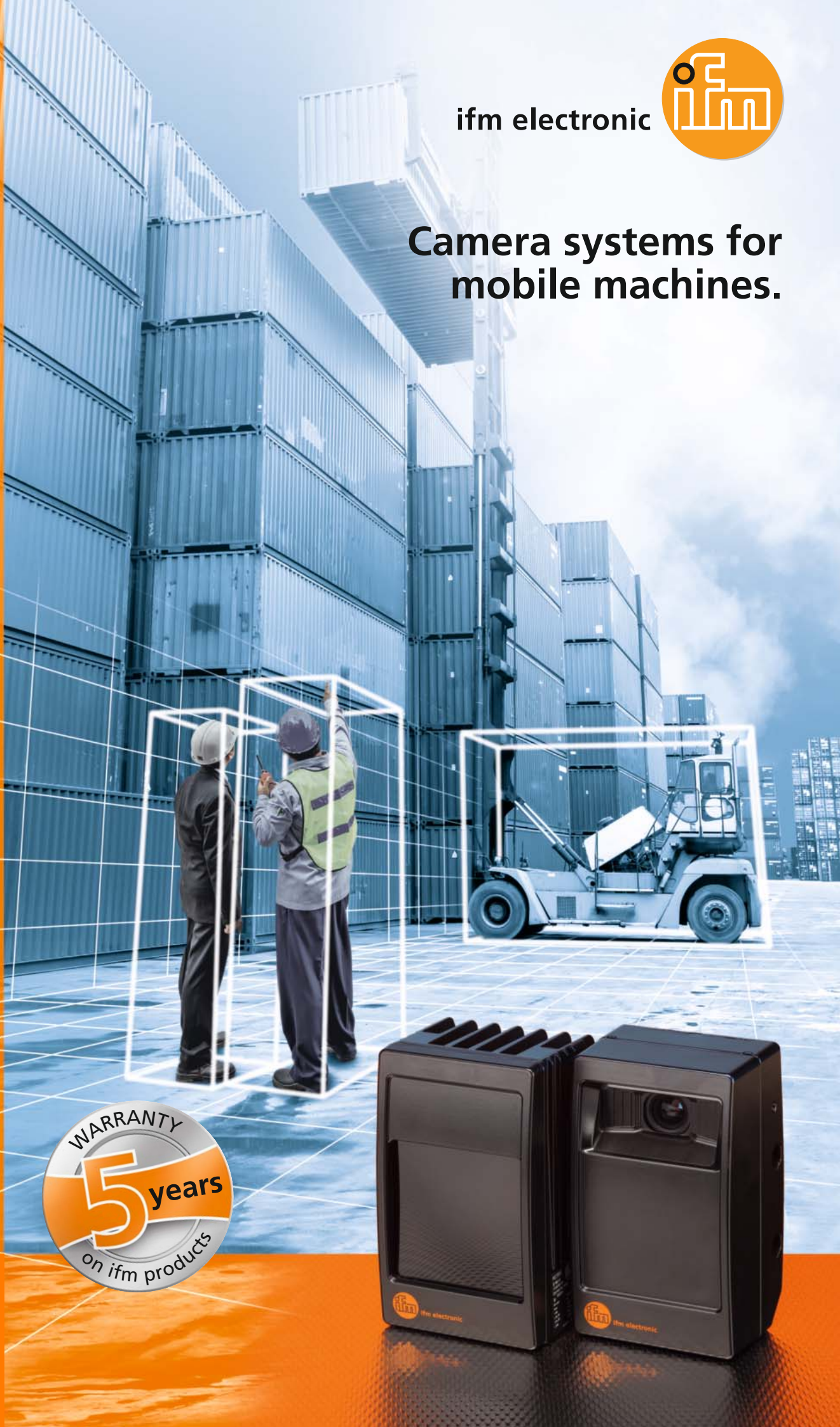
ifm electronic

Camera systems for mobile machines.



