens (A)	O2D532
	18 x 14		standard lens (B)	O2D530
	12 x 9		telephoto lens (C)	O2D534





Match the height profile of an object with the target condition.



Quality control: Checking a welding diode



Degree of difficulty

Moderate Advanced

Correct alignment

Simple



Incorrect alignment



Description:	Testing the quality of the welding electrode on a welding robot.
Industry:	Automotive industry
No.	At certain time intervals, the profile of the welding electrode is compared by the profile sensor with the threshold value for quality set by the customer. The detection of wear ensures the quality of the weld seam.

Quality control: Correct machining of a component



Quality control: Checking the latching of an interconnected clamping system



Fully engaged

Simple





Not fully engaged



Industry:

Description:



The PMD Profiler checks whether a clamp is latched completely. Gaps indicating insuf-ficient latching can be detected in order to prevent scrap or, if undetected, failures at the customer.

Automotive industry

The region of interest here provides a greater difference between the match value of a good part and a bad part to ensure a clear distinc-tion between the parts.

Quality control: Correct assembly of welded parts



Correct position

Degree of difficulty		
Simple	Moderate	Advanced



Incorrect position

Description:	To ensure that parts are in the correct positic before welding, the profiler projects a precise laser line and detects even the smallest mis- alignments.	
Nutrity.	Compared to camera systems which are nor- mally used here, the profile sensor is resilient to external light and outperforms even 1D sensors with its simple alignment.	

Quality control: Checking the tightening of a screw



Completely tightened

Degree of difficulty		
Simple	Moderate	Advanced



Not completely tightened

Description:	In this application, the correct tightening of a screw needs to be monitored.
Industry:	Robotics and automation
- And	This is virtually impossible with a 1D system as its light spot can only focus on one of the two positions, i.e. completely versus partly tight- ened. With camera systems, the installation effort would be extensive compared to the PMD Profiler's quick set-up despite the same precision.

Quality control: Distinction between machined and unmachined parts

		Description:	In this application, the aim is to detect wheth- er a part has already been machined and has a tooth profile, whether it is free of defects or whether the surface is still flat.
		Industry:	Machine tools
		The second	While such an application is practically impos- sible to solve with a 1D sensor, the PMD
Correctly machined	Incorrectly machined		Profiler reliably captures the part profile and detects profile changes with high precision. If
Degree of difficulty			a camera system were used, the differences

Quality control: Checking drill holes

Moderate Advanced



Correct drill holes

Simple





Drill holes too large



Description:

Industry:



effort and cost.



To check whether the parts have been machined correctly, the PMD Profiler compares the finished part with the reference object.

shielding and external lighting with additional

If holes are drilled in the wrong place or with too large a diameter, this is detected directly and the part in question can be rejected.



Quality control: Distinction between machined and unmachined parts



Completely machined

Degree of difficulty		
Simple	Moderate	Advanced



Incompletely machined

Description:	This application can detect when no machin- ing has taken place, indicating a defect in or failure of the machine.
ndustry:	Machine tools
No.	To check whether the parts have been com- pletely machined, the PMD Profiler also compares the finished part with the reference object here.

Completeness check: Bottling apple sauce



Degree of difficulty

Completely filled

Simple



Incompletely filled

Description:	When bottling e.g. apple sauce, it is important to check that the pot is completely filled with apple sauce.
Industry:	Food and pharmaceutical industries
No.	For this purpose, the profile sensor determines the profile of the filled pot and detects wheth- er it is underfilled (no sauce) or overfilled (too much sauce).

Orientation: Alignment of ball bearings

Moderate Advanced



Degree of difficulty

Moderate Advanced

Correct alignment

Simple

Incorrect alignment

Description:	The profiler effectively detects e.g. shiny parts such as ball bearings, and signals when parts with the incorrect alignment need to be dis- posed of.
Industry:	Machine tools
- The second sec	The PMD Profiler checks the correct orienta- tion before another task is performed. The alignment of the parts is crucial in any assem- bly process. If this is not done properly, the machine will crash and production will stop.

Orientation: Alignment of yoghurt pot lids



Correct alignment





Incorrect alignment



To prevent leaks, the profile sensor checks the alignment of lids before they are placed on the yoghurt pots.

Industry:





The PMD Profiler checks that the alignment is correct before performing any other task, such as packing.

Orientation: Alignment of tablets



Correct alignment

Degree of difficulty		
Simple	Moderate	Advanced



Incorrect alignment

Industry:

The detailed profile measurement determines the alignment of tablets in the pharmaceutical industry here.

Food and pharmaceutical industries

The PMD Profiler checks that the tablets are correctly aligned before packing.

In this application, there is only a slight dif-

Sorting: Monitoring whether the correct metal ring has been mounted in the required orientation



Correct part

incer part			
Degree of difficulty			
Simple	Moderate	Advanced	



Incorrect part



Sorting: Checking the appropriate brake for the end product



Degree of difficulty

Moderate Advanced

Appropriate brake

Simple



Incorrect brake

Description:



Robotics and automation

In this application, it is important to ensure that the correct type of brake is supplied with the correct end product, in this case a hospital bed.

