01 | 2011

MagLine | Magnetic Length and Angle Measurement Systems

MagLine Micro
MagLine Basic
MagLine Macro
MagLine Roto

SIKO

Success is the result of a commitment to precision, innovation and customer benefit

"Precision is SIKO's top priority and standard!" True to this philosophy, SIKO has been developing and producing innovative solutions in distance and angle measurement technology for more than 45 years now. Based in Buchenbach in the foothills of the Black Forest, the company produces its own measurement technologies, which are a global success in all areas of mechanical engineering. Even today, SIKO's core concept is still manifest in its innovative power, product development and company spirit. Since taking over the business in 1990, industrial engineer Horst Wandres, son of its founder, has continued to develop this philosophy with impressive results.

Intelligent solutions

Attentive ears will always find the right solution. Automation and process optimization are the cornerstones of SIKO's ambitious new technologies and goal-oriented measurement solutions. The company pursues a clear, consistent line of development, ranging from digital position indicators and handwheels through incremental encoders, absolute encoders and measurement displays to future-oriented technologies with electronically programmable or magnetic measurement systems (MagLine).

SIKO again follows the road to success with its compact, ultra-resilient actuators (DriveLine), which enable automated adjustment of machine axles.

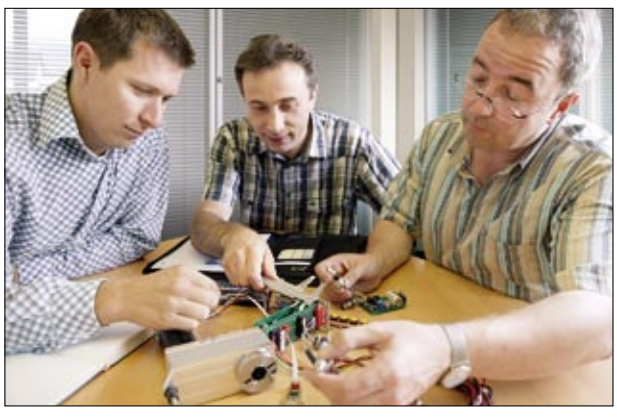
6 distinctive product lines	
PositionLine	Mechanical and electronic position indicators, handwheels with analog indicators, control knobs
RotoLine	Magnetic and optical encoders, geared potentiometers
LinearLine	Wire-actuated encoders
DriveLine	Actuators
MagLine	Magnetic length and angle measurement systems
DisplayLine	Measurement displays

Consistent teamwork

The secret of SIKO's development prowess lies in the motivation and team spirit of its workers. SIKO has a conscious policy of integrating the experiences of its 170 employees, which has a dynamic effect on all areas of company life. Outstanding individual performances blend together to enhance the efficiency of the whole organization.

Not one for all but all together – this motto typifies SIKO's synergetic development process, delivering solutions which dominate the market in all aspects of "measurement technology in mechanical engineering".

This is SIKO today. Precision in motion, dynamic and open for the future ...



We speak the same language: At SIKO, a willingness to participate in open dialog enhances engineering performance. Our production site advantages are not interchangeable.

5.0 | MagLine

Economical solutions and innovative technologies for industrial applications

The MagLine range is a classic example of SIKO's innovative power. The systems are based on the magnetic measurement principle.

Special benefits of MagLine:
- Completely wear-free
- Insensitive to dust, shavings, humidity, oil, fat, etc.
- Very robust with shock and vibration
- No measurement errors caused by gear ratios or gear backlash
- High system accuracy and reproducibility
- Easy handling and mounting

The challenges faced by measuring devices in extreme industrial conditions make great demands on their reliability and reproducibility. MagLine systems are mainly used for extremely precise tracking of linear and radial positions as well as speeds and angles. The contactless technology demonstrates its advantages in all kinds of applications, such as motor feedback or highly dynamic processes in particularly dirty environments.

Since its introduction, MagLine has undergone continuous further development. Four product families provide a general overview: Micro, Basic and Macro for linear length measurement and Roto for angle and speed measurement.

5.0

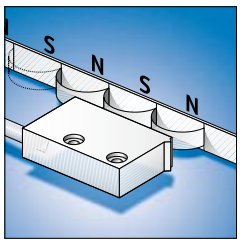
What is the measurement assignment? The following selection criteria indicate the right MagLine system solution:
- Linear or rotating applications
- Incremental/absolute processes
- System accuracy and reproducibility requirements
- Integration into upstream control systems or independent measuring systems

Featuring a constantly expanding spectrum of components in various specifications, MagLine is designed for a number of special tasks. The technology offers future-oriented, extremely versatile and flexible measuring solutions, which are easily integrated and can be continually extended in line with customers' requirements.

Its easy handling and mounting have won MagLine a reputation as a paticularly customer-friendly product line which is universally durable and economical.

Magnetic encoding

The SIKO magnetic bands (flexible steel strips with a magnetic layer) are manufactured precisely and with great care. The bands are equipped with one or more magnetic code tracks in specially developed processes.

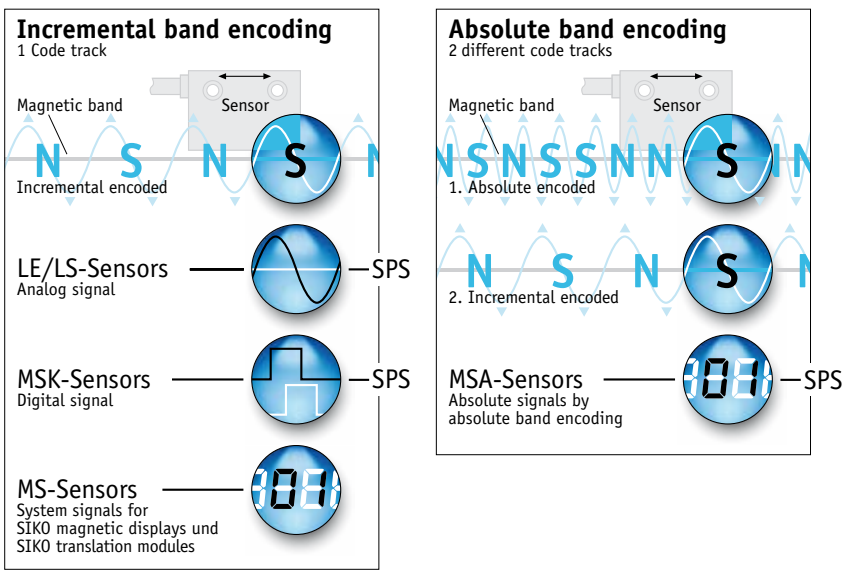


MagLine works in accordance with the principle of contactless scanning of magnetic fields and converts the measured values into digital or analog signals.

The scanning principle is determined by this encoding. Incremental encoding serves for robust and all-round solutions with which, for example, flexible magnetic bands can be individually cut to length before self-adhesive mounting.

The absolute encoding of the band material ensures that the system features a particularly high standard of reproducibility and measuring reliability. Its easy handling and mounting have won MagLine a reputation as a particularly customer-friendly product line, which is universally durable and economical. After power interruptions, for example when the system is switched off and on once more, the actual position value is determined and converted, even if the sensor position has changed in the meantime.

Incremental and absolute encoding methods enable position tracking with different forms of feedback which can be evaluated in various ways (see diagram)



Applications

MagLine systems can be mounted directly on positioning or processing equipment, preventing measurement errors which can occur as the result of gear unit play or spindle tolerances.

The reading distance (sensor/band gap) has a wide tolerance range. This can vary over the whole measuring range and within the defined limits (e.g., due to radial run-out or imprecise guides). Accuracy and reproducibility of the position values are not negatively affected as a result.

The robust measuring equipment is impervious to dirt and mechanical loads in industrial environments. The main advantage is the magnetic measurement method itself, as its principle of operation cannot be negatively affected by typical machine-related effects (vibration, shock), or other influences (bulk solids or fluids).

Demanding conditions require tough equipment. The long service life and durability of the materials and functional units used guarantee maximum reliability. The flexible magnetic bands can also be additionally protected with a stainless steel cover strip to withstand mechanical effects if necessary.

The sensor system itself does not have any moving parts, as the electronics are fully encapsulated. Tough plastic or all-metal housings are generally used for this.

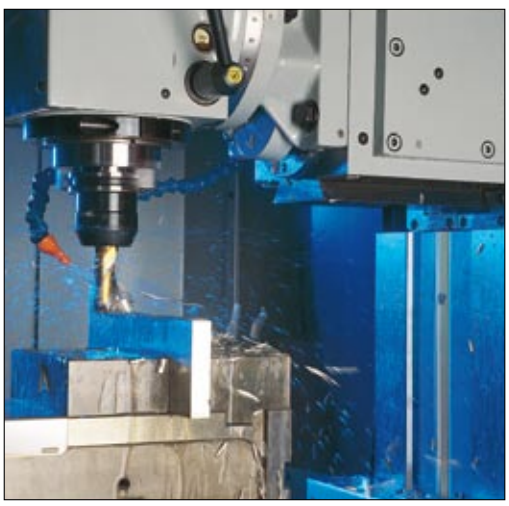
MagLine Micro

This high-resolution linear measuring system was designed for precise and highly-dynamic processes with special requirements regarding measurement in the µm range. The primary applications are in linear and rotary control and drive systems.

With a maximum measuring length of 90 m, MagLine Micro achieves a resolution of 0.2 µm. All main parameters can be freely selected and enable individual adaptation to site requirements. The measurements made by this sensor-band combination are made available in the form of digital square-wave or analog signals. The measuring ranges can be tracked either incrementally or absolutely.

MagLine Micro systems are an inexpensive alternative to conventional length measurement systems, e.g., using optical methods, yet have a wider range of functional applications due to their robust design and resistance to ambient conditions.

MagLine Micro
Resolution: standard 1 µm, max. 0.2 µm
System accuracy ±10 µm
Repeat accuracy of ±1 µm
Sensor/band gap max. 0.4 mm



Reliable high-precision measurement and position tracking is still possible even under particularly difficult ambient conditions.

MagLine Basic

Track-proven and mature, the Basic range features an especially wide range of components for incremental or absolute measurement. The system's resolution makes it suitable for measurements right down to the µm range.

Basic is the MagLine product family with the most comprehensive range. It offers economical solutions for industrial applications, which do not require a very high resolution for measuring accuracy. The system is ideal, for example, for applications in the wood, metal or stone processing industries and also for machines for glass and plastic processing.

Applications using Basic components benefit from its precise, robust measuring methods and matching sensors, with and without integrated translation module.

The versatility of this range is also demonstrated in a series of ready-to-use products. The sensor-display combinations are ready to be fitted with the appropriate self-adhesive band and installed at the desired measuring point. A reliable measuring system can therefore be simply mounted, for example for the length limit stops on a saw.

All measured values can be displayed directly or converted by other controllers for further processing. The Basic series also features interfaces for integration into almost any industrial environment.

MagLine Basic
Resolution: standard 10 µm, max. 1 µm
System accuracy ±25 µm
Repeat accuracy ±10 µm
Sensor/band gap max. 2 mm

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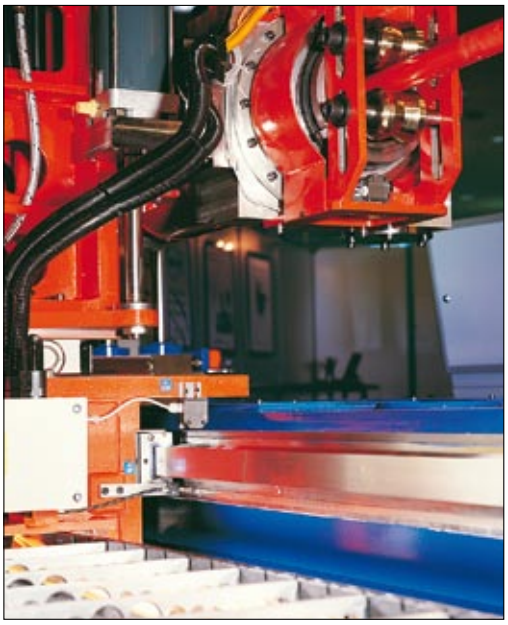


Incremental and absolute position tracking with compatible electronics for connection to controllers or for direct on-site indication.

FELDER KG, Austria

Wilhelm Altendorf GmbH & Co. KG

MagLine Macro

Macro is specially designed for very long distances with both absolute and incremental measurement. The systems provide a reading distance of up to 20 mm, e.g., to compensate for height variations, and accuracy data also designed for particularly long tracking paths e.g., in storage and conveying technology.

Standardized interfaces allow problem-free integration in controls. Central setting and monitoring is, for example, particularly important in stage and studio applications. MagLine Macro ensures reliable position tracking down to the last millimeter with the complex interaction of a number of moving units.

MagLine Macro
Resolution: standard 1 mm, max. 0.25 mm
System accuracy ±1 mm
Repeat accuracy of ±1 mm
Sensor/band gap max. 20 mm

As the sensors are fully encapsulated, MagLine Macro is suitable for use in extreme conditions such as stone processing. The advantages of the high protection category (IP67) and its resistance to even extremely dirty conditions are fully revealed in such applications.

The compact design of the scale and corresponding sensors permits simple and inconspicuous integration into almost any guide unit.

MagLine Roto

The Roto range is an ideal alternative to conventional optical encoder systems, especially when exact speed or angle measurement is required under difficult ambient conditions such as on balancing machines. The system even runs reliably in an oil bath, for example in a hydraulic pump.

Durability is also a feature of the Roto principle: The contactless measuring principle is also advantageous for elevators, as the extreme mechanical stresses in long-term operation are not transmitted to the measuring system.

MagLine Roto
Max. resolution 200 000 pulses/revolution
System accuracy ±0.1°
Repeat accuracy of ±1 increment
Sensor/band gap max. 2 mm

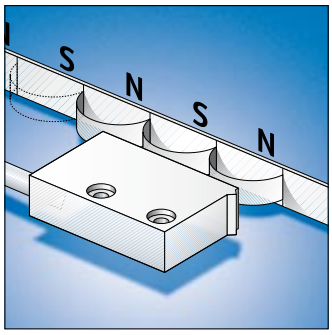
Extremely robust and designed for direct angle and speed measurement – the typical applications of MagLine Roto profit in more ways than one from the contactless magnetic measuring processes.

The magnetic measurement principle

The core element of magnetic linear measurement is a permanently mounted magnetic band (also called the scale). This band is scanned by a magnetic sensor which forwards the information either to an electronic evaluation system, a higher-level controller (PLC) or directly to a connected magnetic display.

The actual magnetic linear measurement is based on the changes in resistance by magnetic effects. The magnetic bands used are encoded by SIKO in specially developed processes.

These encoded scales are scanned by contactless sensors. The integrated electronic system converts the measured values into digital or analog signals for further processing, for example by controllers or a corresponding SIKO indicator.



A sensor registers the magnetically encoded path information and converts this to standardized interface signals for subsequent processing.

5.0

Incremental and absolute processes – the difference

Magnetic linear measurement is performed either incrementally, quasi-absolutely or true-absolutely.

Incremental method

In incremental systems the magnetic band is magnetized at regular intervals with north and south poles, and the pole length also determines the maximum resolution and system accuracy. If the sensor is moved over the band, the periods generate the path information which is processed in the form of square-wave signals (counting pulses). Counting of the pulses provides information on the traveled path.

In an incremental system at least one absolute reference is necessary – the so-called reference point. This point serves for re-orientation of the system and can be stored on the magnetic band as additional information. This reference point is also of importance due to the fact that the actual position value is generally lost in an incremental system if the power supply is interrupted (e.g., if the system is switched on and off) and if the sensor position has been changed in the meantime. A new referencing operation is then necessary.

Incremental to absolute measurement

The system requires re-referencing if ...

Scanning method	Band type	Power interruption	Sensor/band reading distance exceeded
incremental		yes	yes
quasi-absolute	+ -	no	yes
true-absolute		no	no

- A “quasi-absolute” measurement is achieved by buffering the measured data by means of a battery. Movement of the sensor along an incrementally encoded band is recognized even in a currentless state. Referencing is only necessary if the sensor exceeds the maximum band distance.
- A “true-absolute” measurement is achieved when the magnetic strip is encoded absolutely, thus enabling all currentless movements of the sensor/band to receive an absolute position signal direct from the magnetic band when the system is switched on.

The quasi-absolute method
This method is based on incremental measuring methods. The measured values are buffered in a system-related electronic evaluation unit so that they are available as absolute values. An integrated battery ensures that currentless motion is also recognized. The specially developed lowest-power technology enables reliable operation for up to 10 years without changing the battery.

When installing battery-buffered systems, the prescribed maximum reading distance between the sensor/band must not be exceeded, otherwise measurement information can be lost even with this method. If this is the case, a reference operation is necessary.

The true-absolute method
Reference operations are not necessary for linear measurement with absolute encoded magnetic strips. The flexible plastic strip is magnetized with a special absolute code. Commissioning is performed by one-time alignment and calibration of the system. Due to the absolute encoding of the band, no buffer battery is necessary and the current position value is immediately available when the system is switched on.

Even a change in position in a non-powered condition does not affect the accuracy of the displayed measured value, because the position is stored at each point on the encoded magnetic strip. A reference operation is also unnecessary, for example, if the sensor is lifted from the magnetic band for maintenance purposes.

In summary

Each of the measuring methods described above has its advantages. A decision on whether an incremental process is preferable for economic reasons or the absolute process for time and safety reasons can be made once the details of the respective system and application are known.

Path and angle measurement is a standard assignment in mechanical and plant engineering. The SIKO MagLine products have been in use for many years with modern, track-proven solutions. Irrespective of whether an incremental or absolute process is employed, the contactless measuring principle is by far superior in many applications to conventional solutions such as rotary encoders with rack and pinions, wire-actuated encoders or optical systems due to its extreme robustness.

When measurement is required over long distances with a high degree of accuracy and simple handling, MagLine is always an economical solution for a number of tasks. All standard interfaces for connection to control, regulation and bus systems are available.

Incremental systems: Reference signals of sensors and magnetic bands

1. A **sensor with the code "0"** (without index) is only equipped with one sensor element which measures length. A sensor version without index runs, for example, with MB500 incremental (one track).

2. A **sensor with the code"I"** (index signal) is also only equipped with one sensor element which measures length. With an additional electronic system an index signal is generated by the sensor for each period. A second track on the band is not necessary to generate such a signal. This sensor type therefore also runs with MB500 incremental (one track).

3. A **sensor with the code "R/RB"** (one-time or periodical reference point) is equipped with an additional sensor element which scans a second track parallel to the first track on the band. MB500 (2 tracks) with reference point code E (once) or P (periodically) is used, for example, for this sensor. In addition the position of the reference signal on the band must be determined (refer to the data sheet of the respective magnetic band).

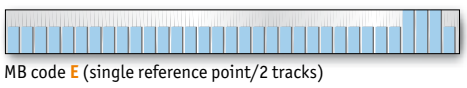
Diagram to sections 1./2.

If a **sensor** has the **code I/O**, it works with ...

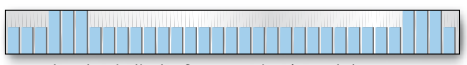
MB code O (without reference point/1 trrack)

Diagram to sections 3.

If a **sensor** has the **code R/RB**, it works with ...



MB code E (single reference point/2 tracks)



MB code P (periodical reference point /2 tracks)

Options for referencing an incremental system

1. **You are using a system comprising a sensor without reference signal and a magnetic band with one track**

The system can be either referenced by moving to a defined position – e.g., a stop block - or by linking a certain position with an external encoder (limit switch, light barrier, etc.). Problem: Depending on the version of the stop block or the external encoder, the repeat accuracy of this method is insufficient.

2. **You are using a system comprising a sensor with the index signal "I" and a magnetic band with one track**

With this version you link an external encoder (limit switch, light barrier, etc.) with an index signal which the sensor emits with each magnetic period. The only function of the external encoder is to determine the correct period. The accuracy of referencing corresponds to the repeat accuracy of the sensor (refer to the respective sensor data sheet). The following must be observed:

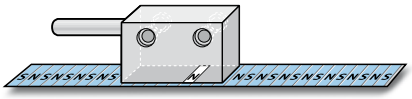
- Referencing can be performed at any point of the traveling path.
- The switching path of the external encoder must be shorter than that of the distance between the index pulses.
  Note: On the MB500 the index pulse distance is 5 mm, on the MB100 only 1 mm.

3. **You are using a system comprising a sensor with the reference signal "R/RB" and a magnetic band with two tracks** (one-time/periodical reference point, magnetized on the second track)

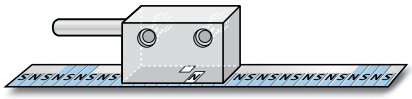
On this version an external encoder is normally not necessary, referencing is only performed with the reference signal of the sensor. Realignment can only be performed at the point at which a corresponding reference point is magnetized onto the band.

With long measurement distances, it is recommended to work with periodical reference points if necessary and to identify these with external encoders. Referencing is performed with the repeat accuracy of the sensor (refer to the respective sensor data sheet).

Sensor with code I without reference point/1 trrack



Sensor with codew R/RB with 1 or x reference point(s)/2 tracks

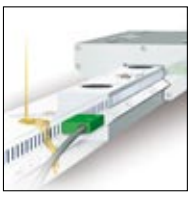


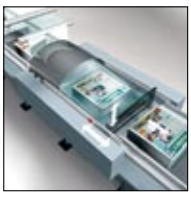
Environmental conditions	Examples of use	Benefits

MagLine Micro
max. resolution 0.2 µm

This system is impervious to outside influences, and the system provides extremely high resolutions.

