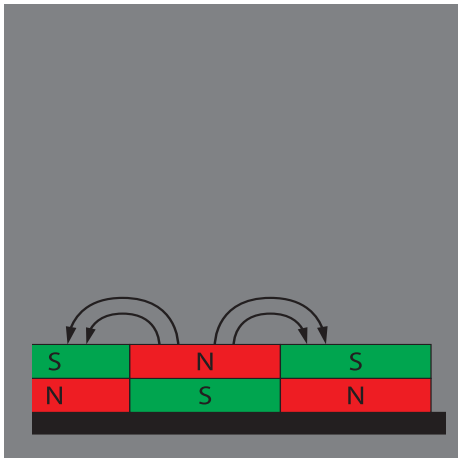
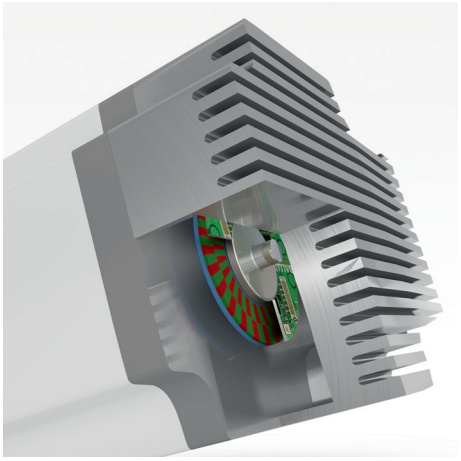
BALLUFF

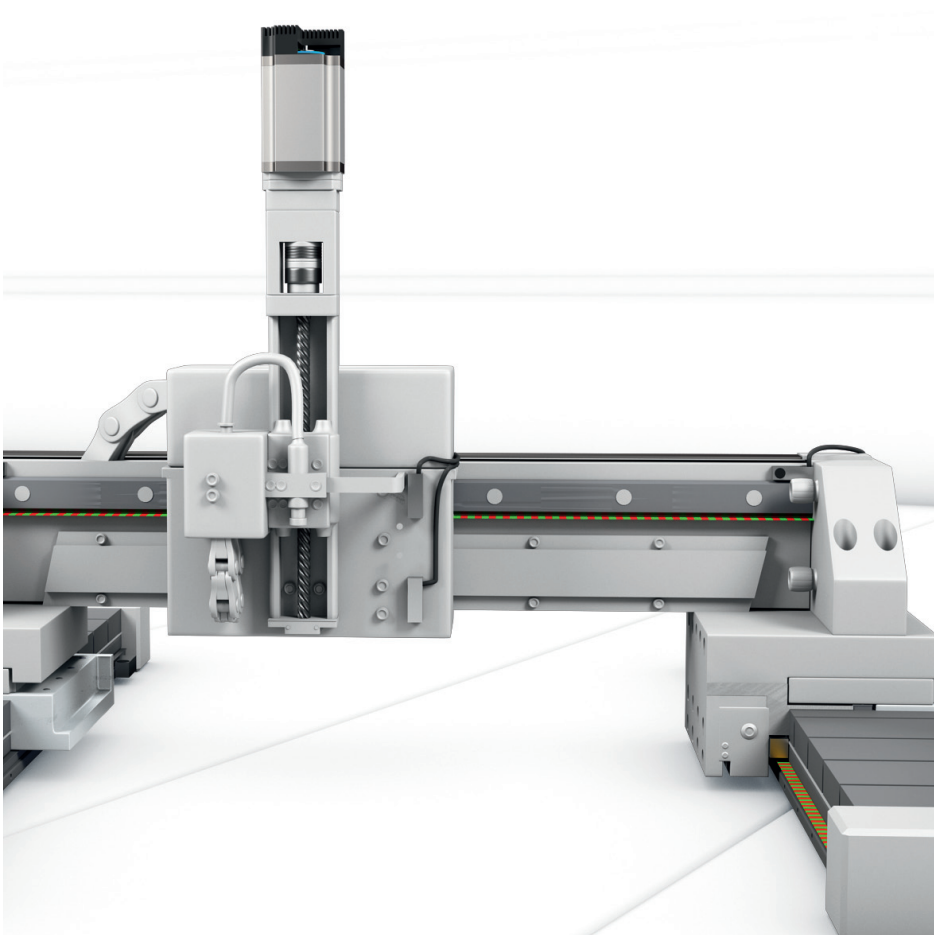
sensors worldwide

Solutions for Drive Technology

Increase energy efficiency – Improve quality







As the leading sensor specialist and system provider with more than 90 years of company tradition, Balluff GmbH has been a recognized partner in factory automation for decades. The global player has a strong presence with 61 sales branches and representative offices as well as nine production sites on all continents. The corporate headquarters in Neuhausen a.d.F. is located near Stuttgart.

Balluff products represent the entire technological spectrum with varied operating principles, including high-quality sensors and systems for position and measurement and identification, as well as sensors for detecting objects and measuring fluids. The full-range assortment includes optimal network and connection technology and a comprehensive line of accessory products.

We offer innovative, first-class products tested in our own accredited laboratory, and maintain certified quality management in accordance with DIN EN 9001:2008. Our technology speaks for itself in international applications since it also meets regional standards.

Balluff stands for application-specific customer solutions, comprehensive services, individual consultation and prompt service. Our staff of more than 2750 employees is committed to providing outstanding service worldwide.

Conserve Resources and Improve Productivity

Linear measurement and sensor solutions for modern drive technology

When the need is to increase productivity, network processes and conserve resources, efficient, intelligent and regulated drives with added or integrated sensors for feedback and position detection are the prerequisite.
Balluff offers a broad range of sensors and linear measurement systems using various technologies, all specially designed to meet the demands made on modern electrical, hydraulic and pneumatic drive systems. Users can choose from a wide spectrum for flexible use in any application. Custom tailored solutions can also be designed and assembled to meet your individual requirements.

Balluff technology has been designed in close cooperation with the manufacturers of electric drive technology. These products are precise, easy to install and simple to integrate in compact motors and actuators (electric drives). This in turn supports rapid startup and high power density.