Using the height profile, the PMD Profiler not only checks whether the correct brake has been installed, but also makes it possible to switch flexibly between applications (e.g. brake A and B), as up to 10 target profiles can be stored with the OPD101.

Sorting: Correct arrangement of the sealing rings



Complete arrangement





Incomplete arrangement



Description:





Here, a precision and alignment is required which 1D sensors, in contrast to the PMD Profiler, cannot provide. As the sealing rings have different colours, the profiler's colour independence is also a decisive advantage.

In a conveyor system for sealing plugs, it is

crucial to detect the complete and correct arrangement of the sealing rings.



Gap check: Packing shampoo



Closed

Simple

Degree of difficulty		
Simple	Moderate	Advanced

Gap check: Packing ice



Gap check: Production of connectors

Moderate Advanced

		Description:	To ensure that the connector can be installed correctly in the subsequent process, it must be ensured that all parts have been completely assembled and that there is no gap between the individual components.
		Industry:	Electronics industry
			The PMD Profiler checks during production
Fully engaged	Not fully engaged		that the plastic housing is correctly engaged.
Degree of difficulty			
Simple Moderate Advanced			

Presence verification: Checking position of the bucket handles

Not closed



Correct position

Degree of difficulty			
_	Simple	Moderate	Advanced



Incorrect position



Description:

Packaging industry If the handle is tilted to the side, the profiler detects it. This confirms that the handle is in the correct position. However, if the handle

The PMD Profiler checks the correct position

of the bucket handle to ensure that the robot arm can grip it in the next step.

is on the other side, the PMD Profiler detects this as well, thereby preventing the robot from gripping nothing.

Description:

	that the lids of the bottles are closed to pre- vent shampoo from leaking.
Industry:	Packaging industry
No.	The PMD Profiler reliably checks whether the different coloured lids of the shampoo bottles are completely closed.

When packing shampoo, it must be ensured

Presence verification: Detection of wafers



Wafer present

Degree of difficulty			
	Simple	Moderate	Advanced

Wafer not present



Description:

The PMD Profiler checks for the presence of wafers on a conveyor belt.

Electronics industry

Regardless of the thinness and reflectivity of the object, the PMD Profiler reliably checks for presence as well as a possible deviation in positioning.

Presence verification: Detection of rubber deposits



No deposits



Deposits



Degree of difficulty		
Simple	Moderate	Advanced

Assembly/presence verification: Silencer on a car body



Silencer present





Silencer is missing

Description:	The car body is checked to ensure that the silencer has been correctly attached.
Industry:	Automotive industry
No.	By matching the height profile with and with- out silencer, the profile sensor monitors manu- al attachment of the insulating material.

Assembly check: Assembly of printed circuit boards in the smartphone



Correct assembly





Deviating assembly



circuit boards in a smartphone.

Industry:





Thanks to its simple installation and high precision, the PMD Profiler detects deviations in even the smallest components (here: 25×25 mm) and therefore ensures quality.

Checking the correct assembly of printed



Assembly check: Mounting plastic caps



Caps mounted

Degree of difficulty			
Simple	Moderate	Advanced	



Caps not mounted

Description:	The application checks that plastic caps are correctly mounted in a plastic part.
Industry:	Plastics and rubber industry
No.	The PMD Profiler uses the height profile of the plastic part shown to check whether the thin plastic caps have been inserted correctly.

Assembly check: Double sheet detection



Assembly check: Correct position of a component



Correct position

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Degree of difficulty
Simple Moderate Advanced
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Description:	A component must be correctly positioned in the vehicle door in order to proceed to the next step in the process.	
Industry:	Automotive industry	
No.	The OPD detects the exact position of the component. At the same time, the sensor is insensitive to external light and does not require any additional shielding.	

Assembly check: Production of automotive components



Correct position





Incorrect position



Description:

Automotive industry



The PMD Profiler checks the presence of the clip on a component and that it is correctly fitted.

In the production of automotive components, the presence and correct position of the components are very important to ensure that subsequent assembly can be carried out.

Machining control: Production of plastic injection moulded parts



Correct part

Degree of difficulty			
Simple	Moderate	Advanced	



Incorrect part



Industry:



whether the holes have been completely punched out during the production of plastic injection moulded parts.

The PMD Profiler checks at short distance

Plastics and rubber industry

Machining control by means of profile analysis is considerably faster and cheaper than the use of a camera system.

Machining control: Packaging for effervescent vitamin tablets





Incomplete processing



Description:

The PMD Profiler checks the correct edging by measuring the profile of the lid and the edges.

This application is intended to control the complete process of tablet packaging.

Food and pharmaceutical industries

Complete processing







Read 1D and 2D codes even at high speed.