- High resolution
- Incremental/absolute



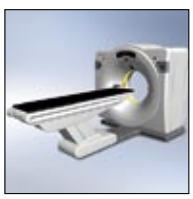
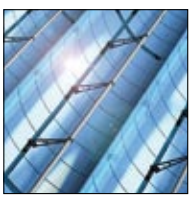
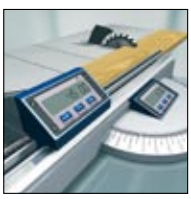
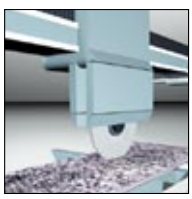



E.g., linear drives with dowel drilling systems, parquet manufacture, tubular film packaging ...

MagLine Basic
max. resolution 1 µm

Unshakeable all-rounder with a number of incremental and absolute components. The special feature: Ready-to-use solutions with indicators and connected sensor.

- Versatile system
- Easy mounting
- Ideal for retrofitting

E.g., CT patient tables, mirror adjustment (solar power plants), sliding table saws, stone cutting ...

MagLine Macro
max. resolution 0.25 mm

Especially height-tolerant magnetic measurement system with sensor/band gap of max. 20 mm; therefore, ideally suited for extreme applications (stone processing).

- High resolution with very long measurement paths
- High protection category (IP67)



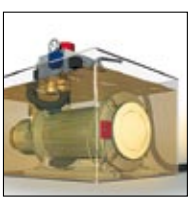


E.g., stage technology, forklifts, waste and scrap presses, stone cutting ...

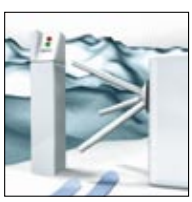
MagLine Roto
max. resolution 0.001°

Roto enables particularly durable angle or speed management, as the contactless measuring method physically separates the Roto sensor from the band or ring.

- Highl operational safety
- Long service life
- High protection category (IP67)







E.g., wind energy plants, elevator technology, tube bending technology, access control ...

5.0


µm
5.1
0.4 mm
SIKO
LE100

5.1 | MagLine Micro

Introduction

The MagLine Micro operates in the µm range and was especially designed for precise and highly dynamic processes on linear and rotary guide and drive systems with their high demands regarding value tracking. With its very high-resolution magnetic measurement the MagLine Micro is available as either an incremental or absolute scanning system with configurable resolutions of up to 0.2 µm and a measuring accuracy of up to 10 µm.

- Incremental and absolute measurement method
- Max. resolution 0.2 µm
- Repeat accuracy max. 1 µm
- Accuracy class up to 10 µm

Product Matrix for the overall system

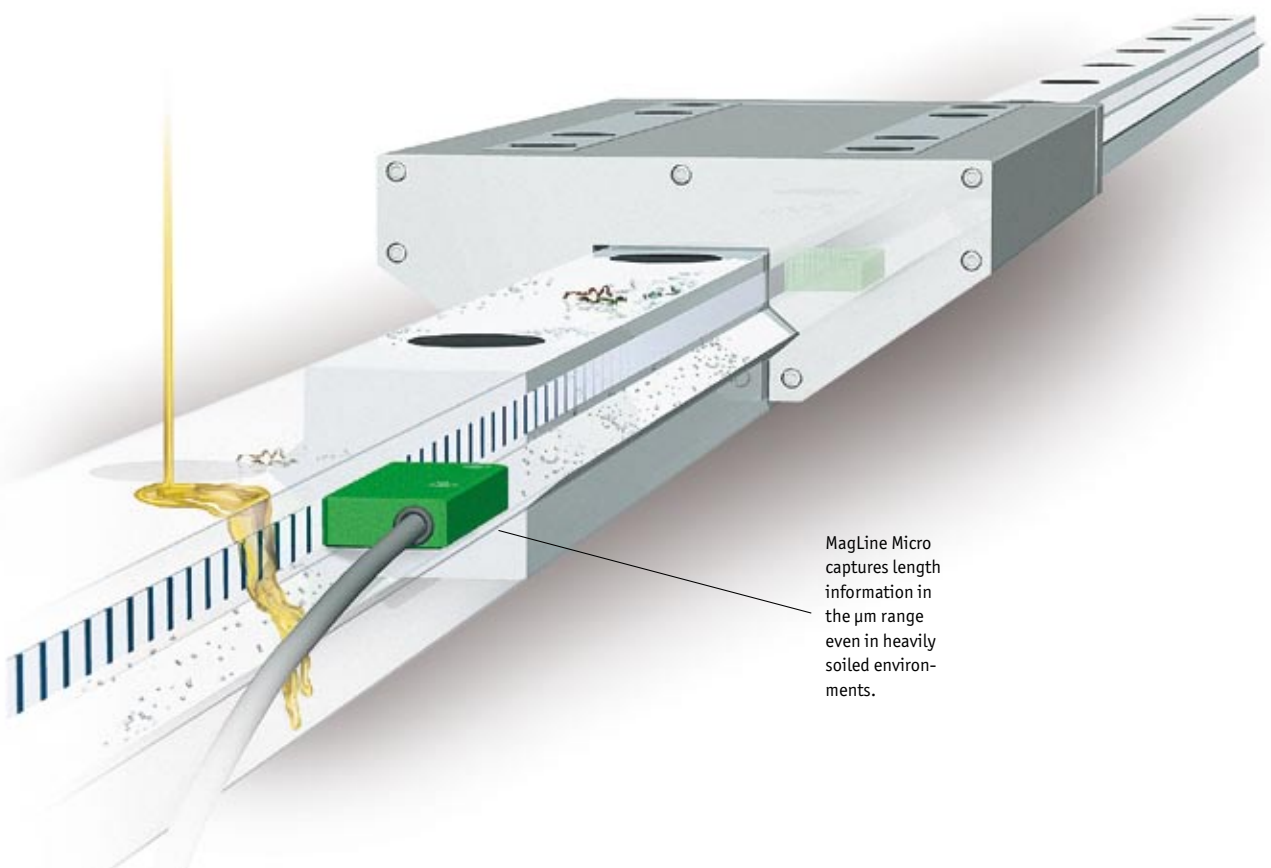
Whether you need a new system or are retrofitting an existing system – with its simple handling and installation the contactless measuring system can also be integrated into existing measuring environments. With MagLine Micro you combine fully coordinated components such as sensor, magnetic band and display or electronic evaluation system to create a complete system which is unsurpassed when it comes to wear-free operation, robustness and economy.

Magnetic bands
Measuring length up to 90 m
Accuracy class up to 10 µm

Sensors
Analog interface 1 V_{SS}
Maximum tolerance of reading distance to scale 0.4 mm

Translation module
Real-time signal processing
Resolution 0.2 µm

Magnetic displays
Direct display
Resolution and repeat accuracy up to 1 µm



MagLine Micro captures length information in the µm range even in heavily soiled environments.

MagLine Micro

Signal analysis via	Incremental systems			Absolute systems		
	Output, digital	Output, analog		Magnetic display	Sensor	Translation module
System accuracy class (µm)	±10	±10	±10	±10	±10	±10
Maximum repeat accuracy (µm)	±1	*)	*)	±1	±1	±5
Maximum measurement length/magnetic display (m)	infinite	infinite	infinite	±9.999.999	4.0	4.0
Maximum reading distance (mm)	0.4	0.4	0.4	0.4	0.2	0.4

Resolution max. in µm	Supply voltage	Output/ interface	Magnetic sensor	Page	
0.2	6.5 ... 30 V DC 4.75 ... 6 V DC	LD	**MSK1000**	18	
*)	10.5 ... 30 V DC 5 V DC	1 V_{SS}	**LE100/1**	22	
*)	24 V DC 5 V DC	1 V_{SS}	**LS100**	25	
*)	feed via down-stream elec-tronics unit	—	**MS100/1**	28	
1	4.5 ... 30 V DC	1 V_{SS}, SSI, RS485	**MSA111C**	36	

			Magnetic display		
1	24 V DC 230 V AC 115 V AC	RS232, RS485	**MA100/2**	30	

			Translation module		
1	24 V DC	1 V_{SS}, LD, SSI, RS485	**ASA110H**	39	

Width in mm	Accuracy class in µm	Available length max. in m/piece	Magnetic band		
5 or 10	10 or 50	4 (10 µm) 90 (50 µm)	**MB100**	16	
10	50	4	**MBA110**	32	
10	10	4.07	**MBA111**	34	

*) depends on the downstream electronics

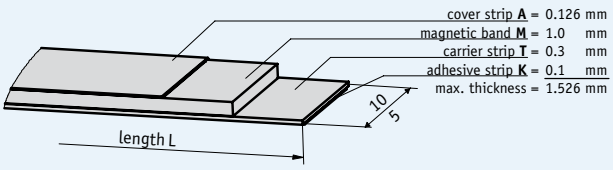
5.1

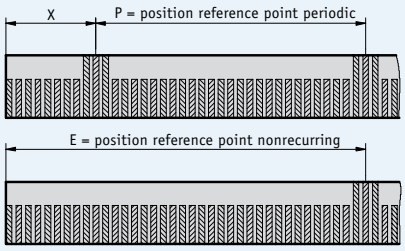
Subject to technical alterations 12/2010

Magnetic Band MB100
Incrementally coded scale, 1 mm pole length

Profile

- Easy adhesive mounting, self-assembly possible
- Reels up to 90 m available
- 1 mm pole length
- System accuracy up to 10 µm





Reference points (all details in mm)	
X	0.02
P	0.02, 0.08, 0.14, 0.2, 0.26, 0.32, 0.38, 0.44, 0.5
E	0.02, 0.06, 0.1, 0.14, 0.18, 0.22, 0.26, 0.34, 0.42, 0.5

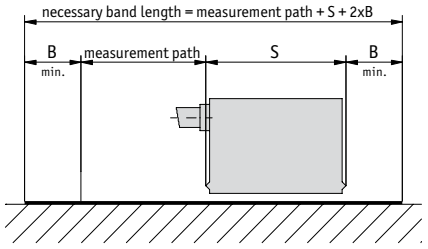
Mechanical data

Feature	Technical data	Additional information
Pole length	1 mm	
Measuring length	infinite	
Band width	10 mm or 5 mm	
Thickness	1.4 mm	without cover strip
Accuracy class	10 µm or 50 µm	
Temperature coefficient	(11 ±1) x 10^{-6}/K (16 ±1) x 10^{-6}/K	spring steel stainless steel
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 10 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Width	10	A	in mm	
	5		in mm	
Accuracy class	0.01	B	0.01 mm	available length: max. 4000 mm
	0.05		0.05 mm	available length: max. 90000 mm
Length	...	C	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length" measurement + sensor length 2 x B
Carrier strip	St	D	steel	
	VA		stainless steel	only with width 10 mm
Adhesive carrier strip	TM	E	with	
	TO		without	
Cover strip	AM	F	with	stainless steel
	AO		without	
Reference point	0	G	without	
	E		one-time	only with width 10 mm
	P		periodic	only with width 10 mm
Position of reference point E one-time	...	H	0.02, 0.06, 0.1, 0.14, 0.18, 0.22, 0.26, 0.34, 0.42, 0.5	indicate only if reference point E was selected
			others on request	max. 5.0 m
or Position of reference point P periodic	...	H	0.02, 0.08, 0.14, 0.2, 0.26, 0.32, 0.38, 0.44, 0.5	indicate only if reference point P was selected
			others on request	

Order code

MB100 – [A] – [B] – [C] – [D] – [E] – [F] – [G] – [H]

Scope of delivery: *MB100, User information*

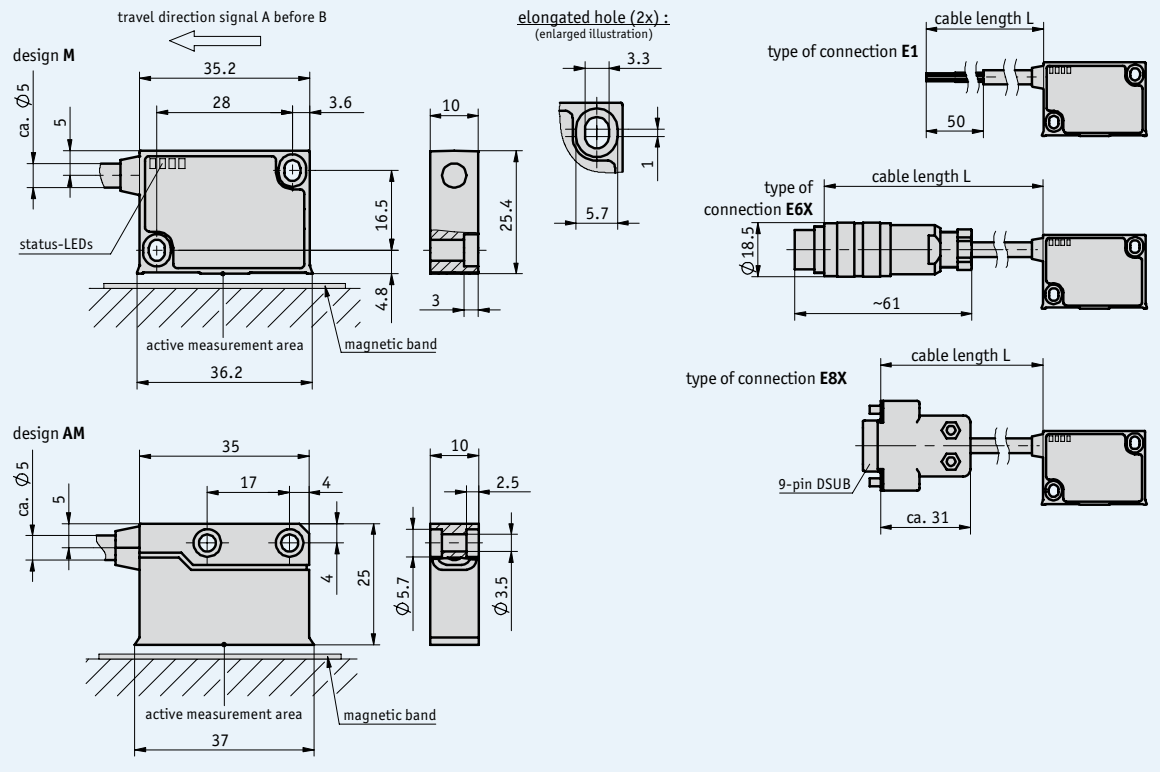
Additional information:
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Sensor MSK1000
Incremental, digital interface, resolution 0.2 µm

Profile

- Max. resolution 0.2 µm
- Repeat accuracy ±1 µm
- Max. sensor/band reading distance 0.4 mm
- Status LED display
- Robust metal housing



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB100	
System accuracy	±10 µm	accuracy class 10 µm with MB100
Repeat accuracy	max. ±1 µm	
Sensor/band reading distance	0.1 ... 0.4 mm	with reference signals 0, I
	0.1 ... 0.2 mm	with reference signal RB
Travel speed	depends on resolution and pulse interval	see table
Housing	zinc die-cast	aluminum front cover, anodized blue
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	in steps of 90 m

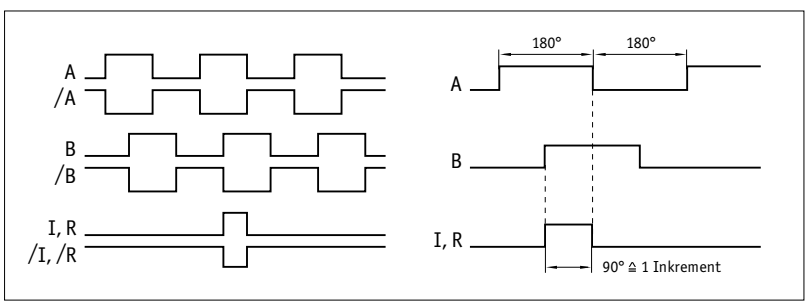
Travel speed

		Travel speed V_{max} (m/s)			
Resolution (µm)	**0.2**	0.64	0.32	0.16	0.08
	1	3.20	1.60	0.80	0.40
	2	6.40	3.20	1.60	0.80
	5	16.00	8.00	4.00	2.00
Pulse interval (µs)		0.25	0.50	1.00	2.00
Counting frequency (kHz)		1000.00	500.00	250.00	125.00

Electrical data

Feature	Technical data	Additional information
Operating voltage	6.5 V DC ... 30 V DC 4.75 V DC ... 6 V DC	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<25 mA	without load
Type of connection	flying leads round connector D-SUB 9-pin	
Output circuit	LD (RS422)	
Output signals	A, /A, B, /B, I, /I, or R, /R	
Pulse width of reference signal	1 or 4 increments	
Resolution	0.2, 1, 2, 5 µm	
Interference protection class	3	IEC-61000-6-2
Real-time requirement	real-time signal processing	
Signal level high	>2.5 V	
Signal level low	<0.5 V	

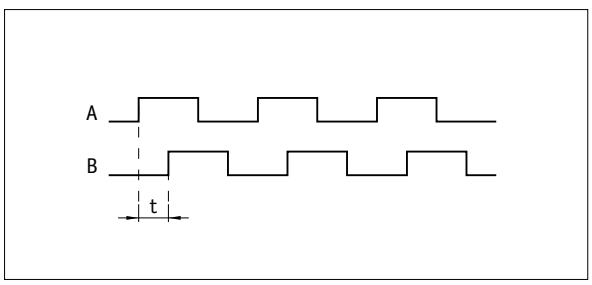
Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

Reference or index signal with 4 increments (360°) signal length is only valid from the 5th counting step onwards. A corresponding delay should be taken into consideration after switching on the operating voltage.

Pulse interval



Example: Pulse interval t = 1 µs
(i.e., the downstream unit must be able to process 250 kHz)

Formula for input frequency $= \frac{1}{1\ \mu s \times 4} = 250\ kHz$

Pin assignment

- **without index signal**

Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
+UB	brown	4	4
GND	black	5	5
/A	yellow	6	6
/B	green	7	7
N.C.		3	3, 8, 9

- **with index signal**

Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
I,R	blue	3	3
+UB	brown	4	4
GND	black	5	5
/A	yellow	6	6
/B	green	7	7
/I, /R	violet	8	8
N.C.			9

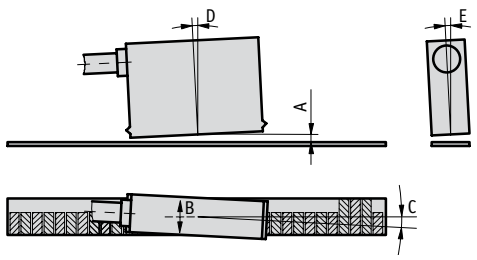
5.1

Mounting note

On systems with reference points on the magnetic band, please ensure the correct alignment of the sensor and band (see diagram).

Reference signal	O, I	RB
A, Sensor/band reading distance	max. 0.4 mm	max. 0.2 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±3°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

Order note

The internal translation module can generate fast counting pulses. The pulse length is limited by the pulse interval. The follow-up electronic system must be coordinated accordingly, if necessary select the pulse interval previously.

