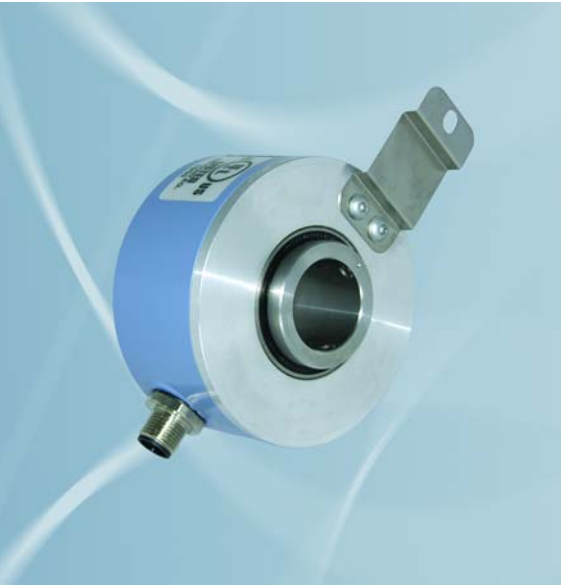


# Cranes and construction

The use of encoders in the construction of cranes

- **High accuracy in positioning of cranes**
- **High reliability in rough environment**
- **Safe and comfortable operation**
- **Joint design with customer**
- **Wide temperature range: -40 °C up to +80 °C**



## A custom product is used in conjunction with limit switches

Geared cam limit switches have for a long time been an integral part of cable winches. They are constructed in such a way that they reproduce numerous turns of a shaft on the angle of rotation of the integral cam-disc or camshaft.

As they move, the individual lobes operate mechanical switch contacts, which for example ensure the emergency shut-down of the winch before the end of the cable is reached, or for slower unwinding of the winch shortly before this point. Geared limit switches are essential component parts of power-operated hoisting equipment, their use being stipulated by accident prevention regulations. They are required for independent limiting of travel on cranes and conveying equipment. However movement in the opposite direction must still be permitted after operation of the limit switch.

### New challenges

For some time now cam gears have also been used in the construction of theatre and stage equipment, as modern stages become evermore mobile and versatile. For also 75 years the Stromag Company from Unna in Germany has been manufacturing clutches, brakes, flexible couplings and geared limit switches. They are one of only a few German companies who have obtained for their geared limit switches the certification required for the stage construction industry. Experience in the manufacture of geared limit switches has been built up over the years. Stromag's design and development department faced a new challenge as a result of the fact that in modern power-operated hoisting equipment geared limit switches are not only required to fulfil their traditional functions but that now there is also the requirement that electronic detection of the winch position has to be provided to the crane operator. This is particularly helpful, because the human eye is not able to accurately estimate large distances and so the crane operator also has to rely on external help. However by using a digital display it is possible to see the exact length of cable that has been paid out or the height to which the crane arm has been raised. This small addition

makes operating a hoist considerably easier and improves the ease of operation especially with heavy loads.

### Ability to retrofit as top priority

In the meantime Stromag has integrated various combinations of geared limit switches with position feedback systems into a flexible choice of housings. However it had been a long road to get there:

The immediate goal for Stromag was to find a system that would be easy to retrofit to already existing systems.

Retrofitting incremental measuring systems to existing geared limit switches can be achieved using an assembly-bell with integrated encoder systems.

### Search for electronic data acquisition

Even the first of these requirements posed a problem, as the hollow-shaft encoder, which was to collect the desired data, together with all the necessary connections, had to fit into the quite small housings of the various cam gears. Furthermore it also had to be capable of accommodating a relatively large 14mm diameter shaft with spring coupling, for retrofitting to older existing systems.

### Wachendorff gets the order

In the face of stiff competition, the Wachendorff Company from Geisenheim in the Rheingau managed to successfully secure the order. They were able to fully comply with the requirements of Stromag by customising their encoder model WDG 58 H, so that the new dimensions of the encoder met Stromag's specifications, with a diameter of 58 mm and an overall length of 44.5 mm. The accuracy of the incremental encoder, with up to five thousand pulses per revolution, is sufficiently high enough for use in the corresponding limit switches.