Product tracking: Reassembling the doors





Description:	The code reader checks that the correct door is fitted to the correct car body.
Industry:	Automotive industry
	The assignment to the car body is stored in the data matrix of the door. The O2I5 receives the corresponding car body code from the controller and identifies inde- pendently for a match.



Product tracking: Identifying appropriate add-on parts

B		Description:	The painted add-on parts must be assigned to the corresponding body.
	The second second	Industry:	Automotive industry
			The multi-code reader detects the codes on the build-tickets. This avoids incorrect assem- bly of attachments
Degree of difficulty			

 $\boldsymbol{\lambda}$

Product tracking: Identify code on gear shaft



Simple Moderate Advanced

L



Description:	The O2I5 identifies the gear shaft by means of a unique needled code on the product. This is then transmitted to the controller via PROFINET.
Industry:	Automotive industry
	This is where the O2I shows its advantages in terms of integrated illumination, polarisation

filters and multiple images.



Product tracking: One code





Description:

A code is to be read which contains the product information, such as serial number or batch number.

Industry:



Single code detection allows the code reader to take over the task of the complete set-up automatically.

Electronics industry

Degree of difficulty
Simple Moderate Advanced

Product tracking: Conveyor belt



Simple Moderate Advanced

Product tracking: Needled code

it sty sales		Description:	The directly marked code remains irrevocably linked to the product and is predominantly used for metallic products.
	Art of Barrier and	Industry:	Automotive industry
Degree of difficulty	North Contraction		This is where the O2I shows its advantages in terms of integrated illumination, polarisation filters and multiple images. In addition, the image processing algorithm is particularly sta- ble with needled codes.

Product tracking: Several images

Moderate Advanced

Moderate Advanced



Simple

Simple



Product tracking: Several codes

	Description:	This application reads the serial and batch numbers from various codes.	
DICHERA TIN ANALY IN ANALY IN ANALY	and a rest	Industry:	Electronics industry
Degree of difficulty Simple Moderate Advanced			The logic integrated in the ifm VisionAssistant compares the information received from a controller with the read code contents and evaluates them independently as "OK" or "not OK".
Product tracking: Metal co	de on round surface		
		Description:	The O2I identifies the product serial number on a metallic product.
		Industry:	Automotive industry
	Second 4		The integrated polarisation filters eliminate the intense stripe-shaped reflections due to the small component diameter.
Degree of difficulty			
Product tracking: Text dete	ection on packaging		
Ce C	-	Description:	This application is designed to read the item number and the item description.
a lord	IL5004 IL5002 BPKG/OSEN/AS-514TPS RT 45128 Essen	Industry:	Packaging industry
	Germany www.fm.com Made in Germany		By using a contour, in this case the company logo, the correct line can always be read in the image with position tracking of the corre- sponding text line, even independently of the rotational position of the product.

Product tracking: Text and code detection

Degree of difficulty

Simple

Simple

Moderate Advanced

Moderate Advanced



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3D vision systems: check completeness, spatially capture moving objects.

Automation and robotics



Obstacle detection for automated guided vehicles (AGVs).



Capture volume of objects.



Detect pallets and pockets.



Grip objects automatically and reliably.



Automated palletising of objects.

The 3D smart sensor O3D captures scenes and objects in their spatial dimensions at a glance. In contrast to laser scanners, this sensor does not have any moving components and is therefore robust and wearfree. The sensor illuminates the scene with an infrared light source and calculates the distance by means of the light reflected from the surface.

Areas of application are found in automation and robotics. If the camera is integrated into a machine, the measured data can be evaluated with common image processing libraries.





PMD 3D smart sensor O3D

PMD 3D smart sensor O3D

59 - 60		Detect several objects or distances at the same time.	66
61-72		Monitor areas and detect people.	67
63		Check products for com- pleteness in the ongoing process.	68
64	53	Detect skew and monitor distances.	69
65		Detect the level of bulk materials.	70

3D vision systems: the sensors.



PMD 3D smart sensor of type O3D

Optical evaluation of distance, level or volume.

Reliable function due to Time-of-Flight measurement.

Illumination, measurement and evaluation in one device.

3072 distance values per measurement for detailed evaluation of the application.

Two switching outputs, one of them programmable as analogue output.

The sensor can be used for completeness checks, volume determination or sorting tasks.

E.g. it can be determined whether containers, such as cartons or pallets, contain the intended number of products. This inspection is independent of the items' colour and texture. The sensor is conveniently and intuitively adjusted to different container sizes using the parameter setting software.

Applications can also be found in the parcel services field, in warehouses and in logistics and distribution centres. For automated storage space planning, the sensor provides the size, orientation and position of the packages. This ensures optimum use of the available storage space.

ifm.com/gb/o3d



Time-of-Flight (ToF).

By measuring the Time-of-Flight, the distance values between the individual pixels and the object can also be determined at the same time as the grey values at pixel level. This ensures that the 3D information is generated directly and in real time. The most common ToF technology is known as PMD (photonic mixer device).