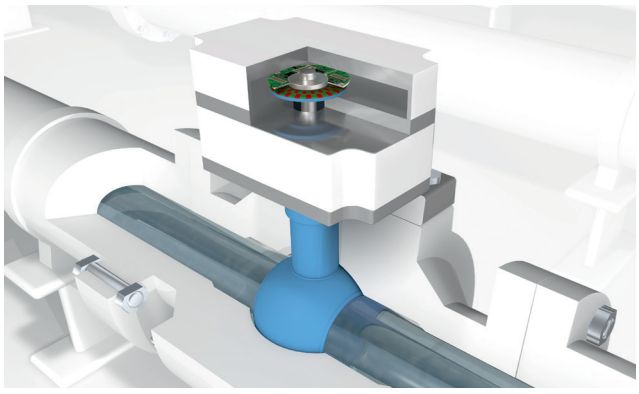
Significant benefits at a glance
- Improved energy efficiency of machines and equipment
- Regulated machine sequences, controlled movements
- High productivity through fast, precise and intelligent drives

For Integration in Linear and Rotary Drives

Compact, high-precision technology

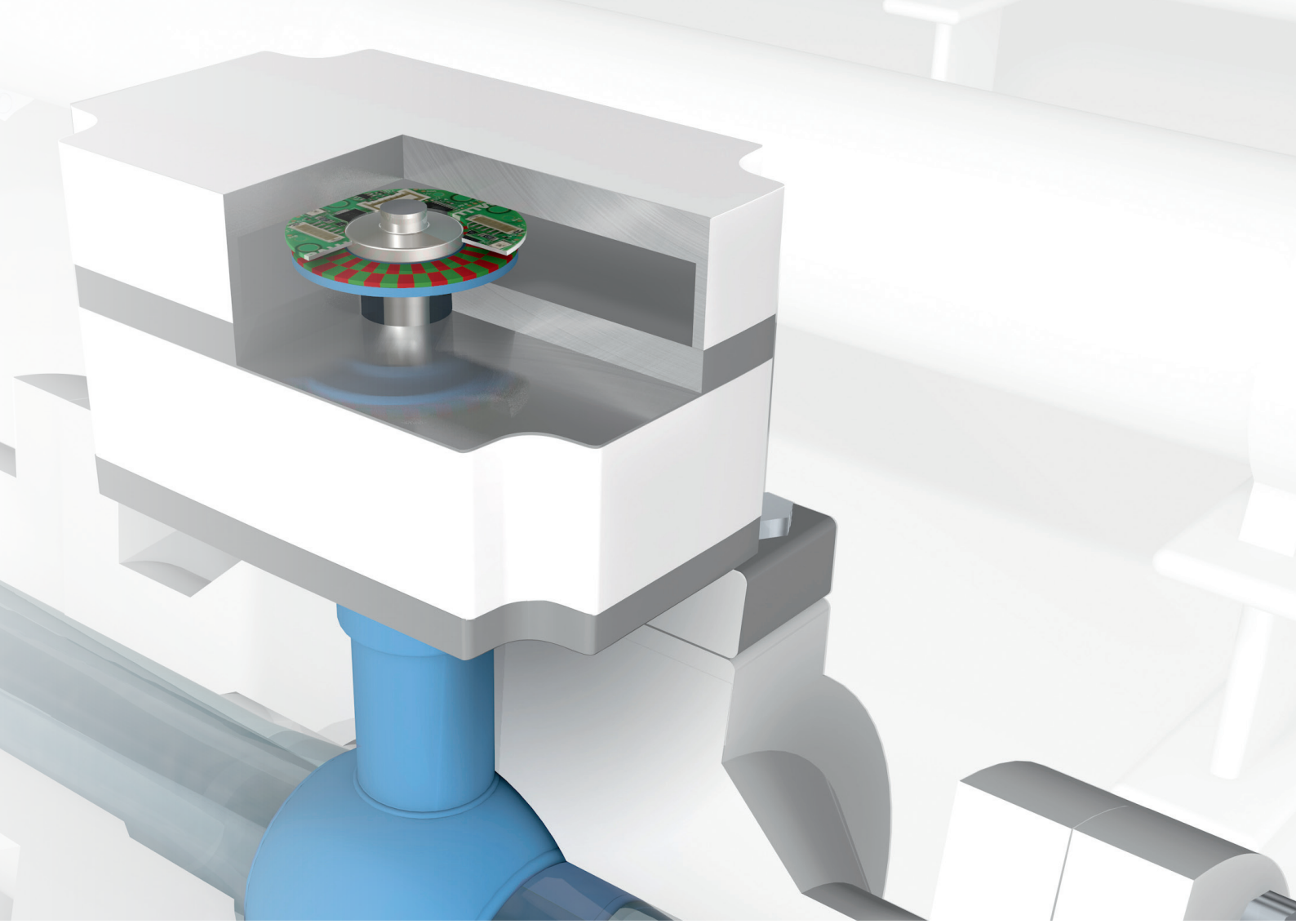
Magnetically encoded position and angle measurement system BML in various versions and as a custom tailored solution
Integrated sensor systems are indispensable for the most compact drive possible. For direct integration in linear and rotary drives we recommend magnetically coded BML magnetically encoded linear and angle measurement systems, which are available in incomparably small form factors. Their high 17-bit resolution permits precise positioning. Insensitive to dirt and deposits, they ensure great operating reliability.
The measuring systems consist of a magnetic tape, which features permamagnet technology for an absolutely homogeneous magnetic field.

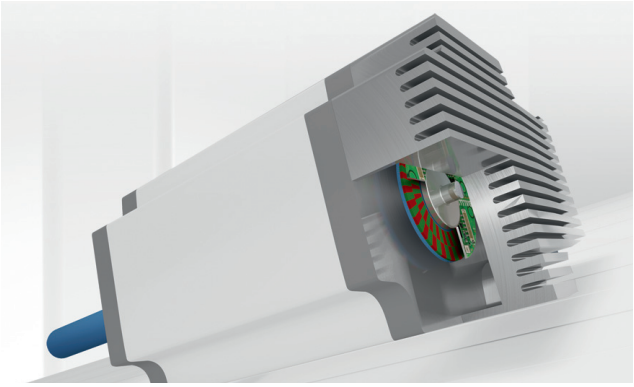
This guarantees high function security, low hysteresis and minimum linearity deviations. The sensor slides over the encoded tape at a distance of up to 5 mm for completely non-contact operation.
The position is available as an absolute or incremental signal. These high-precision systems offer a great selection of various tapes, which can be flexibly adapted to various requirements. The tape is available as a strip for linear operations and in ring or disc form for rotary movement. A variety of interfaces (SSI, BISS-C, SIN/COS, ABZ) can be selected from for great flexibility.