### Dependable over a long service life

The functionality of the encoder is assured even under adver-

se conditions, thanks to its high IP65 protection level. The maximum allowable operating temperature is in the range of  $-40\text{ }^{\circ}\text{C}$  to  $+80\text{ }^{\circ}\text{C}$ .

The encoder's permissible maximum shaft loadings are 80 N radial and 60 N axial. The encoder is double-supported. Two precision ball-bearings provide backlash-free support for the encoder. The service life is 109 revolutions at 100% of full rated shaft load and is extended to 1010 revolutions at only 20% bearing load. The infrared LED that is used has a life of around 100,000 hours – a figure normally only rarely achieved in limit switches applications.

WDG58 encoders also come equipped with an early warning output that transmits a warning signal if the light intensity of the diode falls to more than 10% below the original value, which signals an imminent failure. Despite this, the encoder will go on working without any problems for more than another 1,000 hours, with the advantage that it can thus be exchanged during a normal maintenance period.

As a rule all encoders are wired up via a radial connector, however in this case this would have taken up too much space in the housing, so for the application with Stromag limit switches this was replaced by a cable output. This cable now leads to a connector that is attached externally on the cam gear. The cable length with Wachendorff encoders can be up to 100 metres. In reality however only a few centimetres are necessary. Simple mounting, reliable system

#### Simple mounting, reliable system

If Stromag now receives an order for a cam gear with a position feedback system then the encoder is simply slipped onto the shaft of the cam gear. The separate housing that accommodates and fixes the WDG 58H is then screwed to the gear and wired up – the rest of the limit switch remains totally unaltered.



Image 1  
Encoder in assembly-bell and cam gear



Image 2  
The encoder in his position at the limit switch. The assembly bell has been removed



Image 3  
The cable output goes from the encoder to the connector at the assembly bell



Image 4  
The hollow shaft encoder



Image 5  
A cam gear and the encoder with assembly-bell

**Any Questions?** Just call Dieter Schömel +49 (0) 67 22/9965-10, send him an E-Mail at [sco@wachendorff.de](mailto:sco@wachendorff.de) or call your local distributor.



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# Elevator

## Aiming high with Silent Move

- Smooth running system, quietest in the world
- Fast up to 4 m/s
- For heights up to 180 m
- Complete system, easy to mount
- Incremental and absolute measurement

**Rugged & Tough**



## Aiming high with Silent Move

**A new belt system from Wachendorff ensures silence in the lift shaft. In the Ibbenbüren power station digital shaft copying has been employed in quite exceptional circumstances.**

For many decades the high towers and chimneys of the colliery and power station have dominated the landscape of the town of Ibbenbüren. Even the generator building, in which the steam-turbine of the power station is housed, is more than 100 metres in height. Anyone wishing to aim so high needs reliable lift technology, with qualities that meet the highest standards. For this reason the Silent Move measuring system from Wachendorff has been employed.

Energy and power have traditionally been key factors in the economy of Ibbenbüren. Coal has been mined here for 450 years and even today the 1545 metre colliery shaft is one of the deepest in the world. High-grade anthracite is mined - one of the highest value types of coal. Already back in 1954 coal power generation was begun at this location, in order to extract electrical energy from the available raw material. Then in 1985 the current power station went into operation; today this is equipped with state-of-the-art filter technology and equipment for flue gas desulphurisation.

80 percent of the required coal arrives at the power-station via an enclosed conveyor-belt bridge, where it is subsequently ground to a fine dust and then blown into the molten ash chamber boiler. The Ibbenbüren boiler, in which the particularly hard anthracite is burned, is the largest of this kind in the world. Around 2200 tons of water an hour are heated via piping systems and the resulting steam drives the paddle wheels of the turbine shaft. An electrical generator then transforms this mechanical movement into electrical power.