PMD Time-of-Flight technology captures scenes and objects three-dimensionally and without motion distortion with just one shot of 23,232 pixels. The scene is illuminated by modulated, invisible infrared light and the reflected light hits the PMD sensor. The O3D sensor illuminates the scene with an internal infrared light source.







Obstacle detection for automated guided vehicles (AGVs).



PMD 3D smart sensor of type O3D



Obstacle detection and collision protection: Indoor automated guided vehicles (AGVs)



Degree of difficulty			
	Simple	Moderate	Advanced



Live image 3D sensor



Description:

AGV - automated guided vehicle systems

costs

Indoor automated guided vehicles must avoid

collisions with protruding and floating objects and other obstacles on the travel path at all



The 3D camera also detects obstacles above the detection zone of conventional safety laser scanners. The system uses the speed and steering angle of the AGV to optimise the collision warning. Even difficult obstacles are detected by the spatial detection system in the direction of travel.

Obstacle detection and collision protection: Autonomous wiping robot





Live image 3D sensor

Description:

Industry:



The design of the wiping robot is the same as a normal floor cleaning machine, so employees can work effortlessly with the automated floor cleaning machine even without special training.

Automated guided vehicle systems

The 3D camera allows a cleaning machine to move autonomously in complex and dynamic environments. It detects any objects and people and unerringly avoids them.

Degree of difficulty		
Simple	Moderate	Advanced

Obstacle detection and collision protection: Autonomous navigation of robots in the vineyards





Live image 3D sensor

 Description:
 Various tools are attached to the vehicle which take care of different tasks on the field like loosening earth, cutting leaves and weeds and spraying the plants. The robot is capable of precisely spraying the plants at the right spot with exactly the right dose. This has reduced the use of plant protection products by half.

 Industry:
 Agriculture, mobile machines



Eight electronic "eyes" in form of 3D cameras ensure an autonomous navigation of the robot through the vineyards.







Capture volume of objects.



PMD 3D smart sensor of type O3D



Object dimensioning: Freight dimensioning

		Description:	Freight forwarding companies and customers need to know the volume of the individual pieces of freight as precisely as possible in order to be able to ideally utilise the available space on trucks or in aircraft when loading.
and the		Industry:	Warehouse Logistics
The second			Five 3D cameras are mounted crosswise on
	Live image 3D sensor		a steel frame and capture the sides and the upper part of the pallet. The data from the
Degree of difficulty			five cameras is transmitted to a PC. In less
			exact dimensions which are relevant to the
Simple Moderate Advanced			customer.

Object dimensioning: Dimensioning and position detection of baggage at airports

		Description:	When transporting baggage, physical limits can be reached due to the very high transport speeds, for example when cornering. This is why it is important to determine the baggage position, e.g. whether a suitcase is in an upright position before it enters a transport system.
		Industry:	Airport logistics, conveyor logistics
	Live image 3D sensor		Using the 3D sensor, the correct positioning
Degree of difficulty			interface, the transfer of the suitcases from
Simple Moderate Advanced			the incoming conveyor belt to the airport's internal baggage handling system.

Object dimensioning: Automated position correction of building material bags by means of double turning belt







Live image 3D sensor



Description:

Building materials industry

arranged rotated by 90°.

A 3D sensor detects the rotation angle of filled building material bags and controls a double turning belt, which performs a targeted rotation of the building material bags for palletizing.

In the building materials industry, building material bags are loaded onto specially designed pallets after filling. Here, for reasons of stability, three times two bags are first arranged next to each other and then, in the level above, two times three bags are

ition correction of building material bag

Object dimensioning: Monitoring of logs in the sawmill



Degree of difficulty			
	Modorato	Advanced	





The 3D sensor detects the level of the feed container. In case of overfilling or underfilling, the inlet conveyor belt is adjusted accordingly.

Simple Moderate Advanced

Object dimensioning: Dimensioning of pallets in a cold storage warehouse

		Description:	The picking sizes of frozen products are often so large that the loaded pallets just fit through the cold store doors. Incorrectly loaded or damaged pallets must be detected at an early stage and discharged from the automatic transport into the freezers
T		Industry:	Food and logistics industry
Degree of difficulty	Live image 3D sensor		3D cameras measure and check the loaded pallets. Not only the correct height of the fro- zen food placed on the pallet will be checked, but also its possible rotational and tilted posi- tions.
Object dimensioning: Filli	ng cake tins		
		Description:	In a bakery, the absence or double-filling of dough in the cake tins must be checked to





Degree of difficulty			
Simple	Moderate	Advanced	

	dough in the cake tins must be checked to ensure trouble-free further processing of the dough.
Industry:	Food industry
	Eight 3D sensors were installed to check a total of 16 cake tins. The sensors can be used to scan the dough and also its volume. This ensures optimum filling, to which both the baking time and the pack size can be precisely

adjusted.

Г





Detect pallets and pockets.



