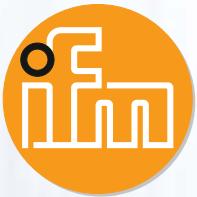


ifm electronic



Processes in the Steel Industry

www.ifm.com/gb/steel

ifm – close to you!

Modern production lines in steelmaking ensure economic success



The steel industry is among the largest and best-established economic sectors worldwide. It has always been an important driving force of the economy. Its products are indispensable for other industries such as automotive and construction.

Quality, reliability and economic efficiency in the production of steel products can only be ensured by means of automated manufacturing facilities.

A central objective of ifm is to increase reliability and operational availability of production lines.

In addition to the proven sensor technology, new areas of application such as condition-based maintenance or monitoring of consumables in plants are constantly opened up.

In the future, too, ifm will remain a reliable and innovative partner for the steel industry.

ifm – close to you





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The company in your vicinity.



State-of-the-art communication.

With the right address – www.ifm.com – only a mouse click separates you from the world of automation technology. See the power of our products in interactive representations. Gain an impression with 3-dimensional views of our units. Download CAD drawings for direct integration in your applications. Or order online in ifm's e-shop – fast, convenient and reliable.



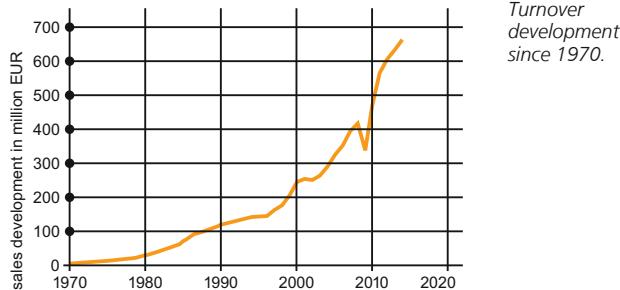
We are there for you.

Close contact with our customers is part of our success. Therefore we have consistently developed our sales network right from the start. Today the ifm group of companies is represented in more than 70 countries – close to you! With application advice and service at the heart of our operation. For the introduction of new products and technologies we support you with workshops and seminars in our training centres or in your plant.

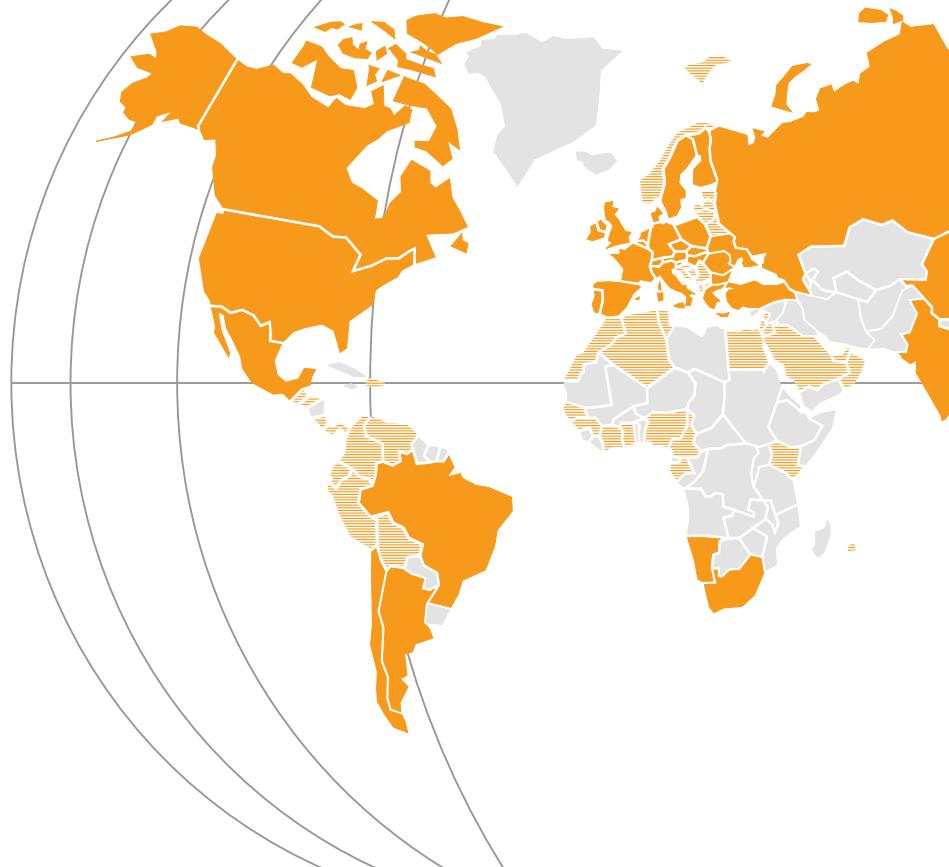


Security by success.

Since its foundation in 1969 ifm has constantly grown, now having more than 5500 employees worldwide, and achieved a turnover of more than EUR 720 million in 2015. This success gives you the security of having a reliable partner for the implementation of your automation projects. Comprehensive service and a warranty of 5 years on standard units are just two examples of this reliability.



Turnover
development
since 1970.



Not only components.

ifm stands for a large range of different sensors and systems for automation. Our range of more than 7,800 articles guarantees flexibility and compatibility. So there is always a reliable solution for your automation projects – from the individual sensor with practical accessories to the complete system.

Availability guaranteed.

Your deadlines matter to us. That is why we are constantly optimising our production processes in order to be able to quickly and flexibly produce large quantities at a constantly high quality – and to continue to shorten delivery times. Your order is dispatched via our centralised logistics centre reliably and on time.

Quality as part of our philosophy.

The quality standard of our products is an integral part of our company philosophy. And we guarantee it! So we provide you, the users, with a maximum degree of security: By means of our own production technology, ifm film technology, as well as by means of extensive quality assurance measures such as 100 % final testing. By quality we understand, for example, ecologically conscious production – Made in Germany!

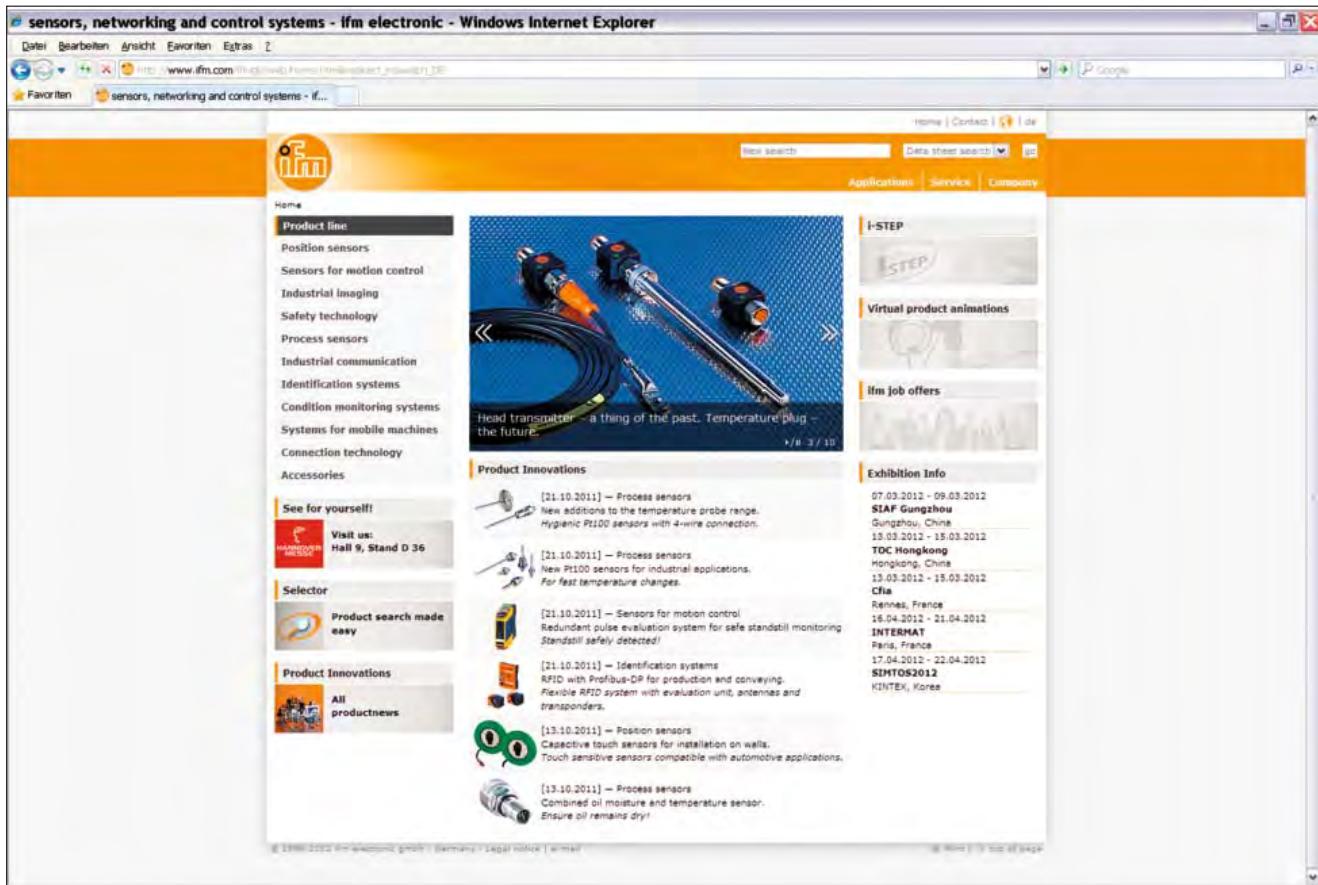


The development of innovative products is one of our core competences. From high-quality standard solutions to products specially tailored to the requirements of the individual industries – from mobile machines to the food industry.



www.ifm.com

Information around the clock and around the globe in 23 languages on the internet.



• Information

- product innovations
- company news
- exhibition info
- locations
- jobs

• Documentation

- data sheets
- operating instructions
- manuals
- approvals
- CAD data

• Communication*

- request for documents
- recall service
- live advice
- newsletter

• Selection

- interactive product selection aids
- configuration tools
- data sheet direct

• Animation

- virtual product animations
- flash movies (video sequences)

• Application

- applications
- product recommendations
- calculation aids

• Transaction*

- e-shop processing
- e-procurement catalogues

*Some offered information is available country-specific

Convenient order processing via the e-shop** on the internet.

The screenshot shows a shopping basket for Max Metzger. The basket contains one item: a pressure sensor with part number 90382020. The details show a quantity of 1, description as 'Pressure sensor ...', availability as 'Available', price as £118.00, and total price as £118.00. Buttons for 'Check Availability' and 'Checkout' are visible.

Secured authentication

Customer-related price indication

Real time availability check

Personal product favourites

Online parcel tracking

Individual order history

Convenient quick input form

Simple order processing

Management of shipping addresses

Confirmations by e-mail

The screenshot shows the 'Automotive Industry' section of the ifm electronic website. It features a large image of a factory floor with various industrial equipment and a smaller image below labeled 'Process chain in meat processing'. A sidebar on the left lists categories like 'Food and beverages', 'Food processing', 'Beverages', 'Sweets', 'Meat processing', and 'Food Catalogue 2013 / 2014'.

ifm application database

ifm's automation technology is used to for applications in many different types of plant in almost all industries. Learn how ifm can improve your production.

Application examples can be found on our website at:
www.ifm.com/gb/applications

** Already available in many countries.

3A



3A Sanitary Standards, Inc. (3-A SSI) is an independent, not-for-profit corporation dedicated to advancing hygienic equipment design for the food, beverage, and pharmaceutical industries.

AS-i



Actuator-Sensor Interface. Bus system for the first binary field level.

ATEX



Atmosphère Explosible. ATEX comprises the directives of the European Union in the field of explosion protection. On the one hand there is the 94/9/EC ATEX product directive and on the other hand the 1999/92/EC ATEX operation directive.

CCC



CCC (China Compulsory Certification) is a compulsory Chinese certification for certain products put on the market in China. Which products are concerned is specified in a catalogue created by the Chinese authorities.

cCSAus



Testing of a product by CSA according to the safety standards applicable in Canada and the USA.

CE



Conformité Européenne. By affixing the CE marking to a product, the manufacturer declares that it meets EU safety, health and environmental requirements.

cRUs



Testing of components by UL according to the safety standards applicable in Canada and the USA. Components can be used when the "condition of acceptability" is complied with for the final product.

CSA



Canadian Standards Association. A non-governmental Canadian organisation that sets standards and tests and certifies products for their reliability. By now it is active worldwide.

cULus



Testing of components by UL according to the safety standards applicable in Canada and the USA.

DIBt (WHG)



Deutsches Institut für Bautechnik (Federal Water Act). The Federal Water Act (WHG) is the essential part of the German law relating to water. It contains provisions for the protection and use of surface water and ground water and also regulations about the expansion of waters, water planning and flood protection.

DKD

The Deutscher Kalibrierdienst (DKD) is an association of calibration laboratories of industrial firms, research institutes, technical authorities, inspection and testing institutes. The DKD calibration certificates prove traceability to national standards as required in ISO 9000 and ISO / IEC 17025. They also serve as a metrological basis for the control of measurement and test equipment within the framework of quality management.

E1

Approval by the Kraftfahrt-Bundesamt (German Federal Motor Transport Authority). The E1 type approval by the German Federal Motor Transport Authority certifies that the units comply with the automotive standards. Units with this marking are allowed to be mounted on vehicles without expiry of their operating permit.

EG 1935/2004

The Regulation EC 1935/2004 has been taken into account for process sensors from ifm which are intended for use in contact with food. You can obtain a list of the corresponding products and detailed information on request.

EHEDG

European Hygienic Engineering & Design Group. European supervisory authority for food and drugs. This authority grants approvals for products and materials used in the food and pharmaceutical industries.

FDA

Food and Drug Administration. US-American supervisory authority for food and drugs. This authority grants approvals for products and materials used in the food and pharmaceutical industries.

FM

Factory Mutual Research. A US-based insurance company that specializes in loss prevention services in the property insurance market sector. They provide material research, material testing and certifications in the field of fire and explosion protection.