3D sensors

www.ifm.com/gb/o3m

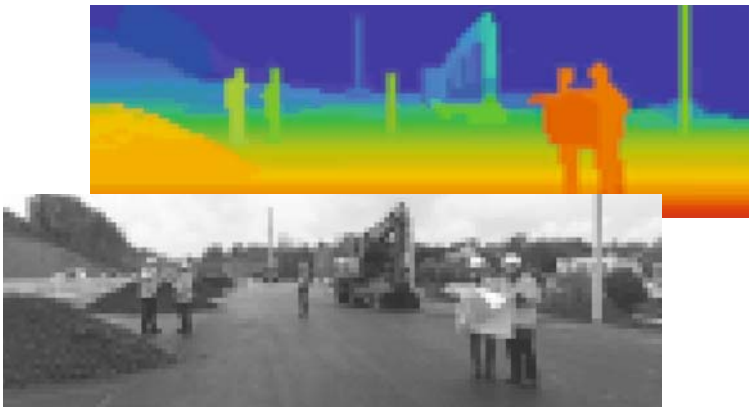
ifm electronic



3D sensor system O3M

Real-Time 3D





Area surveillance



Line guidance



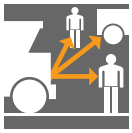
Positioning help



Collision warning



Distance monitoring



Object recognition



Reflector tracking

3D sensors for mobile machines

The PMD 3D sensor from ifm detects scenes and objects three-dimensionally with only one image capture. This avoids the motion blur that can occur with line scanners. ifm's award-winning patented PMD technology forms the basis for a sensor system that can cope with the harsh operating conditions of mobile machines. Besides the robust and compact design the 3D sensor system is specially designed for outdoor applications with changing light conditions or bright sunlight. The ifm 3D sensor has no moving components in contrast to other sensors such as laser scanners. Therefore it is particularly robust and not subject to wear.

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

TOP PRODUCT

Three-dimensional detection of scenes
Automatic detection of objects



Construction machines — Area surveillance in harsh environments — 4 - 5



Agriculture and forestry — Automation solutions for agricultural machinery — 6 - 7



Transport and logistics — Area surveillance of free space and gates — 8 - 9



Transport and logistics — Automation solutions and area surveillance in port areas — 10 - 11



Transport and logistics — Height and distance monitoring in airport areas — 12 - 13



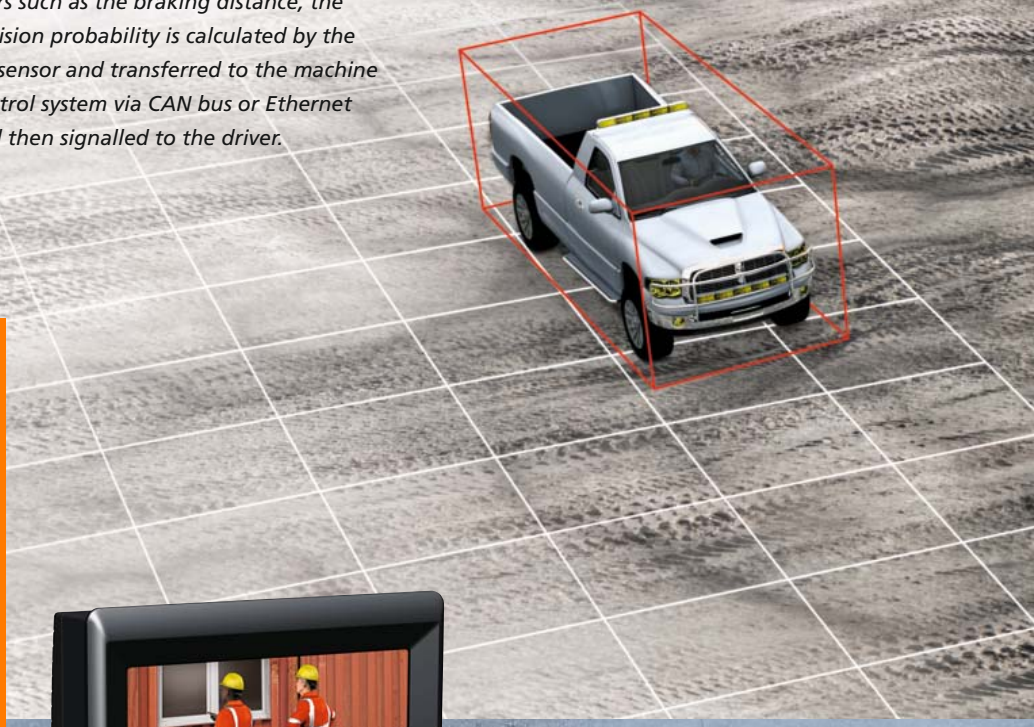
Overview of articles / Technical data — 3D sensor system O3M, Heavy-duty universal camera O2M — 14 - 19

Construction machines



Collision warning

The integrated, automatic object recognition detects up to 20 stationary or moving objects in the path of a construction vehicle. 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.



Patented technology:
The PMD time-of-flight technology ensures detection of scenes and objects with just one image capture in three dimensions and without motion blur.