PMD 3D smart sensor of type O3D



Palette detection: Automatic pallet detection for autonomous vehicles



Palette detection: Checking pallets





Degree of difficulty Moderate Advanced Simple

Description:	Manufacturers of pallets and packaging machines must ensure that the pallets are intact before loading the freight. This con- cerns the presence and integrity of the upper deck boards and middle cross boards and the blocks between the pallets.	
Industry:	Pallet and logistics industry	
	The 3D sensor checks pallets to determine whether they have the correct dimensions, are damaged and are suitable for further use. Damaged pallets can thus be detected at an early stage and diverted from the loading pro- cess for repair or disposal.	

Warehouse logistics and intralogistics

The PDS (Pallet Detection System) is a soft-ware solution for the fast, fully automatic and position-independent detection of all standard pallet types. In combination with the O3D hardware, pallet position detection is fast and accurate. This significantly reduces the total cycle time of the pallet detection.



Grip objects automatically and reliably.



PMD 3D smart sensor of type O3D



Gripper navigation: Sorting parcels with the help of a Universal Robot





Live image 3D sensor

Description:

Picking up and sorting parcels and packages with the help of a pick & place robot arm requires reliable detection of the different dimensions of the objects.

Industry:

Mail order

Milk production

The 3D camera reliably detects the length, width, height and rotational position of the parcels and thus serves as the machine's "eye". The parcels can be placed on the conveyor belt without having to observe any particular arrangement or alignment.

Degree of difficulty		
Simple	Moderate	Advanced

Gripper navigation: Support of a fully automatic milking system









Description:



Industry:

The robot is designed to individually adjust the milking stimulation and cleaning for each teat of the animal to enable a gentle milking process.

The 3D camera gives the milking robot an accurate 3D image of the cow's udder; the robot uses this image to approach the teats precisely and gently for cleaning and auto-mated milking. The time required for milking is reduced and the milk yield of the cows is optimised.





Automated palletising of objects.







Palletising: Depalletising of food packaging





Live image 3D sensor



Industry:

Description:

This application must detect how high a pallet is packed and in which position the individual objects are located. The orientation, on the other hand, is important for depalletising, whereby individual objects are repacked and picked.

Food industry

The 3D sensor detects how high the objects have been stacked and in which position they are located. This ensures that the packages can be gripped specifically by a robot arm during the subsequent depalletising process.

Degree of difficulty
Simple Moderate Advanced



Detect several objects or distances at the same time.



PMD 3D smart sensor of type O3D



Position detection: Toggle clamp for fixing sheet metal parts before the welding process





Live image 3D sensor

Description:

Industry:



Instead of many conventional sensors, a 3D sensor takes over position sensing simultaneously at several points in the device. These ROIs (Region of Interest) can be arranged as desired in the software and therefore the end position of the clamps as well as the presence of the workpiece can be scanned via a distance measurement.

A welding robot is used to weld various stamped and deep-drawn metal sheets together to form a supporting element for the



Distance detection: Checking the height of bricks



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100	A			Calification of the

Live image 3D sensor

Description:	For the production of building blocks, a type of vibration table is used that is connected to a moulding press. The height of the building blocks must not deviate by more than 2 mm.
Industry:	Building materials industry
	The 3D sensor takes a "snapshot" of the entire vibrating table and can therefore check the heights and surface condition of all the bricks on it. This simplifies the calibration

immensely.

car body.

Automotive industry

Degree of difficulty Moderate Advanced Simple

66	





Monitor areas and detect people.







Person detection: Checking the toilet area for automated cleaning of a toilet cubicle





Industry	/ :

Description:

The use of a 3D sensor ensures this while maintaining the privacy of the toilet users. By intelligently setting ROIs, permanently installed objects, such as the toilet seat, the washbasin or a fold-out changing table, can be excluded.

Public toilets, sanitary facilities construction

The cleaning of public toilets is fully automated in modern sanitary facilities. Before the cleaning process, it needs to be ensured that the cabin is free of people and objects.



Person detection: Fall monitoring on patient beds





Description:	Monitoring of patient behaviour to detect falls from bed and facilitate the work of nursing staff.	
Industry:	Medical care, nursing	
	With the help of the 3D sensor, an analysis of the patient's behaviour is carried out based on movement tracking algorithms. This detects if a patient has fallen out of bed or slipped dangerously close to the edge of the bed. In both cases, the nursing staff can be alerted. At the same time, the privacy of the patients	

is guaranteed.

Degree of difficulty			
Simple	Moderate	Advanced	



Check products for completeness in the ongoing process.



PMD 3D smart sensor of type O3D



Completeness check: Inspection of empties in a brewery





Live image 3D sensor

Description:

Industry:

The system checks whether all bottles are present in a crate and no longer have a crown cap. This is required for a smooth cleaning process.

Beverage industry

Packaging industry

Automotive industry

Beforehand a complete crate with empty bottles without crown caps is taught as an "Ok state" with the 3D sensor. If one or more bottles are then missing in the ongoing process, this is signalled by the sensor as "underfilling", a bottle with a crown cap is signalled as "overfilling".