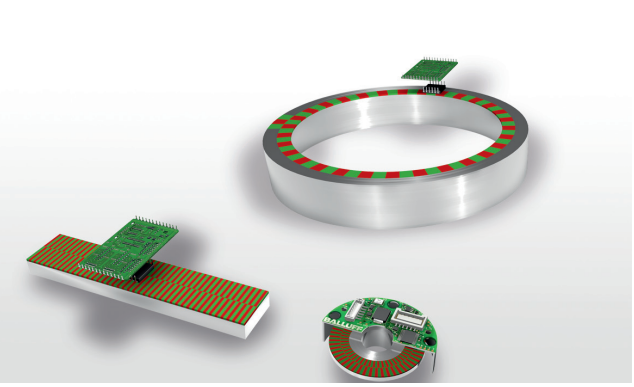


High-precision position feedback for rotary and swivel drives
In order to meet higher safety and environmental standards, process valves need to control the flow with even greater accuracy and process reliability. If an encoder disc system is integrated directly in the position controller, exact and process-reliable flow will be achieved.

- High tolerances between sensor and code disc: rapid startup
- Sensor position eccentric to the axis: media flow-through is possible







Absolute motor feedback in realtime
With the compact version of the absolute encoder disc a simple to integrate, highly precise absolute feedback solution is possible. The BML Encoder Disc System is an alternative to traditional magnetic, inductive or optical solutions.

- Absolute measuring system: no time-consuming reference point moves
- Generous distance between sensor and code disc: rapid startup
- Sensor position eccentric to axis: insensitive to runout tolerances, short installation times

Custom tailored feedback solutions for linear and rotary drives
The large selection of tapes that can be flexibly adapted to various requirements make the BML magnetically encoded linear and angle measuring systems ideal for direct integration in linear and rotary drives.
For cases where standard versions are not suitable, we can develop application-specific processing electronics or an appropriate circuit into the existing electronic design.

Feedback Systems for Linear Direct Drives

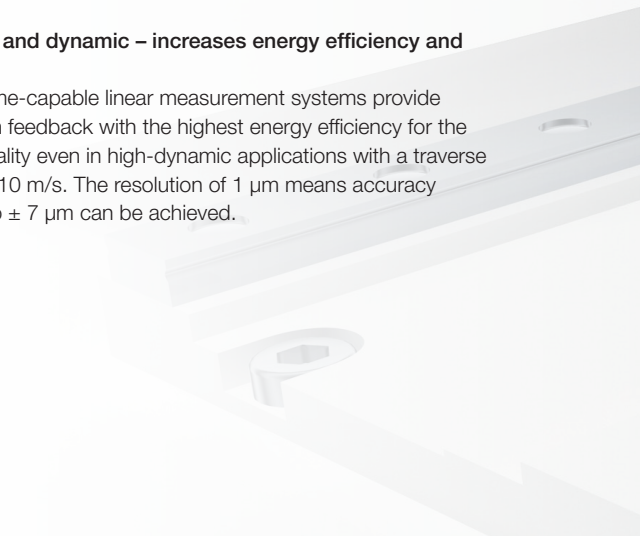
Rugged, contamination-resistant solutions

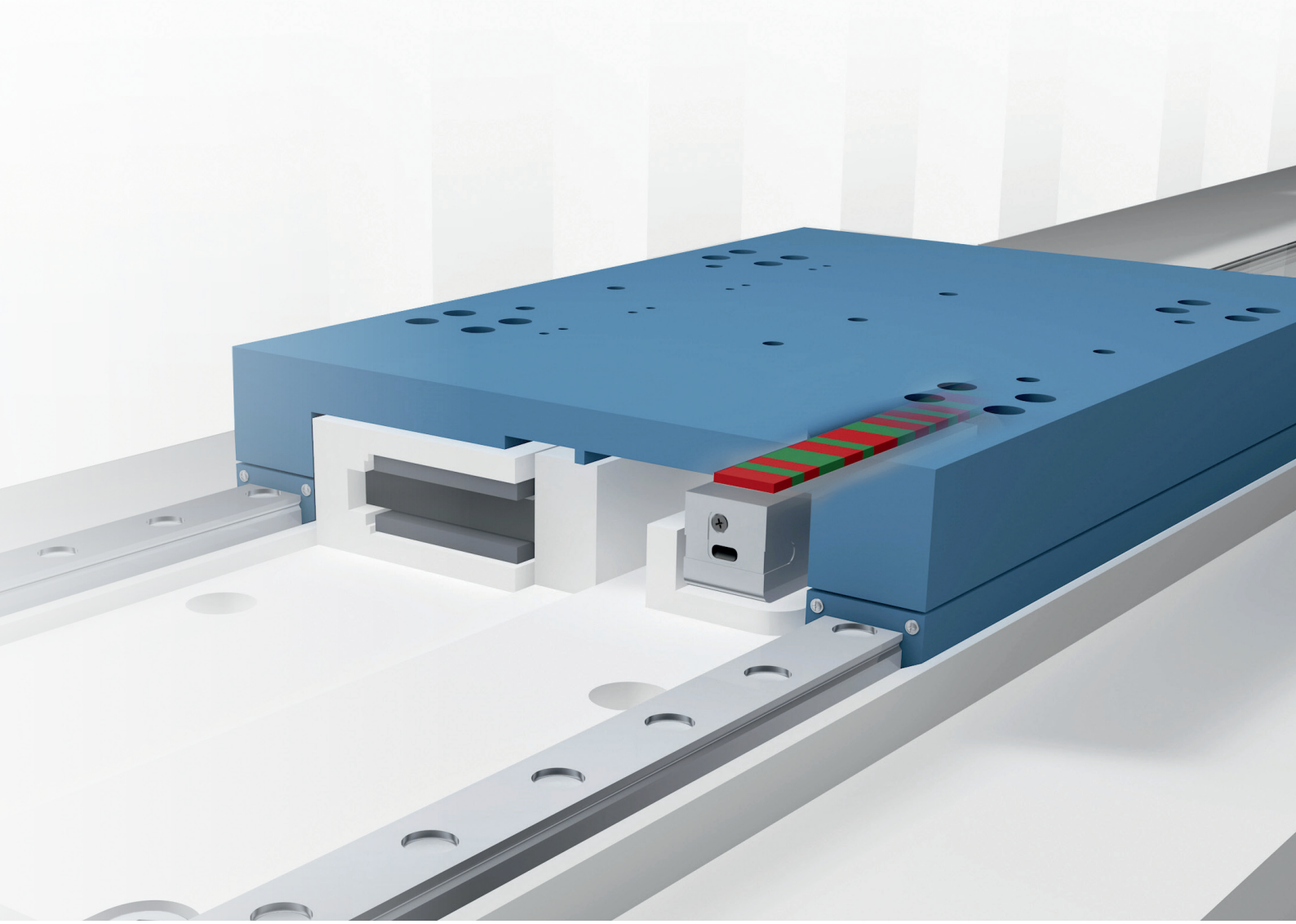
Non-contact – without the need for secondary protection measures