Enormous far sightedness:
The 3D sensor that is optimised for long ranges even detects moving reflective objects at a distance of up to 35 metres.

Integrated evaluation:
All 3D calculations are made in the powerful sensor system and the results are provided via the CAN bus or the Fast Ethernet connection.

Simply convenient:
The parameters of the system are set via the easy-to-handle "ifm vision assistant" for Windows. Ready-to-use function blocks are available for the CODESYS software for machine integration.



Path monitoring

A freely adjustable reference point on the vehicle allows, for example, only obstacles of a predefined height above ground to actually be detected as obstacles.

Area surveillance in harsh environments





Distance monitoring

For simple distance functions the integrated distance monitoring provides up to 64 adjustable regions of interest (ROIs), i.e. individual regions whose distances are to be monitored. Rear area monitoring can be implemented or automation or assistance tasks can be solved.



Agriculture and forestry



For the harshest environments:
Since the sensor does not have any moving components, it is virtually free of wear. Its high ambient temperature range of -40 to 85 °C is the basis for universal use.

Resistant to extraneous light:
The PMD technology ensures high repeatability of the measured data even in difficult ambient light conditions or with direct sunlight.

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

Reliable and fast:
With a highly developed algorithm from the automotive sector and a frame rate of up to 50 frames / second the sensor allows fast and reliable calculation of the 3D information.



Automation solutions for agricultural machinery



Line guidance

A highly developed algorithm with generic recognition of linear contours provides the machine driver with a selection of recognised lines and their guidance. With interrupted contours the data is interpolated. This ensures that guidance does not stop in case of smaller interruptions. An offset function ensures fine adjustment between vehicle and the line to be followed.

Besides the actual line guidance, the volume flow of the harvested material can be determined at the same time so that the speed of the tractor unit or harvester can be adapted to match the quantity of material.

Windrow recognition

The mobile 3D sensor assumes windrow recognition and provides the information for automatic steering to the machine control system.

At the same time the quantity of material [m³/s] is determined to avoid overloading or underloading of the baler.





Grape harvesting machine

To relieve the driver the 3D sensor transmits all relevant data for automatic steering along the grape row to the machine control system.

Transport and logistics



Continuously reliable:
Thanks to the specially modulated infrared light a continuously high recognition rate can be achieved even with reflective material of different intensity. All that with a minimum response time of only 40 ms.

High coverage:
The range of up to 15 m in typical environments and up to 35 m on reflective objects ensures universal use.

Goal-oriented:
Object distances and dimensions are automatically provided in a clear grid using the selectable world coordinate system. The ground recognition integrated in the algorithm ensures high unambiguity of object recognition.



Truck positioning on a loading bay

To protect the logistic facilities the driver is informed as soon as the correct distance to the bay has been reached so that he should come to a stop.

Area surveillance of free space and gates



Area surveillance

With more than 1000 individual distance values the 3D sensor recognises objects in the area to be monitored and signals this to the machine controller depending on the distance to the machine.





Position determination of transport vehicles

For simple position determination the integrated distance monitoring provides up to 64 adjustable regions of interest (ROIs), i.e. individual regions whose distances are to be monitored.
This ensures, for example, position determination of a transport vehicle underneath a loading point.



Transport and logistics



Simple distance monitoring

The integrated function 'minimum distance' can also be used for simple area monitoring. It informs the driver when a minimum distance has been reached and simultaneously it signals where this next distance is in the recognition field.

Fast reaction:
The 2 x 32-bit processor architecture ensures very fast and reliable calculation of the 3D data with up to 50 frames / second directly in the sensor system.

No interference:
Automatic suppression of background illumination ensures reliable recognition even with full solar radiation of 120 klx.

Reliable parallel operation:
The reliable operation of several 3D sensor systems in the same area is guaranteed by an adjustable frequency change method. This may be random or preset.

Automatic detection of reflectors:
By detecting highly reflective objects these can be classified and evaluated as reflectors. Even simple safety vests suffice for this recognition.



Driver assistance on a "ship-to-shore" container stacker crane

Automatic collision prediction supports the crane driver with changing the position and informs about obstacles in the path.