PROFIBUS

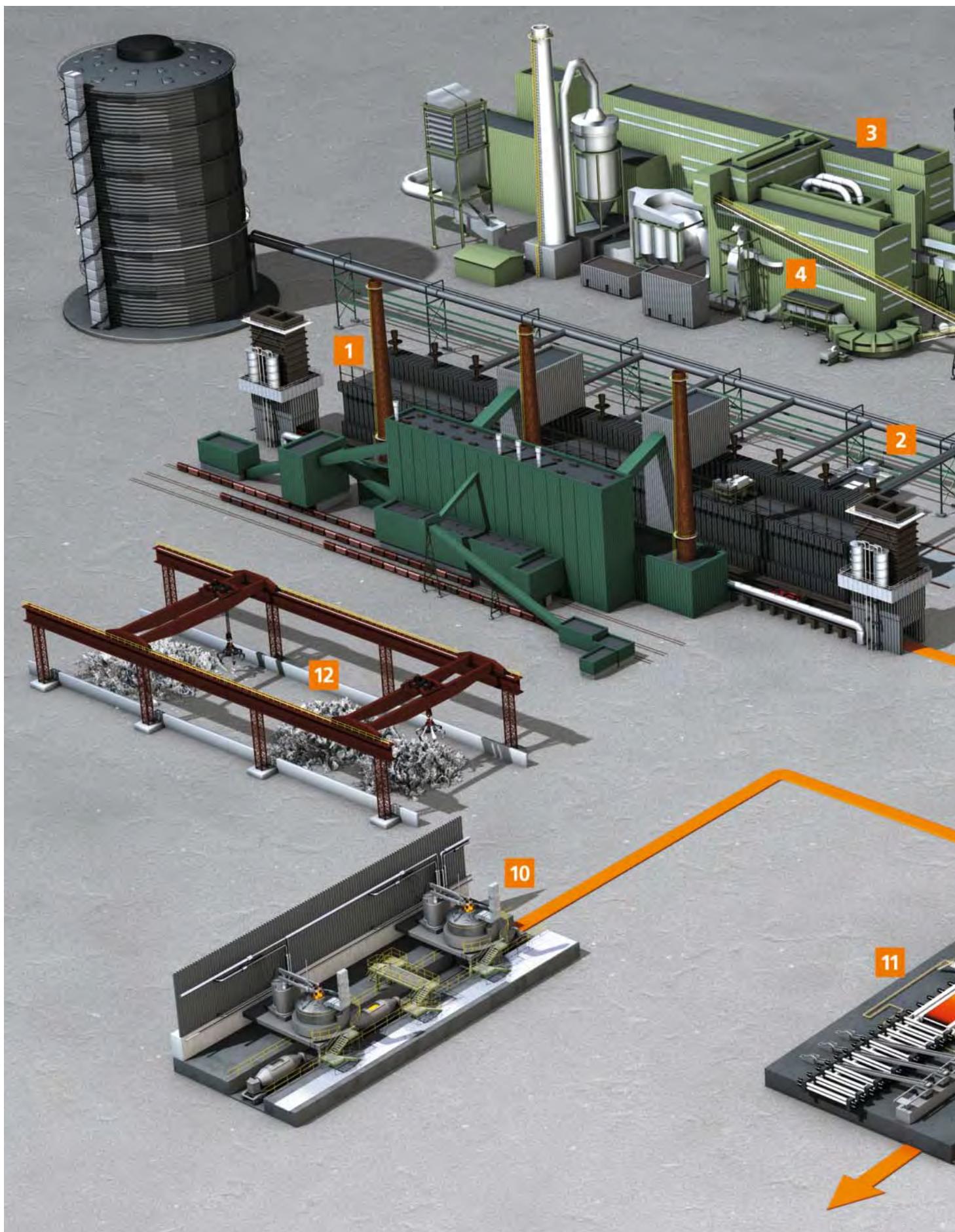
Process Field Bus. Fieldbus system for important data quantities. It is available in several versions such as Profibus FMS, DP or PA. Profibus DP can be used over longer distances, e.g. as fieldbus for AS-i.

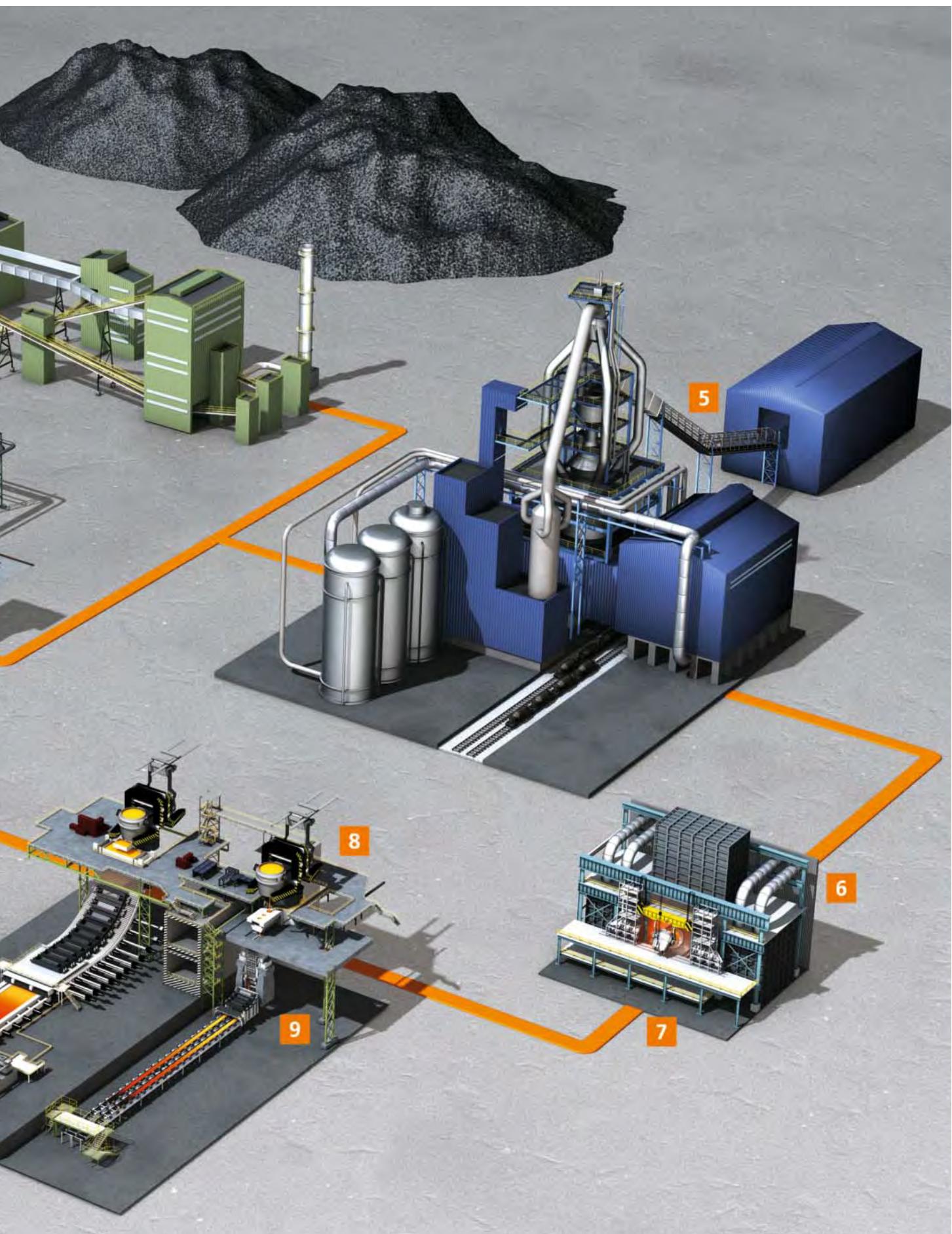
TÜV

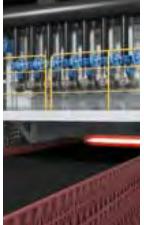
Technischer Überwachungs Verein (technical inspection association). The German TÜV is a private-sector body carrying out technical safety tests that are stipulated by government laws or instructions.

UL

Underwriters Laboratories. An organisation founded in the USA for testing and certifying products and their safety.





Machine	Application	Product group
1 Coke plant		
	Position detection of a furnace door Position detection of a filling machine Monitoring of conveyors	Cylinder sensors Inductive sensors Pulse evaluation systems
2 Hydraulic power pack of a pusher		
	Pressure monitoring in hydraulic power packs Level monitoring in hydraulic power packs Temperature measurement in hydraulic power packs Vibration monitoring	Pressure sensors Level sensors Temperature sensors Vibration monitoring systems
3 Sintering plant		
	Gas supply Tracking of material Hatch monitoring at silos Pressure monitoring at the air inlet	Pressure sensors Temperature sensors Inductive sensors Pressure sensors
4 Conveying systems		
	Decentralised speed monitoring Safety switches in AS-i Safety at Work Integration of mechanical switches into AS-i systems	Pulse evaluation systems AS-Interface Safety at Work AS-Interface Safety at Work
5 Cooling water supply at a blast furnace		
	Pump monitoring Monitoring of the cooling circuits Water pressure monitoring Monitoring of cooling water	Pressure sensors Flow sensors / flow meters Pressure sensors Temperature sensors
6 Converter supply		
	Pressure monitoring in hydraulic power packs Temperature measurement in hydraulic power packs Level monitoring in hydraulic power packs Vibration monitoring	Pressure sensors Temperature sensors Level sensors Vibration monitoring systems

Machine	Application	Product group
7	Material supply at a converter	
	Slide monitoring at silos Hatch monitoring at silos Level monitoring at silos	Cylinder sensors Inductive sensors Capacitive sensors
8	Central compressed air supply	
	Pressure monitoring at a compressed air reservoir Energy efficiency measurement of the compressed air Monitoring at an air dryer Pressure monitoring at the distributor	Pressure sensors Flow sensors / flow meters Level sensors Pressure sensors
9	Continuous casting plant	
	Slag detection at a shroud tube manipulator Monitoring of the cooling circuits Tracking of material Vibration monitoring	Vibration monitoring systems Flow sensors / flow meters Temperature sensors Vibration monitoring systems
10	Cooling at an electric arc furnace	
	Volumetric flow monitoring in cooling circuits Temperature monitoring in cooling circuits Pressure measurement on pumps	Flow sensors / flow meters Temperature sensors Pressure sensors
11	Flame cutters	
	Position detection Gas pressure monitoring Gas supply Consumption measurement of technical gases	Inductive sensors Pressure sensors Inductive sensors Flow sensors / flow meters
12	Crane installations	
	Collision protection Reliable area surveillance End position monitoring Bearing monitoring	Inductive sensors Inductive sensors Inductive sensors Vibration monitoring systems

Modern production plants in steelmaking ensure economic success



Today's steel industry with its modern blast furnaces for pig iron production and the different converter methods can make products with a consistently high quality at low cost.

Because there is a high degree of plant automation the reliability of the components is a critical factor for the economic efficiency of the companies.

Here, sensors play a special role. Whereas in the past they were only used for process control they today provide additional information about the plant condition. Required maintenance and repair can be planned and prepared precisely.

ifm sensors with diagnostic functions are used for condition-based maintenance and contribute to cost reduction. Sensors from ifm help increase the reliability and uptime of the installations.

Hydraulic power pack in coke machines



Monitoring of the system pressure with a multi-colour display

Thanks to the multi-colour display of the electronic pressure sensor the user can quickly and easily see whether the hydraulic power pack generates the required pressure.

Pressure sensors

Type	Process connection	Display	Measuring range [bar]	Poverload max. [bar]	Pbursting min. [bar]	U _b DC [V]	Order no.
	G 1/4 female	Display unit	0...25	150	350	18...30	PN7093



Monitoring of power packs

LK and TR series sensors detect the level and the temperature in hydraulic power packs.

LK level sensors

Type	Probe length [mm]	Active zone [mm]	Inactive zone [mm]	U _b [V]	Medium temperature water [°C]	Medium temperature oil [°C]	I _{load} [mA]	Order no.
	472	390	53 / 30	18...30	0...35 (LK1023 + E43101: 0...60)	0...70	200	LK1023

Evaluation units for temperature sensors

Type	Measuring range [°C]	Process connection	Display	U _b [V]	Current consumption [mA]	I _{load} [mA]	Order no.
	-40...300	G 1/2 male	Display unit	18...32	50	250	TR7432

Oil cooler in a coke machine



Fan monitoring on oil coolers

The oil is cooled to a defined value. The VKV vibration monitor to DIN ISO 10816 detects any damage to the rotating parts in the fan system.

Vibration sensor for bearing monitoring

Type	Description	Order no.
	Vibration monitor · Connection via M12 connector · Vibration monitor to DIN ISO 10816 · Measuring range RMS: 0...25 mm/s · Switching output NC DC PNP and analogue output 4...20 mA · Housing materials: PBT / PC / FPM / stainless steel 316L / 1.4404	VKV021

Degassing dampers of the coke oven batteries



Position detection of a degassing damper

During the coking process when coke is produced from bituminous coal the degassing damper is always in a defined condition. Magnetic sensors are used for damper monitoring.

Magnetic sensors to determine the position on cylinders

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M18 / L = 60	70	High-grade st. steel	10...30	IP 65 / IP 67	5000	200	MGS204

Gas supply in a sintering plant



Gas supply in the sintering process

The sinter material is heated during the sintering process and sucked onto a grate using negative pressure. To ensure a steady feed of the tanks the gas pressure is monitored using electronic pressure sensors.

Pressure sensors for gas monitoring

Type	Process connection	Display	Measuring range [bar]	Poverload max. [bar]	Pbursting min. [bar]	U _b DC [V]	Order no.
	G 1/4 female	Display unit	-1...10	75	150	18...32	PN2024

Decentralised monitoring of conveyors



Protection of conveyor belts

The safety relay detects via sensors whether the conveyor belt is centred and no e-stop function was triggered.