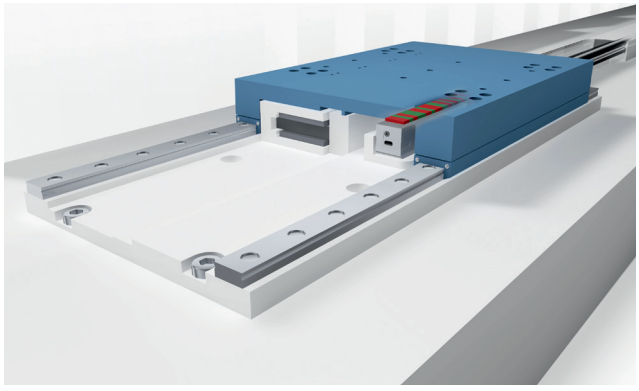
Magnetic or optical systems for feedback of the angle or slide position are generally used in a linear direct drive. Optical systems are highly sensitive to contamination and mechanical effects. They also require cumbersome, expensive encapsulation. This is wear-prone and has a negative effect on the system dynamics. A true alternative to the optical systems are the contamination-resistant BML magnetically encoded linear and angle measurement systems. These measure without contact and require no additional protection measures. This reduces downtimes for service and maintenance, extends the service life of the axis and improves dynamics.

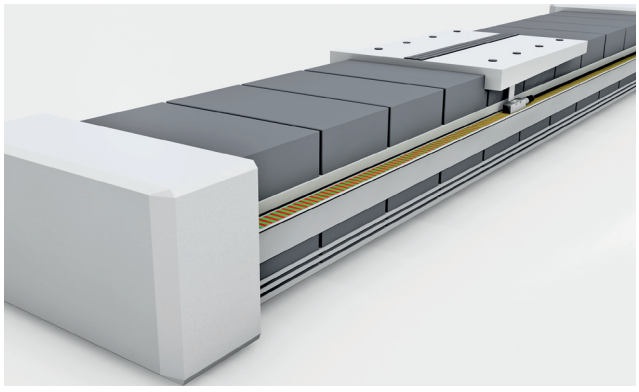
Highly precise and dynamic – increases energy efficiency and drive quality

The BML realtime-capable linear measurement systems provide optimal position feedback with the highest energy efficiency for the best control quality even in high-dynamic applications with a traverse speed of up to 10 m/s. The resolution of 1 µm means accuracy classes of up to ± 7 µm can be achieved.









Linear direct drive for short strokes
Especially in the maintenance-free linear drive for short strokes, high cycle frequencies and accelerations there is no cable between the stationary part and the easily movable slide, eliminating the need for a cable drag chain. The magnetically encoded tape of the BML is attached to the underside of the slide. The sensor head attached to the base plate reads the actual slide position absolutely and without contact. Its extremely precise measurement signal, which is available as soon as the system is powered up, ensures high control and feedback quality. The high velocity increases productivity.

- Simple installation: fast commissioning
- Best ratio between stroke and form factor: space-saving
- Matched motor feedback design: highly energy efficient

Optimal position feedback for direct drives up to 48 m
Gearless linear direct drives are increasingly replacing traditional systems that use belts, recirculating ball and rack and pinion drives. Absolute, high-precision multi-slide capable linear measuring systems for longer strokes are required for position feedback in the servo axes. The new BML-G multi-slide capable absolute measurement system is the ideal feedback solution for linear direct drives. Its precise absolute signal is available over strokes of from 10 to 48000 mm. This increases its efficiency, reduces design costs and multiplicity of parts. System costs are also reduced by its ability to simultaneously measure the position of multiple slides on one stator. The generous distance between sensor and magnetic tape simplifies installation and increases operating reliability.

- Absolute measurement signal: no reference move needed for tapes up to 48 m
- Diagnostic function: optimal uptime – reliable operation

High-precision Position Feedback in the Torque Motor

Flat styles for large hollow shafts

Repeat accuracy, extremely precise and high-dynamic
When you're dealing with high-dynamic, fast and accurate positioning tasks, torque motors with BML magnetically encoded angle measurement systems are the right choice. The small sensor head and flat code disc with large inside diameter make the permamagnet-encoded BML perfect for integration in torque motors. Used with a servo they ensure exact position feedback. This is critical for positioning accuracy, energy efficiency, life expectancy and the design of the entire application.

- High-precision measuring result: optimal control quality
- Play- and hysteresis-free: consistently high positioning accuracy
- Flat code disc: flat drive
- With SIN-/COS and ABZ interface

Exact positioning of a tool pivoting system
The BML magnetically encoded angle measurement system integrated into the torque motor is ideal for exactly positioning the tool pivoting system on a machining center. For example, power for the driven tools, the coolant line or data lines for the measuring unit are routed inside through the large hollow shaft where they are protected from twisting.

- Small sensor head, fits in any recess
- Large inside diameter: ideal for hollow shafts
- Generous distance between sensor and ring: simple to install – high operating security

Rotate and swivel industrial robots with high dynamics
Real-time capable with high positioning accuracy and a small footprint – these virtues make BML magnetically encoded angle measurement systems ideal for position feedback in torque motors used for dynamic rotation and swivel movements in industrial robots.

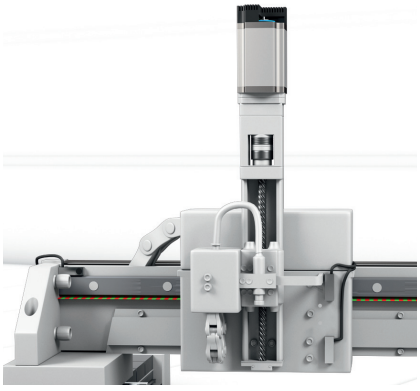
- No play or hysteresis: long uptime thanks to short setup times
- High-dynamic: high cycle frequency increases productivity
- Easy to integrate: slim, weight-reduced design improves energy efficiency
- High power density: no space needed for gears

Detect End and Intermediate Positions with Ease

Comprehensive portfolio of mini-sensors for ideal solutions

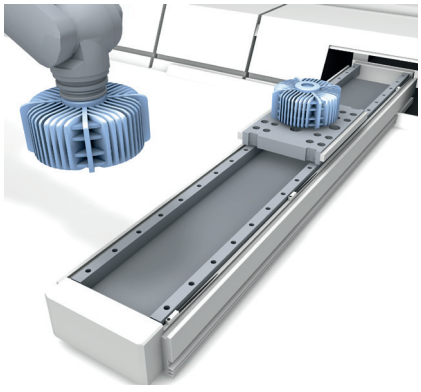
Detect end-of-travel and reference positions
Binary sensors using various technologies ensure reliably simple position detection. Their high enclosure rating and variety of form factors make these high-performance sensors usable anywhere. With their compact sizes and low weight, the miniature series stands out with its minimal space requirements and compatibility with moving actuators and slides. For example, on grippers, gantry loaders or pick-and-place applications, where every ounce of weight saved increases the energy efficiency of the system.