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	10	A	6.5 ... 30 V DC	
	11		4.75 ... 6 V DC	
Design	M	B	metal housing with status LEDs	
	AM		metal housing without status LEDs	
Type of connection	E1	C	flying leads, 2 m cable	
	E6X		round connector without mating connectors	
	E8X		D-SUB 9-pin without mating connectors	
			cable extensions on request	
Cable length L	...	D	1 ... 20 m, in steps of 1 m	
			others on request	
Reference signal	0	E	without	
	I		index periodic	
	RB		fixed reference, scanning on band side	
Resolution in µm	...	F	0.2, 1, 2, 5	
Pulse interval in µs	...	G	0.25, 0.5, 1, 2	
			others on request	

Order code

MSK1000 – [A] – [B] – [C] – [D] – [E] – [F] – [G]

Scope of delivery: *MSK1000, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.2 mm*

Additional information:

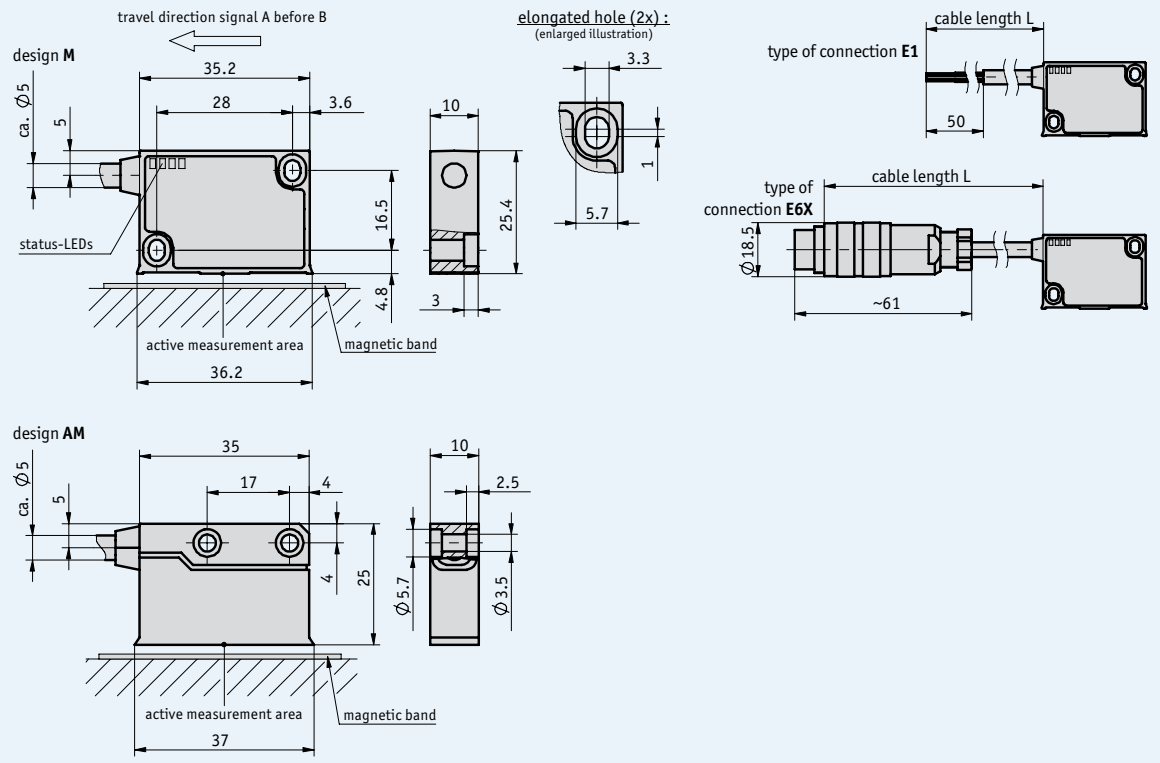
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Sensor LE100/1
Incremental, analog interface 1 V_{SS}

Profile

- Repeat accuracy max. ±1 µm
- Output circuit sin/cos 1 V_{SS}
- Signal period 1 mm
- Status LED display
- Robust metal housing



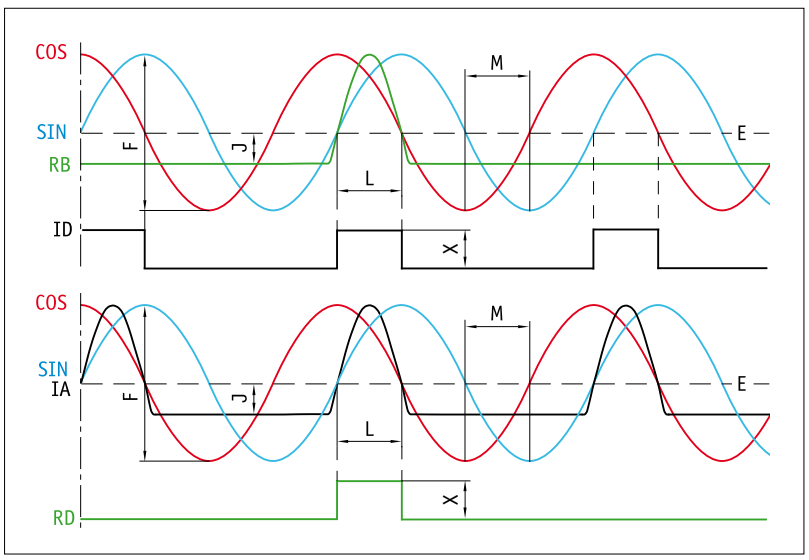
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB100	
System accuracy	±10 µm	accuracy class 10 µm only with MB100
Repeat accuracy	max. ±1 µm	
Sensor/band reading distance	0.1 ... 0.4 mm 0.1 ... 0.2 mm	with reference signal 0, IA, ID with reference signal RB, RD
Travel speed	max. 20 m/s	5 m/s with reference signal RB
Housing	zinc die-cast	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	<200 m/s2 (50 ... 2000 Hz)	

Electrical data

Feature	Technical data	Additional information
Operating voltage	10.5 ... 30 V DC 5 V DC ±5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<25 mA <50 mA	with 24 V with 5 V
Type of connection	flying leads round connector	
Output circuit	1 V_{SS}	
Output signals	sin, cos, /sin, /cos, I, /I, or R, /R	
Pulse width of reference signal	see the drawing of the signal shape	
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal amplitude	1 V_{SS} ±10 %	at 0-70 °C with RA = 120 Ohm to 1 kOhm
Output impedance	0 Ohm (Rload >75 Ohm), short-circuit-proof	
Offset sine/cosine	2.5 V ±100 mV UB/2 ±100 mV	
Phasing sine/cosine	90° ±1°; < ±3° (20 kHz)	
Phasing reference signal	sin 45°, cos 135°	
Signal period	1000 µm	

Signal forms



E: reference voltage 2.5 V
F: 1 V_{SS} ±10 %
J: ≥0.2 V
L: 100° ±20°
M: 90° ±1.0°/< ±3° (25 kHz)
X: 1 V_{SS}

Pin assignment

without reference signal

signal	E1	E6X
GND	black	1
sin	red	2
/sin	orange	3
cos	yellow	4
/cos	green	5
+UB	brown	6
N.C.		7

with reference signal

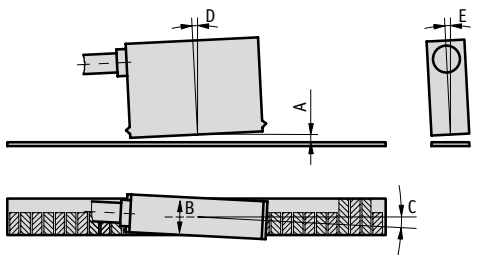
signal	E1	E6X
sin	red	1
cos	yellow	2
index	blue	3
+UB	brown	4
GND	black	5
/sin	orange	6
/cos	green	7
/index	violet	8

Mounting instruction

On systems with reference points on the magnetic band, please ensure the correct alignment of the sensor and band (see diagram).

Reference signal	O, I, ID	RB, RD
A, Sensor/band reading distance	max. 0.4 mm	max. 0.2 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±3°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

Order note

For the “AM” design feature with reference signal “O”, a special version, SA09, is available on request. Housing connected to screen, twisted-pair sensor cable.

5.1

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	10	A	10.5 ... 30 V DC	
	5		5 V DC ±5 %	
Design	M	B	metal housing with status LEDs	
	AM		metal housing without status LEDs	
Type of connection	E1	C		
	E6X			
			cable extensions on request	
Cable length L	...	D	1 ... 20 m, in steps of 1 m	
			others on request	
Reference signal	O	E	without	
	IA		index periodic (analog)	index signal every 1 mm
	ID		index periodic (digital)	index signal every 1 mm
	RB		fixed, band side (analog)	
	RD		fixed, band side (digital)	

Order code

LE100/1 - [A] - [B] - [C] - [D] - [E] - S

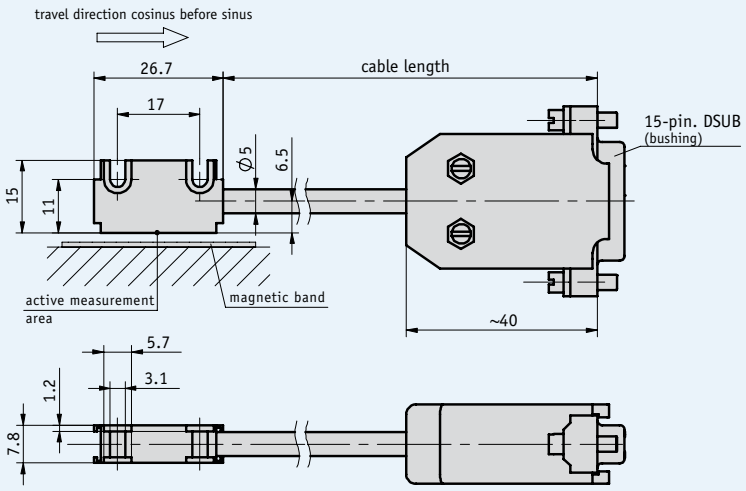
Scope of delivery: *LE100/1, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.2 mm*

Additional information:
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Profile

- Repeat accuracy max. ±1 µm
- Output circuit sin/cos 1 V_{SS}
- Signal period 1000 µm (analog)
- Real-time signal processing



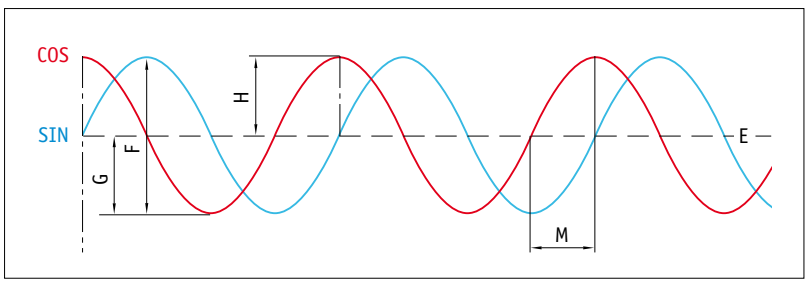
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB100	
System accuracy	±10 µm	accuracy class 10 µm only with MB100
Repeat accuracy	max. ±1 µm	unidirectional
Sensor/band reading distance	0.1 ... 0.4 mm reference signal RB <0.2 mm	over total measuring length, without cover strip
Travel speed	max. 20 m/s	
Housing	zinc die-cast	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70°C	
Storage temperature	-30 ... +80°C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	<200 m/s² (50 ... 2000 Hz)	
Max. measuring length	infinite	

Electrical data

Feature	Technical data	Additional information
Operating voltage	5 V DC ±5 %	no reverse-polarity protection on UB
	24 V DC ±20 %	reverse-polarity protection on UB, on request
Current consumption	approx. 30 mA	off-load
Type of connection	D-SUB-connector 15 pins	
Output circuit	1 V_{SS}	
Output signals	sin, cos, /sin, /cos	
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal amplitude	1 V_{SS} ±10 %	with RA = 120 Ohm up to 1 kOhm at 0 ... 20 °C
Output impedance	R_{load} >75 Ohm	
Offset sine/cosine	2.5 V ±0.5 %	
Phasing sine/cosine	90° ±1°; < ±3° (20 kHz)	
Signal period	1000 µm	

Signal forms



E: 0 V ±5 mV (reference voltage 2.5 V)
F: 1 V_{SS} ±10 %
Ratio of G and H: offset ±10 mV
M: 90° ±1.5°/< ±3° (20 kHz)

Pin assignment

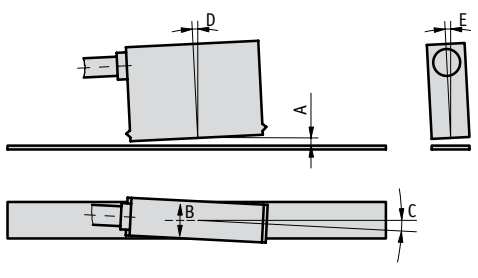
Signal	PIN
GND (0V)	2, 10, 14
/B (cos-)	5
B (cos+)	6
A (sin+)	7
/A (sin-)	8
+UB	12
N.C.	1, 3, 4, 9, 11, 13, 15

Mounting instruction

A, Sensor/band reading distance	max. 0.4 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

The length of the cable between the sensor and connector cannot be subsequently increased or decreased.

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	5	A	5 V DC ±5 %	
	4		24 V DC ±20 %	on request
Cable sheath	PVC	B		
	PUR		oil-resistant	
Cable length L	...	C	1 ... 20 m, in steps of 1 m	
			others on request	

Order code

LS100 – [ ] – [ ] – [ ]
A B C

5.1

Scope of delivery: *LS100, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.2 mm*

Additional information:

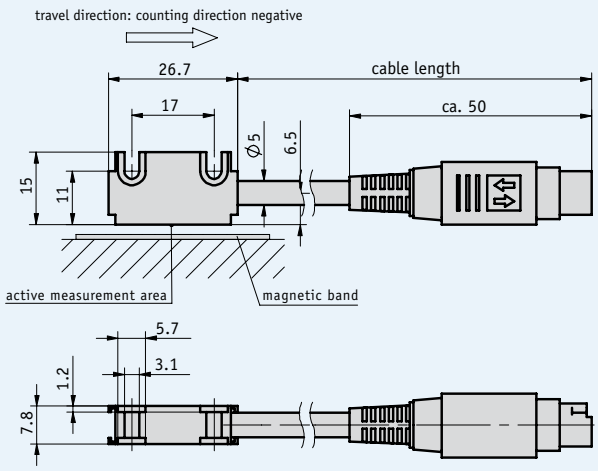
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Sensor MS100/1
Incremental, miniature design, sensor for magnetic display MA100/2

Profile

- Max. resolution of 1 µm in combination with MA100/2
- Repeat accuracy max. ±1 µm in combination with MA100/2
- Small, compact design



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB100	
System accuracy	±(0.01+0.01 x L) mm, L in m	in combination with MA100/2
Repeat accuracy	max. 1 µm	in combination with MA100/2
Sensor/band reading distance	max. 0.4 mm	over total measuring length
Travel speed	max. 5 m/s	
Housing	varnished aluminum, blue	
Sensor cable	PVC or PUR oil-resistant	
Operating temperature	-20 ... +70 °C	
Storage temperature	-20 ... +85 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50Hz	

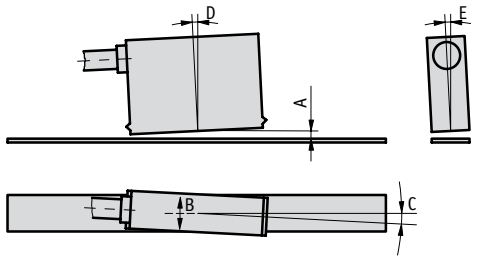
Electrical data

Feature	Technical data	Additional information
Operating voltage	feed via magnetic display	
Current consumption	feed via magnetic display	
Type of connection	DIN mini-connector	for magnetic display MA100/2
Real-time requirement	real-time signal processing	

Mounting instruction

A, Sensor/band reading distance	max. 0.4 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

Sensor/band reading distance (symbolic sensor representation)



5.1

Order

Order table

Feature	Order data		Specifications	Additional information
Cable sheath	PVC	A		
	PUR		oil-resistant	
Cable length L	...	B	1 ... 10 m, in steps of 1 m	

Order code

MS100/1 – L – [A] – [B]

Scope of delivery: *MS100/1, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.2 mm*

Additional information:

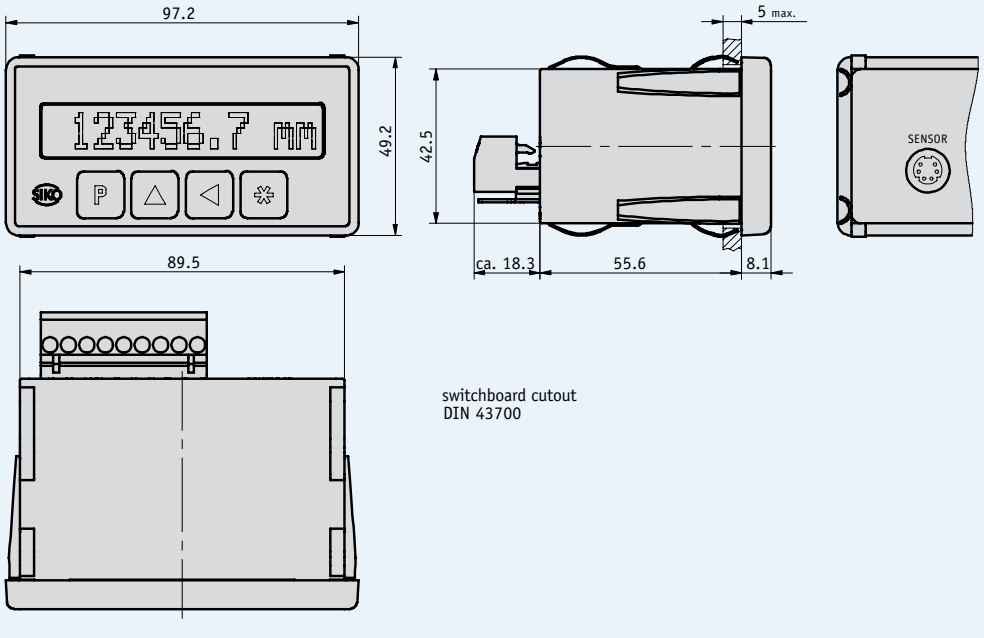
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Display MA100/2
Incremental, display accuracy 1 µm

Profile

- Display accuracy max. 1 µm
- Repeat accuracy max. ±1 µm
- High-contrast LCD, 12-digit LCD dot matrix
- Incremental measurement and reset function
- Direct reference/offset value input
- Reference input
- Works with sensor MS100/1
- Option: serial interface RS232/RS485



switchboard cutout
DIN 43700

Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.01 + 0.01 x L) mm, L in m	at T_U = 20 °C with MB100
Repeat accuracy	max. ±1 µm	± 1 digit
Magnetic sensor	type MS100/1	incremental
Supply connection	9-pin screw-type terminal strip (EG)	IEC connector TG
Sensor connection	Mini-DIN-bush	pluggable
Calibration input	9-pin screw-type terminal strip	
Display/display range	12-digit LCD dot matrix	-9 999 999 ... +9 999 999 sign + units
Housing	plastic black	
Protection category	IP40 for whole device	according to DIN 40050
	IP60 with switchboard installation	according to DIN 40050
Operating temperature	0 ... +50 °C	
Storage temperature	-20 ... +80 °C	
Humidity	95 % rh	condensation inadmissible

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 230 V AC ±10 % 115 V AC ±10 %	
Current consumption	70 mA 20 mA 10 mA	24 V, incl. sensor 115 V, inkl Sensor 230 V, incl. sensor
Interfaces/protocol	without RS232 with standard protocol RS485 with standard protocol	
Resolution	0.001, 0.01, 0.1, 1, 10 0.001, 0.01, 0.1, 1	in mm in inch
Interference protection class	3 according to IEC 801	
Switching output	with or without	

Pin assignment

Signal	Terminal
RESET	1
UB = +24 V DC (for reference switch) max. 50mA	2
GND	3
	4
RS232 (RXD) RS485 (DÜB) A2	5
RS232 (TXD) RS485 (DÜA) A1	6
PE	7
N (230/115 V AC) GND (24 V DC)	8
L (230/115 V AC) UB (24 V DC)	9

5.1

Order

Order table

Feature		Order data	Specifications	Additional information
Operating voltage	A	1	230 V AC ±10 %	
		2	115 V AC ±10 %	
		4	24 V DC ±20 %	
Interface/protocol	B	XX/XX	without	
		S1/00	RS232 with standard protocol	
		S3/00	RS485 with standard protocol	
Switching output	C	S0	without	
		SM	with	only with interface XX/XX

Order code

MA100/2 - EG - [ ] - RM - [ ] - [ ]
A B C

Scope of delivery: *MA100/2, User information*

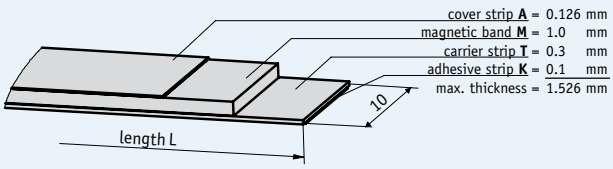
Additional information:
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Band MBA110
Two track coded scale, 4000 mm measuring length

Profile

- Absolutely coded scale MBA110 with 10 mm width
- Easy mounting, self-assembly possible



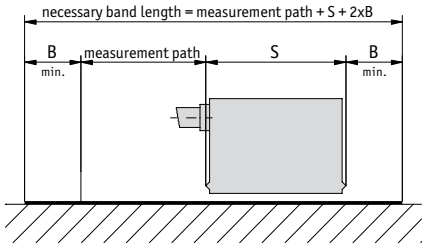
Mechanical data

Feature	Technical data	Additional information
Measuring length	max. 4000 mm	
Band width	10 mm	
Thickness	1.4 mm	without cover strip
Temperature coefficient	(11±1) x 10^{-6}/K	
Operating temperature	-20 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 5 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	0.2 ... 4.0 m, in steps of 0.01-m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	B	with	
	TO		without	
Cover strip	AM	C	with	
	AO		without	

Order code

MBA110 – [A] – [B] – [C]

Scope of delivery: *MBA110, User information*

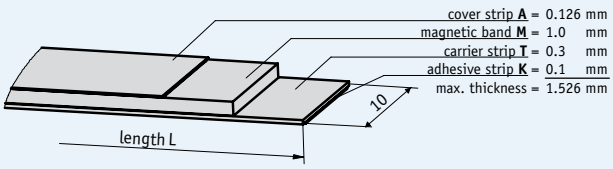
Additional information:
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Band MBA111
Absolutely coded scale, 4000 mm measuring length

Profile

- Absolutely coded scale MBA111 with 10 mm width
- Easy mounting, self-assembly possible



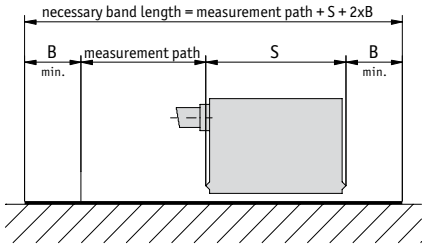
Mechanical data

Feature	Technical data	Additional information
Measuring length	max. 4000 mm	
Band width	10 mm	
Thickness	1.4 mm	without cover strip
Temperature coefficient	(11±1) x 10^{-6}/K	
Operating temperature	-20 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 5 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	0.2 ... 4.09 m, in steps of 0.01-m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	B	with	
	TO		without	
Cover strip	AM	C	with	
	AO		without	

Order code

MBA111 – [A] – [B] – [C]

Scope of delivery: *MBA111, User information*

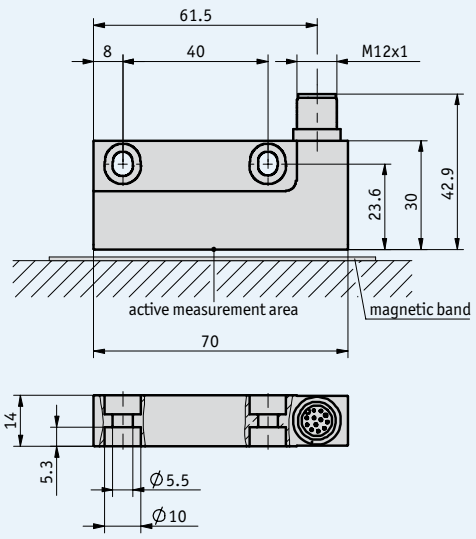
Additional information:
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 10/2008

Magnetic Sensor MSA111C
Absolute, high-resolution position tracking

Profile

- Max. resolution 1 µm
- Repeat accuary 10 µm
- output circuit SSI, RS485
- Additional analog real time output Sin/Cos 1 V_{ss} for high-dynamic control
- Signal period 1 mm



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MBA111	
Resolution	1 µm	
System accuracy	±10 µm	
Repeat accuracy	max. ±2 µm	
Pole length	1 mm	
Period length Sin/Cos output	1000 µm	
Sensor/band reading distance	max. 0.3 mm	(with cover strip on magnetic band)
Travel speed	<2 m/s (SSI)	static operation
	<10 m/s (sin/cos)	dynamic operation
Housing	zinc die casting	
Connector	M12, 12-pin	
Operating temperature	-10 ... +60 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	only with mating plug
Max. measuring length	max. 4000 mm	

Electrical data

Feature	Technical data	Additional information
Operating voltage	4.5 ... 30 V DC	
Power input	max. 1.2 W	
Type of connection	round connector	
Output circuitv	SSI, RS485, 1 V_{ss}	
EMV	EN-61000-6-2, EN-61000-6-4	
Real-time requirement	real-time signal processing via AEA111/1	sin/cos output
Signal amplitude	1 V_{SS}	

Pin assignment

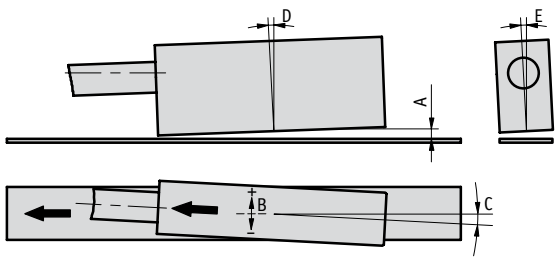
SSI	RS485	PIN
adjust	adjust	1
D+	D+	2
D-	D-	3
T-	N.C.	4
+UB	+UB	5
/sin	/sin	6
sin	sin	7
/cos	/cos	8
cos	cos	9
config	config	10
T+	N.C.	11
0V	0V	12

Mounting instruction

When installing the sensor and magnetic band, always ensure that both system components are correctly aligned. The arrows marked on the band and sensor must point in the same direction during installation.