Evaluation relay for safety technology

Type	U _b [V]	In- puts	Input function	Setting range [puls. / min.]	Setting range [Hz]	Out- puts analogue	Out- puts relays	Out- puts transist.	Order no.
	24 DC	1	PNP	–	0.2 / 0.5 / 1.0 / 2.0	–	2	1	DA101S
	24 DC	1	PNP	–	0.2 / 0.5 / 1.0 / 2.0	–	2	1	DA102S

Safety switches in AS-i Safety at Work



Integration of safety switches into AS-i Safety at Work by means of PCBs

Thanks to safe AS-i PCBs conventional rope switches can be integrated into AS-i Safety networks. Thus, the functionality of the switches combines with the easy installation of AS-i.

AS-i safety PCB

Type	Inputs / outputs	Description	Order no.
	2 safe inputs / 1 unsafe LED output	AS-i safety PCB · Complies with the requirements: IEC 61508: SIL 3	E70155

Integration of mechanical switches into AS-i systems



Integration of belt drift switches into AS-i networks using PCBs

Thanks to AS-i PCBs belt drift switches on conveyor belts can be integrated into AS-i networks. Thus, the functionality of the switches combines with the easy installation of AS-i.

AS-i PCB

Type	Inputs / outputs	Description	Order no.
	4 inputs / 4 outputs	Active AS-i module · AS-i slave with extended addressing mode · Only for operation with AS-i masters with the profile M4 · 12 x 0.2 m · housing: PC potted	AC2750

Pump monitoring at a blast furnace



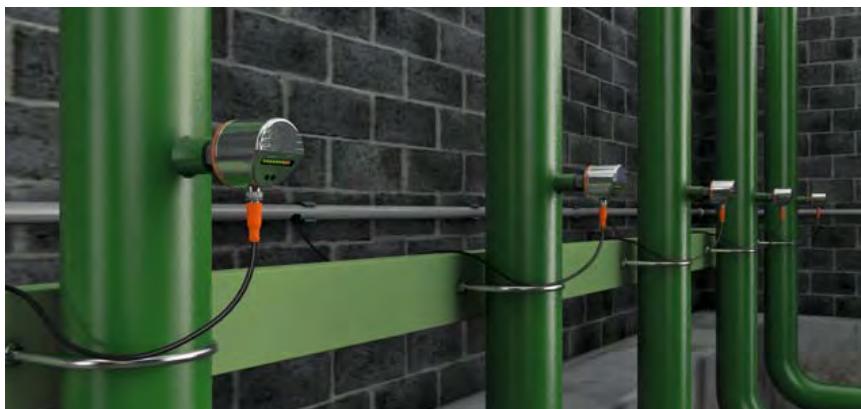
Pump protection on heavy duty pumps

With regulated heavy duty pumps cavitation may occur if the pump duty is too high. Special pressure sensors detect the cavitation and down-regulate the pump duty.

Pressure sensors for monitoring the pump motor

Type	Process connection	Display	Measuring range [bar]	Poverload max. [bar]	Pbursting min. [bar]	Ub DC [V]	Order no.
	Aseptoflex	Display unit	-1...25	100	350	18...32	PIM093

Monitoring the cooling circuits at a blast furnace



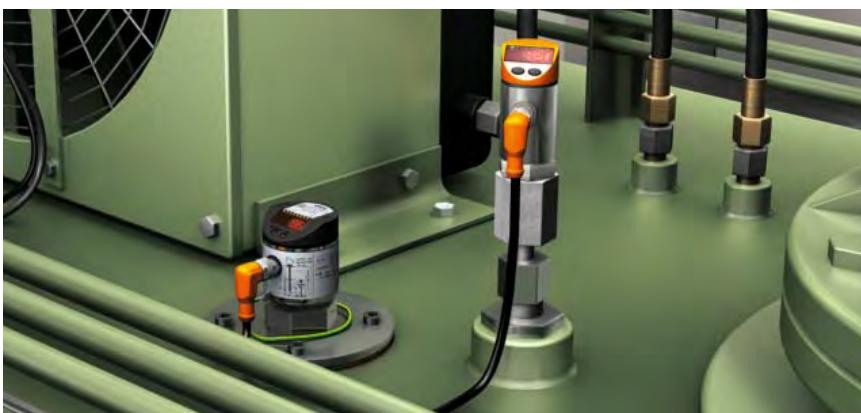
Safe operation in blast furnaces

Blast furnaces have several cooling circuits. In order to ensure a reliable operation of the blast furnaces these cooling circuits are monitored using electronic flow sensors.

Flow sensors for monitoring cooling circuits

Type	Setting range liquids / gases [cm/s]	Material sensor tip	Medium temperature [°C]	Pressure rating [bar]	Response time [s]	Ub DC [V]	Order no.
	3...300 / 200...3000	stainless steel 316L / 1.4404	-25...80	30	1...10	19...36	SI5000

Hydraulic power packs in secondary metallurgy



Hydraulic power packs in steelworks

LK and TR series sensors detect the level and the temperature in hydraulic power packs.

LK level sensors

Type	Probe length [mm]	Active zone [mm]	Inactive zone [mm]	U _b [V]	Medium temperature water [°C]	Medium temperature oil [°C]	I _{load} [mA]	Order no.
	472	390	53 / 30	18...30	0...35 (LK1023 + E43101: 0...60)	0...70	200	LK1023

Evaluation units for temperature sensors

Type	Measuring range [°C]	Process connection	Display	U _b [V]	Current consumption [mA]	I _{load} [mA]	Order no.
	-40...300	G 1/2 male	Display unit	18...32	50	250	TR7432

Hatch monitoring at silos



Hatch control in steel production

In secondary metallurgy metals such as nickel, cobalt or molybdenum are added to the primary steel. This material comes onto the conveyor belts through hatches. Inductive sensors monitor these hatches.

Inductive sensors for position control

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M18 / L = 46	8 f	Brass	10...30	IP 67	300	100	IGS200

f = flush / nf = non flush

Product selectors and further information can be found at: www.ifm.com

Level monitoring at silos



Level detection at a silo

Capacitive sensors on the silos detect whether sufficient material is available for the metallurgical processes.

Capacitive sensors for level detection

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M18 / L = 110	8 nf	PBT	10...36	IP 65	50	250	KG5041

f = flush / nf = non flush

Slide monitoring at silos



Pneumatic slides

The silos can be completely closed using pneumatically actuated slides. The slides are monitored using magnetic sensors from ifm.

Cylinder sensors for monitoring hydraulic and pneumatic cylinders

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	25 x 5 x 6.5	f	PA (polyamide)	10...30	IP 65 / IP 67	10000	100	MK5101

f = flush / nf = non flush

Slag detection at a shroud tube manipulator



Vibration analysis at a shroud tube manipulator

Only molten steel is allowed to flow through the shroud tube into the ladle. Thanks to vibration analysis at the shroud tube manipulator it can be detected whether slag has already flown into the tube of the manipulator.

Vibration monitoring systems

Type	Description	Order no.
	Accelerometer · for connection to external diagnostic electronics type VSE · Connector · housing: stainless steel 316L / 1.4404	VSA101

Central compressed air supply



Pressure monitoring at a pressure accumulator

In the central compressed air monitoring system compressed air is temporarily stored in a tank. Electronic pressure sensors monitor the pressure which can be read out easily thanks to the analogue display.

Pressure sensors for monitoring the system pressure

Type	Process connection	Display	Measuring range [bar]	P _{overload} max. [bar]	P _{bursting} min. [bar]	U _b DC [V]	Order no.
	G 1/2	Display unit	-1...25	100	300	18...32	PG2453

Energy efficiency with compressed air



Detection of compressed air in main supply lines

Here, compressed air meters from ifm detect consumption in the pressure systems. Leakage can also be detected.

Compressed air meters for consumption measurement and leakage detection

Type	Process connection	Setting range [Nm ³ /h]	Pressure rating [bar]	Response time [s]	U _b [V]	Order no.
	R2 (DN50)	5...700	16	< 0.1	18...30	SD2000
	R1½ (DN40)	3.5...410.0	16	< 0.1	18...30	SD9000

Monitoring at an air dryer



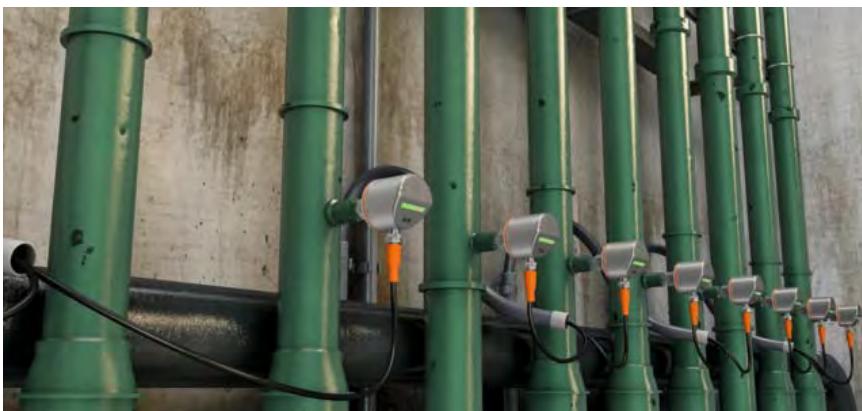
Dry compressed air for pneumatic consumers

Humidity in compressed air can damage pneumatic consumers in the long run. Therefore compressed air is dried after it has been generated. ifm's humidity sensor is used to monitor the relative humidity of compressed air.

Oil humidity sensor

Type	Process connection	Pressure rating [bar]	Protection	Medium temperature oil [°C]	Ambient temperature [°C]	Order no.
	G ¾	10	IP 67	-20...100	-20...85	LDH100

Flow rate in cooling circuits at an electric arc furnace



Monitoring of cooling circuits for flow rate at an electric arc furnace

Electric furnaces have cooling circuits in the outer walls and in the lid. In order to ensure a reliable operation of the blast furnaces these cooling circuits are monitored using electronic flow sensors.

Flow sensors for monitoring cooling circuits

Type	Setting range liquids / gases [cm/s]	Material sensor tip	Medium temperature [°C]	Pressure rating [bar]	Response time [s]	U_b [V]	Order no.
	3...300 / 200...3000	stainless steel 316L / 1.4404	-25...80	30	1...10	19...36	SI5000

Temperature in cooling circuits at an electric arc furnace



Monitoring of cooling circuits for temperature at an electric arc furnace

To ensure cooling of the electric furnace the temperature of the water is monitored in the various cooling circuits.

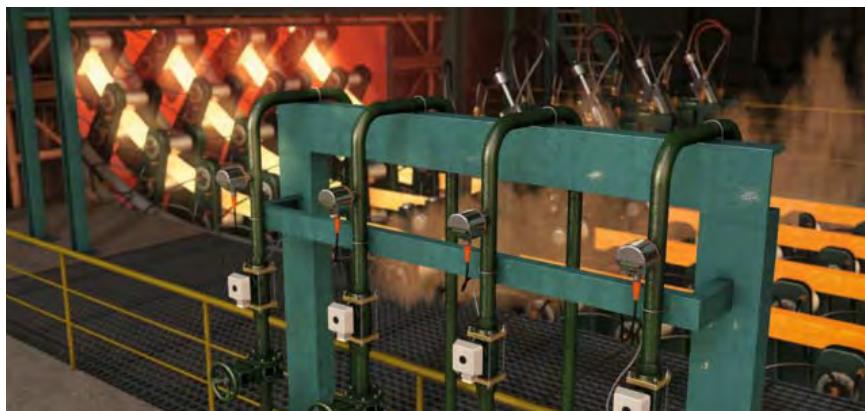
Evaluation units for temperature sensors

Type	Measuring range [°C]	Process connection	Display	U_b [V]	Current consumption [mA]	I_{load} [mA]	Order no.
	-40...300	G ½ male	Display unit	18...32	50	250	TR2432

Evaluation units for temperature sensors

Type	Measuring range [°C]	Diameter [mm]	Installation length [mm]	Sensor element	Dynamic response T05 / T09 [s]	Order no.
	-40...150	10	160	1 x Pt 1000	1 / 3	TT1050

Cooling in continuous casting plants



Spray cooling in continuous casting plants

After the steel has been poured into the mould in the continuous casting plant it must be cooled. This is done by means of an air / water mixture. Flow sensors monitor the supplied quantity of water.

Flow sensors

Type	Setting range liquids / gases [cm/s]	Material sensor tip	Medium temperature [°C]	Pressure rating [bar]	Response time [s]	U _b [V]	Order no.
	3...300 / 200...3000	3...100 / 200...800	-25...80	300	1...2 / 1...10	18...36	SI5010

Positioning at a flame cutter



High-temperature applications up to 180 °C

At the end of the process the slabs or billets cast in the continuous casting plant are cut to the requested length using a flame cutter. Positioning is monitored using inductive sensors.

Inductive sensors for position feedback

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M18 / L = 70	5 f	stainless steel	10...35	IP 65	400	150	IG6614

f = flush / nf = non flush

Gas pressure monitoring in flame cutters



Industrial gas monitoring

At the end of the continuous casting plant the flame cutters are supplied with natural gas and oxygen. To ensure process reliability of the installation the supply of the industrial gases is monitored using electronic pressure sensors.

Pressure sensors for gas monitoring

Type	Process connection	Display	Measuring range [bar]	Poverload max. [bar]	Pbursting min. [bar]	U _b DC [V]	Order no.
	G 1/4 female	Switching status	0...10	50	150	18...30	PN7024

Gas supply in flame cutters



Monitoring of valve actuators

The supply of the flame cutters with industrial gases can be interrupted by means of valve actuators. This is, for example, necessary during maintenance. These actuators are monitored using inductive dual sensors.