### Self-guiding special belts

The turbine and the generator are housed in their own building, where workshops and stores are also to be found over

a total of 24 floors. On the outside a lift travels the 116 metres up to the roof, from where there is a breathtaking view over the whole area. For the purposes of determining the position in the shaft a digital shaft-copying system from Wachendorff is used. The Silent Move system is new and ensures not only outstanding running characteristics, but also has the advantage of being maintenance-free with a long service-life.

The special feature here lies in the fact that the belt is not flat but has nubs, which keep it on-track as it moves over a belt-pulley that has been designed with matching grooves. It runs securely, with no sliding or slipping, and with no need for lateral guides. The big advantage is that no friction occurs on the sides, so there is very little wear, and maintenance, such as the regular application of talcum powder, can be dispensed with completely.

### Exceptionally quiet in operation

The self-guiding belt runs very quietly through the sound deadening overhead suspension and the noise reducing wheel. Test measurements taken directly next to the guide pulley gave a result of 68 dB, whereas conventional systems produce a noise level of over 90 dB. This currently makes Silent Move the quietest belt system in the world. Sounds generated in this fashion should not be underestimated when in an industrial environment, as there is virtually no noise dampening in large halls and with smooth concrete and metal walls. In fact, in certain circumstances, the noise can actually be magnified and echo throughout the whole building.

### High measurement accuracy

One particular challenge posed by the Ibbenbüren application is the total of 24 stops. These are not at regular intervals, but rather extremely irregular, due to the varying heights of the halls. This calls for high precision - guaranteed thanks to the WDG incremental encoders with their accuracy of up to 0.08 mm. Another option is to use WDG multiturn encoders,

which also offer CAN-, Liftopen- or SSI interfaces. For heights up to 70 metres there is a circumferential alternative - however in Ibbenbüren a guided-belt shaft copying system was used that is ideal for heights up to 120 metres. All Wachendorff encoders benefit from proven ruggedness in industrial use, as well as from a long service life. They also act as bearings, so no additional intermediate bearings are required for the special pulley.

#### Complete systems that can be tailored to suit

The quiet Silent Move shaft-copying systems are already pre-assembled and can be installed quickly and easily in the shaft. All the installation components required for standard installation to the lift cab rail or on the wall are supplied. Alternatively the encoder can be predefined - on request it can be supplied with individual values for the resolution and maximum operating frequency. For the belts, either a standard length can be selected or an individual size can be ordered. Wachendorff is also happy to offer individual solutions, for instance to lift manufacturers. All Silent Move components can be designed to suit special types of lift and then supplied as a system ready for installation. The flexible production department can manufacture more or less any quantity and even offers an express service with a delivery time of just 48 hours.



Image 3  
encoder



Image 4  
power plant



Image 1  
panorama



Image 2  
on top



Image 5  
controller

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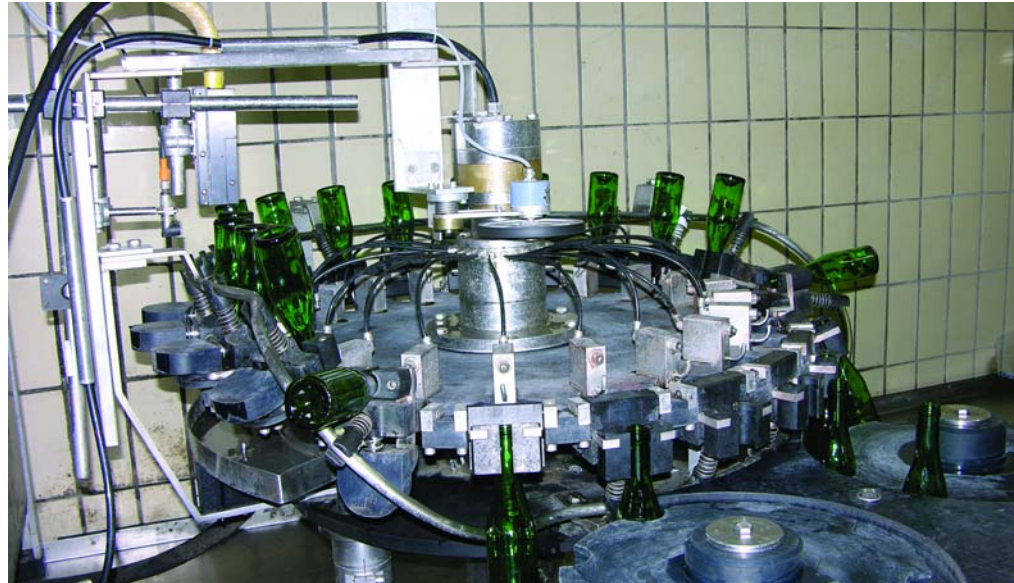
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# Drink Technology