A, Sensor/band reading distance	max. 0.3 mm
B, Lateral offset	max. +0.4 mm, -0.2 mm
C, Misalignment	<±1°
D, Longitudinal tilt	Max. reading distance sensor/ band **A** must nowhere be exceeded.
E, Lateral tilt	Max. reading distance sensor/ band **A** must nowhere be exceeded.

Sensor/band reading distance (symbolic sensor representation)



Order

Order note

This sensor is sold in Switzerland and Austria under the product name “AMSA111C“.

Order table

Feature	Order data	Specifications	Additional information
Output circuit	RS485	SIKONETZ3	
	SSI	RS422	

Order code

MSA111C - [A] - [S]

Scope of delivery: *MSA111C, User information, distance gage*

Accessories:

Mating plug *Page 176*
Cable extension KV12S2 *Page 180*

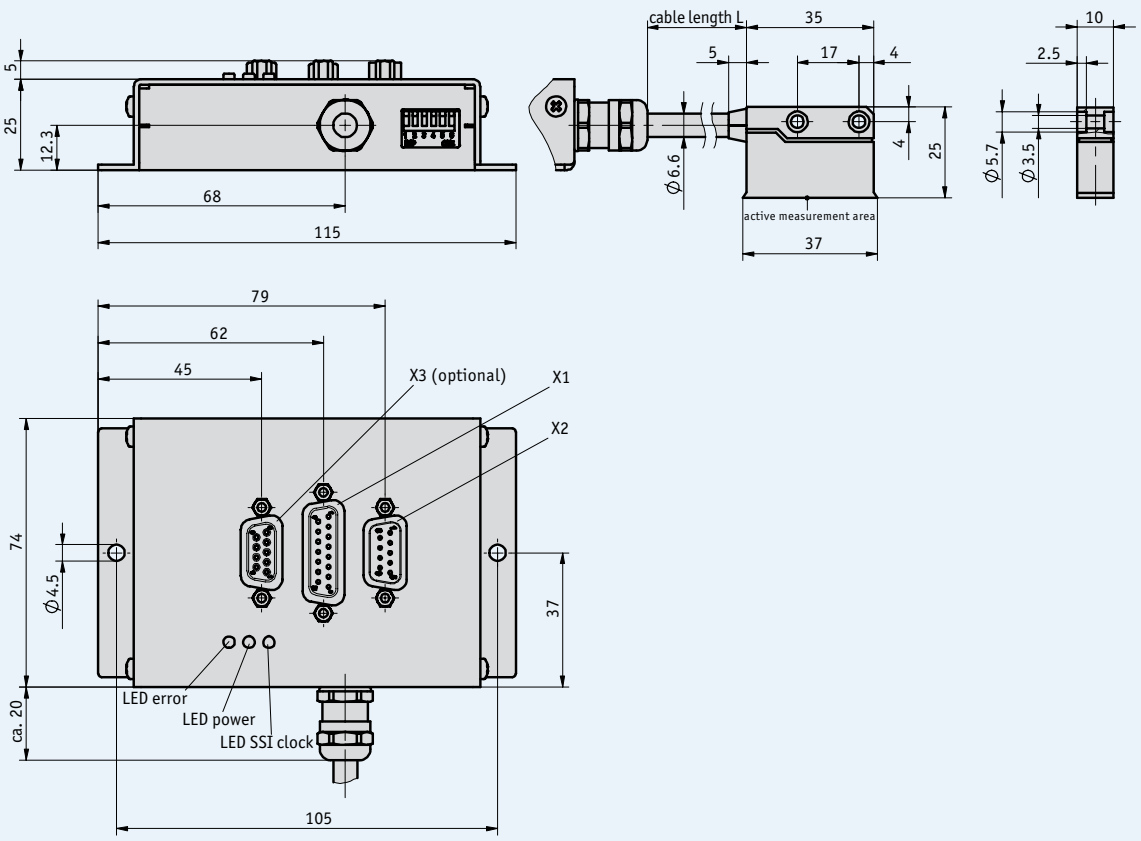
Additional information:

Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Profile

- Max. resolution 0.2 µm (LD)
- Repeat accuracy ±5 µm
- SSI or RS485 interface
- Scale MBA110
- Max. sensor/band reading distance 0.4 mm
- Compact, absolutely measuring unit with hard-wired sensor
- Maintenance-free backup battery
- Optional digital LD interface
- Optional analog 1 V_{ss} interface (period length 1 mm)



5.1

Mechanical data

Feature	Technical data	Additional information
System accuracy	(0.025 + 0.01 x L) mm, L in m	at T_U = 20 °C; (L= length per each meter started)
Repeat accuracy	± 5 µm	
Resolution	SSI, 1 µm; fix	selectable via DIP switch
	LD, max. 0.2 µm	
	1 V_{ss} period length 1 mm	
Sensor/band reading distance	0.1 ... 0.4 mm	over the whole measuring length
Measuring length	4000 mm	others on request
Housing translation Module	sheet steel	electrogalvanized
Housing sensor	zinc die casting	
Cable length of sensor	max. 6 m	
Sensor cable sheath	PVC	
Drag chain suitability	min. 1000000 at bending radius = 8x cable diameter and 20 °C	
Travel speed of magnetic sensor	max. 0.5 m/s SSI	absolute value
	max. 8 m/s	
Protection category	IP20 (translation module)	according to DIN VDE 0470
	IP67 (sensor)	according to DIN 40050
Humidity of translation module	max. 95 % rh	condensation inadmissible
Humidity of sensor	max. 100 % rh	condensation permitted
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +70 °C	
Weight	approx. 420 g	

5.1

Travel speed

		Travel speed V_{max} (m/s)				
Resolution (µm)	**0.5**	0.80	0.32	0.15	0.06	0.02
	1	4.00	1.60	0.72	0.32	0.12
	10	8.00	8.00	7.20	3.20	1.25
	12.5	8.00	8.00	8.00	4.00	1.60
Pulse interval (µs)		0.2	0.5	1.1	2.5	6.3
Counting frequency (kHz)		1250.00	500.00	230.00	100.00	40.00

The internal translation module can generate fast counting pulses, the lengths of wich are limited by the pulse interval. The follower elctronics must be adjusted accordingly. Select the pulse interval in advance, if necessary.

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 %	with reverse-polarity protection
Current consumption	<150 mA	
Backup battery	service life ~ 10 years	at TU = 20 °C; according to manufacturer's specification
EMV	DIN EN 61000-6-2	
	DIN EN 61000-6-4	

Pin assignment

connector X1

SSI	SSI + 2xLD	PIN
N.C.	A	1
N.C.	B	2
+24 V DC	+24 V DC	3
0 V	0 V	4
SSI_DATA	SSI_DATA	7
/SSI_DATA	/SSI_DATA	8
N.C.	/A	9
N.C.	/B	10
SSI_GND	SSI_GND	12
SSI_CLK	SSI_CLK	14
/SSI_CLK	/SSI_CLK	15
N.C.	N.C.	5, 6, 11, 13

connector X2

RS485	RS485 + LD	PIN
N.C.	A	1
N.C.	B	2
N.C.	N.C.	3
+24 V DC	+24 V DC	4
0 V	0 V	5
N.C.	/A	6
N.C.	/B	7
DÜA	DÜA	8
DÜB	DÜB	9

connector X3 (optional)

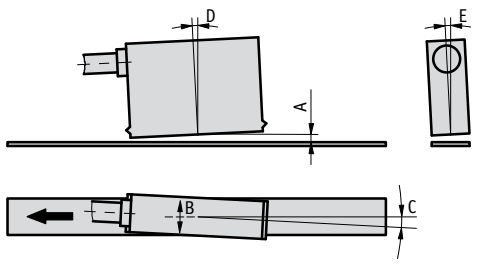
1 V_{SS}	PIN
sin	1
/sin	2
cos	3
ANA_GND	7
/cos	8
N.C.	4, 5, 6, 9

Mounting instruction

When installing the sensor and magnetic band, always ensure that both system components are correctly aligned. When mounting, the arrow mark must point to the same direction as the cable outlet.

A, Sensor/band reading distance	0.1 ... 0.4 mm
B, Lateral offset	<±0.5 mm
C, Misalignment	<±1°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±2°

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Sensor cable length	...	A	1 ... 6 m in steps of 1 m	
Interface digital	LD	B	Line Driver (RS422)	
	2xLD		2xLine Driver (RS422)	
	0		without	
Resolution digital	...	C	0.2, 1, 10, 12.5	
Pulse interval (µs)	...	D	0.2, 0.5, 1.1, 2.5, 6.3	
Interface analog	1Vss	E	1 V_{SS}	
	0		without	

Order code

ASA110H - [ ] - [ ] - [ ] - [ ] - [ ] - [S]
A B C D E

5.1

Scope of delivery: *ASA110H, User information, grounding material*

Accessories:
Mating plug *Page 176*

Additional information:
Short Description, Technical Details *Page 14 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010


mm
5.2
2 mm
SIKO
MSK5000

5.2 | MagLine Basic

Introduction

The track-proven and mature Basic range features a varied number of components for incremental and absolute measurement through to the µm range. All measured values can be displayed directly and also processed further by controllers. MagLine Basic is equipped with interfaces for integration into almost all industrial environments.

- Resolutions max. 1 µm
- Repeat accuracy max. 10 µm
- Absolute accuracy up to 20 µm

Product matrix^3 – the key to variety

In accordance with its three functional groups and for a faster overview, the MagLine Basic components and their possible combinations are shown in the following product matrices:

1. **Incremental systems** and
2. **Absolute systems**
   as configurable individual components with a choice between signal evaluation via digital output, a translation module or indicators
3. **Absolute systems with hard-wired sensor**
   For direct indication or evaluation of the measured signal

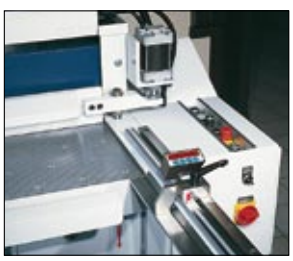
While free and flexible integration and the related combinability of individual components are the main feature of the incremental and absolute systems (matrices 1 and 2), ready-for-use absolute systems with their integrated sensors (matrix 3) have the “plug and play” advantage. These closed circuit systems are extremely suitable for the direct use of signals at the measuring point (display, evaluation).

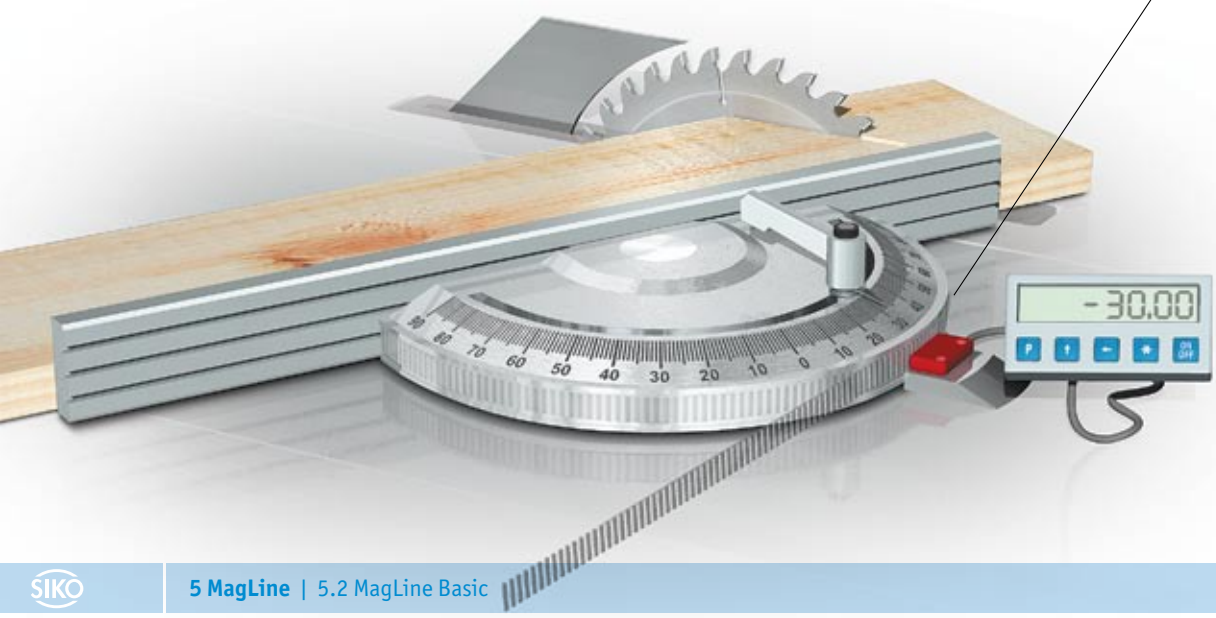
Magnetic bands
Available length up to 90 m
Accuracy class up to 20 µm
Reference points as an option

Sensors
Direct connection to translation module and magnetic displays
Max. tolerance of reading distance to scale 2 mm

Translation module
Incremental and absolute position tracking
Real-time signal processing
Resolution 1 µm

Magnetic displays
Incremental and absolute position tracking
Resolution and repeat accuracy up to 10 µm





The magnetic band serves as a scale in the measuring system. Its flexible design also permits curved installation on small radii for easy angle measurement.

MagLine Basic

Signal analysis via	Incremental systems Output, digital				Translation module	Magnetic display	
System accuracy class (µm)	±50	±100	±25	±25	±25	±100	±50
Maximum repeat accuracy (µm)	±25	±40	±10	±10	±5	±10	±10
Maximum measurement length/magnetic display (mm)	infinite	infinite	infinite	infinite	infinite	±99.999	±9.999.999
Maximum reading distance (mm)	1.0	2.0	2.0	2.0	2.0	2.0	2.0

Resolution max. in µm	Supply voltage	Output/ interface	Magnetic sensor	Page
25	24 V DC 5 V DC	PP, LD, TTL	**MSK210**	56
40	24 V DC 5 V DC	PP, LD, TTL	**MSK320**	59
1	6.5 ... 30 V DC 4.75 ... 6 V DC	PP, LD	**MSK5000**	63
5	10 ... 30 V DC 5 V DC	PP, LD, TTL	**MSK5000R**	67
*)	feed via downstr. electronics unit	—	**MS500**	70

			Magnetic display	
10	24 V DC 230 V AC 115 V AC	RS232	**MA502**	72
10	24 V DC 230 V AC	—	**MA506**	74

			Translation module	
5	24 V DC 5 V DC	PP, LD	**AS510/1**	76

Width in mm	Accuracy **class** in µm	Available length max. in m/piece	Magnetic band	
10	0.05	90.0	**MB200**	50
5 or 10	0.1	90.0	**MB320**	52
5 or 10	0.1 or 0.05	90.0	**MB500**	54

*) depending on the downstream electronics or magnetic display

5.2

Subject to technical alterations 12/2010

MagLine Basic

Signal analysis via	Absolute systems				
	Magnetic display		Translation module	Translation module	
System accuracy class (µm)	±50	±50	±50	±50	±100
Maximum repeat accuracy (µm)	±10	±10	±10	±10	±10
Maximum measurement length/magnetic display (mm)	5120	5120	5120	5120	20480
Maximum reading distance (mm)	1.0	1.0	1.0	1.3	2.0

Resolution max. in µm	**Supply voltage**	**Output/ interface**	**Magnetic sensor**	**Page**					
*)	**)	—	**MSA**	84					
10	10 … 30 V DC	SSI or RS485	**MSA501**	86					
10	24 V DC	SSI	**MSA511**	89					
			Magnetic display						
10	24 V DC 230 V AC 115 V AC	RS232	**MA505**	92					
10	10 … 30 V DC	—	**MA561**	94					
			Translation module						
10	24 V DC	PP, SSI, Profibus, RS232, RS485	**AEA**	96					

Width in mm	**Accuracy class** in µm	**Available length** max. in m/piece	**Magnetic band**						
20	±50	90.0	**MBA**	78					
20	±50	90.0	**MBA501**	112					
20	±100	90.0	**MBA511**	82					

*) depending on the downstream electronics or magnetic display, **)feed via downstream electronics unit

5.2

Subject to technical alterations 12/2010

MagLine Basic

	Absolute systems with wired sensor				
Signal analysis via	**Magnetic display**				**Translation module**
System accuracy class (µm)	±100	±100	±100	±100	±25
Maximum repeat accuracy (µm)	±10	±10	±10	±10	±5
Maximum measurement length/magnetic display (mm)	±999 999	±999 999	±999 999	±999 999	±655 000
Maximum reading distance (mm)	2.0	2.0	2.0	2.0	2.0

Resolution max. in µm	**Supply voltage**	**Output/ interface**	**Magnetic display**	**Page**					
10	3 V DC 1.5 V DC	—	**MA503/2**	98					
10	3 V DC	—	**MA503WL** sender	102					
	24 V DC	RS232, RS485	**RTX500** receiver	105					
10	1 ... 3.3 V DC	—	**MA504**	107					
100	internal 3 V DC	—	**MA508**	110					

Resolution max. in µm	**Supply voltage**	**Output/ interface**	**Magnetic sensor**						
*)	feed via downstr. electronics unit	—	**MS500H**	100					

			Translation module						
5	24 V DC	1 V_{SS}, LD, SSI, RS485	**ASA510H**	112					

Width in mm	**Accuracy class** in µm	**Available length** max. in m/piece	**Magnetic band**						
5 or 10	0.1 or 0.05	90.0	**MB500**	54					

*) abhängig von der nachgeschalteten Elektronik bzw. Messanzeige

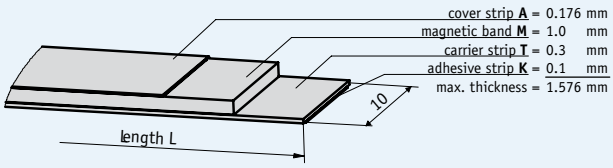
5.2

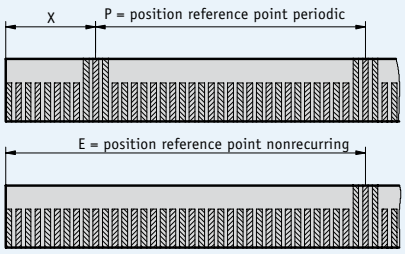
Subject to technical alterations 12/2010

Magnetic Band MB200
Incrementally coded scale, 2 mm pole length

Profile

- Easy adhesive mounting, self-assembly possible
- Pole length 2 mm
- System accuracy up to 20 µm





Reference points (all details in m)	
X	0.05
P	0.2, 0.5
E	0.05, 0.1, 0.2, 0.5

5.2

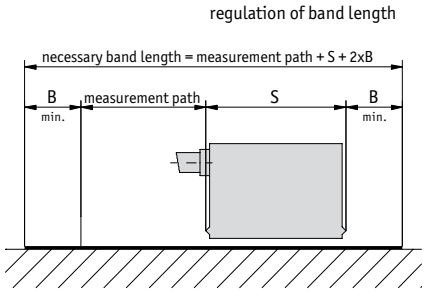
Mechanical data

Feature	Technical data	Additional information
Pole length	2 mm	
Measuring length	infinite	
Band width	10 mm	
Thickness	1.4 mm	without cover strip
Accuracy class	50 µm	
Temperature coefficient	(11 ±1) x 10^{-6}/K	spring steel
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 10 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	B	with	
	TO		without	
Cover strip	AM	C	with	stainless steel
	AO		without	
Reference point	0	D	without	
	E		one-time	
	P		periodic	
Position of reference point E one-time	...	E	0.05, 0.1, 0.2, 0.5	indicate only if reference point E was selected
			others on request	max. 5.0 m
or				
Position of reference point P periodic	...	E	0.2, 0.5	indicate only if reference point P was selected
			others on request	