Inductive dual sensors for position feedback on pneumatic valve actuators

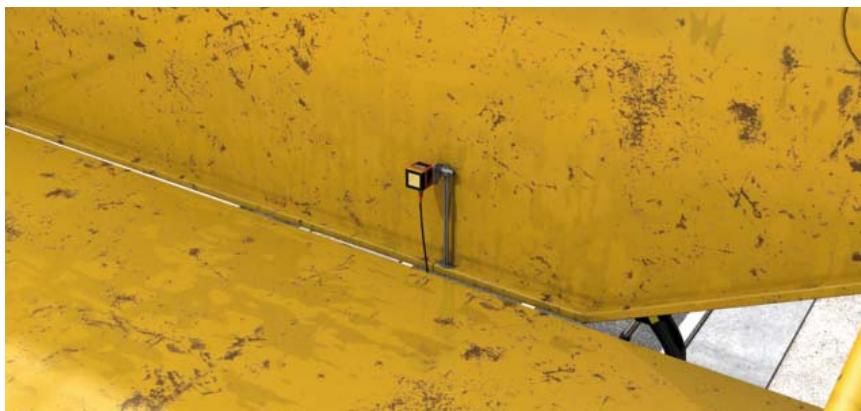
Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f AC / DC [Hz]	I _{load} AC / DC [mA]	Order no.
	40 x 26 x 26	4 nf	PBT	10...36	IP 67	1300	250	IN5225

f = flush / nf = non flush

Accessories

Type	Description	Order no.
	Target puck · Ø 102 mm · Housing materials: Target puck: PA 6 / screws: V2A	E17328

Collision avoidance in crane installations



Several cranes on a crane bridge

Two or more cranes on a crane bridge pose the risk of collision. A laser distance sensor is used to measure the distance between the cranes. If the distance is too short, the crane travel is stopped.

PMDLine photoelectric sensors with time of flight measurement

Type	Operating principle	Range	Sampling rate [Hz]	Spot Ø at max. range [mm]	U_b	Order no.
	Photoelectric distance sensor	1...100 m	1...25	< 200 x 200	18...30	O1D209

Accessories

Type	Description	Order no.
	Prismatic reflector · 226 x 262 mm · rectangular · Housing materials: plastics	E21159

Reliable area monitoring at crane installations



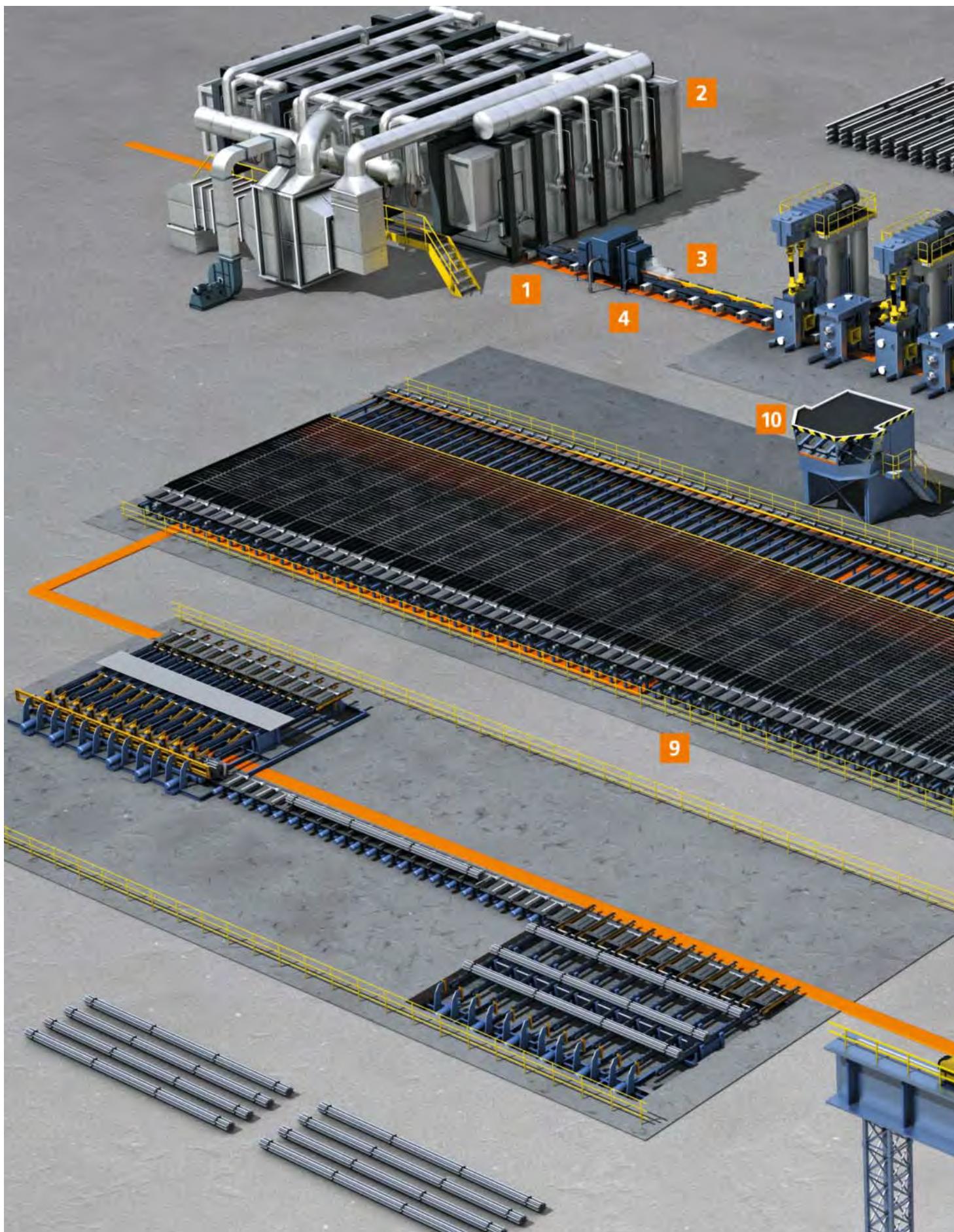
Limitation of the trolley travel on crane installations

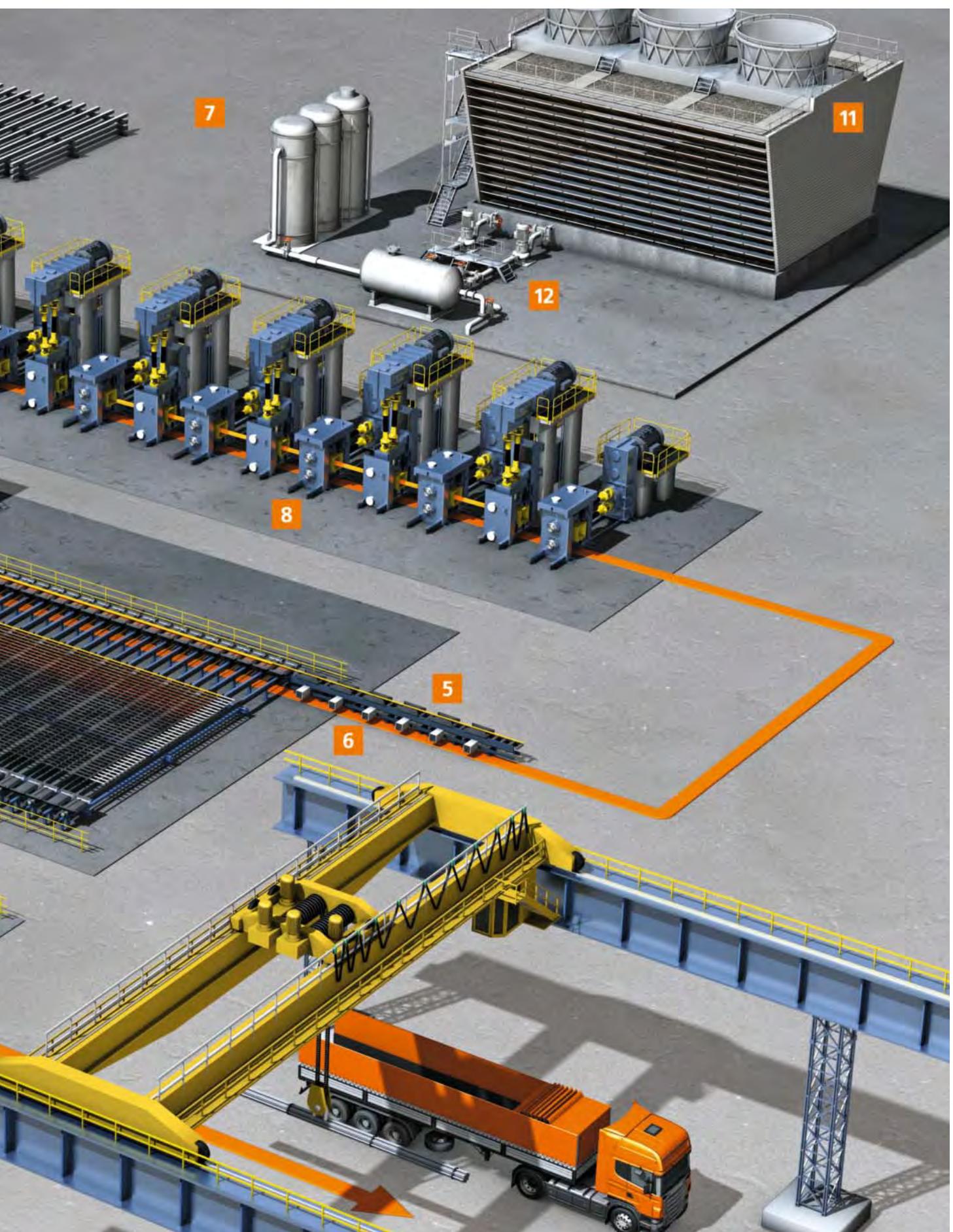
By means of a fail-safe inductive sensor and a metal rail the trolley travel of cranes can be limited.

Fail-safe inductive sensors

Type	Length [mm]	Enable zone [mm]	Housing material	U_b DC [V]	Protection	Response time in case of a safety request / enable time [ms]	Order no.
	66	10...15 nf	PPE	24	IP 65 / IP 67	≤ 50 / ≤ 200	GM7015

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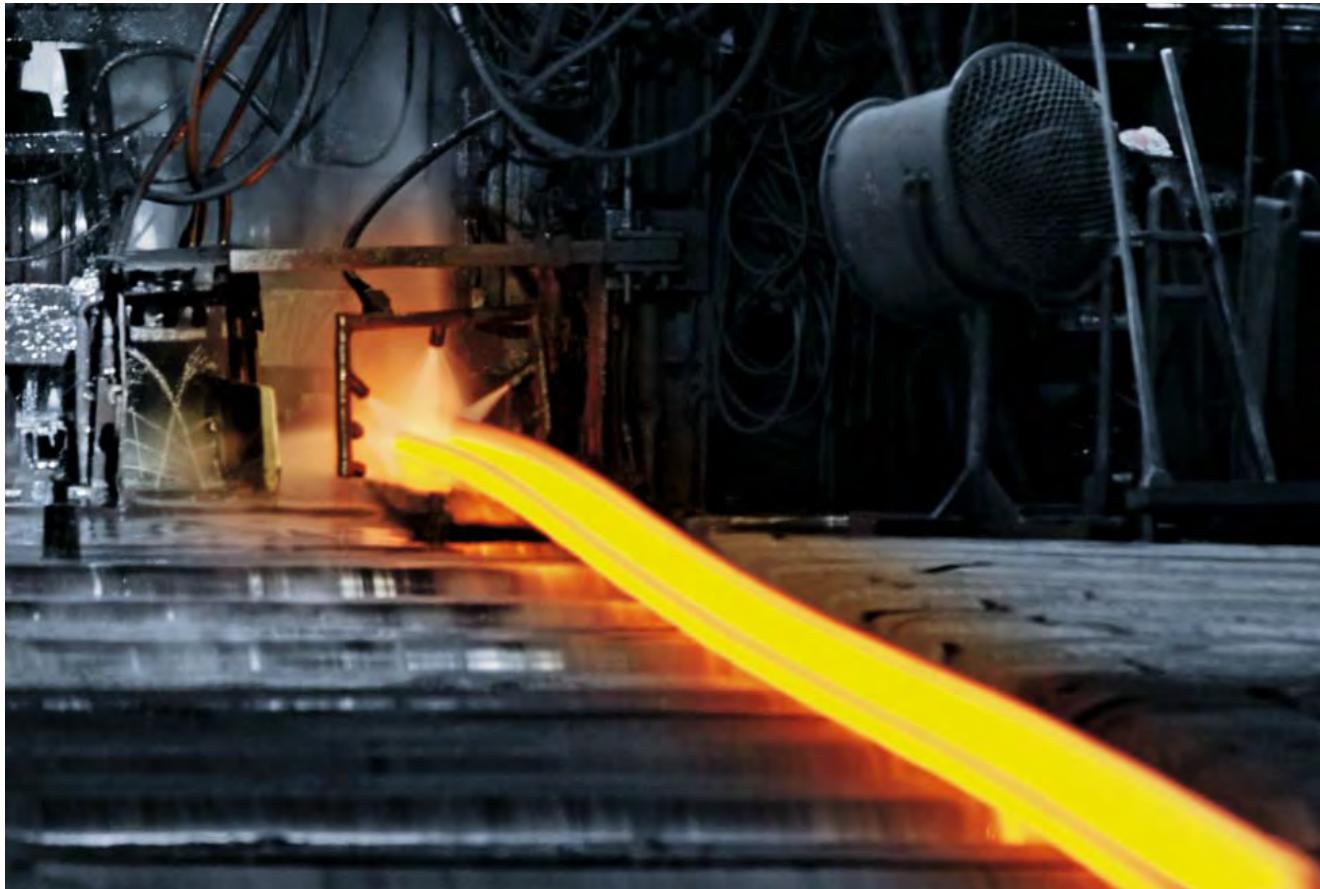




Machine	Application	Product group
1	Positioning on the heating furnace	
	Monitoring the material at the inlet side of the furnace Monitoring the material at the outlet side of the furnace Position detection of a furnace door	Laser sensors / distance measurement sensors Temperature sensors Inductive sensors
2	Cooling circuits on furnaces	
	Flow monitoring Temperature monitoring Pressure monitoring Connection of sensors	Flow sensors / flow meters Temperature sensors Pressure sensors Sockets
3	High-pressure pump in descaling lines	
	Pressure monitoring Position detection of shut-off valves Temperature monitoring Bearing monitoring	Pressure sensors Inductive sensors Temperature sensors Vibration monitoring systems
4	Tracking of material in descaling lines	
	Position detection of nozzles Monitoring of material Position detection on doors Level monitoring	Laser sensors / distance measurement sensors Temperature sensors Inductive sensors Level sensors
5	Decentralised monitoring in large installations	
	Voltage supply in the field Speed measurement Vibration monitoring Pulse generator	Power supplies Pulse evaluation systems Vibration monitoring systems Inductive sensors
6	Speed monitoring at conveyors	
	Rotational speed monitoring Rotational speed monitoring Connection of sensors	Pulse evaluation systems Encoders Sockets

Machine	Application	Product group
7 Compressed air supply		
	Pressure monitoring Measurement of compressed air consumption Monitoring of remaining humidity Pressure indication in the installation	Pressure sensors Flow sensors / flow meters Systems for oil quality monitoring Pressure sensors
8 Drive monitoring on the rollers		
	Temperature monitoring Condition monitoring of drives Rotational speed monitoring	Temperature sensors Vibration monitoring systems Pulse evaluation systems
9 Cooling bed		
	Tracking of material Monitoring of material Protection of sensors Condition monitoring of drives	Inductive sensors Laser sensors / distance measurement sensors Sockets Vibration monitoring systems
10 Hydraulic aggregates		
	Pressure monitoring Temperature monitoring Level monitoring Oil condition monitoring	Pressure sensors Temperature sensors Level sensors Systems for oil quality monitoring
11 Fans in cooling towers		
	Vibration monitoring Temperature monitoring Rotational speed monitoring	Vibration monitoring systems Temperature sensors Pulse evaluation systems
12 Cooling towers		
	Pressure monitoring Flow monitoring Level monitoring Vibration monitoring	Pressure sensors Flow sensors / flow meters Level sensors Vibration monitoring systems

ifm sensors carry out their tasks even in tough environments



In a hot rolling mill slabs, blooms or billets produced in steelworks are processed further. To do so, they are heated up to a temperature above the recrystallisation temperature.