## Secure marking ensures traceability

- **Precise application of important information, e.g. production data, batch etc.**
- **Exact positioning, long-term durability**
- **Always reliable, even in wet environments**
- **Simple installation with virtually non-slip spring lever**



## The right pressure is what is needed - not just inside the Sekt bottle

Modern quality control systems also incorporate the possibility for product traceability – this requires clear, durable labelling. Industrial rugged components from Wachendorff ensure correct rotation during printing onto Sekt bottles.

For customer protection purposes, foodstuffs are subject to a whole series of strict regulations, including the obligation to provide unique lot marking, in order to facilitate product tracing and identification. The law requires the product to be marked in a way that is both clearly visible and legible. This is not problem, for example, on bags of flour or bars of chocolate; however it is a whole different story when it comes to bottles.

It is not only that glass offers a poor background onto which to print, but glass bottles are not exactly flat, due to their shape, and during the filling process they are wet as well. This was the difficult challenge facing Karlheinz Bubeck, technical plant manager at the Ohlig Sekt winery in Rüdeshheim.

The finest wines are fermented here to produce Sekt (German quality sparkling wine). In the vaulted cellars, which are more than 100 years old, lie bottles of Sekt fermented in the classical way, whilst elsewhere more hectolitres of the delicious liquid are maturing in tanks and barrels. The inside of the winery has more the appearance of a stately villa than a production facility.

The business was founded back in 1919 at the same location where it stands today and has grown continuously. Currently 2 million bottles of Sekt leave the Rüdeshheim plant each year – and the trend is upwards. The Germans are still world leaders in Sekt consumption – increasingly however other countries are becoming aware of the excellent quality of this German product. The Rheingau is particularly appreciated by lovers of Sekt, due to the traditional high quality Rieslings grown here.

Karlheinz Bubeck places special emphasis on the latest technology when it comes to bottling the various Sekts from the barrels and tanks. It is crucial that the noble wine is protected from oxidation, so that it can be laid down for a long period of time whilst keeping the taste fresh. The bottling plant is able to handle up to 20,000 bottles per day, including quality control – and including printing the base of the bottles.

Karlheinz Bubeck has a specialist for printing and labelling to thank for the fact, that this can all be carried out without problems. This company retrofitted a specially designed inkjet printing system to the existing bottling plant. Using a non-contact method, the figures are squirted onto the domed bottle base using a white pigmented ink; this dries completely within a second, so that it cannot be washed off or smeared as the bottle continues on its way.

Because of the high speed at which the bottles move through the bottling plant, precision is very important. To ensure that the bottle is in exactly the right position when the jet of ink is applied, a tough industrial encoder, type WDG58A, supplied by the Wachendorff company, has been installed.

Grippers lift the bottles one after the other from the carousel, so that the base of the bottle faces upwards. The encoder WDG58A measures very precisely the distance that the bottles have travelled, so that the printing process starts at exactly the instance that that bottle bases pass by the print head. Subsequently the bottles are inverted again and set down.

Then they are conveyed onto the actual filling station, where they are filled with overpressure and then sealed. The final stage in the plant is quality control, where a further Wachendorff encoder is employed. Here a camera checks the fill level of the bottles. If too little Sekt is in the bottle, then this is removed from the conveyor used a compressed-air pusher. Once again, so that the air blast is applied at exact-

ly the correct moment, another WDG58A encoder measures the precise distance the bottle has travelled and then triggers the air blast at just the right point in time.