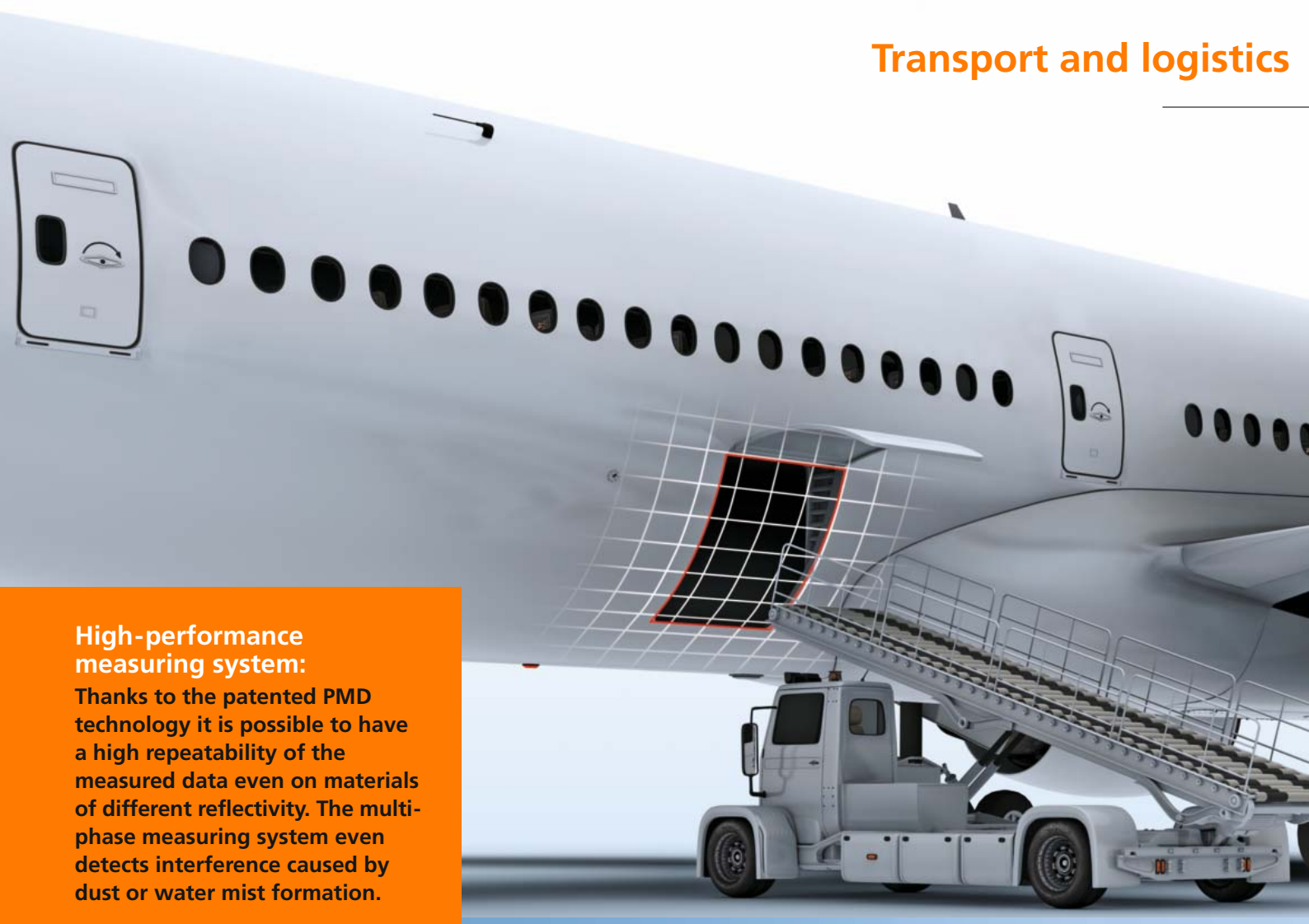
Automation solutions and area surveillance in port areas





Automatic vehicle tracking with collision warning

A special classification of reflective objects is used as basis for automatic tracking of the vehicle ahead. The proven and highly-developed algorithm from the automotive sector is relied on.
For example, the minimum and maximum distance to the vehicle ahead is set or recognition is limited to a certain arrangement of reflectors via various parameters. An additional collision warning ensures that obstacles are reliably detected and signalled to the machine control system in two stages. Interference by direct solar radiation or other 3D sensor systems is automatically suppressed.



High-performance measuring system:

Thanks to the patented PMD technology it is possible to have a high repeatability of the measured data even on materials of different reflectivity. The multi-phase measuring system even detects interference caused by dust or water mist formation.

Robust sensors:

The protection ratings IP 67 and IP 69K and a wide temperature range of -40 to 85 °C ensure universal use in different applications.