Depending on the starting material, long steel products (such as wires, rails or beams) or wide flat steel products (e.g. sheet metal) are made in hot rolling mills. These semi-finished products are then processed further in subsequent processes.

As a result of the high temperatures and harsh environmental conditions the sensors used must meet higher demands than in other industries. Robust sensors with extended temperature range from ifm reliably detect the relevant parameters even in these harsher conditions.

Here, ifm sensors help to ensure high plant uptime in the event of extreme environmental influences.

Monitoring the material at the inlet side of the furnace



Detecting the position of the billets at the inlet side of the furnace

The door at the inlet side of the furnace is closed when the billet is completely inside the furnace. The position of the billet is detected using a laser distance measurement sensor.

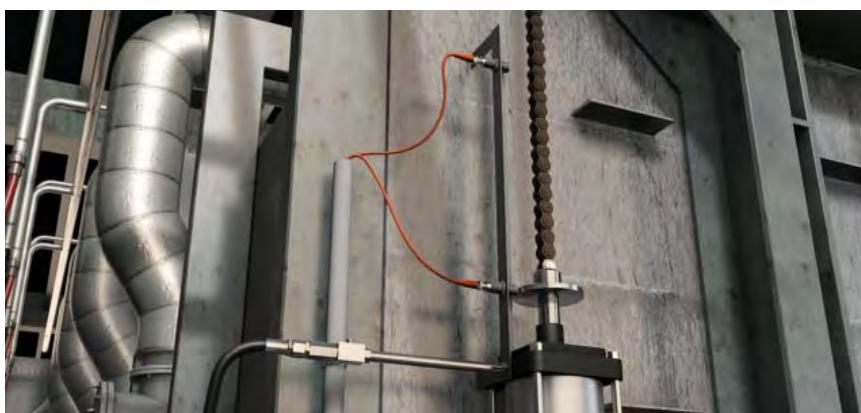
PMDLine photoelectric sensors with time of flight measurement

Type	Operating principle	Range	Sampling rate [Hz]	Spot Ø at max. range [mm]	U_b	Order no.
	Photoelectric distance sensor	0.2...10 m	1...50	< 15 x 15	18...30	O1D100

Protective housing for distance measurement sensors

Type	Description	Order no.
	Cooling box · Protective housing with an active cooling system for the O1D design · for type O1D · Housing materials: housing: aluminium transparent anodised / cover: aluminium black anodised / bezel: aluminium black anodised / window: float glass / cable gland: Brass nickel-plated / nozzle: Brass nickel-plated / sealing: FPM	E21248

Monitoring of the furnace door



Monitoring the door at the outlet side of the furnace

Via a cylinder the door is moved at the outlet side of the furnace. This happens indirectly via a chain. The position of the door is monitored using high-temperature inductive sensors.

Inductive sensors for determining position

Type	Dimensions [mm]	Sensing range [mm]	Material	U_b [V]	Protection	f [Hz]	I_{load} [mA]	Order no.
	M18 / L = 70	5 f	stainless steel	10...35	IP 65	400	150	IG6614

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Monitoring the material at the outlet side of the furnace



Detecting hot billets at the outlet side of the furnace

After a hot billet has moved out of the furnace the door must be closed again. An infrared sensor detects that the billet is no longer in the door area.

Infrared temperature sensors for the detection of material

Type	Temperature range [°C]	Wave length range [μm]	Material lens	Response time [ms]	Order no.
	250...1250	1.0...1.7	tempered optical glass	≤ 2	TW7001

Measurement of the cooling water volume



Monitoring of the cooling circuits

Cooling circuits must be operated with a defined quantity of water. This is monitored using flow sensors. They ensure that the quantity is not too small.

Flow sensors for monitoring cooling circuits

Type	Setting range liquids / gases [cm/s]	Material sensor tip	Medium temperature [°C]	Pressure rating [bar]	Response time [s]	U _b [V]	Order no.
	8...600	stainless steel 316L / 1.4404	-10...70	16	< 0.35	18...32	SM2000

Connectors

Type	Description	Order no.
	Socket · straight · Free from silicone · Free from halogen · Gold-plated contacts · For welding applications · M12 connector · 5 m · Housing materials: housing: TPU orange / sealing: FKM	EVW002

Pressure monitoring of the lubrication



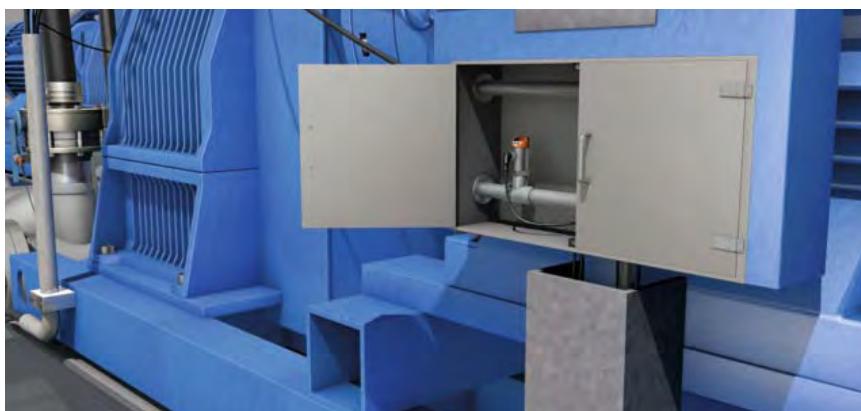
Pressure monitoring at the lubrication of the high-pressure pumps

The high-pressure pumps of the descaling lines are continuously lubricated by means of a separate oil circuit. The pressure in this circuit is continuously monitored.

Pressure monitoring in descaling lines

Type	Process connection	Display	Measuring range [bar]	Poverload max. [bar]	Pbursting min. [bar]	U _b DC [V]	Order no.
	G 1/4 female	Display unit	0...25	150	350	18...30	PN7093

Temperature monitoring of the lubrication



Temperature monitoring at the lubrication of the high-pressure pumps

The lubricity of oils depends on the oil temperature. The temperature of the oil circuit is monitored using temperature sensors (TS) and displayed by the temperature monitor (TR).

Temperature monitoring in descaling lines

Type	Measuring range [°C]	Diameter [mm]	Cable material	Sensor element	Dynamic response T05 / T09 [s]	Order no.
	-40...90	Ø 10	PUR cable	1 x Pt 100	6 / 25	TS5089

Evaluation units for temperature sensors

Type	Measuring range [°C]	Process connection	Display	U _b [V]	Current consumption [mA]	I _{load} [mA]	Order no.
	-40...300	G 1/2 male	Display unit	18...32	50	250	TR2432

Monitoring of shut-off valves



Effective pump protection

The shut-off valves in the intake of the high-pressure pumps of the descaling line are manually operated. An inductive sensor detects the valve position and prevents unintentional switch-on of the high-pressure pump in the event of a closed intake.

Inductive sensors for determining position

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M30 / L = 60	22 nf	Brass	10...30	IP 65 / IP 66 / IP 67 / IP 68 / IP 69K	100	100	IIS227

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Detection of material at the descaling line



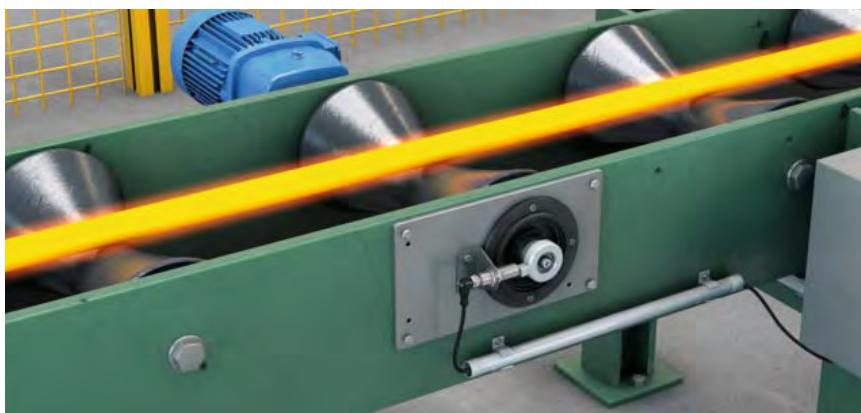
Control of the water jet in the descaling line

An infrared temperature sensor is used to detect the hot billet before the descaling line. The water supply to the nozzles is opened via a switching signal.

Infrared temperature sensors for the detection of material

Type	Temperature range [°C]	Wave length range [μm]	Material lens	Response time [ms]	Order no.
	250...1250	1.0...1.7	tempered optical glass	≤ 2	TW7001

Speed monitoring at conveyors



Transport of rolled bars or rods

The compact speed monitor detects pulses on the drive shaft of the roller conveyor. The monitor is an inductive sensor with integrated speed evaluation.

Compact speed monitor for pulse detection

Type	Dimensions [mm]	Sensing range [mm]	Electrical design	U _b [V]	Setting range [puls. / min.]	Start-up delay [s]	Order no.
	M30 / L = 82	10 f	DC PNP	10...36 DC	5...300	15	DI5009

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Decentralised speed monitoring



Detecting speed, standstill and acceptable range

The speed monitor evaluates the signals from one or several inductive sensors. It has one switch point for monitoring underspeed / overspeed and one for monitoring the acceptable range.

Speed monitor for pulse evaluation

Type	U _b [V]	In- puts	Input function	Setting range [puls. / min.]	Setting range [Hz]	Out- puts analogue	Out- puts relays	Out- puts transist.	Order no.
	110...240 AC (50...60 Hz) / 27 DC (typ. 24 DC)	2	PNP / NPN / Namur	1...60000	0.1...1000	-	2	2	DD2505

Pulse pick-ups for speed monitoring



Control of the roller conveyor

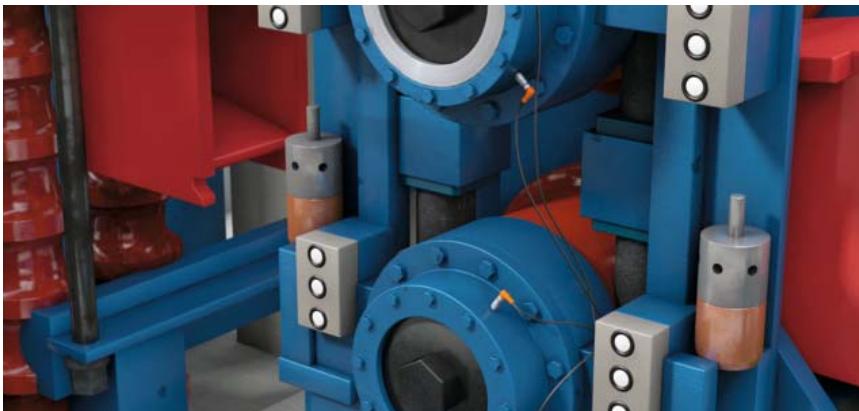
The speed of all drives of the roller conveyor is synchronised and controlled. An inductive sensor detects the switching cam mounted on the shaft, generating the pulses for a downstream speed monitoring.

Inductive sensor as pulse pick-up

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M18 / L = 60	8 f	Brass	10...30	IP 65 / IP 66 / IP 67 / IP 68 / IP 69K	400	100	IGS232

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Vibration sensors on bearings



Monitoring bearings in the hot rolling area

Vibration sensors monitor the bearings of the roller stands. The sensor measures the rms vibration velocity and transmits the value as current signal to the process control system.

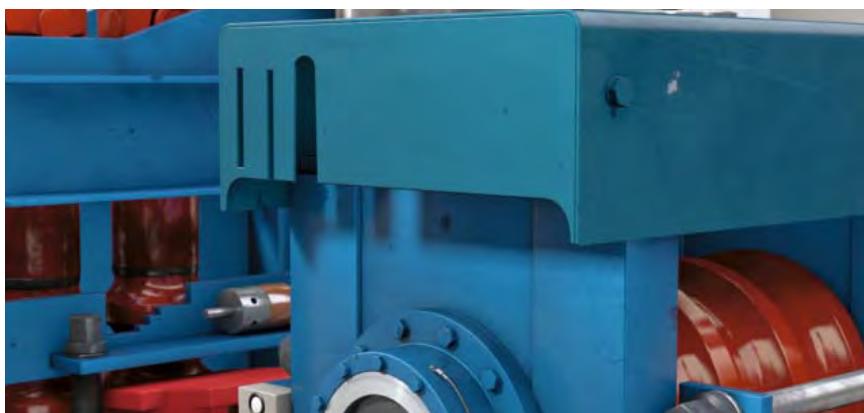
Vibration monitoring systems

Type	Description	Order no.
	Accelerometer · for connection to external diagnostic electronics type VSE · Connector · housing: stainless steel 316L / 1.4404	VSA001

Connectors

Type	Description	Order no.
	Jumper · straight / straight · Free from silicone · Free from halogen · Gold-plated contacts · For welding applications · 1 m · Housing materials: housing: TPU orange / sealing: FKM	EVW024

Temperature monitoring of bearings



Temperature measurement of bearings

Besides vibration, the housing temperature of a bearing in the hot rolling area is indicative of the machine condition. A bolt-on sensor (TS) detects the temperature which is processed and displayed in the evaluation unit (TR).