The information printed on the base of the bottles allows Karlheinz Bubeck to see at a glance, when the bottle was filled and even identify which bottles and corks were used. This means that if a customer later has problem with corks or if a bottle bursts, then it can be determined which supplier was responsible.

For Karlheinz Bubeck the chosen solution with the special inkjet printing system and the integrated Wachendorff encoders has proved a great practical success. Despite the very high number of bottles that pass through the machines, the print system is easy to maintain, with service intervals of just six months. Ink usage has also been considerably reduced.

The WDG58 series encoders, located within the filling plant, are subjected to constant wet conditions that they withstand without problem. Thanks to their optimal combination of mechanics, optics and electronics, the Wachendorff products are amongst the safest, most reliable devices available today. The high pulse rates possible in the WDG58 series, with 5,000 ppr, 10,000 ppr and up to 25,000 ppr, together with the control electronics facilitate consistently high resolution photos at precisely defined positions. Accessories such as measuring wheels and adjustable pre-tensioned spring levers that are suitable for the application described above, are available from Wachendorff's range of accessories. This means that a complete functioning system can be handed over to the user.

The high IP67 protection rating, permissible shaft loads of up to 400 N and a wide temperature range make the Wachendorff WDG incremental encoders the right choice, even under harsh operating conditions. Their EMC design ensures secure signals. A special output gives early warning that the LED performance is degrading - this occurs around 1000 hours before the encoder could actually fail, so that appropriate timely action can be taken to keep the system safe.



Fig 1:  
Precise measurement of bottle position for the start of printing



Fig 2:  
Virtually non-slip application of the measuring device via spring lever and measuring wheel



Fig 3:  
Measurement of the bottle position for optimal quality inspection

Encoders



Fig 4:  
Synergy - traditional production and hi-tech processing

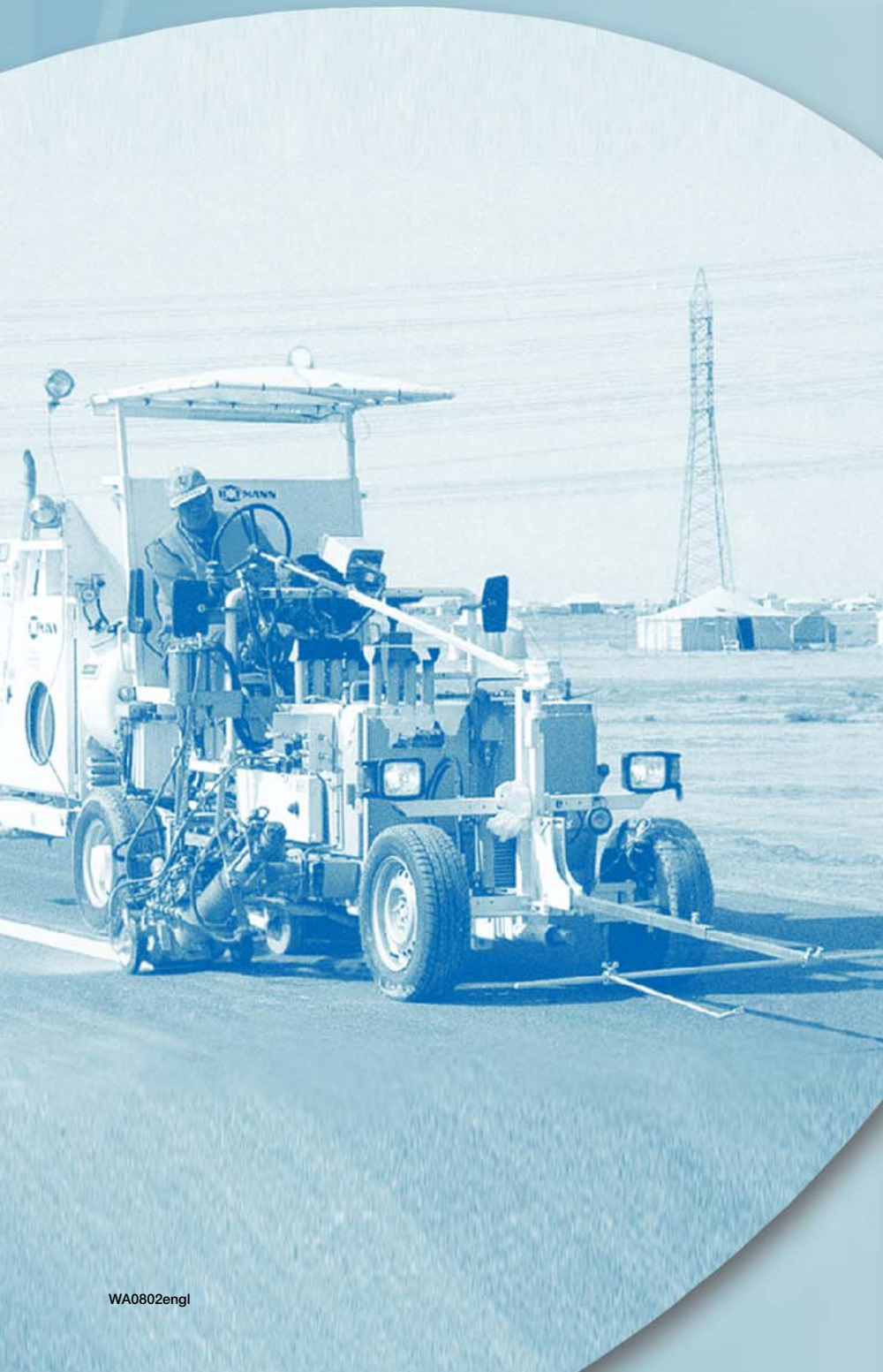
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Please contact your local distributor:

# Construction vehicles

## Roadmarking with millimetre accuracy

- High accuracy measurement of speed, distance and consumption for optimal application
- Very high continuous load capacity
- Reliable even in the most extreme conditions
- Jointly developed solutions





## How the white lines appear on our roads

The road network in Germany alone encompasses more than 200,000 kilometers - covered just about everywhere with painted lines showing the centre or edge of the carriageway or restricted areas such as box junctions. Wachendorff encoders are used to ensure the precise application of these road markings.

Every day we drive next to them or over them – road markings. Most of the time we are oblivious to them – they only really register when they are not there and we lose track of the road or are forced to slow down.

The white lines at the edge of the road or in the centre of the carriageway are an important safety factor and ensure clearly visible traffic flow and improved orientation for drivers.

The rules concerning how and where these road markings are to be applied is well defined in Germany in the road traffic regulations and relevant directives. Precision is of immense importance and the application of these white lines is a factor that needs to be costed in during road construction. Clearly the procedure has to be done correctly the first time round, otherwise the paint would have to be laboriously removed; this not only costs money but normally results in considerable traffic delays. This means that both the men and their machinery have to work very accurately. Moreover the white compound has to dry as quickly as possible, so that the road can be opened to traffic again without major delay.

These white lines on the carriageway are made up of a wide variety of substances according to the application in question. Some need to be heated, others have two components that need to be mixed together immediately prior to application. Yet again, others are applied not as a solid line but as thick drops, so that when they are driven over they create a loud rumbling noise, acting as a warning to the driver. Finally, for light reflexion purposes, very small fine glass beads are scattered over the damp material. All in all, quite complex procedures, which place high demands on the machine. As

they have to be used in all types of weather and windy conditions, the machines have to be both rugged and at the same time be able to work with high accuracy.