Simple Moderate Advanced

Completeness check: Automated packaging of goods and merchandise



Degree of difficulty

Simple

Moderate Advanced



Live image 3D sensor

Industry:

Description:

In the automated packaging of goods and merchandise, underfill or overfill of cartons can occasionally occur. Overfill can shut down the packaging process, underfill can lead to costly complaints later on.

When merchandise is being packaged, the 3D sensor detects with precision whether the exact quantity, the correct spacing, the desired level or the correct amount of merchandise or

number of products are in the package.

Completeness check: Component monitoring in the production process







For the automated assembly of threaded beads, the presence of the components on the workpiece carrier must be checked.

Industry:



The thread beads are detected by two 3D sensors. The bead is gripped by a robot arm and transported to the next production step for assembly. If a component is missing, the assembly robot skips this position and moves directly to the next available component. Empty runs or rejects due to assembly errors are reliably prevented.

Degree of difficulty
Simple Moderate Advanced



68





Detect skew and monitor distances.



PMD 3D smart sensor of type O3D



Distance detection: Detection of the centre of gravity of screw holes on highly reflective car rims

		Description:	The biggest challenge is to achieve a constant and stable image, as the surfaces of the rims vary from the classic steel colour to glossy black, depending on the type.
		Industry:	Automotive industry
Degree of difficulty Simple Moderate Advanced	Live image 3D sensor	ge 3D sensor	The O3D camera can also be used to reliably detect highly reflective surfaces. The 3D cam- era transmits the width information of the detected screw holes to a controller which guides the robot arm and places balls on the screw holes to protect them from being painted.
Distance detection: Skew	control in the production	of carpet rolls	
		Description:	In the production of carpet rolls, the material is transported on a chain belt with nails. The carpet edge is to be monitored for skewing in order to prevent potential slipping and a resulting standstill.
- CAR		Industry:	Production logistics, warehouse logistics
Degree of difficulty	Live image 3D sensor	Sec. 1	This application was solved with the help of a 3D sensor. Surfaces can be reliably detected regardless of their colour and reflectance – in this case the dark carpet material.

Distance detection: Monitoring of the cross bars of shelf trolleys for holding car tyres







Live image 3D sensor



Description:

Automotive industry



The 3D sensor automatically checks the condition of the trolleys and reports possible damage. For this purpose, a large number of ROIs were defined in advance which immediately detect the type of trolley and any damage to the cross bars on the basis of distinguishing features.

Car tyres are often transported in metal shelf trolleys. High forces act on these, so that the metal supports bend after some time and have to be repaired.



Detect the level of bulk materials.



PMD 3D smart sensor of type O3D



Level measurement: Container with food





 Description:
 The system detects solid, opaque solids and bulk materials in tanks, silos or hoppers with levels of up to 10 m.

 Industry:
 Food industry

 The sensor determines the level via a defined background and transmits the process value via analogue output or digitally and noise immune via the Ethernet process interface. Alternatively, the O3D may be used as a point level switch.

Degree of difficulty
Simple Moderate Advanced

Level measurement: Checking bulk material on a conveyor belt



Level measurement: Checking bulk material in silos



Moderate Advanced





The 3D sensor is used for photoelectric detection of the level of bulk materials or media with special properties in silos. This reliably prevents underfilling and overfilling.

Degree of difficulty

 Degree of difficulty

 Simple
 Moderate
 Advanced



Simple



Operating distance / field of view size 3D smart sensor O3D



Horizontal x vertical opening angle [°]	Description	Order no.
40 x 30	infrared, telephoto lens (C)	O3D300
60 x 45	infrared, standard lens (B)	O3D302
40 x 30	infrared, telephoto lens (C), stainless steel	O3D310
60 x 45	infrared, standard lens (B), stainless steel	O3D312

3D vision systems: collision warning, object detection, automation.

Logistics automation and mobile machines



Detect obstacles in the movement area.



Determine distances between the mobile machine and objects.



Reliable early collision warning.



Protection of employees by detecting reflective clothing.

The 3D smart sensor O3M captures scenes and objects three-dimensionally with just one shot. The device illuminates the scene with an external infrared light source and calculates the distance based on the light reflected from the surface using the time-of-flight method. Due to its excellent shock and vibration resistance, the sensor is particularly suitable for use in mobile machines but is also used in logistics automation.


PMD 3D smart sensor O3M			PMD 3D smart sensor O3M
75		Positioning aid for efficient and safe starting situations.	79
76	-	Automated movement of machines via line guidance.	80
77		Capture moving objects in the work environment.	81
78			

3D vision systems: the sensors.



PMD 3D smart sensor of type O3M

Suitable for use in mobile machines.

Fast distance measurement using time-of-flight technology.

Reliable data output via CAN J1939/CANopen or Ethernet UDP. Compact and robust housing.

Very long range up to 35 m on reflective objects.