Temperature sensors

Type	Measuring range [°C]	Diameter [mm]	Cable material	Sensor element	Dynamic response T05 / T09 [s]	Order no.
	-25...90	12 x 8.7 x 51	PUR cable	1 x Pt 100	9 / 15	TS2229

Evaluation units for temperature sensors

Type	Measuring range [°C]	Process connection	Display	U _b [V]	Current consumption [mA]	I _{load} [mA]	Order no.
	-40...300	G ½ male	Display unit	18...32	50	250	TR7432

Monitoring the remaining humidity in compressed air



Monitoring the compressed air drying

After compression in the compressor the compressed air cools down. The steam condensed in this process is removed using a downstream dryer. The humidity sensor measures the relative humidity and temperature of the compressed air and provides these as analogue values.

Oil humidity sensor

Type	Process connection	Pressure rating [bar]	Protection	Medium temperature oil [°C]	Ambient temperature [°C]	Order no.
	G ¾	10	IP 67	-20...100	-20...85	LDH100

Compressed air measurement at the compressed air distribution



Detection of compressed air in main supply lines

Here, compressed air meters detect the volume flow both in the normal pressure (6 bar) and high-pressure system (12 bar). So both consumption and leakage are detected.

Compressed air meters for consumption measurement and leakage detection

Type	Process connection	Setting range [Nm ³ /h]	Pressure rating [bar]	Response time [s]	U _b [V]	Order no.
	R2 (DN50)	5...700	16	< 0.1	18...30	SD2000

Pneumatics



Monitoring the maintenance unit

Here, pressure sensors with the easy-turn operating concept monitor the correct operating pressure in the compressed air supply. The innovative SD compressed air meter determines consumption.

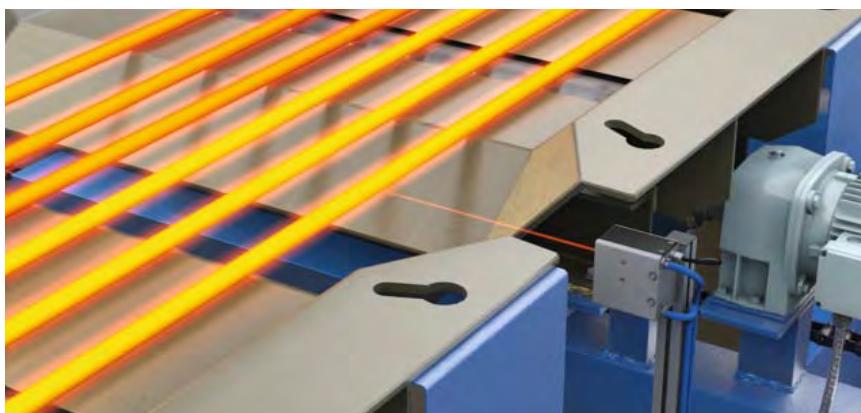
Pressure sensors

Type	Process connection	Display	Measuring range [bar]	P _{overload} max. [bar]	P _{bursting} min. [bar]	U _b DC [V]	Order no.
	G _{1/4} male / M5 female	Operation	0...10	25	300	9.6...32	PK6524

Compressed air meter for the measurement of compressed air consumption

Type	Process connection	Setting range [Nm ³ /h]	Pressure rating [bar]	Response time [s]	U _b [V]	Order no.
	R _{1/2} (DN15)	0.6...75.0	16	< 0.1	18...30	SD6000

Protection of sensors



Protection at a high ambient temperature

At ambient temperatures up to 180 °C the electronics of the laser distance measurement sensors is protected from overheating using a cooling box. In addition, it ensures a reliable mechanical protection for photoelectric sensors.

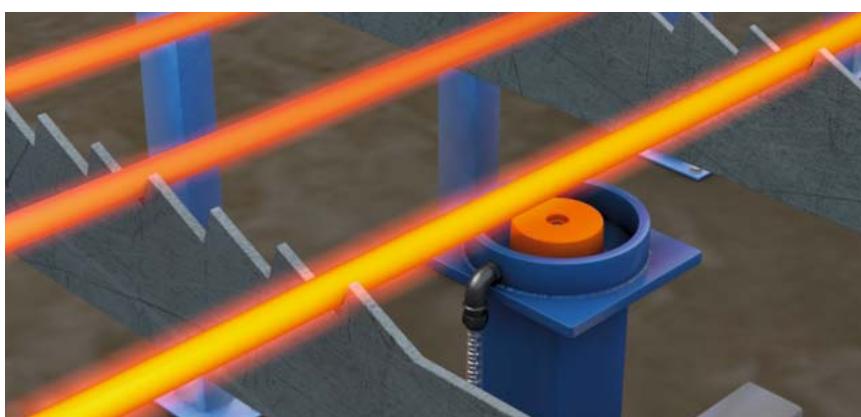
Protective housing for distance measurement sensors

Type	Description	Order no.
	Cooling box · Protective housing with an active cooling system for the O1D design · for type O1D · Housing materials: housing: aluminium transparent anodised / cover: aluminium black anodised / bezel: aluminium black anodised / window: float glass / cable gland: Brass nickel-plated / nozzle: Brass nickel-plated / sealing: FPM	E21248

PMDLine photoelectric sensors with time of flight measurement

Type	Operating principle	Range	Sampling rate [Hz]	Spot Ø at max. range [mm]	U _b [V]	Order no.
	Photoelectric distance sensor	0.2...10 m	1...50	< 15 x 15	18...30	O1D100

Tracking of material in the cooling bed



Long distance to hot steel

In cooling beds inductive sensors, among others, are used to detect the produced material. The sensors have sensing ranges up to 120 mm to ensure a long distance to the material.

Inductive sensors with long sensing ranges

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	Ø 100	70 nf	PBT	10...36	IP 65	5	250	I17001

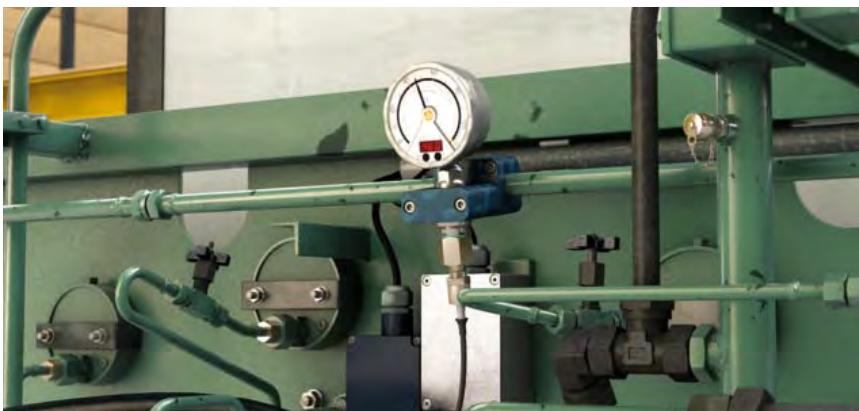
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Vibration monitoring at the cooling bed**Avoiding machine damage**

Vibration monitors monitor the drives of the roller conveyor. The sensor measures the rms vibration velocity and transmits the value as current signal to the process control system.

Vibration sensors for bearing monitoring in drives

Type	Description	Order no.
	Vibration monitor · Connection via M12 connector · Vibration monitor to DIN ISO 10816 · Measuring range RMS: 0...25 mm/s · Switching output NC DC PNP and analogue output 4...20 mA · Housing materials: PBT / PC / FPM / stainless steel 316L / 1.4404	VKV021

Pressure monitoring in hydraulic power packs**Electronic contact manometer in hydraulics**

The system pressure at the hydraulic power pack must be monitored continuously. The electronic contact manometer combines an easy-to-read analogue display with the advantages of an electronic pressure sensor.

Pressure sensors for monitoring the system pressure

Type	Process connection	Display	Measuring range [bar]	P _{overload} max. [bar]	P _{bursting} min. [bar]	U _b DC [V]	Order no.
	G 1/2	Display unit	-1...25	100	300	18...32	PG2453

Oil temperature at the gear of the fan



Differential temperature measurement

The difference between the start and end temperature of the oil is indicative of the gear condition. A defined preset value must not be exceeded. Temperature sensors detect the oil temperatures reliably and precisely.

Temperature sensors

Type	Factory setting [°C / °F]	Process connection	Installation length [mm]	U _b [V]	Dynamic response T05 / T09 [s]	Order no.
	-50...150 / -	G 1/2	30	18...32	1 / 3	TA2405

Vibration sensors at the fan



Monitoring fans for imbalance

Vibration sensors monitor the gear at a fan of the cooling tower. When a limit value to be set is exceeded a switching contact is triggered.

Vibration sensor for bearing monitoring

Type	Description	Order no.
	Vibration monitor · Connection via M12 connector · Vibration monitor to DIN ISO 10816 · Measuring range RMS: 0...25 mm/s · Switching outputs: normally closed and analogue 4...20 mA · Housing materials: PBT / PC / FPM / stainless steel 316L / 1.4404	VKV021

Vibration monitoring at pumps



Condition monitoring at pumps

Vibration sensors detect the vibration generated by pumps. This allows condition-based maintenance. The sensor is specifically used for measured data acquisition for the VSE type diagnostic electronics.

Vibration monitoring systems

Type	Description	Order no.
	Accelerometer · for connection to external diagnostic electronics type VSE · Connector · housing: stainless steel 316L / 1.4404	VSA001

Drive monitoring at pumps



Diagnostic electronics for pump sensors

The diagnostic electronics enables to simultaneously analyse the measured signals of up to four vibration sensors. To do so, up to eight digital and two analogue sensors can be connected, monitoring the complete pump station.

Vibration monitoring systems

Type	Description	Order no.
	Diagnostic electronics for vibration sensors · Integrated history memory with real-time clock · Counter function · TCP/IP Ethernet interface · Active wire break detection and self-test (only MEMS) of the connected acceleration sensors · Parameter setting via PC software VES004 · Combicon connection · PA	VSE100

Monitoring the cooling water at cooling towers



Cooling water supply in the steelworks

To ensure that enough cooling water is available in the production process both flow rate and pressure of the water are detected.

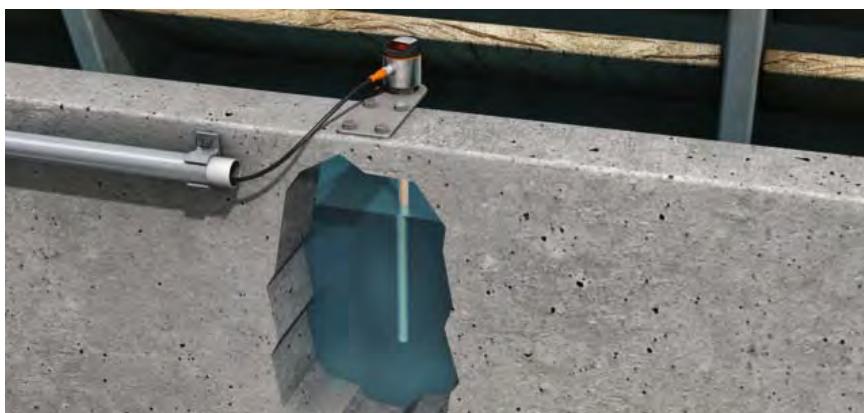
Flow sensors for monitoring cooling circuits

Type	Setting range liquids / gases [cm/s]	Material sensor tip	Medium temperature [°C]	Pressure rating [bar]	Response time [s]	U _b [V]	Order no.
	3...300 / 200...3000	stainless steel 316L / 1.4404	-25...80	30	1...10	19...36	SI5000

Pressure sensors for monitoring the system pressure

Type	Process connection	Display	Measuring range [bar]	P _{overload} max. [bar]	P _{bursting} min. [bar]	U _b DC [V]	Order no.
	G ½	Display unit	-1...10	50	150	18...32	PG2454

Level monitoring in the cooling tower



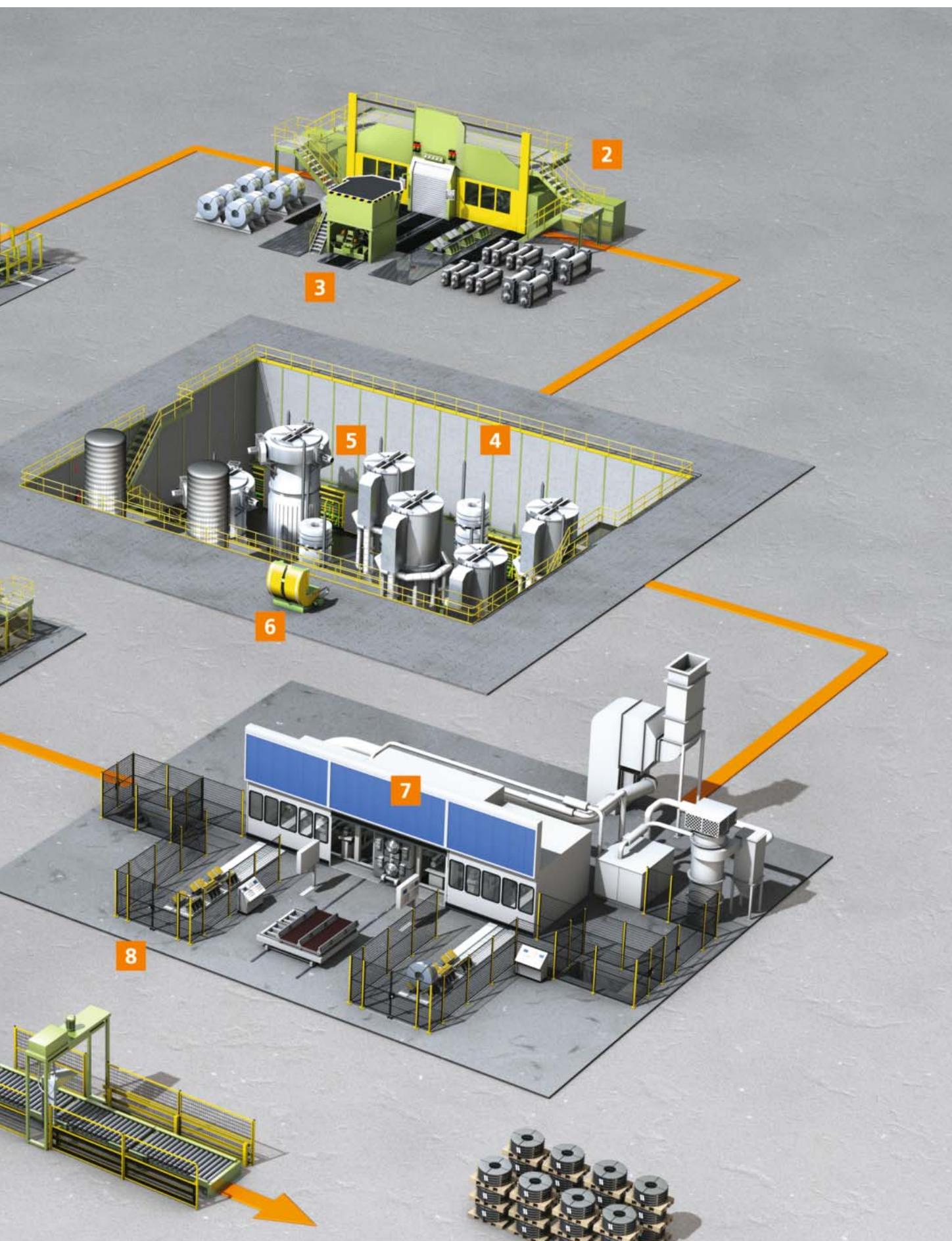
Optimum level in the basin of the cooling tower

Cooling water circuits are supplied with water from the basin of the cooling tower. The heated water is pumped back with fresh water replacing the losses. The optimum level is ensured by a level sensor.