High reliability:

Integrated self-diagnostic functions from the sensor to the IR system illumination unit always ensure comprehensive information of the machine control system about the current function status of the 3D sensor. In case of damage, interference or heavy soiling the sensor system can give corresponding signals in time.

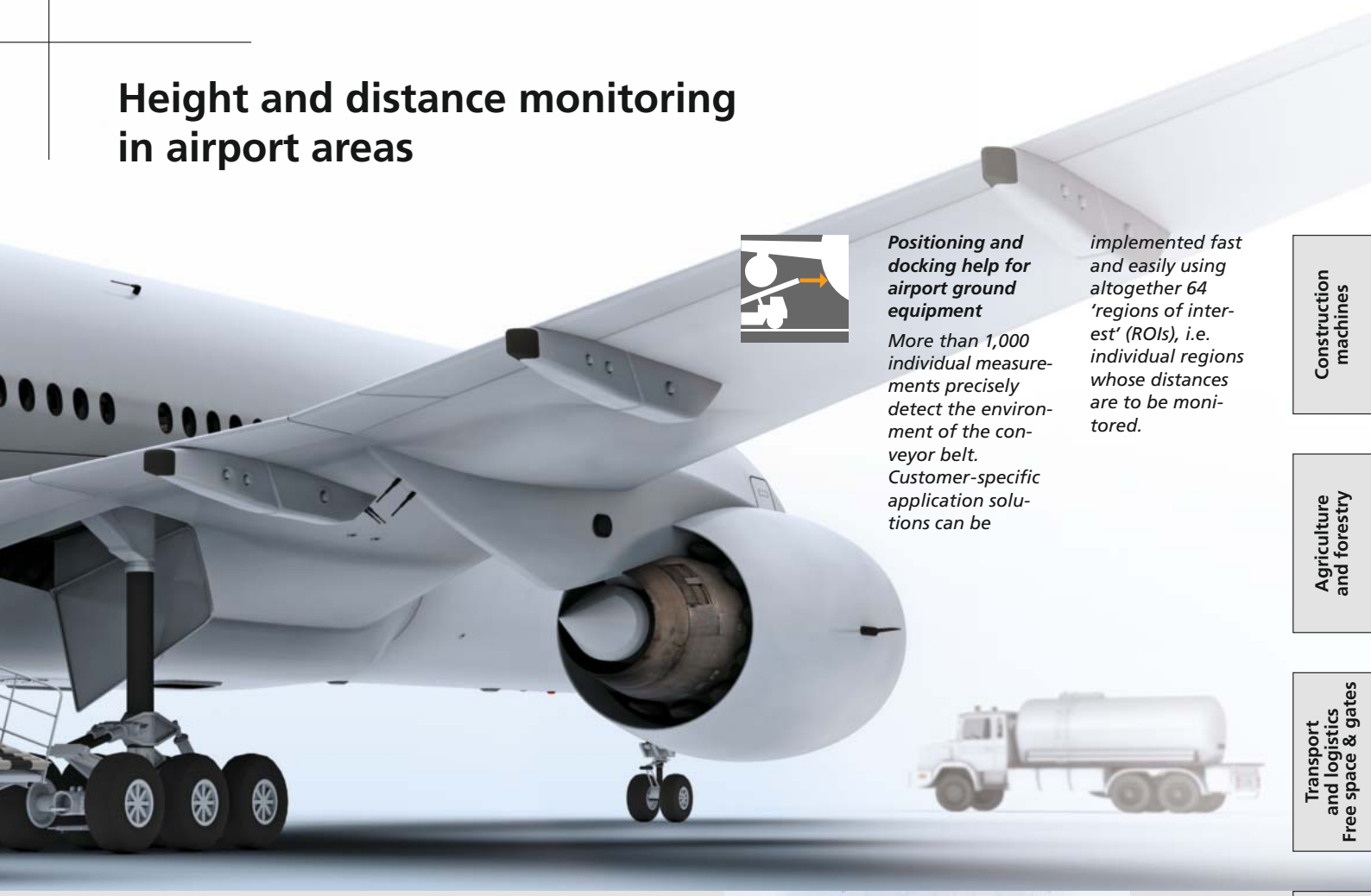
Height monitoring for tankers

The integrated distance function 'minimum distance' can monitor up to 64 selectable points above the tanker simultaneously.

The driver can, for example, be supported when he positions the tanker underneath the aeroplane wing or is informed if the wing is lowered.