The sensor captures scenes and objects three-dimensionally with just one shot. Besides the robust and compact design the 3D sensor system is especially designed for outdoor applications with changing light conditions or bright sunlight. Unlike other sensors, e.g. laser scanners, the ifm 3D sensor does not require any moving components. Therefore it is particularly robust and not subject to wear.

The so far unique combination of PMD 3D sensor and 2D camera with integrated overlay function allows a completely new perception. Overlay of customer-specific symbols, warning messages, texts and even drawings of complex, geometric shapes is supported by the new 3D smart camera system.

ifm.com/gb/o3m



Augmented reality – new 3D smart camera.

The function principle of ifm's PMD technology is based on time-of-flight (ToF). The scene is illuminated by modulated invisible infrared light and the reflected light hits the PMD sensor. This sensor is also connected to the source of modulation. Each pixel on the PMD chip determines the distances to the scene from the phase shift between the transmitted and the received signal.





Detect obstacles in the movement area.



PMD 3D smart sensor of type O3M

Area monitoring: Disposal vehicle side loader





Live image 2D/3D camera



Description:

The 3D system for the side loader automat- ically detects objects such as pedestrians or cyclists in the danger zone to the side and rear of the vehicle. Lowering is immediately stopped.
Disposal vehicles

Thanks to the 180° rear area monitoring

system, disposal vehicles can also drive into cul-de-sacs without a banksman. The 3D system detects objects in the travel path and automatically brakes to a standstill.

Area monitoring: Vertical drill





Live image 2D/3D camera

Description:	To prevent the machine operator from reach- ing into the rotating rods while the drill is in operation, two 3D systems are installed at the top of the drill mast and monitor the protect- ed area.
Industry:	Construction machines
	The system is automatically stopped if some- thing enters the monitored area. Due to the previously entered machine parameters, the 3D system is tamper-proof compared to con- ventional systems.

Area monitoring: Travel path monitoring gantry crane





Description:

Industry:



In the area of gantry cranes, containers slip time and again or the trailers of the trucks are too close to the driving area. The crane operator cannot always assess whether there is still enough space. This is why accidents very often occur here.

Port logistics

The functions already integrated in the 3D sensor are suitable for monitoring the travel path and rails. The sensor detects when an obstacle is on the rails or protruding into the travel path and signals this to the crane operator in good time. The crane is stopped automatically in critical situations.



Determine distances between the mobile machine and objects.



PMD 3D smart sensor of type O3M



Distance monitoring: Positioning a truck on a loading ramp





Live image 3D camera



Industry:



When the truck backs up to the gate, it is often driven "on contact". In contrast, distance detection using O3M protects materials.

Logistics

The 3D sensor monitors the area in front of the logistics gate. When a truck trailer approaches, the personnel in the hall are informed in good time. The driver of the truck receives visual assistance when manoeuvring and a clear stop signal when he is close enough to the ramp.

Distance monitoring: Positioning a truck under a loading point





Live image 2D/3D camera

Description:

The positioning of trucks under loading points or even mobile X-Ray systems is time-consuming and often inaccurate. It must be ensured that not only the front or rear part of the truck is positioned as accurately as possible, the central position to the sides is also important.

Industry: Logistics



The 3D system monitors the exact positioning of the truck and gives the driver correction instructions in good time. When using an X-ray, for example, a signal is given when the truck has approached close enough to the scan area.





Reliable early collision warning.



PMD 3D smart sensor of type O3M



In the port area, collisions with other vehicles or containers occur time and again when vehicles are being manoeuvred. As the vehicles are usually in operation around the clock, down-

Early collision warning: Reachstacker in the port area





Live image 2D/3D camera



Description:

Port logistics

times must be minimised.

The 2D/3D system automatically detects hazardous situations by matching vehicle movement and possible obstacles in the travel path. Obstacles are displayed directly in the live image and the driver is warned in good time.

Early collision warning: Fork-lift truck





Live image 2D/3D camera

Description:

Industry:



often narrow and there are many areas which cannot be seen. Logistics The 2D/3D system detects hazardous situations at an early stage by means of intelligent collision monitoring and warps the driver

When using forklift trucks in the logistics area,

the most dangerous situations occur when reversing and manoeuvring. It usually has to be done quickly, as the manoeuvring areas are

collision monitoring and warns the driver acoustically and visually. The detected obstacle is highlighted in the 2D live image and the distance to it is displayed.

Early collision warning: Dumper





Description:

Industry:



Large vehicles in the mining sector are often difficult to see and when approaching loading or unloading points there is a risk of accidents with major consequences. Mining

By comparing the current speed, the motion vector and fixed parameters such as the braking distance, the collision probability is calculated by the 3D sensor and transferred to the machine control system via CAN bus or Ethernet and then signalled to the driver.



Protection of employees by detecting reflective clothing.