World leader in this market is the Hofmann company from Rellingen, near Hamburg, which has been manufacturing road marking machines since as far back as 1952; Hofmann supplies a wide variety of machines from small hand-controlled machines up to high-performance roadmarking trucks that can hold up to 3000 litres of sprayable thermoplastic compound. This family business is always making the news thanks to its innovations – for example, due to its machines, which were the first in the world to be able to work when the road bed is damp or wet. The success here of so many innovations that are 'Made in Germany' is clear to be seen: 90 % of all the machines they manufacture are exported and in use worldwide – in each case adapted to the local climatic conditions and technical requirements. Also on the agenda at Hofmann are special machines, manufactured to customers' requirements.

In Rellingen they prefer generally not to rely on off-the-shelf components. Their vertical range of manufacture is impressive; around 100 highly-qualified skilled workers produce in-house the majority of individual components that are used in their machines. One of the rare exceptions to this: an encoder, supplied by the Wachendorff company.

Wachendorff, also a family business, based in the Rheingau, has a company philosophy similar to that of Hofmann; it designs and manufactures its own encoders in-house, to a large extent by hand and with the utmost care and attention, so that they are able to meet the high quality requirements of their Rellingen-based customer.

Encoders are essential in marking technology, as they provide precise information regarding the distance covered – after all, when it comes to a line in the centre of the road, all the

lines should be exactly the same length. The Wachendorff encoder used in the Hofmann machines is based on the standard model WDG 58B; however it has been customized in line with the wishes of the Hofmann company, featuring a longer, reinforced shaft and special bearings. The housing has also been slightly modified and is equipped with a socket that accepts a plug connector used in all Hofmann machines.

"We adapted our encoder, so that it fitted into the already existing system at Hofmann", explains Stephan Rump, who works for Wachendorff. Special solutions, such as this, are not unusual for him. Such solutions can be implemented quickly and cost-effectively at Wachendorff, especially as all the employees, starting from R&D via production and through to after-sales service, are housed under one roof at the Geisenheim factory location. Short distances and communications that run smoothly between the individual departments ensure extremely fast reaction times.

"We were especially impressed by the ruggedness of the Wachendorff encoders", says Jens-Uwe Eymers, who is the control engineer at Hofmann and responsible for the high precision functioning of their marking equipment. Not only is the encoder in later use subjected to the effects of weather and vibration – but it itself acts as a bearing and must tolerate high loads. "In our experience it is the Wachendorff devices that best withstand these challenges," he comments, making the point that this is the reason why his company insists on the devices from the Rheingau.

However even the standard encoders featured in the Wachendorff catalogue can tolerate extremely high loads. Their design combines precision mechanics and a compact optical track with high-performance noise-resistant electronics. In addition they boast a high level of protection and a very wide operating temperature range. This makes Wachendorff encoders amongst the safest, most rugged devices available in the market.

The WDG58 series of encoders is now available with up to 25,000 pulses per revolution. These higher resolutions of 10,000, 12,500, 20,000 or 25,000 ppr for the hollow and solid shaft encoder series WDG58 now allow for even more precise measurement.



Fig 1:  
Marking machine for road marking



Fig 2:  
WDG 58 encoder employed on the front wheel



Fig 3:  
WDG 58B with longer shaft and special bearings



Fig 4:  
Impact and vibration resistant mounting. A special measuring wheel offers virtually non-slip measurement



Fig 5:  
Optimized consumption, thanks to precise measurement,  
saves costs and protects the environment

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Please contact your local distributor:



# Food Industry

Automated control of the cutting  
thanks to profile detection

- Lower wastage rate as a result of precise material positioning and cut control
- Increased throughput quantities
- Reduced downtimes
- Encoders are food-grade and resistant to salt water
- Totally reliable, even in frosty conditions

**Rugged & Tough**



## Wachendorff encoders ensure accurate cutting and trimming

Tons of fish fillets pass daily over shop counters, yet hardly anyone spares a thought to how the contents of the nets out there at sea end up being the ready-to-eat pieces that we can toss into a pan with no skin or bones to trouble us.