Height and distance monitoring in airport areas



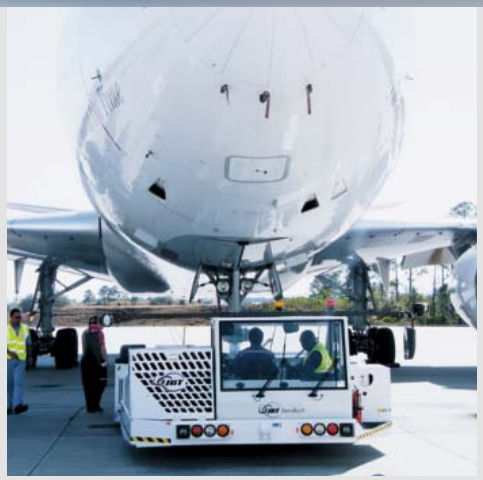
Positioning and docking help for airport ground equipment

More than 1,000 individual measurements precisely detect the environment of the conveyor belt. Customer-specific application solutions can be implemented fast and easily using altogether 64 'regions of interest' (ROIs), i.e. individual regions whose distances are to be monitored.



Simple distance monitoring

The integrated function 'minimum distance' can also be used for simple area monitoring. It informs the driver when a minimum distance has been reached and simultaneously it signals where this next distance is in the recognition field.



Assistance for aircraft tractors

Thanks to easy monitoring of a pre-defined area the 3D sensor can either provide an end position message or even a contour image of the nose wheel to the machine control system.

PMD 3D sensor O3M

Type	Horizontal x vertical angle of aperture [°]	Order no.	Suitable illumination	Order no.
Mobile 3D sensor without data preprocessing[1)]	70 x 23	**O3M150**	IR system illumination unit	**O3M950**
Mobile 3D sensor without data preprocessing[1)]	95 x 32	**O3M160**	IR system illumination unit	**O3M960**
Mobile 3D smart sensor[2)]	70 x 23	**O3M151**	IR system illumination unit	**O3M950**
Mobile 3D smart sensor[2)]	95 x 32	**O3M161**	IR system illumination unit	**O3M960**

[1)] without apps, only for customised programming [2)] incl. apps, for simple application solutions



E1

Technical data		
Type of sensor		PMD 3D chip
Pixel resolution	[Pixel]	64 x 16
Illumination		external illumination necessary
max. frame rate	[Hz]	25 / 33 / 50
Connection		M12 connector
Protection rating / protection class		IP 67 / IP 69K, III
Operating voltage	[V DC]	9...32
Ambient temperature	[°C]	-40...85

Accessories

Type	Description	Order no.
	CAN/RS232 USB Interface CANfox	**EC2112**
	Adapter cable set for CANfox	**EC2114**
	Operating software for vision sensors	**E3D300**
	Weather protective cover, stainless steel black	**E3M101**
	Adjustable U-shaped fixture, stainless steel black	**E3M102**

Type	Description	Order no.
	U-shaped bracket, suitable for sensor or illumination unit, stainless steel	**E3M100**
	Mounting set for clamp mounting, Ø 14 mm, stainless steel / high-grade stainless steel	**E3M103**
	Reflector triangular, 200 mm	**E3M140**
	Reflective tape triangular, self-adhesive, 200 mm	**E3M141**
	Reflective tape 210 x 297 mm, self-adhesive	**E3M142**

Technical data and accessories





Connection technology

Type	Description	Order no.
	MCI connection cable, connection sensor / system illumination unit, 1 m	E3M121
	MCI connection cable, connection sensor / system illumination unit, 2 m	E3M122
	MCI connection cable, connection sensor / system illumination unit, 3 m	E3M123
	Socket, M12, voltage supply system illumination unit, 2 m, PUR cable, 4 poles	E3M131
	Socket, M12, voltage supply system illumination unit, 5 m, PUR cable, 4 poles	E3M132
	Socket, M12, voltage supply system illumination unit, 10 m, PUR cable, 4 poles	E3M133

Type	Description	Order no.
	Socket, M12, CAN bus, 2 m, PUR cable, 5 poles	E11596
	Socket, M12, CAN bus, 5 m, PUR cable, 5 poles	E11597
	Ethernet, cross-over patch cable, 2 m, PVC cable, M12 / RJ45	E11898
	Ethernet, cross-over patch cable, 10 m, PVC cable, M12 / RJ45	E12204
	Ethernet, cross-over patch cable, 20 m, PVC cable, M12 / RJ45	E12205
	Ethernet, cross-over patch cable, 2 m, PVC cable, M12 / RJ45, angled / straight	E12226