Level sensors

Type	Probe length [mm]	Active zone [mm]	Inactive zone [mm]	U _b [V]	Medium temperature water [°C]	Medium temperature oil [°C]	I _{load} [mA]	Order no.
	728	585	102 / 40	18...30	0...35 (LK3124 + E43102: 0...55)	0...70	200	LK3124

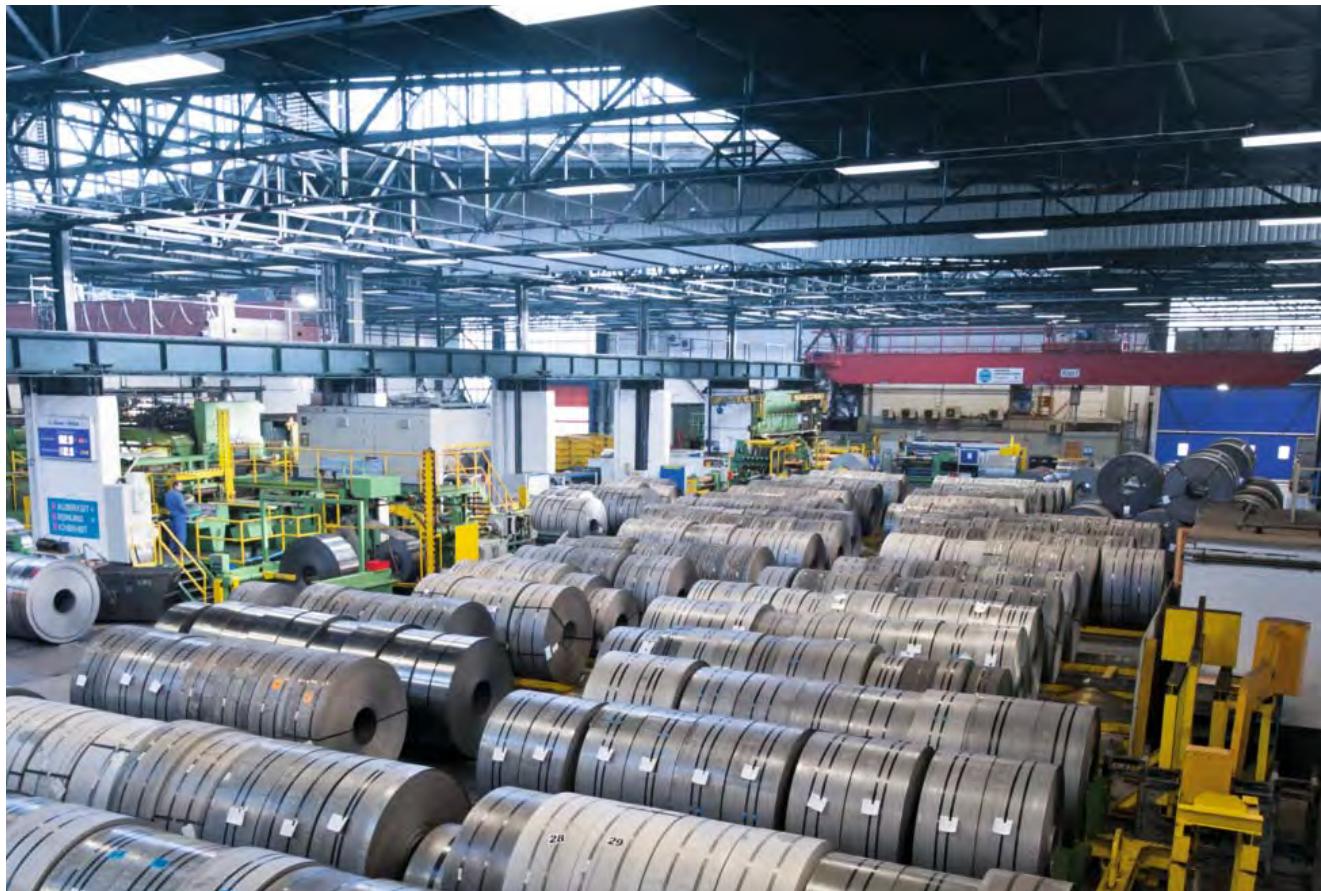




Machine	Application	Product group
1	Suction in the pickling line	
	Speed measurement	Pulse evaluation systems
	Vibration monitoring	Vibration monitoring systems
	Airflow monitoring	Flow sensors / flow meters
2	Roller stand drive	
	Vibration monitoring	Vibration monitoring systems
	Temperature measurement	Temperature sensors
	Voltage supply	Power supplies
	Speed measurement	Pulse evaluation systems
3	Roller replacement cars	
	Hydraulic system pressure detection	Pressure sensors
	Level monitoring in hydraulic power packs	Level sensors
	Temperature measurement in hydraulic power packs	Temperature sensors
	Position detection of replacement cars	Inductive sensors
4	Annealing furnace	
	Pressure monitoring protective gas	Pressure sensors
	Detection of equipment parts	Inductive sensors
	Monitoring of cooling water	Flow sensors / flow meters
	Vibration monitoring	Vibration monitoring systems
5	Annealing furnace supply unit	
	Pressure monitoring protective gas	Pressure sensors
	Monitoring of quarter-turn actuators	Inductive sensors
	Monitoring of cooling water	Flow sensors / flow meters
	Pressure monitoring of natural gas	Pressure sensors
6	Upender	
	End position monitoring	Inductive sensors
	Position detection of fixing bolts	Inductive sensors
	Position detection of coil	Photoelectric sensors for general applications

Machine	Application	Product group
7	Position monitoring in roller stand	
	Position detection of transfer table Detecting the stop Photoelectric detection of unwinding coil Position detection of lifting carriage	Cylinder sensors Inductive sensors Laser sensors / distance measurement sensors Inductive sensors
8	Access control / securing the area	
	Monitoring of high-speed doors Door protection Safety monitoring	Inductive sensors AS-Interface Safety at Work Safety light curtains
9	Slitting line	
	Position detection of shear stand Photoelectric detection of sag Belt centring control Cutting of sheets	Inductive sensors Laser sensors / distance measurement sensors Flow sensors / flow meters Encoders
10	Roller conveyor systems	
	Tracking of material Speed measurement Safety monitoring Position detection of rotary table	Photoelectric sensors for general applications Pulse evaluation systems Safety light curtains Inductive sensors
11	Temporary coil store	
	Occupation of storage location Position check of positioning carriage Hydraulic system pressure detection Temperature measurement	Photoelectric sensors for general applications Inductive sensors Pressure sensors Temperature sensors
12	Packaging machine	
	Centring of coils Detection of material on the electromagnet Tracking of material Safety monitoring	Inductive sensors Inductive sensors Photoelectric sensors for general applications Safety light curtains

Reliable sensors increase plant uptime



In the cold rolling mill sheets are usually supplied as coils and then reduced to the requested thickness by rolling the material. The starting material, usually hot-rolled wide strip, is first descaled and then the cross-section is reduced by the rolling process. When the sheet has achieved its final thickness, it is cut to the requested width and then packed and dispatched. Markets are, among others, the automotive industry / suppliers, pipe manufacturers and the electrical white goods.

The demand on reliability and machine uptime is extremely high in usually very rough environmental conditions (aggressive chemicals in pickling lines, shocks and vibrations in rolling and shearing lines). Reliable and robust sensors from ifm meet these high demands effectively, securing sustained success.

Suction in the pickling line – fan monitoring



Speed detection on fans

The compact DI speed monitor detects pulses on the fan drive shaft.

Compact speed monitor for pulse detection

Type	Dimensions [mm]	Sensing range [mm]	Electrical design	U_b [V]	Setting range [puls. / min.]	Start-up delay [s]	Order no.
	M30 / L = 82	10 f	DC PNP	10...36 DC	5...300	15	DI5009

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Suction in the pickling line – bearing monitoring



Monitoring of shaft bearings

The compact VKV vibration sensor monitors the vibration on the bearing of a drive shaft. Too high a vibration can be detected early, avoiding machine damage.

Vibration sensors for bearing monitoring in drives

Type	Description	Order no.
	Vibration monitor · Connection via M12 connector · Vibration monitor to DIN ISO 10816 · Measuring range RMS: 0...25 mm/s · Switching output NC DC PNP and analogue output 4...20 mA · Housing materials: PBT / PC / FPM / stainless steel 316L / 1.4404	VKV021

Vibration monitoring on the roller drive**Condition monitoring of drives**

VSA series sensors record the vibration levels of the drives, enabling condition-oriented maintenance.

Vibration monitoring systems

Type	Description	Order no.
	Accelerometer · for connection to external diagnostic electronics type VSE · Connector · housing: stainless steel 316L / 1.4404	VSA001

Drive monitoring in a rolling installation**Evaluation of the drive monitoring on the roller drive**

The vibration data provided by the VSA sensors is automatically evaluated in the VSE diagnostic electronics. The current equipment condition can be transferred directly to higher-level systems.

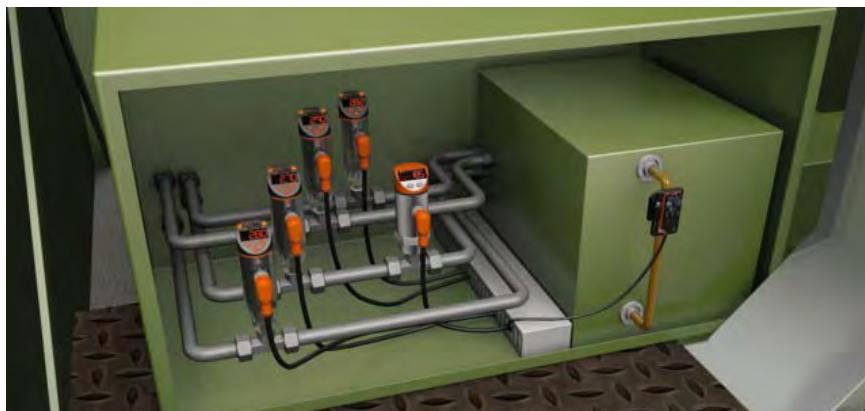
Vibration monitoring systems

Type	Description	Order no.
	Diagnostic electronics for vibration sensors · Integrated history memory with real-time clock · Counter function · TCP/IP Ethernet interface · Active wire break detection and self-test (only MEMS) of the connected acceleration sensors · Parameter setting via PC software VES004 · Combicon connection · PA	VSE100

Speed monitor for drive monitoring

Type	U _b [V]	In- puts	Input function	Setting range [puls. / min.]	Setting range [Hz]	Out- puts analogue	Out- puts relays	Out- puts transist.	Order no.
	110...240 AC (50...60 Hz) / 27 DC (typ. 24 DC)	2	PNP / NPN / Namur	1...60000	0.1...1000	-	2	2	DD2505

Monitoring of a hydraulic power pack in roller replacement cars



Pressure and temperature monitoring in hydraulic power packs

PN and TN type sensors detect the pressure and temperature of the hydraulic oil.

Pressure sensors

Type	Process connection	Display	Measuring range [bar]	P _{overload} max. [bar]	P _{bursting} min. [bar]	U _b DC [V]	Order no.
	G 1/4 male / M5 female	Display unit	0...25	150	350	18...30	PN7593

Temperature sensors

Type	Measuring range [°C / °F]	Process connection	Installation length [mm]	U _b [V]	Dynamic response T05 / T09 [s]	Order no.
	-40...150 / -40...302	M18 x 1.5	45	18...32	1 / 3	TN7531

Filter monitoring in a hydraulic system



Detection of filter blockage

Pressure sensors monitor the status of an oil filter in a hydraulic power pack. If the filter is blocked, a signal is sent to the controller.

Pressure sensors

Type	Process connection	Display	Measuring range [bar]	P _{overload} max. [bar]	P _{bursting} min. [bar]	U _b DC [V]	Order no.
	G 1/4 male	–	0...25	60	600	8.5...36	PT3553

Positioning of the roller replacement car



End position monitoring on the roller replacement car

For an exact positioning of the rails on which the working rollers are pushed into the roller stand the end positions of the tool table are monitored using an inductive sensor.