Order code

MB200 – [A] – [B] – [C] – [D] – [E]

Scope of delivery: *MB200, User information*

Accessories:

Profile rail PS	*Page 182*
Protective strip SB	*Page 183*
Cover rail PS1	*Page 181*

Additional information:

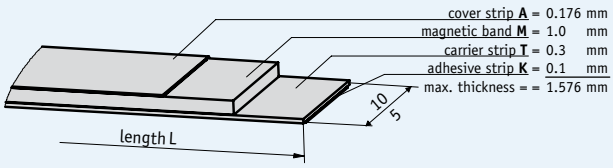
Short Description, Technical Details	*Page 46 cont.*
Product Overview	*Page 4 cont.*

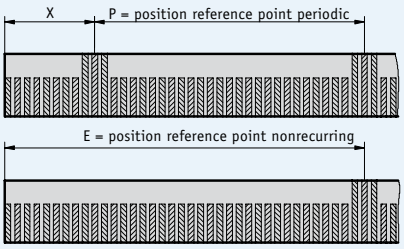
Subject to technical alterations 09/2010

Magnetic Band MB320
Incrementally coded scale, pole length 3.2 mm

Profile

- Easy adhesive mounting, self-assembly possible
- Pole length 3.2 mm
- System accuracy up to 100 µm





Reference points (all details in m)	
X	0.032
P	0.32, 0.64
E	0.032, 0.064, 0.128, 0.32

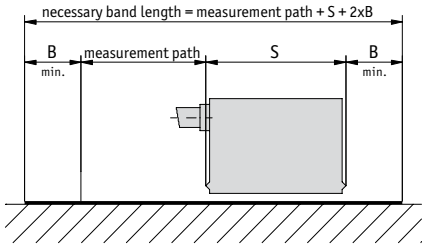
Mechanical data

Feature	Technical data	Additional information
Pole length	3.2 mm	
Measuring length	infinite	
Band width	10 mm	
	5 mm	
Thickness	1.4 mm	without cover strip
Accuracy class	100 µm	
Temperature coefficient	(11 ±1) x 10^{-6}/K	spring steel
	(16 ±1) x 10^{-6}/K	stainless steel
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 10 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Width	10	A	in mm	
	5		in mm	
Length of magnetic band	...	B	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Carrier strip	St	C	steel	
	VA		stainless steel	
Length pf carrier strip	...	D	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	E	with	
	TO		without	
Cover strip	AM	F	with	stainless steel
	AO		without	
Reference point	0	G	without	
	E		one-time	only with width 10 mm
	P		periodic	only with width 10 mm
Position of reference point E one-time	...	H	0.032, 0.064, 0.128, 0.320	indicate only if reference point E was selected
			others on request	max. 5.0 m
or				
Position of reference point P periodic	...	H	0.32, 0.64	indicate only if reference point P was selected
			others on request	

Order code

MB320 – [A] – [B] – [C] – [D] – [E] – [F] – [G] – [H]

Scope of delivery: *MB320, User information*

Accessories:

Profile rail PS *Page 182*
Protective strip SB *Page 183*
Cover rail PS1 *Page 181*

Additional information:

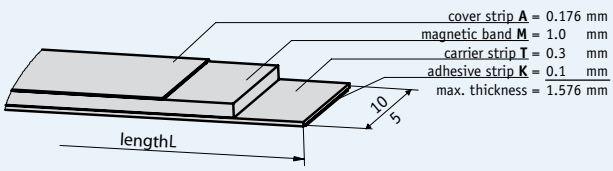
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

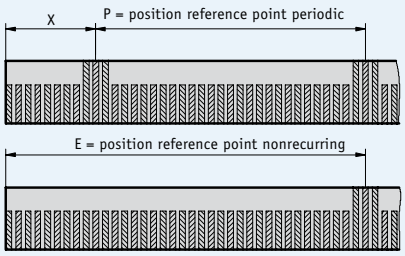
Subject to technical alterations 09/2010

Magnetic Band MB500
Incrementally coded scale, pole length 5 mm

Profile

- Easy adhesive mounting, self-assembly possible
- Pole length 5 mm
- System accuracy up to 50 µm





Reference points (all details in m)	
X	0.05
P	0.2, 0.5
E	0.05, 0.1, 0.2, 0.5, 0.9, 1.3, 2.0

5.2

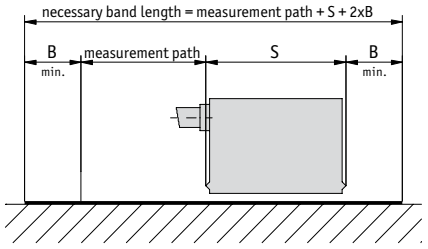
Mechanical data

Feature	Technical data	Additional information
Pole length	5 mm	
Measuring length	infinite	
Band width	10 mm	
	5 mm	
Thickness	1.4 mm	without cover strip
Accuracy class	50 µm or 100 µm	
Temperature coefficient	(11 ±1) x 10^{-6}/K	spring steel
	(16 ±1) x 10^{-6}/K	stainless steel
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 10 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Width	10	A	in mm	
	5		in mm	
Accuracy class*	0.1	B	0.1 mm	
	0.05		0.05 mm	only with width 10 mm
Carrier strip	St	C	steel	
	VA		stainless steel	only with width 10 mm
Length	...	D	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	E	with	
	TO		without	
Cover strip	AM	F	with	stainless steel
	AO		without	
Width of cover strip	10	G	in mm	
	5		in mm	
Reference point	0	H	without	
	E		one-time	only with width 10 mm
	P		periodic	only with width 10 mm
Position of reference point E one-time	...	I	0.05, 0.1, 0.2, 0.5, 0.9, 1.3, 2.0	indicate only if reference point E was selected
			others on request	max. 5.0 m
or				
Position of reference point P periodic	...	I	0.2, 0.5	indicate only if reference point P was selected
			others on request	

Order code

MB500 – [A] – [B] – [C] – [D] – [E] – [F] – [G] – [H] – [I]

Scope of delivery: *MB500, User information*

Accessories:

Profile rail PS *Page 182*
Protective strip SB *Page 183*
Cover rail PS1 *Page 181*

Additional information:

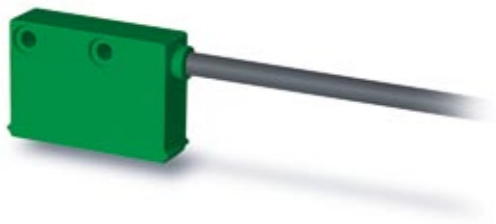
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

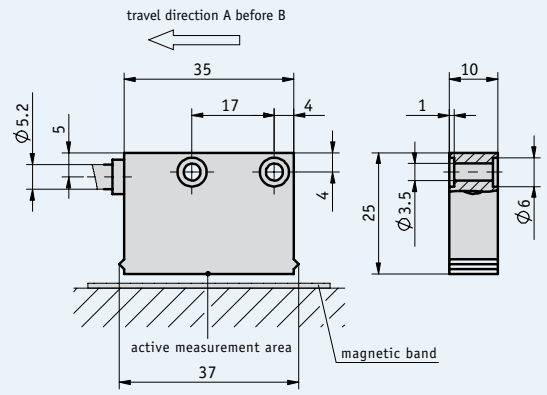
Subject to technical alterations 09/2010

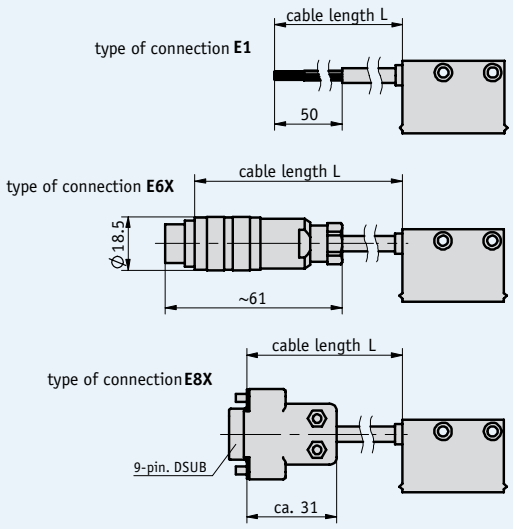
Magnetic Sensor MSK210
Incremental, digital interface, resolution 25 µm

Profile

- Max. resolution 25 µm
- Repeat accuracy ±1 increment, max. ±0.025 mm
- Works with magnetic band MB200
- Reading distance up to 1 mm







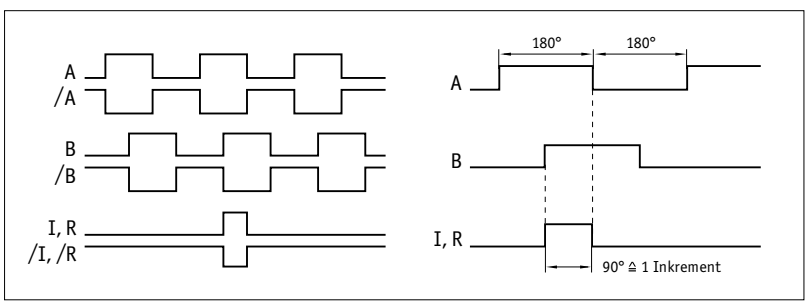
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB200	
System accuracy	±(0.05 + 0.01 x L) mm, L in m	
Repeat accuracy	±1 increment, max. ± 0.025 mm	
Sensor/band reading distance	0.1 ... 1 mm	with reference signals 0, I
	0.1 ... 0.4 mm	with reference signal R
Travel speed	max. 25 m/s	max. referencing speed 2 m/s
Housing	plastic green	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ± 20 % 5 V DC ± 5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<20 mA off-load <75 mA loaded	at 24 V
Type of connection	flying leads round connector D-SUB 9-pin	
Output circuit	PP, LD (RS422), TTL	PP only with 24 V
Output signals	A,B A, /A, B, /B, Option: I, /I, or R, /R	quadrature signal
Pulse width of reference signal	1 increment	
Resolution	0.025, 0.05, 0.1 mm	
Jitter	<15 % bei	sensor/band reading distance 0.5 mm
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal level high	>UB – 2.5 V >2.5 V >2.4 V	with PP with LD with TTL
Signal level low	<0.8 V <0.5 V <0.4 V	with PP with LD with TTL

Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

5.2

Pin assignment

non-inverted

Signal	E1	E6X	E8X
A	red	3	3
B	orange	4	4
+UB	brown	2	2
GND	black	1	1
N.C.		5,6,7	5,6,7,8,9

inverted

Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
N.C.		3	3, 8, 9

inverted with reference signal

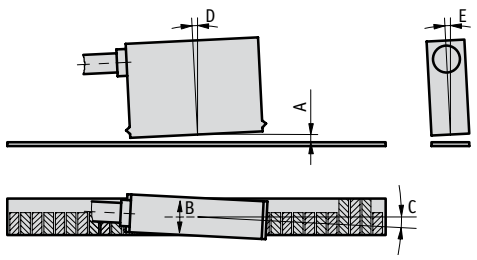
Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
I	blue	3	3
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
I/	violet	8	8
N.C.			9

Mounting instruction

On systems with reference points on the magnetic band, please ensure the correct alignment of the sensor and band (see diagram).

Reference signal	0, I	R
A, Sensor/band reading distance	max. 0.8 mm	max. 0.4 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±1°	<±1°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature		Order data	Specifications	Additional information
Operating voltage	A	4	24 V DC ±20 %	reverse-polarity protection
		5	5 V DC ±5 %	
Type of connection	B	E1	flying leads, 2 m cable	
		E6X	round connector without mating connectors	
		E8X	D-SUB 9-pin without mating connectors	
			cable extensions on request	
Cable length L	C	...	1 ... 20 m, in steps of 1 m	
			others on request	
Output circuit	D	PP	push-pull	only with operating voltage 4
		LD	line driver	
		TTL		only with non-inverted output signal, max. cable length 5 m
Output signal	E	NI	non-inverted	
		I	inverted	with reference signal I or R
Reference signal	F	0	without	
		I	index periodic	
		R	index fixed	not possible with resolution 0.5 mm
Resolution	G	...	0.025, 0.05, 0.1, 0.5	

Order code

MSK210 - [ ] - A - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ]

A B C D E F G

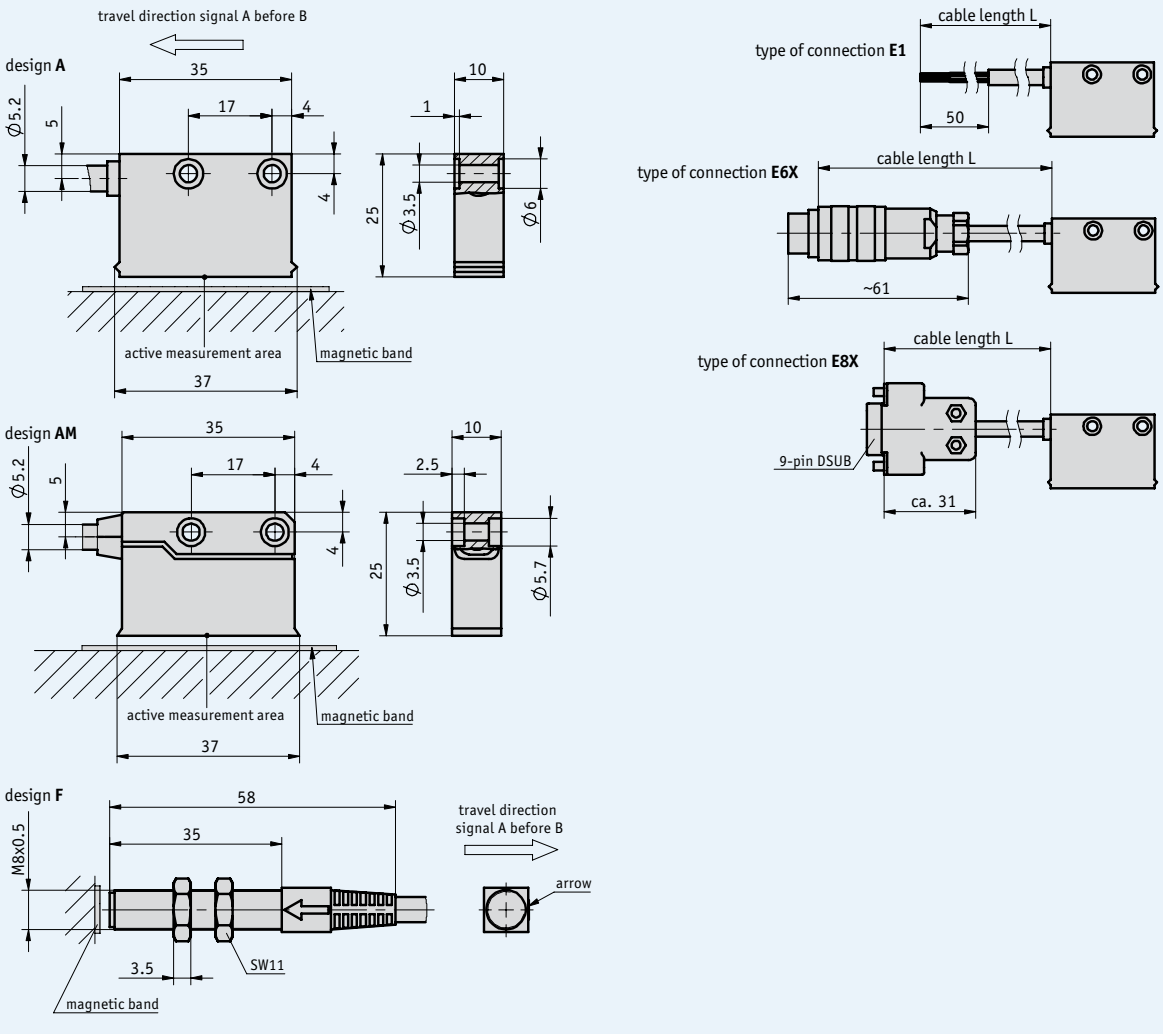
Scope of delivery: *MSK210, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.3 mm*

Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Profile

- Max. resolution 40 µm
- Repeat accuracy ±0.04 mm
- Works with magnetic band MB320
- Reading distance up to 2 mm



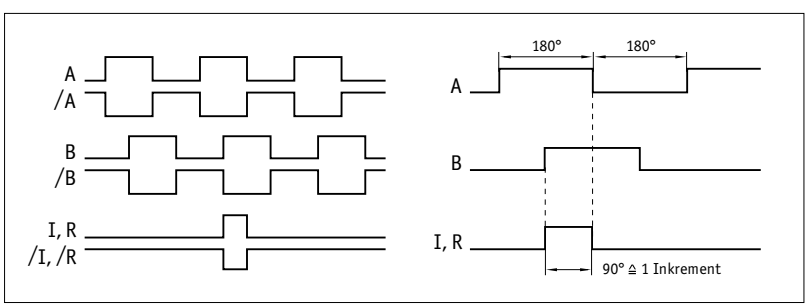
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB320	
System accuracy	±(0.1 + 0.01 x L) mm, L in m	
Repeat accuracy	±1 increment	with T_U = 20 °C
Sensor/band reading distance	0.1 ... 2 mm 0.1 ... 1.5 mm	with reference signals 0, I with reference signal R
Travel speed	max. 25 m/s	max. referencing speed 3.2 m/s
Housing	rectangular housing, plastic red; round housing, steel	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	in steps of 90 m

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 5 V DC ±5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<20 mA off-load <75 mA loaded	at 24 V
Type of connection	flying leads round connector D-SUB 9-pin	
Output circuit	PP LD (RS422) TTL	PP only with 24 V
Output signals	A, /A, B, /B, Option: I, /I, or R, /R	quadrature signal
Pulse width of reference signal	1 increment	
Resolution	0.04, 0.05, 0.08, 0.1, 0.16, 0.2, 0.8 mm	
Jitter	<15 %	with reading distance of 0.5 mm
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal level high	>UB – 2.5 V >2.5 V >2.4 V	with PP with LD with TTL
Signal level low	<0.8 V <0.5 V <0.4 V	with PP with LD with TTL

Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

Pin assignment

non-inverted

signal	E1	E6X	E8X
A	red	3	3
B	orange	4	4
+UB	brown	2	2
GND	black	1	1
N.C.		5,6,7	5,6,7,8,9

inverted

signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
N.C.		3	3, 8, 9

inverted with reference signal

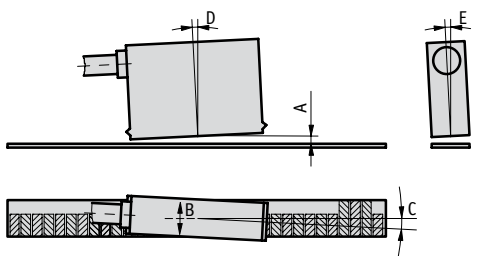
signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
I	blue	3	3
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
I/	violet	8	8
N.C.			9

Mounting instruction

On systems with reference points on the magnetic band, please ensure the correct alignment of the sensor and band (see diagram).