Heavy-duty universal camera O2M

Camera with analogue video output O2M

Type	Angle of aperture [°]	Mirror function	Order no.
CMOS camera	78	–	**O2M200**
CMOS camera	78	integrated	**O2M201**
CMOS camera	115	–	**O2M202**
CMOS camera	115	integrated	**O2M203**



E4

Technical data		
Type of sensor		1/4" 4:3 VGA CMOS image sensor colour
PAL resolution	[Pixel]	680 x 480
Image repetition rate	[fps]	25
Connection		Connection cable 0.5 m with M16 connector
Protection rating / protection class		IP 68 / IP 69K
Operating voltage	[V DC]	8...32
Ambient temperature	[°C]	-40...85
Lens heating		automatical

Accessories

Type	Description	Order no.
	Protective metal cover, stainless steel	**E2M212**
	Dome fixture	**E2M211**
	Vibration damper set	**E2M213**
	Replacement fixture	**E2M210**

Connection technology

Type	Description	Order no.
	Adapter cable M12 connector to M16 socket, black, PVC cable. To connect a camera to the PDM NG	**E2M200**
	Adapter cable M12 connector to M16 socket, black, PVC cable. For connection of two cameras to the PDM NG	**E2M201**
	Connection cable M16 connector to M16 socket, 5 m black, PVC cable	**E2M203**
	Connection cable M16 connector to M16 socket, 11 m black, PVC cable	**E2M204**
	Connection cable M16 connector to M16 socket, 16 m black, PVC cable	**E2M205**
	Connection cable M16 connector to M16 socket, 21 m black, PVC cable	**E2M206**

Technical data and accessories

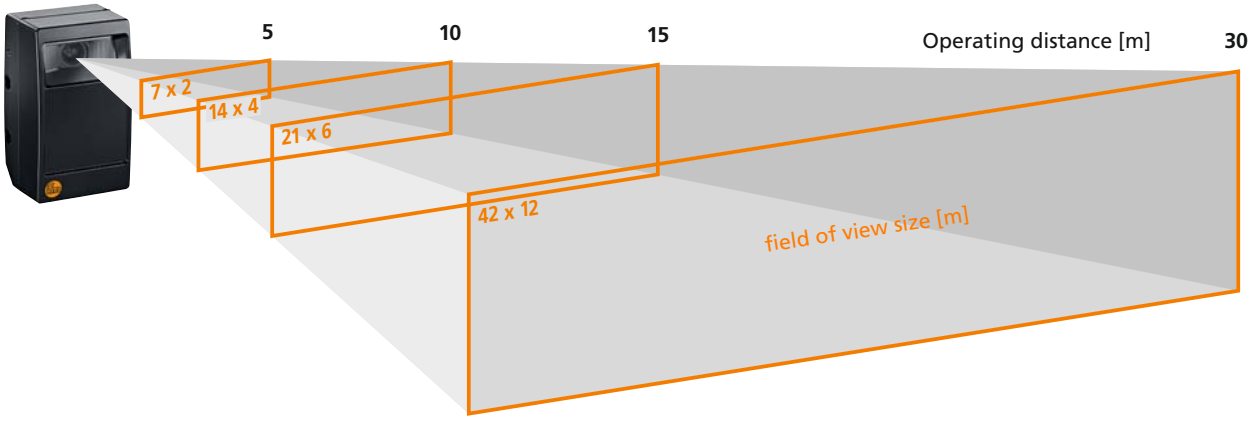




Dialogue module PDM360 NG

Type	Description	Order no.
	7" colour display, 9 function keys, navigation key, 2 x analogue video input, touch screen	CR1082
	7" colour display, 9 function keys, navigation key, 2 x analogue video input	CR1085
	7" colour display, 8 function keys, 2 x analogue video input	CR1083
	7" colour display, 9 function keys, encoder, 2 x analogue video input	CR1084
	12" colour display, 13 function keys, navigation key, 2 x analogue video input	CR1200
	12" colour display, 13 function keys, navigation key, 2 x analogue video input, touch screen	CR1201