Inductive sensors for tool table positioning

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	Ø 34 / L = 98	20 nf	PBT	10...36	IP 65	350	250	IB5063

f = flush / nf = non flush

End position monitoring on the upender



Positioning the upender using inductive sensors

For feeding the annealing furnaces the coils are tilted by 90°. This is done using an upender. It is controlled by a coolant-resistant sensor.

Inductive sensors for positioning the upender

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M12 / L = 45	4 f	Brass	10...30	IP 68	700	100	IFC200

f = flush / nf = non flush

Connectors

Type	Description	Order no.
	Socket · angled · Free from silicone · Free from halogen · Gold-plated contacts · For welding applications · M12 connector · 5 m · Housing materials: housing: TPU black transparent / sealing: FKM	EVW008

Monitoring of the cooling water for annealing furnaces



Flow rate measurement during the cooling process of the annealing furnaces

To ensure the operational reliability of annealing furnaces it is necessary to cool certain equipment parts (e.g. the base). The minimum quantity of cooling water is monitored using a flow sensor.

Flow sensors for monitoring cooling circuits

Type	Setting range liquids / gases [cm/s]	Material sensor tip	Medium temperature [°C]	Pressure rating [bar]	Response time [s]	U_b [V]	Order no.
	3...300 / 200...3000	stainless steel 316L / 1.4404	-25...80	30	1...10	19...36	SI5000

Protective gas supply for an annealing furnace



Monitoring industrial gases in an annealing furnace

Annealing furnaces operate in a protective gas atmosphere. Using pressure sensors the pressure of industrial gases is monitored.

Pressure sensors for gas monitoring

Type	Process connection	Display	Measuring range [bar]	$P_{overload}$ max. [bar]	$P_{bursting}$ min. [bar]	U_b DC [V]	Order no.
	G ½	Display unit	-1...10	50	150	18...32	PG2454

Control of the gas supply for an annealing furnace



Controlling the industrial gases for an annealing furnace

The supply of the annealing furnace with protective gas for the protective covers or with natural gas for the burners is controlled using valve actuators. These are monitored by means of inductive sensors.

Inductive dual sensors for position feedback on pneumatic valve actuators

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f AC / DC [Hz]	I _{load} AC / DC [mA]	Order no.
	40 x 26 x 26	4 nf	PBT	10...36	IP 67	1300	250	IN5225

f = flush / nf = non flush

Accessories

Type	Description	Order no.
	Target puck · Ø 102 mm · Housing materials: Target puck: PA 6 / screws: V2A	E17328

Detection of equipment parts of an annealing furnace



Distinction of various equipment parts

On the base of an annealing furnace either the furnace or a cooling cover is in operation. Depending on the cover used the base is supplied with cooling water or gas. For differentiation inductive sensors are used.

Inductive sensors for equipment control

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M30 / L = 50	15 f	Brass	10...36	IP 67	100	100	IIS204

f = flush / nf = non flush

Positioning of the transfer table



Position detection of the transfer table

Introducing a strip of the coil into a rolling installation is done automatically. By means of transfer tables the strip is positioned correctly. Cylinder sensors monitor the position of the tables.

Cylinder sensors for monitoring hydraulic and pneumatic cylinders

Type	Dimensions [mm]	Material	U _b [V]	f [Hz]	Protection	I _{load} [mA]	T _a [°C]	Order no.
	25 x 5 x 6.5	PA (polyamide)	10...30	10000	IP 65 / IP 67	100	-25...85	MK5100

Accessories

Type	Description	Order no.
	Adapter for tie rod / integrated profile cylinders · for types MKT (T-slot cylinder sensors) · Clamping range 9...15 mm · Housing materials: aluminium / screw: stainless steel	E11799

Locking of the rollers



Securing the rollers during the rolling process

Before sheets are rolled it must be ensured that the rollers are correctly positioned and mechanically locked. This is monitored using inductive sensors.

Inductive sensors for monitoring the locking of rollers

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	M18 / L = 46	8 f	Brass	10...30	IP 67	300	100	IGS200

f = flush / nf = non flush

Monitoring of high-speed doors



Door monitoring

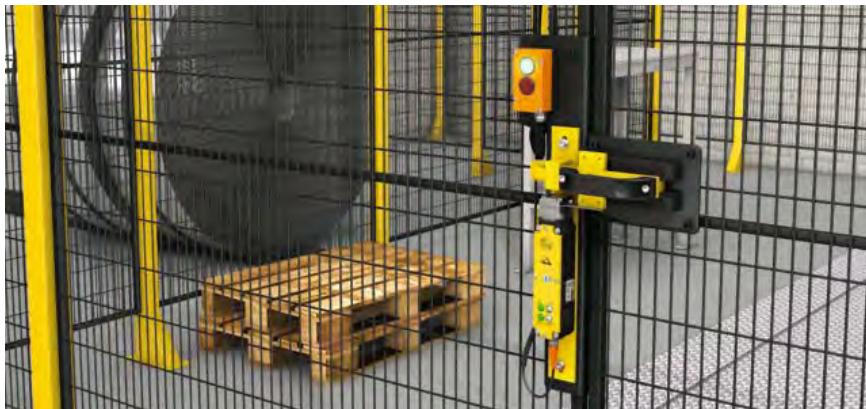
Category 4 and SIL 3 fail-safe inductive sensors directly detect the end stop of the high-speed door without contact and without requiring a special counter piece.

Fail-safe inductive sensors

Type	Length [mm]	Enable zone [mm]	Housing material	U _b DC [V]	Protection	Response time in case of a safety request / enable time [ms]	Order no.
	66	10...15 nf	PPE	24	IP 65 / IP 67	≤ 50 / ≤ 200	GM701S

f = flush / nf = non flush

Safety during equipment operation



Protection of hazardous areas against unwanted access

While a rolling installation is in operation some hazardous areas, e.g. areas with rotating equipment parts, must not be accessed. This is avoided by protective screens and door switches with guard locking.

Door switch with guard locking

Type	Description	Order no.
	Safety switch with guard locking · Normally closed principle · Rotatable actuating head made of metal · Mechanical release on the front · Supply via AS-i / solenoid supply ext. from 24 V DC · M12 connector · Housing materials: thermoplastic reinforced glass-fibre	AC901S

Accessories

Type	Description	Order no.
	Actuator S standard straight · With rubber bush, overtravel 5 mm · Suitable for a maximum pull force of 2500 N for the door switches AC901S - AC904S	E7903S

Positioning of the shear stand



Position monitoring on the rotary plate of the shear stands

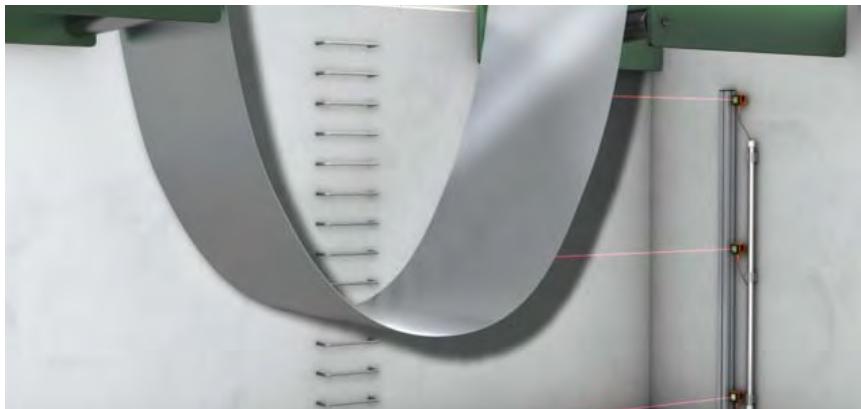
By means of a rotary plate two shear stands are exchanged. To avoid rotation of the plate if a shear stand is not correctly positioned an inductive sensor detects the stand position.

Inductive sensors for positioning equipment parts

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	Ø 34 / L = 98	20 nf	PBT	10...36	IP 65	350	250	IB5063

f = flush / nf = non flush

Loop pit



Sag control with PMD time of flight sensors

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.

PMD distance sensors with time of flight measurement

Type	Operating principle	Range	Sampling rate [Hz]	Spot Ø at max. range [mm]	U _b [V]	Order no.
	Photoelectric distance sensor	0.2...10 m	1...50	< 15 x 15	18...30	O1D100

Monitoring of belt centring control



Travel speed limitation of the positioning cylinder

Coils must move straight into the installations. To ensure this the whole coiler is hydraulically moved transversely to the direction of movement. A flow sensor monitors the limitation of the travel speed.

Flow sensors

Type	Setting range liquids / gases [cm/s]	Material sensor tip	Medium temperature [°C]	Pressure rating [bar]	Response time [s]	U _b [V]	Order no.
	3...300 / 200...3000	3...100 / 200...800	-25...80	300	1...2 / 1...10	18...36	SI5010

Cutting straightened sheets to length



Straightened strip is cut to length as needed

After processing the sheets blanks are cut to the dimensions as requested by customers. Encoders ensure that the lengths are precisely measured.

Multiturn encoder for linear measurement

Type	Resolution [V]	U _b [V]	f [kHz]	I _{load} [mA]	Shaft [mm]	Ambient temperature [°C]	Cable entry	Order no.
	4096	4.5...30	–	–	6	-40...85	axial	RM8001

Monitoring a roller conveyor for occupied sections



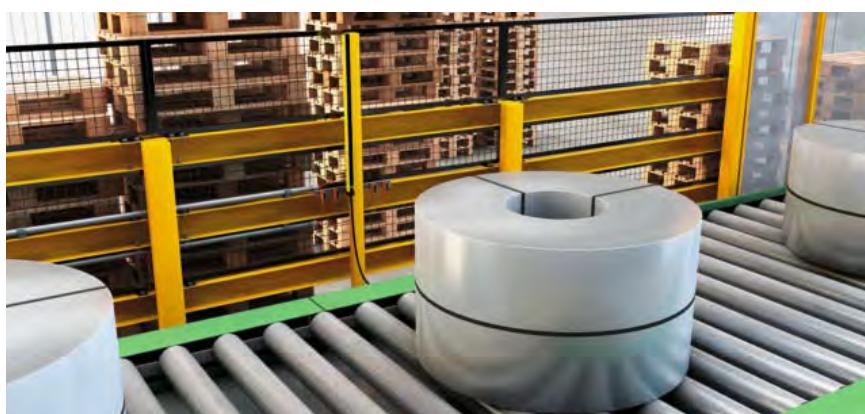
Automation of the conveyors

The roller conveyors are split up into individual sections. To ensure that no coil is moved into a section which is already occupied photoelectric sensors with polarisation filter detect the material on the conveyor.

Photoelectric sensors for conveyor control

Type	Operating principle	Range	Type of light	Spot Ø at max. range [mm]	Output H = light-on D = dark-on	Order no.
	Polarisation filter	0.075...10 m	Red	250	H/D PNP	O5P500

Coil transport



Coil transport on roller conveyors

The O5S (transmitter) / O5E (receiver) through-beam sensors detect the coils on the roller conveyors. This ensures a correct transport to the packaging lines.

Photoelectric sensors for determining position

Type	Operating principle	Range	Type of light	Spot Ø at max. range [mm]	Output H = light-on D = dark-on	Order no.
	Transmitter	25 m	Red	625	-	O5S500
	Receiver	25 m	Red	-	H/D PNP	O5E500

Safety light curtains for access prevention

Type	Sensor length [mm]	Resolution / detection capacity [mm]	Protected area height [mm]	Protected area width [m]	Response time [ms]	U _b [V]	Order no.
	813	90	760	0...4 / 3...12	4.5	24	OY105S

Temporary coil store – packaging line



Temporary store for coils from the shears to the packaging line

If it is not possible to directly transport the cut strip from the shears to the packaging line, it is stored temporarily. The OG diffuse reflection sensor precisely detects whether the store is occupied.

Photoelectric sensors for monitoring storage locations

Type	Operating principle	Range	Type of light	Spot Ø at max. range [mm]	Output H = light-on D = dark-on	Order no.
	Background suppression	15...300 mm	Red	25	H/D PNP	OGH500

Temporary coil store – transport cars



Transport car positioning

Coils are transported from the temporary store to the upenders of the packaging lines. For exact positioning inductive sensors with a long sensing range are used.

Inductive sensors for determining position

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
	Ø 34 / L = 98	20 nf	PBT	10...55	IP 65	300	300	IB5124

f = flush / nf = non flush

Coil centring in the packaging line



Centring of coils before packing them on pallets

If coils are dispatched on pallets, they must be positioned in the centre. Centring is done before lifting them from the roller conveyor onto the pallet. An inductive sensor is used to detect the material.

Inductive sensors for detecting the material

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
IM5115	40 x 40 x 54	20 f	PA (polyamide)	10...36	IP 67	100	200	IM5115

f = flush / nf = non flush

Connectors

Type	Description	Order no.
EVT004	Socket · angled · Free from silicone · Gold-plated contacts · M12 connector · 5 m · Housing materials: housing: PVC orange / sealing: EPDM	EVT004

Detection of material under an electromagnet



Control of the electromagnet

The centred coils are lifted onto the pallets using an electromagnet. The plunger moved by the coil is detected using an inductive sensor. This ensures that material is under the electromagnet.

Inductive sensor for electromagnet monitoring

Type	Dimensions [mm]	Sensing range [mm]	Material	U _b [V]	Protection	f [Hz]	I _{load} [mA]	Order no.
IB5096	Ø 34 / L = 82	20 nf	PBT	10...36	IP 67	60	250	IB5096

f = flush / nf = non flush

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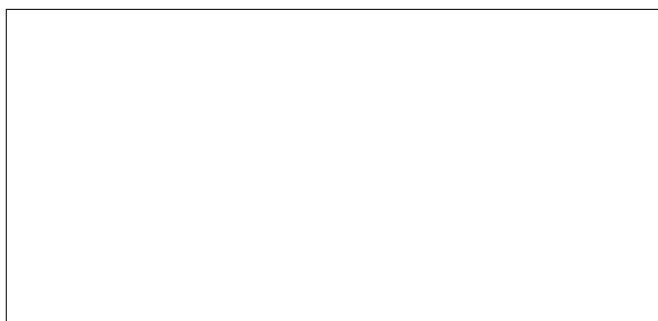


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