Measure rotational speeds, rotation directions and stop conditions
Whether directly in the drive or on various shafts of a packaging machine – rotational speeds are detected everywhere in machine and systems building. As diverse as the applications are, so are the demands made on the sensors that measure rotational speed.
For simple detection, one or – for simultaneous detecting of rotation direction – two inductive standard sensors are sufficient.
For demanding use at higher speeds or precise speed determination, BML measurement systems with magnetically encoded rings are the right choice.



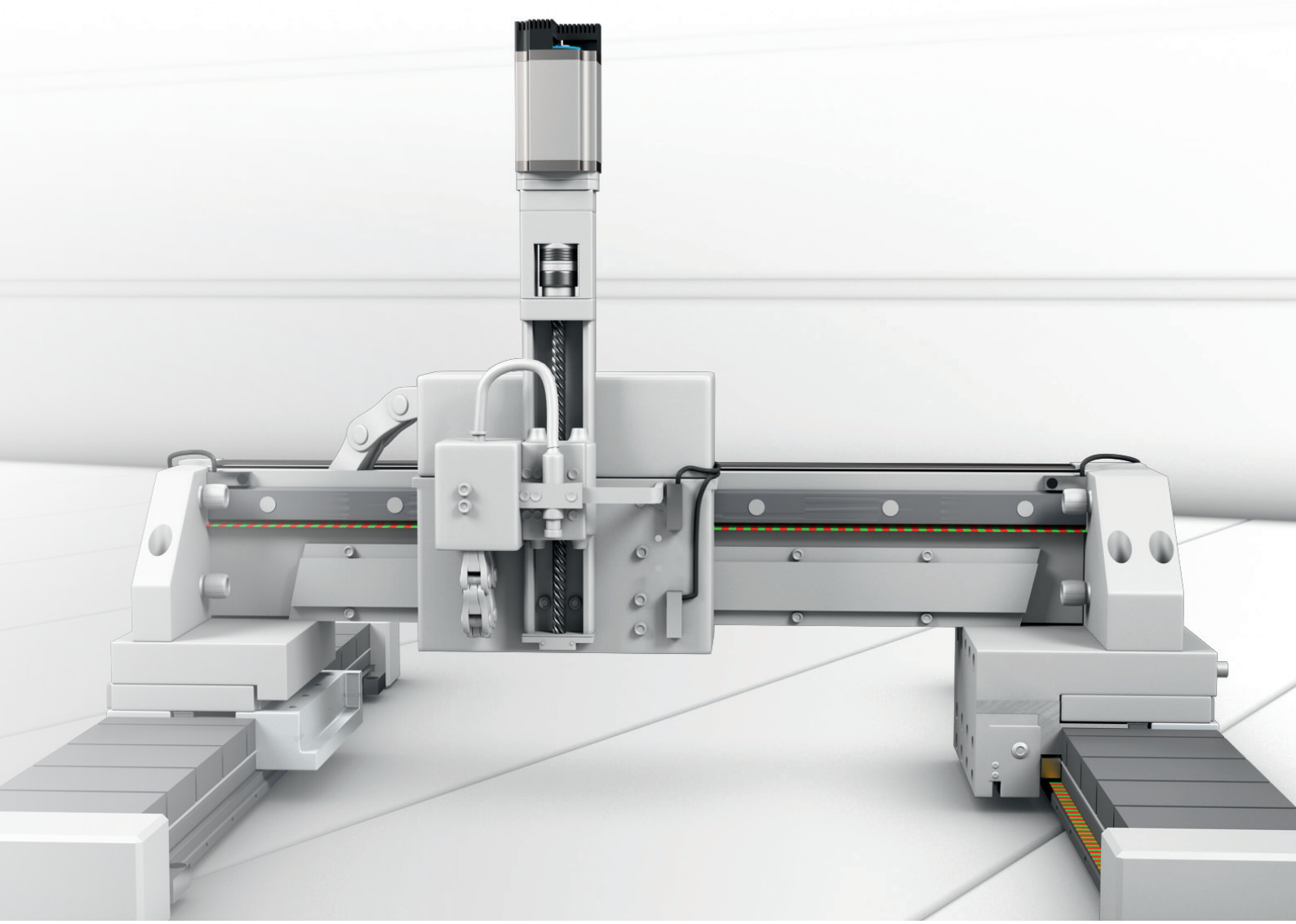
Spindle feed positioning
Block-style mini-sensors are ideal for end-of-travel sensing in the spindle drive. Their flat form factor fits in any design and are easy to mount.

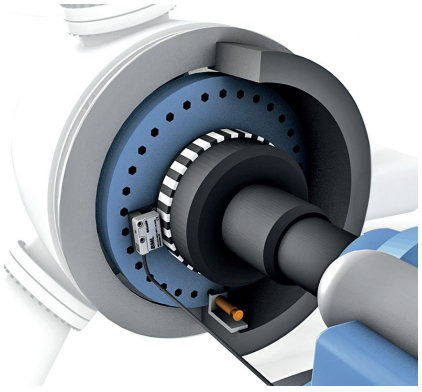
- Very rugged: high uptime
- Optimal price/performance ratio: reduced overall cost



Detect individual positions
Light, high-performance inductive mini-sensors reliably detect end or reference positions in linear drives. They enable great freedom of design when laying out single or multi-axis linear drives. Their small, compact size means they can be integrated in locations that would otherwise be too tight for a sensor.

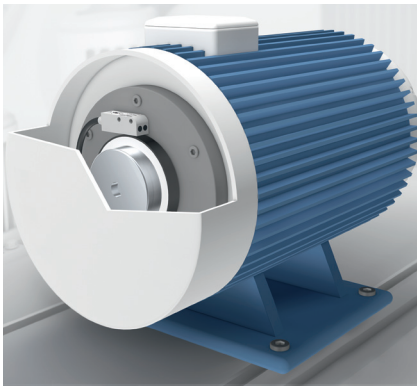
- Small form factors improve the power density of drive units
- Low weight increases the dynamics of the movement





Measure slow and fast speeds
BML magnetically encoded measurement systems are also extremely precise at very slow speeds. They detect both the direction of rotation and the correct shaft position using reference points. All without contact and wear-free.