Type O3M150 / O3M151 angle of aperture 70° x 23°



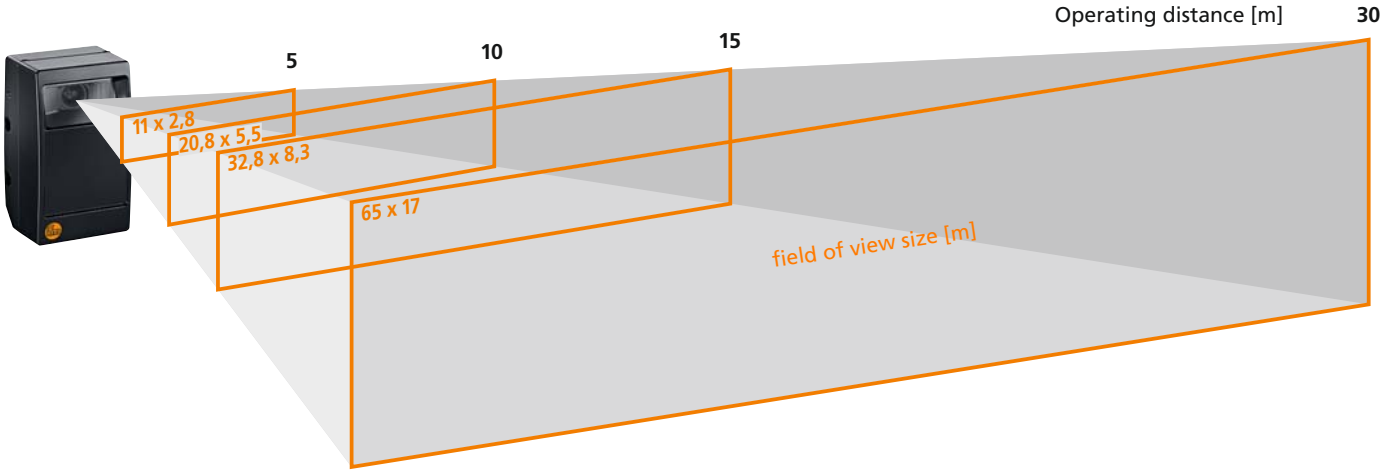
Type O3M151 measurement accuracy

Software version	Object type	Operating conditions	Measuring range for object recognition [m]	Typ. measuring range for ROI [m]	Typ. measurement accuracy [cm]
OD object recognition	vehicle	sunny (~120 kLux)	0.25...30	–	–
		cloudy (~20 kLux)	0.25...40	–	–
		darkness	0.25...50	–	–
OD object recognition	person*	sunny (~120 kLux)	0.25...12	–	–
		cloudy (~20 kLux)	0.25...16	–	–
		darkness	0.25...20	–	–
OD object recognition	highly reflective object (e.g. high visibility vest)	sunny (~120 kLux)	1...40	–	–
		cloudy (~20 kLux)	1...60	–	–
		darkness	1...80	–	–
DI / BF distance image basic functions		sunny (~120 kLux)	–	0.25...12	± 15
		cloudy (~20 kLux)	–	0.25...15	± 10
		darkness	–	0.25...30	± 5

*The term person is only to be understood as a reference for size

Overview Operating distance / field of view size

Type O3M160 / O3M161 angle of aperture 95° x 32°



Type O3M161 measurement accuracy

Software version	Object type	Operating conditions	Measuring range for object recognition [m]	Typ. measuring range for ROI [m]	Typ. measurement accuracy [cm]
OD object recognition	vehicle	sunny (~120 kLux)	0.25...21	–	–
		cloudy (~20 kLux)	0.25...30	–	–
		darkness	0.25...35	–	–
OD object recognition	person*	sunny (~120 kLux)	0.25...9	–	–
		cloudy (~20 kLux)	0.25...12	–	–
		darkness	0.25...15	–	–
OD object recognition	highly reflective object (e.g. high visibility vest)	sunny (~120 kLux)	1...29	–	–
		cloudy (~20 kLux)	1...42	–	–
		darkness	1...55	–	–
DI / BF distance image basic functions		sunny (~120 kLux)	–	0.25...8	± 15
		cloudy (~20 kLux)	–	0.25...11	± 10
		darkness	–	0.25...21	± 5

*The term person is only to be understood as a reference for size

Visit our website:

www.ifm.com

Over 70 locations worldwide –
at a glance at **www.ifm.com**

ifm electronic gmbh
Friedrichstraße 1
45128 Essen
Tel. +49 / 201 / 24 22-0
Fax +49 / 201 / 24 22-1200
E-mail info@ifm.com



ifm – close to you!

Overview
ifm product range:



Position sensors



Sensors for motion control



Industrial imaging



Safety technology



Process sensors



Industrial communication



Identification systems



Condition monitoring systems



Systems for mobile machines



Connection technology



Accessories

ifm article no. 78001860 · We reserve the right to make technical alterations without prior notice. · Printed in Germany on non-chlorine bleached paper. 03/16