Somebody, who has made a business out of the intermediate steps, is the Baader company, based in Lübeck, North Germany. Here machines for the food industry are designed and manufactured; these carve meat of all types into portions suitable for sale – the main focus however is on machines that process fish – from a small grading machines up to large production equipment, which can completely skin and fillet the fish. The products from Lübeck are in use all over the world and can be found, wherever fish is caught or farmed.

The machines are fully automated and the process sequences are carried out seamlessly. In short, the freshly caught fish arrive at one end and the processed fillets drop off the conveyor belt at the other. A closed loop under vacuum ensures that everything remains inside the machine during the gutting process and all waste then lands in closed containers, which can be transported away for use in the feed and fertilizer industries.

High precision is of utmost importance, so as to ensure that on the one hand as little good flesh as possible is trimmed off and on the other that no bones remain behind to upset the customer. An automated control was designed for the processing, to minimize errors when cutting the flesh – Wachendorff encoders represent an integral part of this.

The first stage of the production process is to measure the fish; here a measuring wheel, attached to the encoder via a spring lever, travels over the fish, thus detecting its profile. The encoder registers the distance travelled by the wheel and makes this data available to the cutting controller.

Other processing alternatives can be discounted, as each fish is different, its surface being curved irregularly, wet and reflecting. This means that non-contact methods cannot be employed. Furthermore, all the internal machine components become soiled very quickly, so these need to be tough and very easy to clean.

This is why Rüdiger Eggert, who is in charge of the electrical engineering department at Baader, uses Wachendorff encoders here. They are perfectly suited to such extreme conditions thanks to their rugged construction and high IP67 level of protection (IP65 directly on the shaft). The stainless steel version of the 58 series is specially developed for food and beverage industry.

Once the profile of the fish has been established, it is transported via conveyor belts to the knives, which in a split-second remove the head, fins and innards and then the bones. Depending on the type of fish, this is then skinned as required. So that the knives can work accurately at all points, encoders are also used when moving the fish forward during the processing – these ascertain the exact position and supply this data at the start and end of each cut.

The big advantage of Wachendorff encoders lies in the fact that the encoder bearing can also assume the function of the counterbearing – this means that one mounting bracket can be eliminated, saving on costs. The stainless-steel shaft withstands high loads, vibration and external forces. The operating temperature range of between -40 °C and +80 °C ensures reliable measurement in every environment – even with fish cooled on ice. Thanks to their optimal combination of mechanics, optics and electronics, the Wachendorff products are amongst the safest, most reliable devices available today. Naturally the Wachendorff product range also includes accessory products, such as the measuring wheel and spring lever



Image 1  
Cutting up fish is a precision job - every millimetre counts when removing the dorsal fins.



Image 4  
A wheel, mounted via a spring arm, measures - with the help of an encoder from Wachendorff - the length of each individual fish and then transmits the values on to the controller for the cutter motor.



Image 2  
Here the skin is removed.

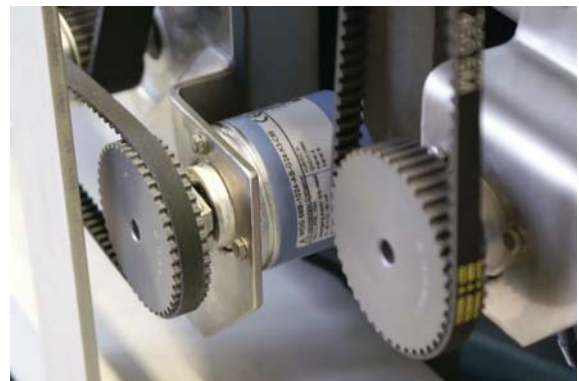


Image 5  
The encoder bearing simultaneously assumes the function of the counterbearing, saving on the need for an additional mounting bracket.



Image 3  
The final stage - the processed fillets drop off the conveyor belt.



Image 6  
Wachendorff encoders measure with millimetre accuracy the distance the fish have travelled in the machine.



Image 7  
A view of the inside of the machine, showing in the foreground where initially the length is measured. In the background the knives can be seen, which are waiting to remove the head, fins, skin and bones.

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