Reference signal	O, I	R
A, Sensor/band reading distance	max. 2 mm	max. 1.5 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±3°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/band reading distance (symbolic sensor representation)



5.2

Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	24 V DC ±20 %	reverse-polarity protection
	5		5 V DC ±5 %	
Design	A	B	rectangular	
	AM		metal housing without status LEDs	
	F		round	only with output signal NI, reference signal 0 and Resolution 0.1
Type of connection	E1	C	flying leads, 2 m cable	
	E6X		round connector without mating connectors	
	E8X		D-SUB 9-pin without mating connectors	
			cable extensions on request	
Cable length L	...	D	1 ... 20 m, in steps of 1 m	
			others on request	
Output circuit	PP	E	push-pull	only operating voltage 4
	LD		line driver	
	TTL			only with non-inverted output signal, max. cable length 5 m
Output signal	NI	F	non-inverted	
	I		inverted	only with design A or AM and reference signal I or R
Reference signal	0	G	without	
	I		index periodic	only with design A or AM
	R		index fixed	only with design A or AM, not with resolution 0.8 mm
Resolution	...	H	0.05, 0.1, 0.2, 0.8, 0.04, 0.08, 0.16	

Order code

MSK320 – [A] – [B] – [C] – [D] – [E] – [F] – [G] – [H]

Scope of delivery: *MSK320, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable*

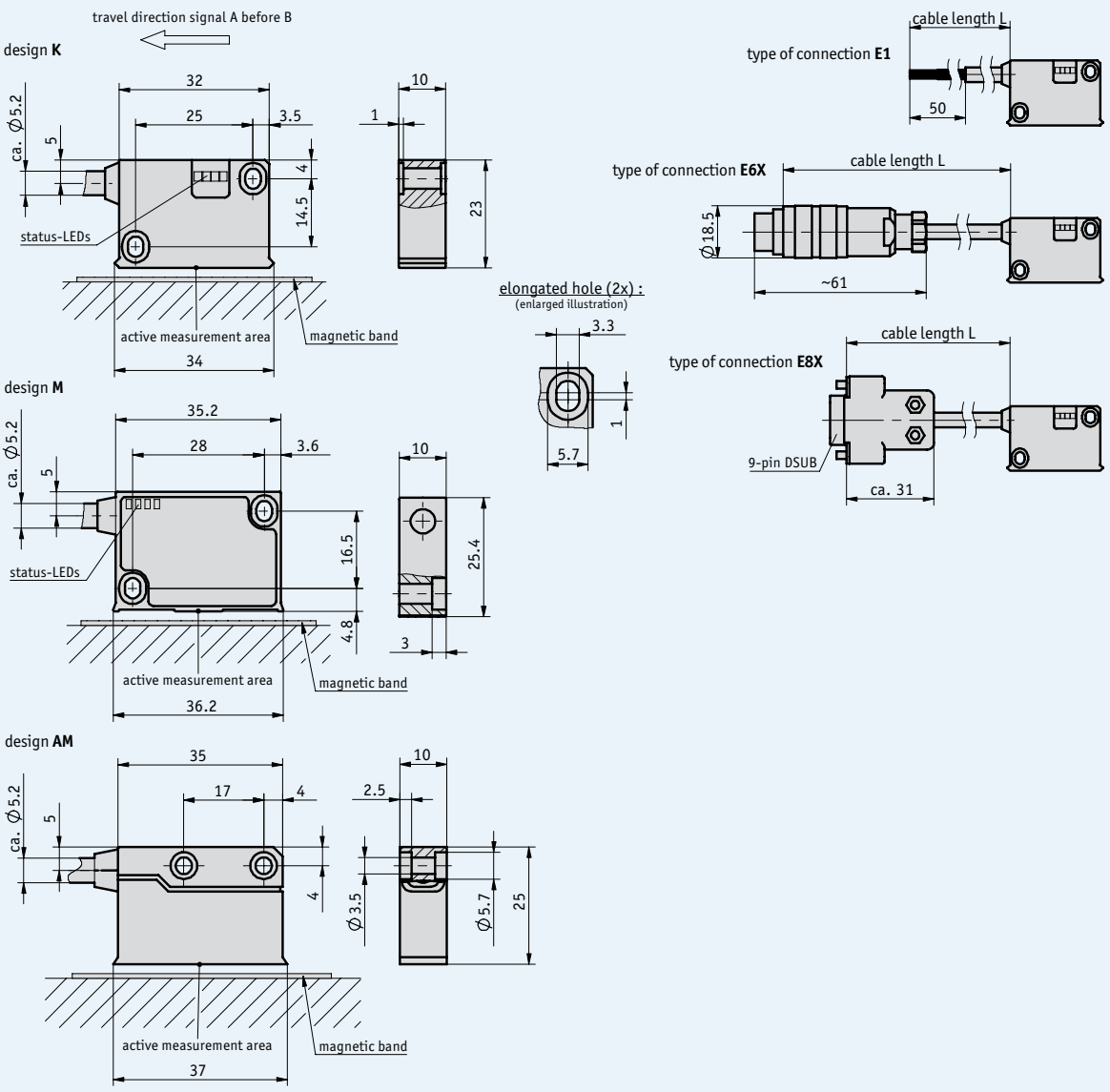
Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Profile

- Max. resolution up to 1 µm
- Repeat accuracy ±0.01 mm
- Status LED display
- Works with magnetic band MB500
- Reading distance up to 2 mm



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB500	
System accuracy	±(0.025 + 0.01 x L) mm, L in m	
Repeat accuracy	max. ±0.01 mm	
Sensor/band reading distance	0.1 ... 2 mm 0.1 ... 1.5 mm	with reference signals 0, I with reference signal R
Travel speed	depends on resolution and pulse interval	see table
Housing	plastic black	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	

Travel speed

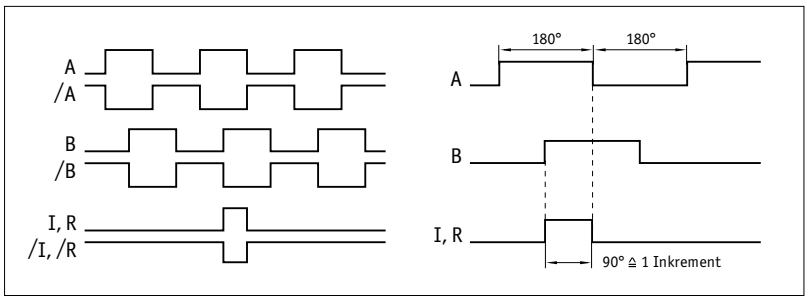
		Travel speed V_{max} (m/s)									
Resolution (mm)	**0.001**	4.00	3.20	1.60	0.80	0.32	0.20	0.10	0.05	0.03	0.01
	0.005	20.00	16.00	8.00	4.00	1.60	1.00	0.50	0.25	0.13	0.06
	0.010	25.00	25.00	16.00	8.00	3.20	2.00	1.00	0.50	0.25	0.12
	0.025	25.00	25.00	25.00	20.00	8.00	5.00	2.50	1.25	0.63	0.30
	0.050	25.00	25.00	25.00	25.00	16.00	10.00	5.00	2.50	1.25	0.61
	0.100	25.00	25.00	25.00	25.00	25.00	20.00	10.00	5.00	2.50	1.21
Pulse interval (µs)		0.20	0.25	0.50	1.00	2.50	4.00	8.00	16.00	32.00	66.00
Counting frequency (kHz)		1250.00	1000.00	500.00	250.00	100.00	62.50	31.25	15.63	7.81	3.79

5.2

Electrical data

Feature	Technical data	Additional information
Operating voltage	6.5 V DC ... 30 V DC 4.75 V DC ... 6 V DC	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<20 mA off-load <75 mA loaded	at 24 V
Type of connection	flying leads round connector D-SUB 9-pin	
Output circuit	PP LD (RS422)	
Output signals	A, /A, B, /B, Option: I, /I or R, /R	
Pulse width of reference signal	1 or 4 increments	
Resolution	0.001, 0.005, 0.01, 0.025, 0.05, 0.1 mm	
Interference protection class	3	IEC-61000-6-2
Real-time requirement	real-time signal processing	
Signal level high	>UB – 2.5 V >2.5 V	with PP with LD
Signal level low	<0.8 V	

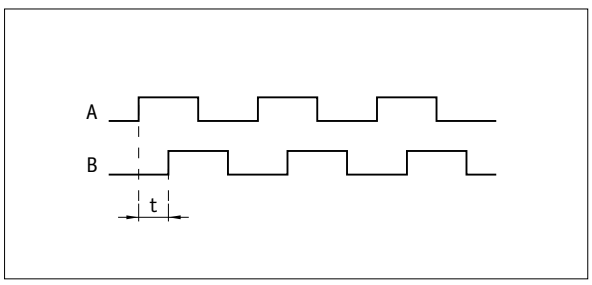
Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

Reference or index signal with 4 increments (360°) signal length is only valid from the 5th counting step onwards. A corresponding delay should be taken into consideration after switching on the operating voltage.

Pulse interval



Example: Pulse interval t = 1 µs
(i.e., the downstream unit must be able to process 250 kHz)

Formula for counting frequency = $\frac{1}{1\ \mu s \times 4}$ = 250 kHz

5.2

Pin assignment

inverted without index signal

Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
+UB	brown	4	4
GND	black	5	5
/A	yellow	6	6
/B	green	7	7
N.C.		3	3, 8, 9

inverted with index signal

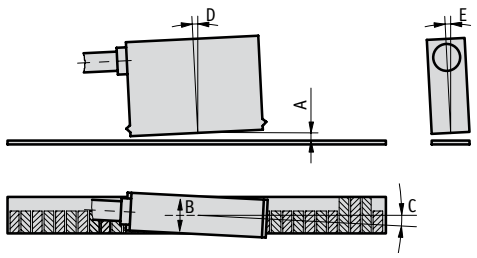
signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
I,R	blue	3	3
+UB	brown	4	4
GND	black	5	5
/A	yellow	6	6
/B	green	7	7
/I, /R	violet	8	8
N.C.			9

Mounting instruction

On systems with reference points on the magnetic band, please ensure the correct alignment of the sensor and band (see diagram).

Reference signal	0, I	R
A, Sensor/band reading distance	max. 2 mm	max. 1.5 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±3°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/band gap (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	**10**	A	6.5 ... 30 V DC	
	11		4,75 ... 6 V DC	
Design	**K**	B	plastic housing	
	M		metal housing with status LEDs	
	AM		metal housing without status LEDs	
Type of connection	**E1**	C	flying leads, 2 m cable	
	E6X		round connector without mating connectors	
	E8X		D-SUB 9-pin without mating connectors	
			cable extensions on request	
Cable length L	**...**	D	**1 ... 20** m, in steps of 1 m	
			others on request	
Output circuit	**PP**	E	push-pull	only operating voltage 10
	LD		line driver	
Reference signal	**0**	F	without	
	I		index periodic	
	R		fixed reference	
Resolution	**...**	G	**0.001, 0.005, 0.010, 0.025, 0.050, 0.1**	
Pulse interval in µs	**...**	H	**0.2, 0,25, 0.5, 1, 2.5, 4, 8, 16, 32, 66**	

Order code

MSK5000 – [A] – [B] – [C] – [D] – [E] – [F] – [G] – [H]

Scope of delivery: *MSK5000, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.8 mm*

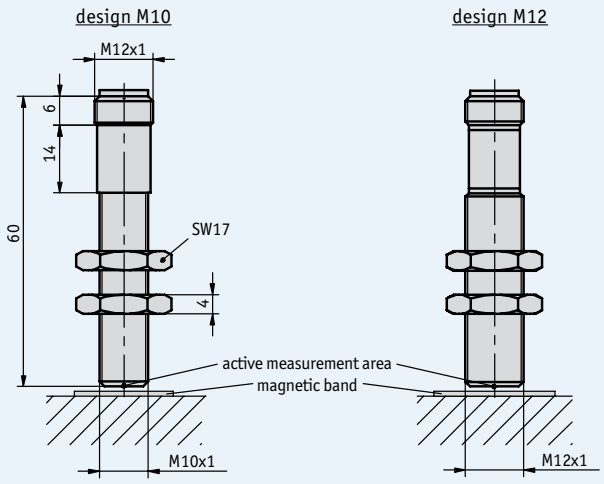
Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Profile

- Max. resolution up to 5 µm
- Repeat accuracy ±0.005 mm
- Index signal periodical
- Stainless steel housing
- M10 or M12 thread design



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB500	
System accuracy	±(0.025 + 0.01 x L) mm, L in m	
Repeat accuracy	max. ±0.005 mm	
Sensor/band reading distance	0.1 ... 2 mm	
Travel speed	depends on resolution and pulse interval	see table
Housing	stainless steel	
Operating temperature	-20 ... +80 °C	
Storage temperature	-30 ... +85 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Max. measuring length	infinite	

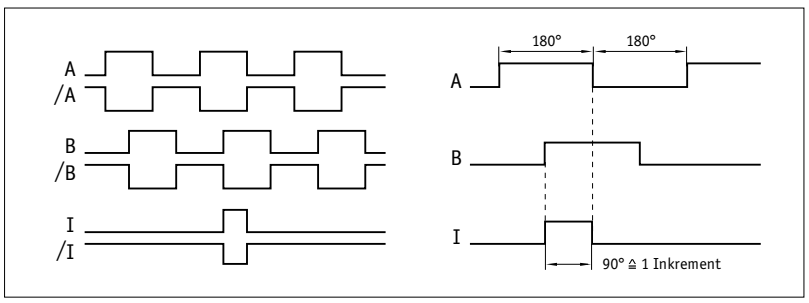
Travel speed

		Travel speed V_{max} (m/s)								
Resolution (mm)	**0.005**	20.00	10.00	5.00	3.25	1.54	0.75	0.375	0.195	0.13
	0.010	20.00	20.00	10.00	6.50	3.00	1.50	0.75	0.395	0.26
Pulse interval (µs)		0.12	0.29	0.48	1.00	2.00	4.00	8.00	16.00	24.00
Counting frequency (kHz)		2083.40	862.10	520.84	250.00	125.00	62.50	31.25	15.625	10.42

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC 10 ... 30 V 5 V DC ±5 %	
Current consumption	<30 mA off-load	
Output circuit	PP LD (RS422) TTL	
Output signals	A, /A, B, /B, I, /I	
Resolution	0.005, 0.01 mm	
Interference protection class	EN50081-2, EN50082-2	
Real-time requirement	real-time signal processing	

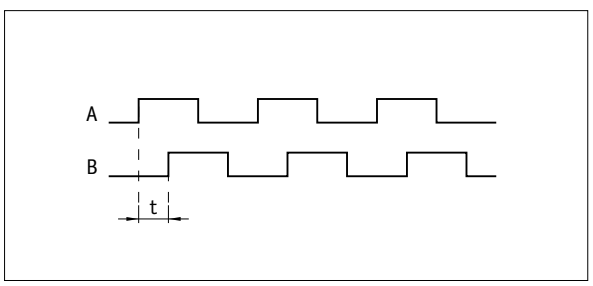
Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

5.2

Pulse interval



Example: Pulse interval t = 1 µs
(i.e., the downstream unit must be able to process 250 kHz)

Formula for counting frequency = $\frac{1}{1\ \mu s \times 4}$ = 250 kHz

Pin assignment

non-inverted

signal	PIN
+UB	1
A	2
GND	3
B	4
I	5

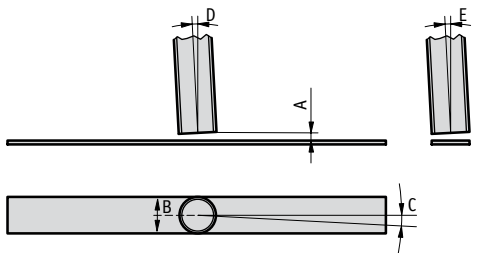
inverted

signal	PIN
I	1
/I	2
B	3
/B	4
/A	5
A	6
GND	7
+UB	8

Mounting instruction

A, Sensor/band reading distance	0.1 ... 2.0 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±3°
E, Lateral tilt	<±3°

Sensor/band gap (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	24 V DC 10 ... 30 V	
	5		5 V DC ±5 %	
Design	M10	B		
	M12			
Output circuit	PP	C	Push-Pull	
	LD		Line Driver	
	TTL			only with output signal NI
Output signals	NI	D	non-inverted	
	I		inverted	
Resolution	...	E	0.005, 0.010 µm	
Pulse interval in µs	...	F	0.12, 0.29, 0.48, 1, 2, 4, 8, 16, 24	

Order code

MSK5000R - [A] - [B] - [C] - [D] - I - [E] - [F]

Scope of delivery: *MSK5000R, User information*

Accessories:
Mating plug *Page 176*

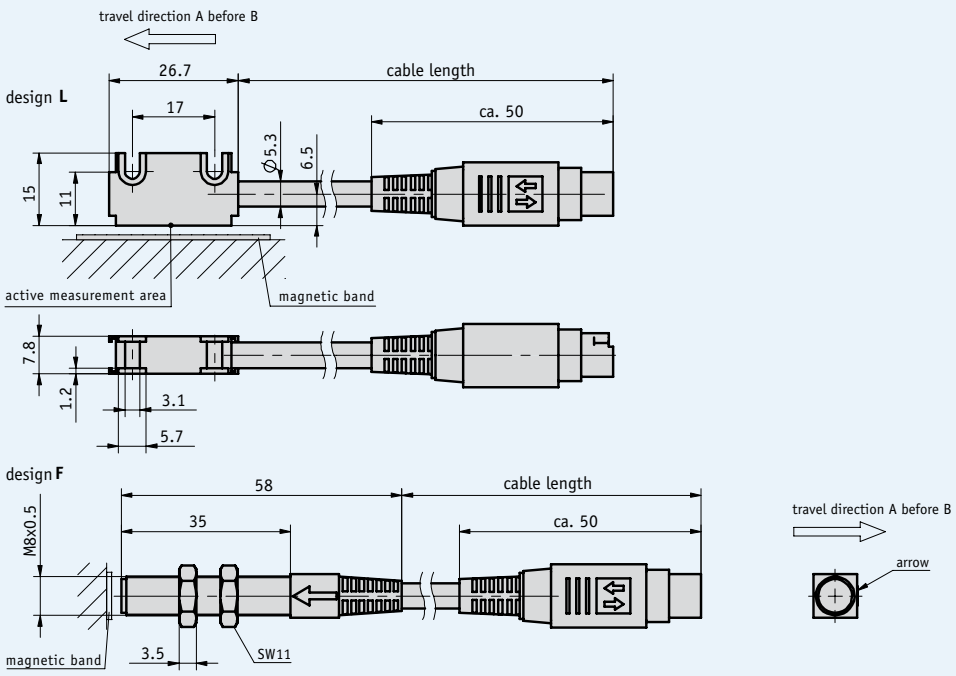
Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Sensor MS500
Incremental, miniature design

Profile

- Compact design of sensor and connector
- To be connected to MA502, MA506 or AS510/1
- Works with magnetic band MB500
- Max. sensor/band reading distance 2 mm



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB500	
System accuracy	depends on downstream electronics unit	
Repeat accuracy	depends on downstream electronics unit	
Sensor/band reading distance	0.1 ... 2 mm	
Travel speed	depends on downstream electronics unit	
Housing	aluminum, varnished red	sensor design L
	steel	sensor design F
Sensor cable	PVC	drag chain-compatible
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	5 ... 2000 Hz bei 20 g	
Shock resistance	200 g at 11 m/s	
Max. measuring length	infinite	

Electrical data

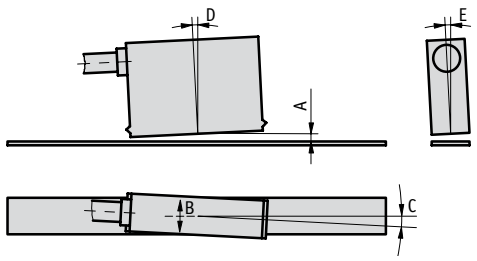
Feature	Technical data	Additional information
Operating voltage	feed via magnetic display/ downstream electronics unit	
Current consumption	depends on magnetic display/ downstream electronics unit	
Type of connection	Mini-DIN 6-pin	
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	

Mounting instruction

A, Sensor/band reading distance	max. 2 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

The connection must not be changed(e.g., different cable, cable length ...)

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Sensor design	**L**	A	rectangular	
	F		round	
Cable sheath	**PVC**	B		
	PUR		oil-resistant	
Cable length L	**...**	C	**1 ... 20** m, in steps of 1 m	

Order code

MS500 – [A] – [B] – [C]

Scope of delivery: *MS500, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable*

Additional information:

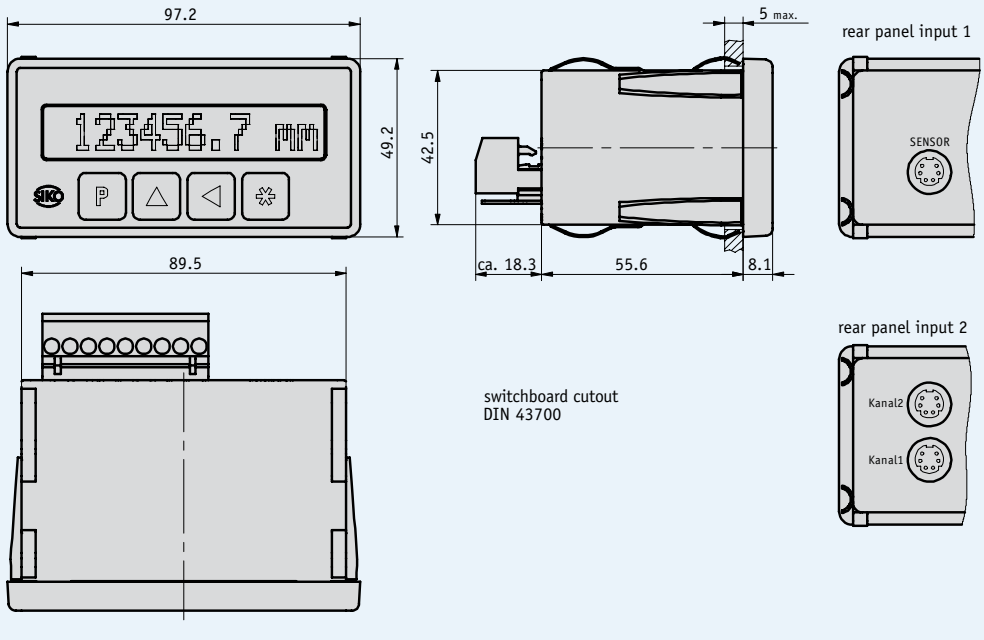
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Display MA502
Incremental, LCD dot matrix display, display accuracy 10 µm

Profile

- Display accuracy max. 10 µm
- Repeat accuracy max. ±0.01 mm
- High-contrast LCD, 12-digit LCD dot matrix
- Incremental measurement and reset function
- Direct reference/offset value input
- Reference input
- Programmable actual-value memory
- Works with sensor MS500
- Option: serial interface RS232/RS485
- Option: 2 measurement channels



Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.05 + 0.01 x L) mm, L in m	at T_U = 20 °C
Repeat accuracy	max. ±0.01 mm	± 1 digit
Magnetic sensor	MS500	incremental
Supply connection	9-pin screw-type terminal strip	
Calibration input connection	9-pin screw-type terminal strip	
Sensor connection	mini-DIN	
Display/display range	12-digit LCD dot matrix	-9 999 999 ... 9 999 999, sign, units
Sensor travel speed	5 m/s	with reading distance of 0.1 ... 2 mm
Design	panel-mount housing cut-out 92 x 45 mm	Noryl GFN 2SE 1, snap module
Housing	plastic black	
Protection category	IP40 for whole device	according to DIN 40050
	IP60 with switchboard installation	according to DIN 40050
Operating temperature	0 ... +50 °C	
Storage temperature	-20 ... +80 °C	
Humidity	95 % rh	condensation inadmissible

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 230 V AC ±10 % 115 V AC ±10 %	
Current consumption	70 mA 20 mA 10 mA	24 V, incl. sensor 115 V, incl. sensor 230 V, incl. sensor
Interfaces/protocol	RS232 with standard protocol RS485 with standard protocol	
Resolution	0.01, 0.1, 1, 10 0°–90°–0°/ 0°–360°	linear path measurement, in mm angle measurement, max. 0.001°
Interference protection class	3	according to IEC 801
Switching output	with or without	