- Wide speed range: high system security
- Reference points: fast commissioning



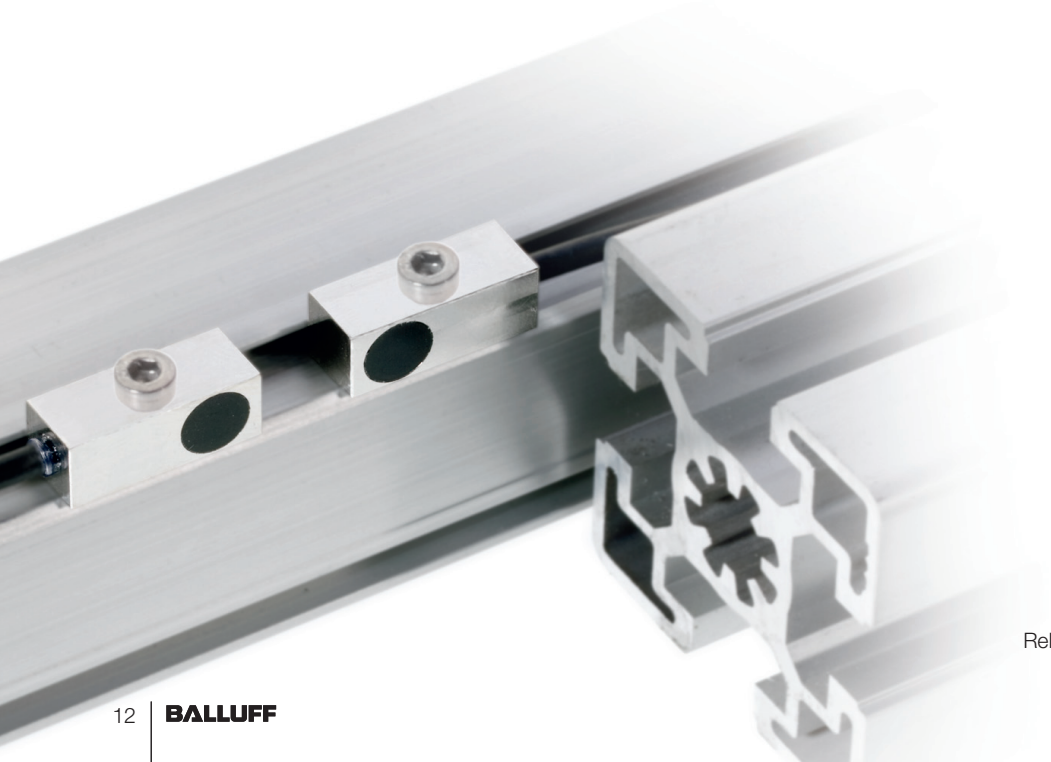
High speeds directly on the motor shaft
BML S1F measurement systems precisely and reliably measure the speeds of the drive shaft directly on the motor. Their narrow form factor allows the existing motor design to remain compact.

- Extremely accurate, even at very low speeds
- Non-contact: maintenance-free
- SIN-/COS- or ABZ interface

Detect both speed and rotation direction
BES inductive standard sensors detect shaft speeds in systems building extremely reliably and at temperatures up to –40 °C. Two aligned sensors are sufficient for detecting the speed and direction of rotation and protecting the equipment from overspeed.

- Generous switching distance: simple installation
- Extended temperature range: failsafe operation
- Contactless detection: high equipment uptime
- Insensitive to contamination: no additional protection measures required

Series		5×5 mm	5×5 mm
Installation		Flush	Flush
Rated switching distance sn		1.5 mm	1.5 mm
Assured switching distance sa		0...1.2 mm	0...1.2 mm
Switching distance marking		■■	■■
PNP, NO		**BES01RP**	**BES01RN**
PNP, normally closed		**BES01RK**	**BES01RJ**
NPN, NO		**BES01RE**	**BES01RC**
NPN, NC		**BES01R8**	**BES01R7**
Supply voltage U_S		10...30 V DC	10...30 V DC
Voltage drop U_d at I_e max.		2.5 V	3 V
Rated insulation voltage U_i		75 V DC	75 V DC
Rated operating current I_e		100 mA	100 mA
Polarity reversal protected/transposition protected/short-circuit protected		Yes/Yes/Yes	Yes/Yes/Yes
Ambient temperature T_a		–25...+70 °C	–25...+70 °C
Switching frequency f max.		2 kHz	2 kHz
Output function indicator		Yellow LED	Yellow LED
Degree of protection as per IEC 60529		IP 67	IP 67
Approvals		CE, cULus	CE, cULus
Special properties		Narrow design	Narrow design
Material	Housing	Stainless steel	Stainless steel
	Sensing surface	PBT	PBT
Connection		M5 connector, 3-pin	2 m PUR cable, 3×0.14 mm²



Reliably detect individual positions

			
SUPER*SHORTIES*			**SUPER***SHORTIES*
8×8 mm	8×8 mm	8×8 mm	8×8 mm
Flush	Flush	Flush	Flush
2 mm	2 mm	2 mm	2 mm
0...1.6 mm	0...1.6 mm	0...1.6 mm	0...1.6 mm
■■	■■	■■	■■
BES03Y8	**BES01U2**	**BES01UW**	**BES041N**
BES03U3	**BES01TF**	**BES01UK**	**BES041P**
BES03UC	**BES01T3**	**BES01UC**	**BES041R**
BES03YJ	**BES01RW**	**BES01U6**	**BES041T**
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
2.8 V	2.5 V	2.5 V	2.8 V
75 V DC	75 V DC	75 V DC	75 V DC
200 mA	200 mA	200 mA	200 mA
Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes
–25...+70 °C	–25...+70 °C	–25...+70 °C	–25...+70 °C
3 kHz	3 kHz	3 kHz	3 kHz
Yellow LED	Yellow LED	Yellow LED	Yellow LED
IP 67	IP 67	IP 67	IP 67
CE, cULus	CE, cULus	CE, cULus	CE, cULus
Short design			Short design
Brass-coated	Cast zinc	Cast zinc	Brass-coated
PBT	PBT	PBT	PBT
M8 connector, 3-pin	M8 connector, 3-pin	M8 connector, 3-pin	0.3 m PUR cable with M8 connector, 3-pin