PMD 3D smart sensor of type O3M



Reflector tracking: Rear area monitoring forklift truck





Live image 2D/3D camera

Industry:

Description:



The application package ZZ1103 makes it very easy to set selective detection of people's reflective clothing. This means that a warning is given in good time. The warning of other obstacles is not given unless they are very close to the vehicle.

In road construction, it is very difficult to distinguish between people and other obstacles,

as false alarms often occur due to dust formation or other operating conditions. As a result, simple assistance systems are often switched

In the logistics area, it is important for driver assistance systems to have as few false triggers as possible. It is not helpful to be constantly warned acoustically or visually of irrelevant obstacles. If in doubt, the driver

switches off the system.

Logistics

Reflector tracking: Rear area monitoring construction vehicle





Live image 2D/3D camera

Description:

Industry:



Construction vehicles

off by the driver.

The ZZ1103 application package offers, among other things, the reflector tracking function to reliably detect people's reflective clothing. This means that adverse operating conditions do not have a significant impact on the system and there are virtually no false alarms.

Note

The 3D sensors of the O3M series can be used for example as driver assistance for collision avoidance or for area surveillance. They are photoelectric systems whose function may be impaired by heavy soiling, for example.

This system does not meet the requirements of IEC 61496 for electro-sensitive protective equipment and must not be used for implementing a safety function for operator protection.

The 3D sensors of the O3M series can be used to assist the machine operator. The machine operator is, however, always fully responsible.





Positioning aid for efficient and safe starting situations.



PMD 3D smart sensor of type O3M



Docking aid: Airport ground support equipment





Description: Industry:	An aircraft fuselage consists of sensitive composite materials. This is why many air- lines insist on a technical device which stops ground vehicles and equipment (GSE, Ground Support Equipment) in good time before they come into contact with the aircraft. Airport
	The 3D system reliably detects the aircraft fuselage with over 1,000 distance values and ensures that the GSE reduces speed in several stages depending on the distance to effective- ly avoid collisions.

Automatic docking: Cargo loader





Description:	Airlines are working hard to keep the time their aircraft spend on the ground as short as possible. The docking process of large cargo loaders to the aircraft is an incalculable time factor.
Industry:	Airport
	On many aircraft, special reflector markers are affixed next to the cargo doors. The 3D system detects these markers using the inte- grated reflector tracking system and transmits the position data to the vehicle controller. This enables the loader to automatically approach the correct position on the aircraft.

Distance monitoring: Baggage conveyor belt





Industry:

Description:

Airport The collision warning system for approaching airport apron vehicles detects the aircraft

Conveyor belts are driven to the aircraft for an efficient loading or unloading process. If the aircraft hull is damaged during the approach, this means a longer downtime for the aircraft.

The collision warning system for approaching airport apron vehicles detects the aircraft hull and continuously calculates the collision probability. The baggage conveyor belt can be slowed down or even completely braked to prevent a collision with the aircraft.



Safe movement of machines via line quidance.



PMD 3D smart sensor of type O3M

Line guidance: Swath tracking baler





Live image 2D/3D camera

Description:

Industry:



The 3D system detects the swath and determines the volume. This allows the tractor to be steered automatically and guided over the swath at maximum working speed. The mate-

rial is optimally distributed and filled in the

material is optimally distributed in the trailer. The integrated video camera allows the driver

to observe the filling process.

When harvesting hay, it is important to guide the baler over the swath as accurately as pos-

sible, but also at the correct speed.

Agriculture

chamber of the baler.

Line guidance: Grape harvester



Description: The overloading process on the forage harvester requires the utmost attention. The driver must swivel the ejection arm while driving and simultaneously align the forage jet. Industry: Agriculture The 3D camera captures the trailer with over 1000 distance values. The swivel arm is controlled fully automatically. The harvested





Capture moving objects in the work environment.



PMD 3D smart sensor of type O3M



Collision warning: Driver assistance when reversing a forklift truck





Live image 2D/3D camera



Description:

In logistics areas, accidents occur time and again due to time pressure and inattention. Many collision warning systems are rather disruptive, as they warn too early and therefore issue too many false alarms.

Steel production

To prevent accidents, the danger zone behind the forklift is captured in 3D. The driver receives a warning message in good time, and by directly recognising people wearing reflective clothing, too early triggering of the alarm can be reduced to an acceptable minimum. Simultaneously the machine control system can get a command to lower the speed.

Operating distance / field of view size 3D smart sensor O3M



Horizontal x vertical opening angle [°]	Description	Order no.
70 x 23	mobile 3D Smart Sensor	O3M151
70 x 23 (3D) 90 (2D)	mobile 3D smart sensor with integrated 2D/3D overlay	O3M251
95 x 32	mobile 3D Smart Sensor	O3M161
95 x 32 (3D) 120 (2D)	mobile 3D smart sensor with integrated 2D/3D overlay	O3M261
97 x 44	mobile 3D Smart Sensor	O3M171
97 x 44 (3D) 155 (2D)	mobile 3D smart sensor with integrated 2D/3D overlay	O3M271