Pin assignment

panel-mount housing EG

signal	PIN
Reset	1
UB= +24 V for calibration input	2
GND	3
N.C.	4
RXD (RS232); DÜB (RS485); A2 (switching output)	5

signal	PIN
TXD (RS232); DÜA(RS485); A1(switching output)	6
PE	7
GND (24 V DC) N (230/115 V AC)	8
UB (24 V DC) L (230/115 V AC)	9

Order

Order table

Feature		Order data	Specifications	Additional information
Operating voltage	A	1	230 V AC ±10 %	
		2	115 V AC ±10 %	
		4	24 V DC ±20 %	
Interface/protocol	B	XX/XX	without	
		S1/00	RS232 with standard protocol	
		S3/00	RS485 with standard protocol	
Switching output	C	S0	without	
		SM	with	only with interface XX/XX
Input	D	1	one channel	
		2	two channels	
Software	E	S		
		SW01	for two channels	

Order code

MA502 – EG – [A] – RM – [B] – [C] – [D] – [E]

Scope of delivery: *MA502, User information*

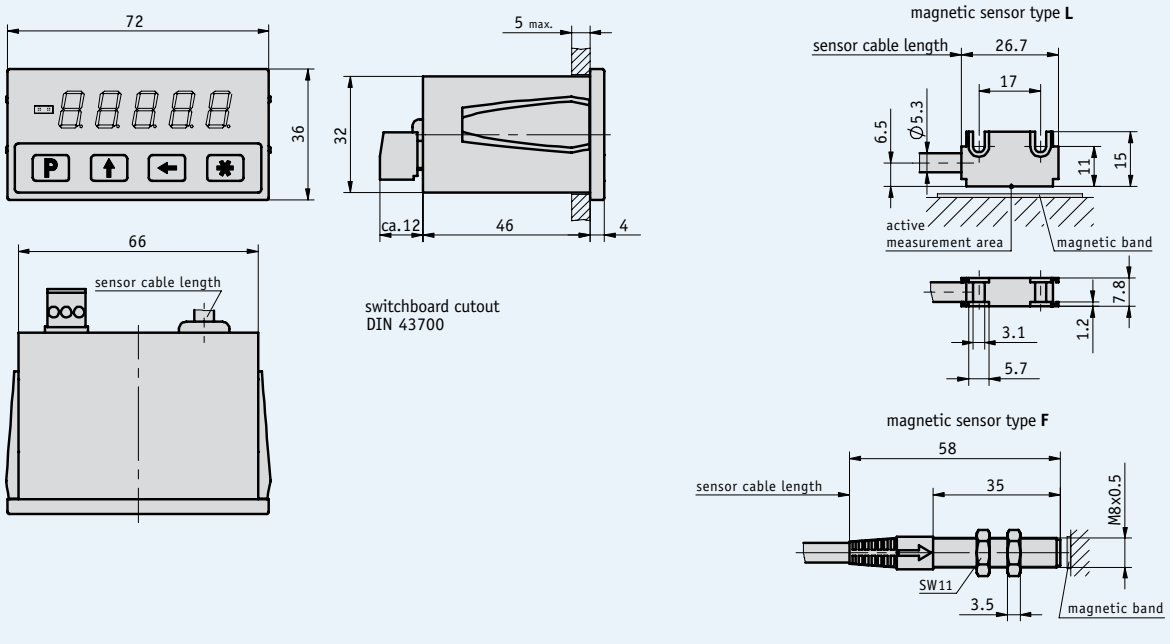
Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Display MA506
Incremental, LED display, display accuracy 10 µm

Profile

- Display accuracy max. 10 µm
- Repeat accuracy max. ±0.01 mm
- Incremental measurement and reset function
- Direct reference/offset value input
- Reference input
- Works with sensor MS500



Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.1+ 0.01 x L) mm, L in mm	at T_U = 20 °C
Repeat accuracy	max. ±0.01 mm	± 1 digit
Supply connection	3-pin terminal strip	
Display/display range	5-digit LED, red, 10 mm	-99 999 ... 99 999
Sensor travel speed	5 m/s	with reading distance of 0.1 ... 2 mm
Design	panel-mount housing, cutout 68 x 33 mm bench-top housing	plastic, red transparent, snap module aluminum profile, black anodized
Protection category	IP40 for whole device	according to DIN 40050
	IP60 with switchboard installation	according to DIN 40050
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	max. 95 % rh	condensation inadmissible

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 %	
	230 V AC -10/+6 %	only with TGL
Current consumption	<60 mA	with 24 V DC
Resolution	in mm 0.01, 0.05, 0.1, 1	in inch 0.001, 0.01 programmable angle display
Interference protection class	3	according to IEC 801

Pin assignment

Signal
GND
+UB
Reset

Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	24 V DC ±20 %	
	1		230 V bench-top housing design on request	
Sensor connection	S	B	pluggable	delivery without sensor MS500
	M		hard-wired	
Type of magnetic sensor	0S	C	without sensor	only with sensor connection "S"
	L		L design	
	F		F design	
Sensor cable length	...	D	1 ... 20 m, in steps of 1 m	only with sensor connection M

Order code

MA506 - EG - [A] - [B] - [C] - [D]

Scope of delivery: *MA506, User information*

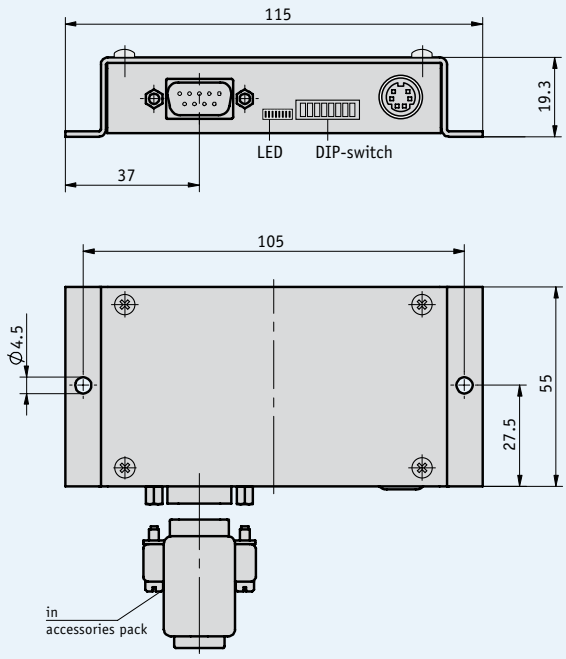
Additional information:
SShort Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Translation Module AS510/1
Incremental, interface, resolution 1 µm

Profile

- Parameters adjustable via DIP switches
- Resolution up to 1 µm
- Reference signal with intervals of 5 mm
- Works with sensor MS500



Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.025 + 0.01 x L) mm, L in m	at T_U = 20 °C (with MB500 and 0.05 mm accuracy class)
Repeat accuracy	±1 increment	
Housing	sheet steel	electrogalvanized
Cable length of connection line	max. 50 m	acc. to RS422 specification
Electrical connection	D-SUB 9-pin for supply and signal output	DIN mini-connector for sensor
Protection category	IP 40 according to DIN VDE 0470	
Humidity of translation module	max. 95 % rh	condensation inadmissible
Operating temperature	0 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Weight	approx. 400 g	
Sensor travel speed	max. 20 m/s	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 5 V DC ±5 %	reverse-polarity protection no reverse-polarity protection
Current consumption	<70 mA	
Resolution (µm)	5, 10, 20, 25, 50, 100	with quadrature evaluation DIP switch-selectable
Output signals	quadrature A, B, 0	each inverted
Output circuit	PP, LD (RS422)	switch-selectable via DIP switches
Real-time requirement	real-time signal processing	
Interference protection class	3	according to IEC 801

Pin assignment

Signal	PIN
A	1
A/	2
GND (for output signals)	3
B	4
B/	5
0/	6
=	7
+ UB	8
GND (for supply)	9

Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	24 V DC ±20 %	reverse-polarity protection
	5		5 V DC ±5 %	no reverse-polarity protection

Order code

AS510/1 – [ ]
A

Scope of delivery: *AS510/1, User information*

Additional information:

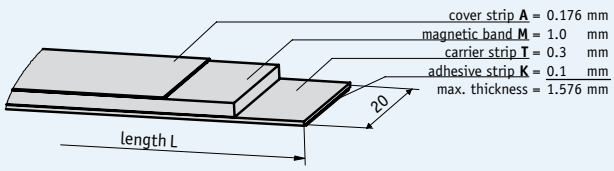
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 10/2008

Magnetic Band MBA
Absolutely coded scale, measuring length 5120 mm

Profile

- Easy adhesive mounting, self-assembly possible



5.2

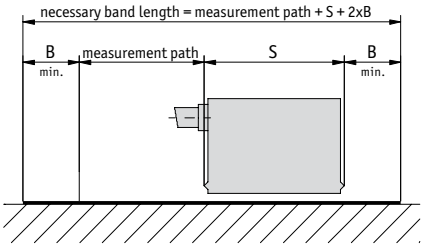
Mechanical data

Feature	Technical data	Additional information
Measuring length	max. 5120 mm	
Band width	20 mm	
Thickness	1.4 mm	without cover strip
Accuracy class	±50 µm	bei T_U = 20 °C
Temperature coefficient	(11±1) x 10^{-6}/K	
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 5 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	0.2 ... 75 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	B	with	
	TO		without	
Cover strip	AM	C	with	
	AO		without	

Order code

MBA – [A] – [B] – [C]

Scope of delivery: *MBA, User information*

Accessories:
Profile rail PSA *Page 184*

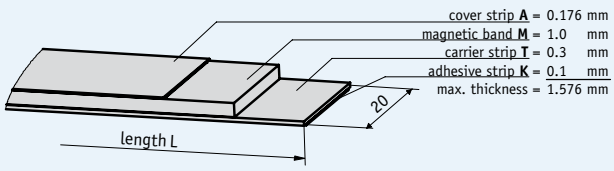
Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 10/2008

Magnetic Band MBA501
Absolutely coded scale, measuring length 10240 mm

Profile

- Easy adhesive mounting, self-assembly possible



5.2

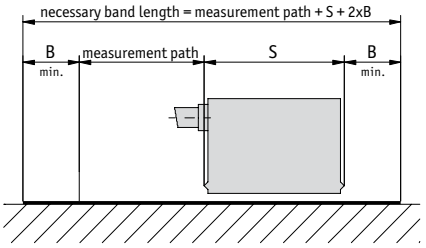
Mechanical data

Feature	Technical data	Additional information
Measuring length	max. 10240 mm	
Band width	20 mm	
Thickness	1.4 mm	without cover strip
Accuracy class	±50 µm	bei T_U = 20 °C
Temperature coefficient	(11±1) x 10^{-6}/K	
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 5 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	0.2 ... 75 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	B	with	
	TO		without	
Cover strip	AM	C	with	
	AO		without	

Order code

MBA501 – [ ] – [ ] – [ ]
A B C

Scope of delivery: MBA501, User information

Accessories:
Profile rail PSA — *Page 184*

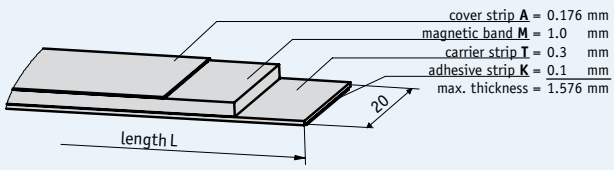
Additional information:
Short Description, Technical Details — *Page 46 cont.*
Product Overview — *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Band MBA511
Absolutely coded scale, measuring length 20480 mm

Profile

- Easy adhesive mounting, self-assembly possible



5.2

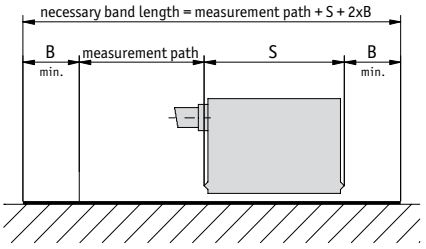
Mechanical data

Feature	Technical data	Additional information
Measuring length	max. 20480 mm	
Band width	20 mm	
Thickness	1.4 mm	without cover strip
Accuracy class	±100 µm	at T_U = 20 °C
Temperature coefficient	(11±1) x 10^{-6}/K	
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ...+70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 5 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	0.5 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	B	with	
	TO		without	
Cover strip	AM	C	with	
	AO		without	

Order code

MBA511 – [A] – [B] – [C]

Scope of delivery: *MBA511, User information*

Accessories:
Profile rail PSA *Page 184*

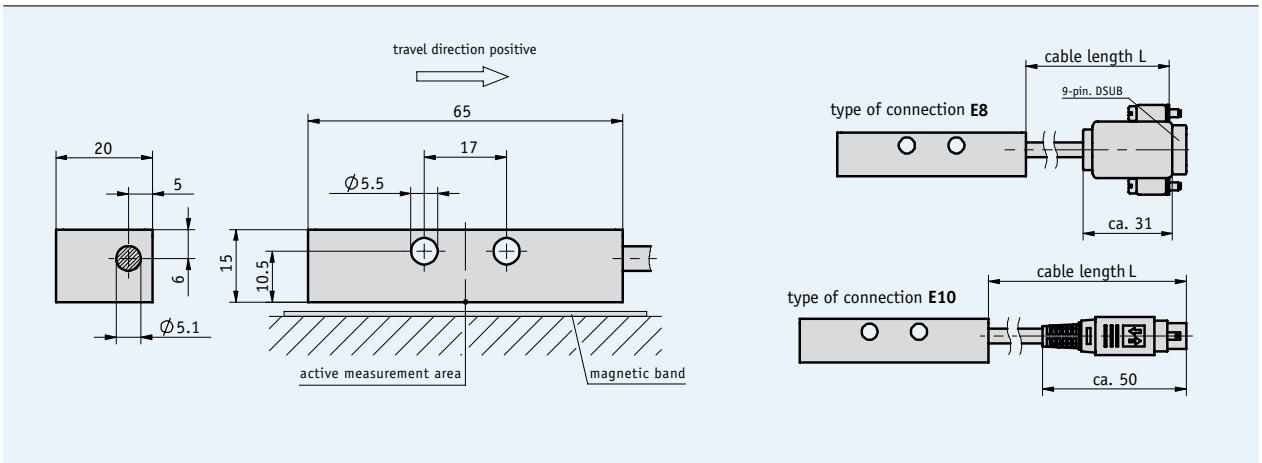
Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 03/2009

Magnetic Sensor MSA
Absolute, sensor for MA505, MA561 and AEA

Profile

- To be connected to magnetic displays MA505 and MA561 as well as translation module AEA
- Max. resolution depends on downstream electronics unit
- Repeat accuracy depends on downstream electronics unit
- Max. sensor/band reading distance of 1 mm
- Max. measuring length 5120 mm



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MBA	
System accuracy	(0.05 + 0.03 x L), L in m	
Repeat accuracy	0.01 mm	
Sensor/band reading distance	max. 1 mm	
Travel speed	max. 5 m/s	
Housing	aluminum natural chromated	
Sensor cable	PUR	
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	DIN 40050
Vibration resistance	10 g/50 Hz	
Max. measuring length	max. 5120 mm	

Electrical data

Feature	Technical data	Additional information
Operating voltage	feed via downstream electronics unit	
Current consumption	see downstream electronics unit	
Type of connection	Mini-DIN, D-SUB 9-pin	
Resolution	depends on magnetic display, downstream electronics unit	

Pin assignment

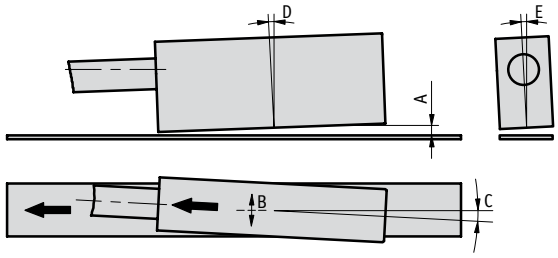
signal	E8	E10
LK14-A	2	1
SENS- DATA	3	3
LK14-B	4	5
CLK	6	4
+5V	7	8
GND	8	6
STR	9	7
N.C.	1, 5	2

Mounting instruction

When installing the sensor and magnetic band, always ensure that both system components are correctly aligned. The arrows marked on the band and sensor must point in the same direction during installation.

A, Sensor/band reading distance	max. 1.0 mm
B, Lateral offset	max. ±1.0 mm
C, Misalignment	<±2°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

Order note

This sensor is sold in Switzerland and Austria under the product name “AMSA“.

Order table

Feature	Order data		Specifications	Additional information
Type of connection	E8	A	D-SUB 9-pin	
	E10		Mini-DIN	
Cable length L	...	B	1 ... 20 m, in steps of 1 m	
			others on request	

Order code

MSA - A - [ ] - [ ]
A B

Scope of delivery: *MSA, User information, distance gage 0.5 mm, snap ferrite on sensor cable*

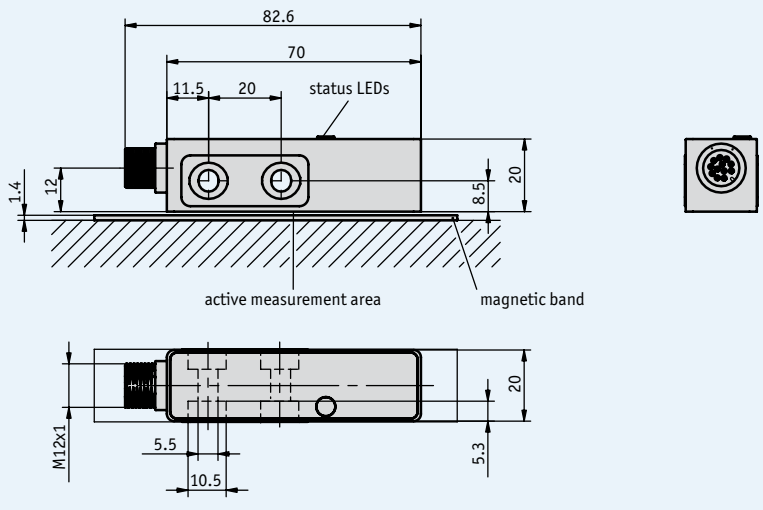
Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Sensor MSA501
Absolute, SSI interface, resolution 1 µm

Profile

- Max. resolution of 5 µm absolute, 1 µm incremental
- Repeat accuracy of 0.005 mm
- SSI, RS485 output circuits
  Additional incremental signals LD as an option
- Max. sensor/band reading distance 1.3 mm
- Max. measuring length 10.24 m
- status LEDs for diagnosis



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MBA501	
Auflösung	absolute 0.005, 0.01 mm	
	incremental 0.001, 0.005, 0.01 mm	
System accuracy	±(0.03 x L) mm, L in m	at T_U = 20 °C
Repeat accuracy	max. 0.005 mm	at T_U = 20 °C
Sensor/band reading distance	max. 1.3 mm	
Travel speed	max. 5 m/s	
	incremental, see travel speed table	
Housing	zinc die casting	
Connector	12-pin, M12	
Operating temperature	-30 ... +85 °C	
Storage temperature	-40 ... +85 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	only with mating plug
Max. measuring length	max. 10.24 m	

Travel speed

		Travel speed V_{max} (m/s)								
Resolution (mm)	**0.001**	4.00	1.60	0.80	0.32	0.20	0.10	0.05	0.03	0.01
	0.005	20.00	8.00	4.00	1.60	1.00	0.50	0.25	0.13	0.06
	0.010	25.00	16.00	8.00	3.20	2.00	1.00	0.50	0.25	0.13
Pulse interval (µs)		0.20	0.50	1.00	2.50	4.00	8.00	16.00	32.00	66.00
Counting frequency (kHz)		1250.00	500.00	250.00	100.00	62.50	31.25	15.63	7.81	3.79

Electrical data

Feature	Technical data	Additional information
Operating voltage	4.5 ... 30 V DC	
Power input	<1.5 W	
Type of connection	round connector on the housing	
Output circuit	SSI, RS485 (absolute)	
	LD (RS422, incremental)	
EMV	EN-61000-6-2, EN61000-6-4	
SSI clock rate	<925 kHz	depending on cable length
Cycle time	<25 µs	

Pin assignment

without LD

SSI	RS485	PIN
D+	DÜA	2
D-	DÜB	3
T-	N.C.	4
+UB	+UB	5
config	config	10
T+	N.C.	11
GND	GND	12
N.C.	N.C.	1, 6, 7, 8, 9

with LD

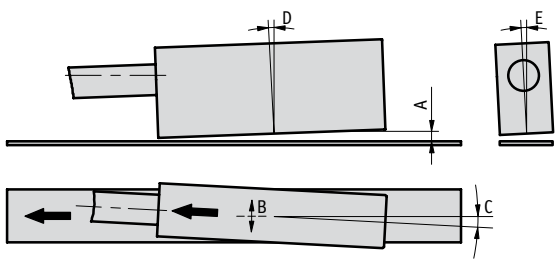
SSI	RS485	PIN
N.C.	N.C.	1
D+	DÜA	2
D-	DÜB	3
T-	N.C.	4
+UB	+UB	5
/A	/A	6
A	A	7
/B	/B	8
B	B	9
config	config	10
T+	N.C.	11
GND	GND	12

Mounting instruction

When installing the sensor and magnetic band, always ensure that both system components are correctly aligned. The arrows marked on the band and sensor must point in the same direction during installation

A, Sensor/band reading distance	max. 1.3 mm
B, Lateral offset	max. ±3.0 mm
C, Misalignment	<±1.5°
D, Longitudinal tilt	<±1.0°
E, Lateral tilt	<±4°

Sensor/band reading distance (symbolic sensor representation)



Order

Order note

This sensor is sold in Switzerland and Austria under the product name “AMSA501“.