For information about object detection, refer to our catalog or look online at **www.balluff.com**

Series		8×16×4 mm R04	8×16×4 mm R04
Installation		Flush	Flush
Rated switching distance s_n		1.5 mm	1.5 mm
Assured switching distance s_a		0...1.2 mm	0...1.2 mm
Switching distance marking		■	■
PNP, NO		**BES01YC**	**BES01YJ**
PNP, normally closed		**BES01Y7**	**BES03J1**
NPN, NO			**BES01Y3**
NPN, NC		**BES01WY**	**BES01WZ**
Supply voltage U_S		10...30 V DC	10...30 V DC
Voltage drop U_d at I_e max.		1.5 V	1.8 V
Rated insulation voltage U_i		75 V DC	75 V DC
Rated operating current I_e		100 mA	100 mA
Polarity reversal protected/transposition protected/short-circuit protected		Yes/Yes/Yes	Yes/Yes/Yes
Ambient temperature T_a		–25...+70 °C	–25...+70 °C
Switching frequency f max.		2.5 kHz	2.5 kHz
Output function indicator		Yellow LED	Yellow LED
Degree of protection as per IEC 60529		IP 67	IP 67
Approvals		CE, cULus	CE, cULus
Material	Housing	PA 6 (fiberglass reinforced)	PA 6 (fiberglass reinforced)
	Sensing surface	PA 6 (fiberglass reinforced)	PA 6 (fiberglass reinforced)
Connection		0.2 m PUR cable with M5 connector, 3-pin	2 m PVC cable, 3×0.09 mm²

End-of-travel sensor integrated into drive.



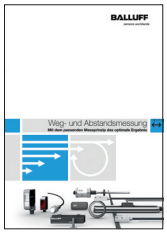

8×16×4 mm R04	8×16×4 mm R04	10×30×6 mm R03	10×30×6 mm R03
Non-flush	Non-flush	Flush	Flush
2.5 mm	2.5 mm	3 mm	3 mm
0...2.2 mm	0...2 mm	0...2.4 mm	0...2.4 mm
■■	■■	■	■
BES01YM	**BES01YT**	**BES01WR**	**BES01WP**
BES0447			
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
2.5 V	2.5 V	2.5 V	1.8 V
75 V DC	75 V DC	75 V DC	75 V DC
100 mA	100 mA	100 mA	100 mA
Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes
–25...+70 °C	–25...+70 °C	–25...+70 °C	–25...+70 °C
3 kHz	150 Hz	3 kHz	3 kHz
Yellow LED	Yellow LED	Yellow LED	Yellow LED
IP 67	IP 67	IP 67	IP 67
CE, cULus	CE, cULus	CE, cULus	CE, cULus
PA 6 (fiberglass reinforced)	PA 6	PA 6	PA 6
PA 6 (fiberglass reinforced)	PA 6/GF 30	PA 6	PA 6
0.3 m PUR cable with M8 connector, 3-pin	2 m PVC cable, 3×0.09 mm²	2 m cable TPU, 3×0.14 mm²	0.3 m PUR cable with M8 connector, 3-pin

For information about object detection, refer to our catalog or look online at **www.balluff.com**

Product overview

Series	BIP 14	BIP 40	Profile PF/P
Resolution	14 µm	40 µm	1...1000 µm
System accuracy			
Linearity	±250 µm	±400 µm	±30 µm
Repeat accuracy	±80 µm	±100 µm	±5 µm
Distance to tape, magnet or target	0.5...2 mm	1...3 mm	0.1...15 mm
Measuring range	1...14 mm	1...40 mm	50...7620 mm
Target/position encoder metal	■	■	
Interfaces			
Analog voltage 0...10 V, 10...0 V, –10 V...+10 V	■	■	■
Analog current 4...20 mA, 0...20 mA	■	■	■
SSI			■
BISS C			
SSI-SYNC			■
CANopen			■
DeviceNet			■
Profibus-DP			■
Start/stop pulse interface			■
Profinet			■
VARAN			■
EtherCAT			■
IO-Link	■	■	■
Incremental digital RS422 (TTL)			
Incremental digital HTL			
Incremental analog sin/cos (1 V_{pp})			

Accessories
Pole pitch (fine interpolation track)



For information on our Micropulse transducers BTL and BIW, refer to our catalog or visit our website at **www.balluff.com**

Accessories	
Ring	No. of poles
	Pole width




BML-S1H_-M3CA...	**BML-S1G0...**	**BML-S1F_-Q...**	**BML-S2B0-Q...**
1...10 µm	1...10 µm	1...10 µm	5...50 µm
±7 µm	±20 µm	±10 µm	±50 µm
0.1...0.35 mm	0.1...0.8 mm	0.1...0.35 mm	0.1...2 mm
0...1024 mm	0...48 mm	0...48 mm	0...48 mm
■	■		
■	■		
	■	■	■
			■
■	■	■	

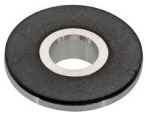



Magnetic tape	Magnetic tape	Magnetic tape	Magnetic tape
BML-M02-A...-M0028-C	BML-M02-A...-A	BML-M02-I3...	BML-M02-I4...
1 mm	2 mm	1 mm	5 mm


	Magnet ring tape	Magnet ring tape
	BML01KM	**BML002M**
	238	32
	1 mm	5 mm

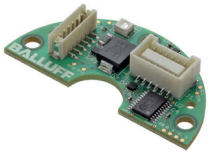
Motor Feedback Evaluation Kit
Absolute, innovative and flexible integration

Absolute disk with perpendicular magnetization

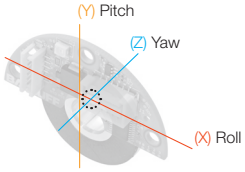


Coding	2-track nonius
Air gap	0.3 ±0.2 mm
System accuracy with iC-MU	< ±0.2° absolute (error per rotation)
Operating temperature	-40...+85 °C
Pole width (master/nonius track)	1.28 mm/0.96 mm
Number of pole pairs (master/nonius track)	32/31
Base body/tape material	Aluminum/rubber ferrite

Electronic processor unit



Dimensions		**24.2×12.1×1.6 mm**
Air gap (sensor/tape)	Z	-0.2...+0.6 mm
	Y	-0.5...+0.5 mm
	X	-0.5...+0.5 mm
Angular deviation (sensor/tape)	Yaw	< ±5°
	Pitch	< ±4.5°
	Roll	< ±4.5°
Mounting holes		2× Ø 2 mm, 3× Ø 3.4 mm



Order:

Package 1
BAV000M

Scope of delivery:
- Absolute disk
- Electronic processor unit
- Cable set for electronics and controller

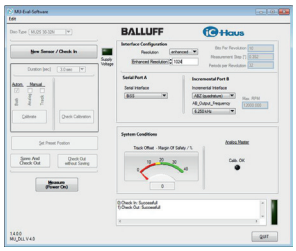
Package 2
BAE00MW

Scope of delivery:
- PC adapter
- Cable set for adapter and PC

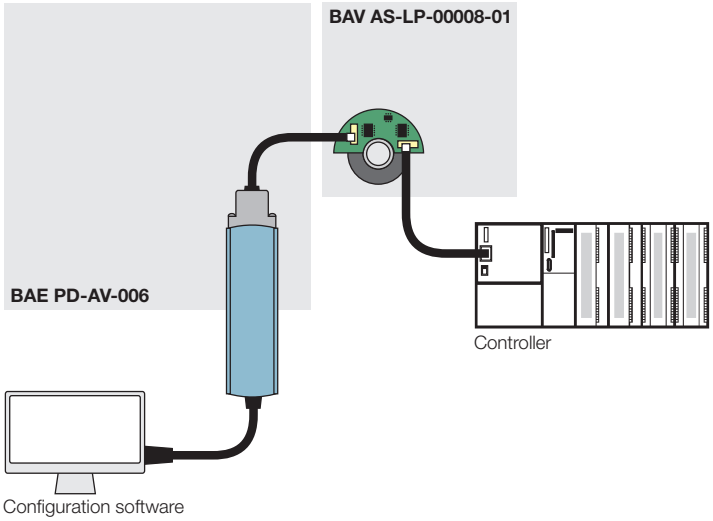
The Evaluation Kit is an all-in-one product offering various interface choices for test environments. Electronics and geometry composed of PCBA can be modified for series production.

The following interfaces are available:
- BISS-C
- SSI
- Sin/cos
- ABZ

Configuration software

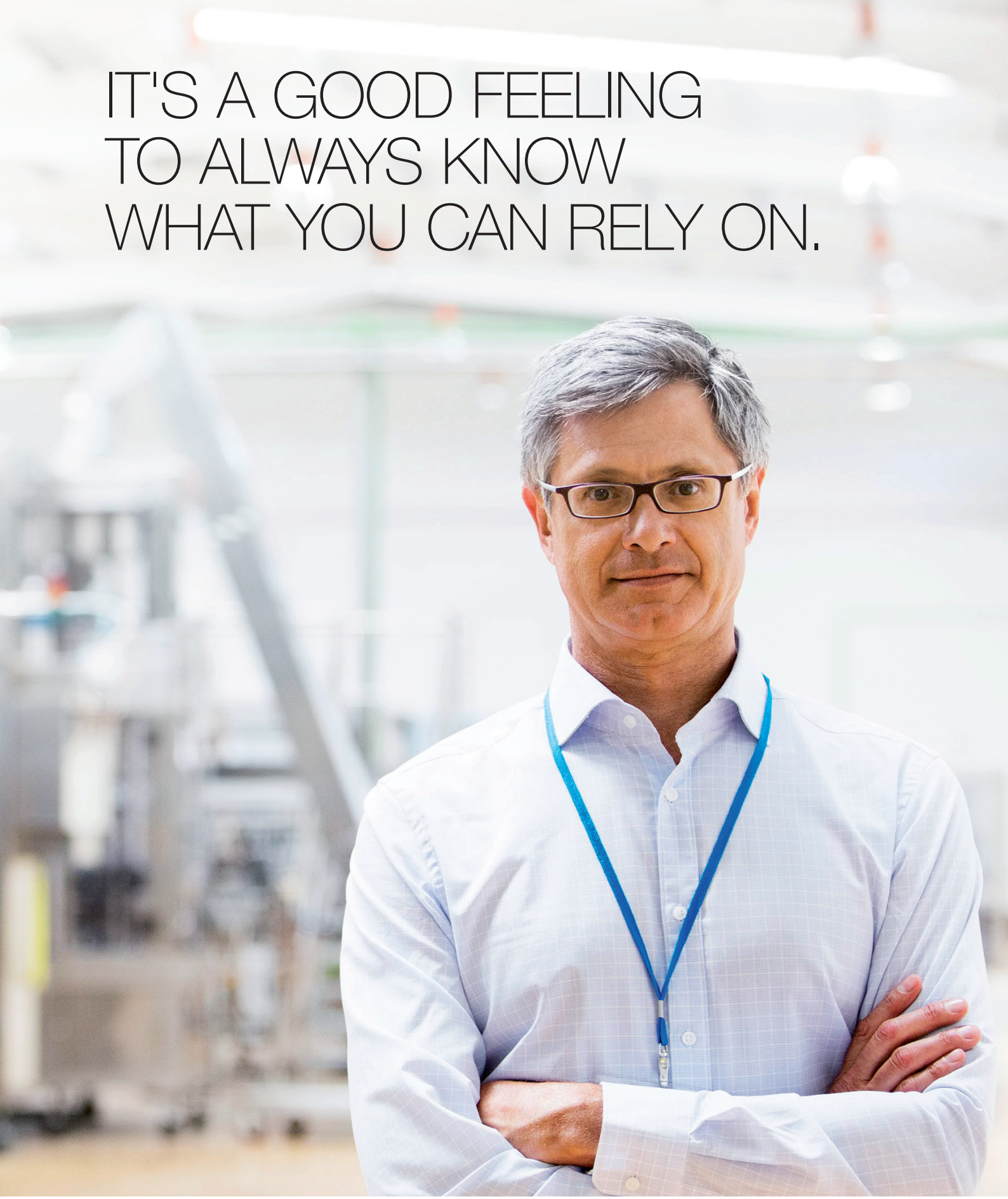


Processor unit



Information about our motor feedback system can be found in our catalog or visit us online at **www.balluff.com**

IT'S A GOOD FEELING TO ALWAYS KNOW WHAT YOU CAN RELY ON.



Sensors. Systems. Network technology.

BALLUFF
sensors worldwide

www.balluff.com

BALLUFF

sensors worldwide

- Systems and Service
- Industrial Networking and Connectivity
- Industrial Identification
- Object Detection
- Linear Position Sensing and Measurement
- Condition Monitoring and Fluid Sensors
- Accessories

Headquarters
Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a.d.F.
Germany
Phone +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.de

www.balluff.com

Doc. No. 921245/Mat. No. 245367 EN
C15; Subject to modification.