Feature	Order data		Specifications	Additional information
Interface	RS485	A	SIKONETZ3	
	SSI		RS422	
Resolution absolute	5	B	0.005 mm	
	10		0.01 mm	
Output circuit	0	C	without LD	
	LD		RS422 incremental	
Resolution incremental only with output circuit LD	1	D	0.001 mm	
	5		0.005 mm	
	10		0.01 mm	
Pulse interval in µs	...	E	0.2, 0.5, 1, 2.5, 4, 8, 16, 32, 66	

Order table

MSA501 - [ ] - [ ] - [ ] - [ ] - [ ] - [S]
A B C D E

5.2

Scope of delivery: *MSA501, User information, distance gage 0.5 mm*

Accessories:

Mating connectors *Page 176*
Cable extension KV12S2 *Page 180*

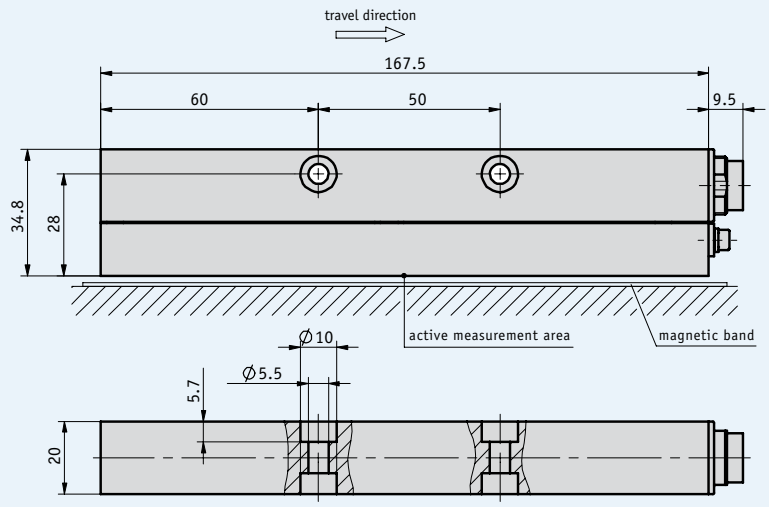
Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Profile

- Max. resolution 10 µm
- Repeat accuracy 0.01 mm
- SSI, RS485 output circuits
- Max. sensor/band reading distance 2 mm
- Max. measuring length 20480 mm



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MBA511	
System accuracy	±(0.1 + 0.03 x L) mm, L in m	
Repeat accuracy	±0.01 mm	
Sensor/band reading distance	max. 2 mm	
Travel speed	max. 5 m/s	
Housing	aluminum natural chromated	
Operating temperature	-20 ... +60 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP65	according to DIN VDE 0470 with a suitable mating connector
Vibration resistance	10 g/50 Hz	
Max. measuring length	20480 mm	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 %	reverse-polarity protection on UB
Current consumption	<100 mA	
Power input	<2 V A	
Type of connection	plug connection, 12-pin	
Output circuit	SSI	according to RS422
Output signals	sine, cosine	1 V_{SS} (±100 mV), offset 2.5 V (±100 mV), 5 mm period length
Interfaces	RS485, service interface	
Resolution	10 µm	
Interference protection class	3	according to IEC 801
Baud rate	<500 kHz	
Cycle time	<2 ms	

Pin assignment

- **SSI (according to RS422)**

Signal	
SSI data-	A
SSI data+	B
SSI clock-	C
SSI clock+	D
+24 V DC	E
Sine	F
RS485 DÜA	G
RS485 DÜB	H
GND	J
N.C.	K
Zeroing input	L
Cosine	M

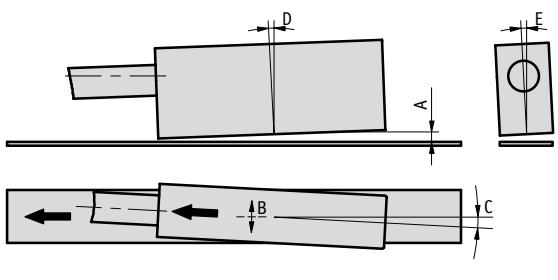
5.2

Mounting instruction

When installing the sensor and magnetic band, always ensure that both system components are correctly aligned. The arrows marked on the band and sensor must point in the same direction during installation

A, Sensor/band reading distance	max. 2 mm
B, Lateral offset	max. ±1.0 mm
C, Misalignment	<±1°
D, Longitudinal tilt	<±0.5°
E, Lateral tilt	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

- **Order note**
  This sensor is sold in Switzerland and Austria under the product name “AMSA511“.

- **Order code**

  MSA511 – SSI

Scope of delivery: *MSA511, User information*

Accessories:

Mating connectors *Page 176*
Cable extension KV12S0 *Page 179*

Additional information:

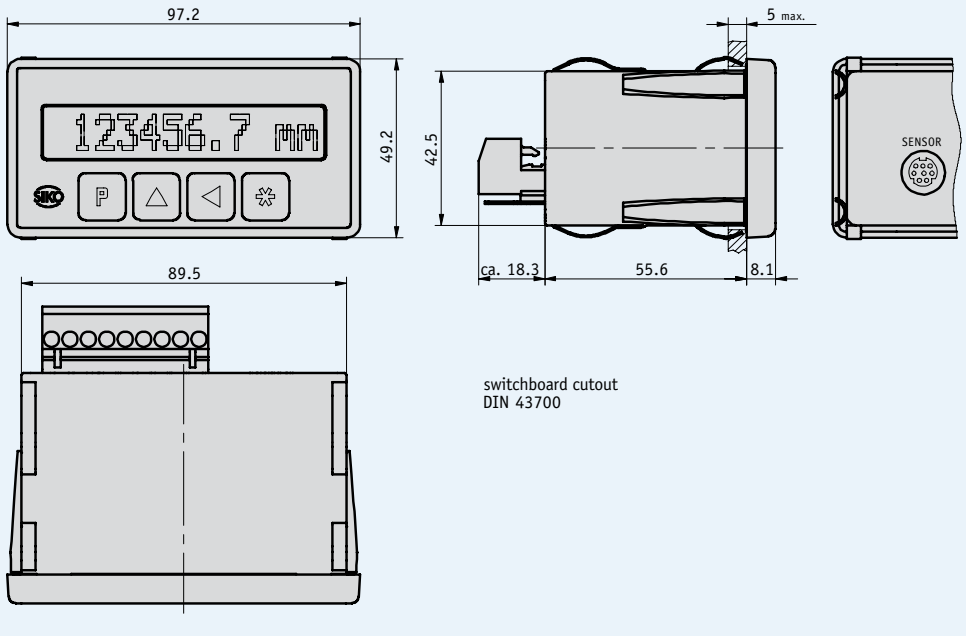
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Display MA505
Absolute, LCD dot matrix display, display accuracy 10 µm

Profile

- Display accuracy max. 10 µm
- Repeat accuracy max. ±0.01 mm
- High-contrast LCD, 12-digit LCD dot matrix
- Incremental measurement and calibration function
- Direct reference/offset value input
- Calibration input
- Works with sensor MSA
- Option: serial interface RS232/RS485



switchboard cutout
DIN 43700

Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.05+0.03 x L) mm, L in m	at T_U = 20 °C
Repeat accuracy	0.01 mm	
Magnetic sensor	MSA	absolute
Calibration input	9-pin screw-type terminal strip (EG)	
Supply connection	9-pin screw-type terminal strip(EG)	
Sensor connection	pluggable via Mini-DIN	
Display/display range	12-digit LCD dot matrix	-9 999 999 ... 9 999 999, sign, units
Design	panel-mount housing cutout 92 x 45 mm	Noryl GFN 2SE 1, as a snap module
Housing	plastic black	
Protection category	IP40 for whole device	according to DIN 40050
	IP60 with switchboard installation	according to DIN 40050
Operating temperature	0 ... +50 °C	
Storage temperature	-20 ... +80 °C	
Humidity	95 % rh	condensation inadmissible

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 230 V AC ±10 % 115 V AC ±10 %	
Current consumption	70 mA 20 mA 10 mA	24 V, incl. sensor 115 V, incl. sensor 230 V, incl. sensor
Interfaces/protocol	without RS232 with standard protocol	others on request
Resolution	in mm 0.01, 0.1, 1, 10 in inch 0.001, 0.01, 0.1, 1	programmable angle display
Interference protection class	3	according to TEC 801

Pin assignment

panel-mount housing EG

Signal	PIN
CAL	1
UB = +12 V for calibration input	2
GND	3
N.C.	4
RXD (RS232); DÜB (RS485); A2 (switching output)	5
TXD (RS232); DÜA (RS485); A1 (switching output)	6
PE	7
GND (24 V DC) N (230/115 V AC)	8
UB (24 V DC) L (230/115 V AC)	9

Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	1	A	230 V AC ±10 %	
	2		115 V AC ±10 %	
	4		24 V DC ±20 %	
Interface/protocol	XX/XX	B	without	
	S1/00		RS232 with standard protocol	
	S3/00		RS485 with standard protocol	
Switching output	SO	C	without	
	SM		with	only with interface XX/XX

Order code

MA505 – EG – [ ] – KM – [ ] – [ ] – S – MSA
(A) (B) (C)

Scope of delivery: *MA505, User information*

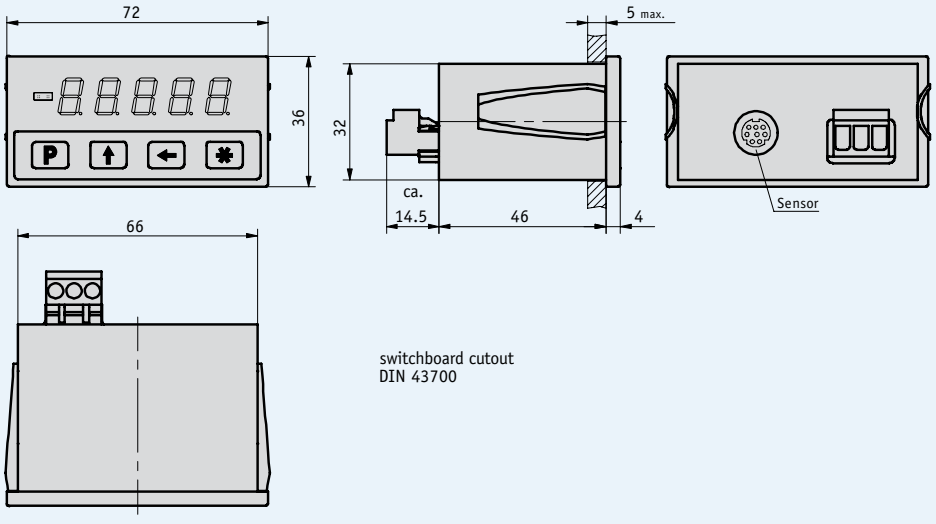
Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Display MA561
Absolute, LED display, display accuracy 10 µm

Profile

- Display accuracy max. 10 µm
- Repeat accuracy max. ±0.01 mm
- Incremental measurement and calibration function
- Direct reference/offset value input
- Calibration input
- Works with sensor MSA



Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.05 + 0.03 x L) mm, L in m	
Repeat accuracy	±1 digit	max. ±0.01 mm
Magnetic sensor	MSA	
Supply connection	3-pin terminal strip	
Sensor connection	pluggable via Mini-DIN	
Display/display range	5-digit LED, red, 10 mm	-99 999 ...+99 999
Design	panel-mount housing, cutout 68 x 33 mm	
Housing	plastic, red transparent	snap module for switchboard installation
Protection category	IP40 for whole device	according to DIN 40050
	IP60 with switchboard installation	according to DIN 40050
Operating temperature	0 ... +50 °C	
Storage temperature	-20 ... +85 °C	
Humidity	max. 95 % rh	condensation inadmissible

Electrical data

Feature	Technical data	Additional information
Operating voltage	10 ... 30 V DC	
Current consumption	<50 mA with 24 V DC	incl. sensor
Resolution	0.01, 0.05, 0.1, 1 mm 0.001 inch, 0.01 inch	programmable angle display
Interference protection class	3	according to IEC 801

Pin assignment

Signal
CAL
+UB
GND

Order

- **Order code**

MA561 – MSA

Subject to technical alterations 09/2010

Scope of delivery: *MA561, User information*

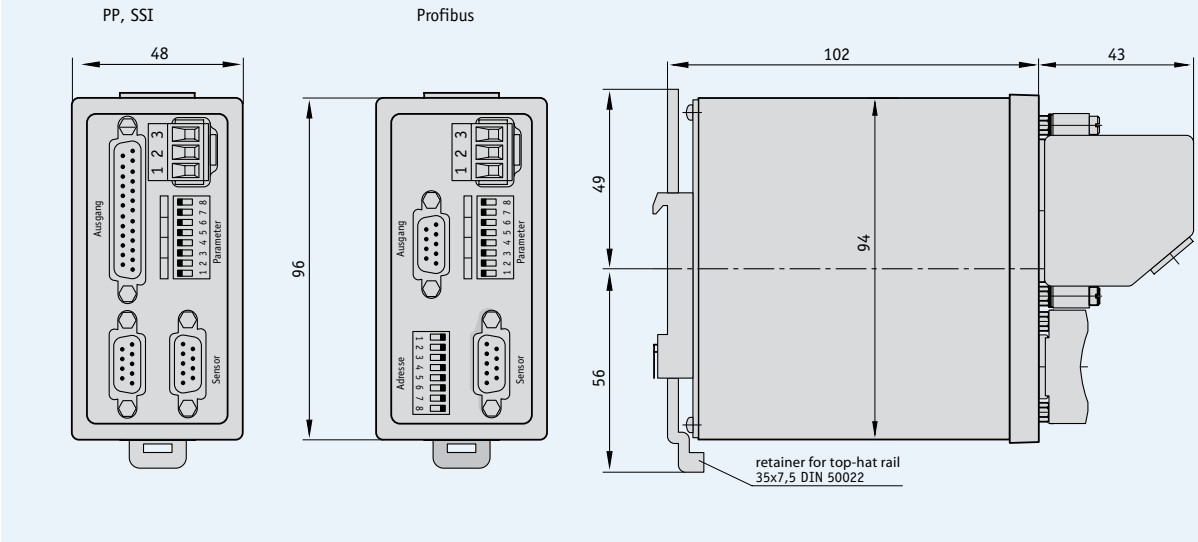
Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Translation Module AEA
Absolute, SSI, Profibus interfaces , resolution 10 µm

Profile

- Max. resolution 10 µm
- Repeat accuracy 0.01 mm
- SSI, PP parallel, Profibus output circuits
- RS232, RS485 interface options
- Parameters adjustable via DIP switches
- External bus connections can be established (e.g., CAN, Inter-Bus-S ...)



Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.05 + 0.03 x L) mm, L in m	at T_U =20 °C
Repeat accuracy	0.01 mm	
Housing	aluminum	snap module for top-hat rail mounting
Electrical connection	D-SUB 9-pin for sensor connection D-SUB 9-pin for Profibus connection D-SUB 25-pin for PP/SSI	
Supply connection	3-pin terminal strip	
Protection category	IP 20 according to DIN 40050	
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +80 °C	
Weight	approx. 350 g	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 %	
Power input	<5 VA	
Resolution	0.01, 0.1, 1, 10 mm	inch 0.001, 0.01, 0.01, 1
Interfaces	RS232 with standard protocol RS485 with standard protocol	
Output circuit	PP parallel/SSI/Profibus	
Interference protection class	3	according to ICE801
SSI clock rate	62.5 – 500 kHz	
Monoflop time	16 µm	
Cycle time	<1 ms	

Pin assignment

SSI

Signal	PIN
SSI-clock +	1
SSI-clock -	2
SSI-data +	3
SSI-data -	4
GND	5
N.C.	6–25

PP, parallel

Signal	PIN
D0	1
D1	2
⋮	⋮
D18	19
D19	20
N.C.	21, 22, 23
GND	24, 25

Power supply

Terminal	PIN
+24 V DC	1
0 V	2
PE	3

Interfaces

RS232	RS485	PIN
RXD	DÜA	3
TXD	GND	5
GND	DÜB	8
N.C.	N.C.	1, 2, 4, 6, 7, 9

Order

Order table

Feature	Order data		Specifications	Additional information
Output	PP	A	parallel	
	SSI		synchronous serial interface	
	PB		Profibus	
Interfaces	XX/XX	B	without	
	S1/00		RS232 with standard protocol	
	S3/00		RS485 with standard protocol	

Order code

AEA – [A] – 4 – [B] – MSA

Scope of delivery: *AEA, User information, D-SUB connector 25-pin, D-SUB bush 9-pin*

Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

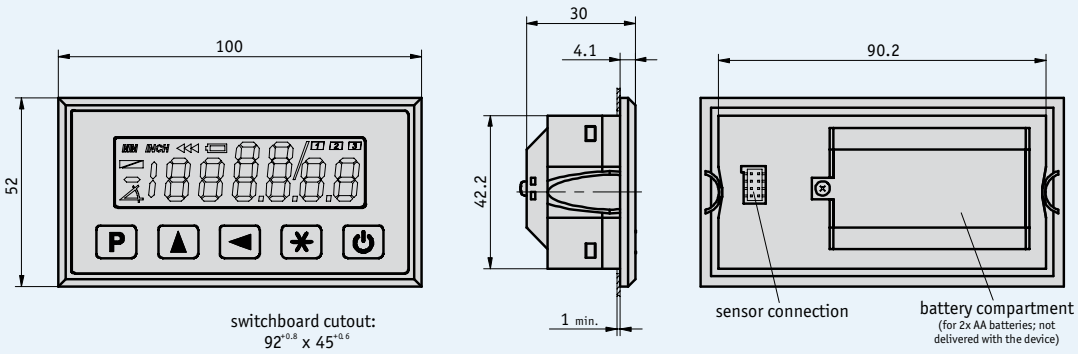
Subject to technical alterations 10/2008

Magnetic Display MA503/2

Quasi-absolute, mains-independent LCD display, display accuracy 10 µm

Profile

- Max. display accuracy 10 µm or 1/64 inch
- Repeat accuracy max. ±0.01 mm
- Low-power LCD with decimal and fraction-inch function
- Max. sensor/band reading distance 2 mm
- Incremental measurement and reset function
- Direct reference/offset value input
- Battery-buffered memory
- Battery operation
- MS500H sensor pluggable



Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.1+ 0.01 x L) mm, L in mm	
Repeat accuracy	max. ±0.01 mm	± 1 digit
Magnetic sensor	pluggable	
Supply connection	integrated battery compartment	
Display/display range	low-power LCD, approx. 13 mm high	decimal up to 10 µm, fraction-inch up to 1/64 Inch
Housing	panel-mount housing	
Protection category	IP40 whole device, IP54 front side	
Operating temperature	0 ... +60 °C	
Storage temperature	-30 ...+80 °C	
Humidity	max. 95 % rh	condensation inadmissible
Travel speed	max. 5 m/s	

Electrical data

Feature	Technical data	Additional information
Operating voltage	3 V DC	
Current consumption	approx. 220 µA with 3 V DC	
Resolution	max. 10 µm	programmable
Interference protection class	3	according to IEC 801

5.2

Order

- **Order code**

MA503/2- EG - S

Scope of delivery: *MA503/2, User information*

Additional information:

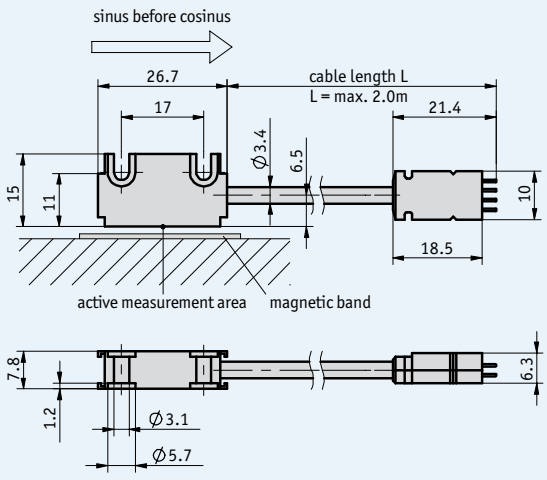
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Sensor MS500H
Incremental, miniature design

Profile

- Compact design of sensor and connector
- To be connected to MA503/2
- Works with magnetic band MB500, MR500, MBR500
- Max. sensor/band reading distance 2 mm



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB500, MR500, MBR500	
System accuracy	depends on downstream electronics unit	
Repeat accuracy	depends on downstream electronics unit	
Sensor/band reading distance	0.1 ... 2 mm	
Travel speed	depends on downstream electronics unit	
Housing	aluminum, varnished red	
Sensor cable	PVC	
Bending radius	≥17 mm	static
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	

Electrical data

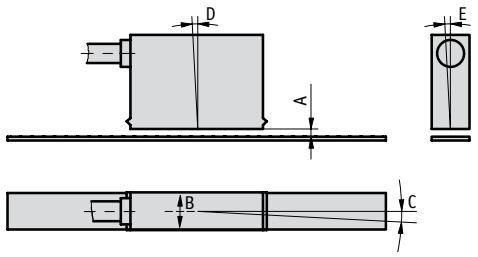
Feature	Technical data	Additional information
Operating voltage	feed via magnetic display/ downstream electronics unit	
Current consumption	depends on magnetic display/ downstream electronics unit	
Type of connection	flat connector	

Mounting instruction

A, Sensor/band reading distance	max. 2 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

The connection must not be changed(e.g., different cable, cable length ...)

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data	Specifications	Additional information
Cable length L	... A	0.2 ... 2.0 m, in steps of 0.1 m	

Order code

MS500H - L - E16 - [ ] A

Scope of delivery: *MS500H, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable*

Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

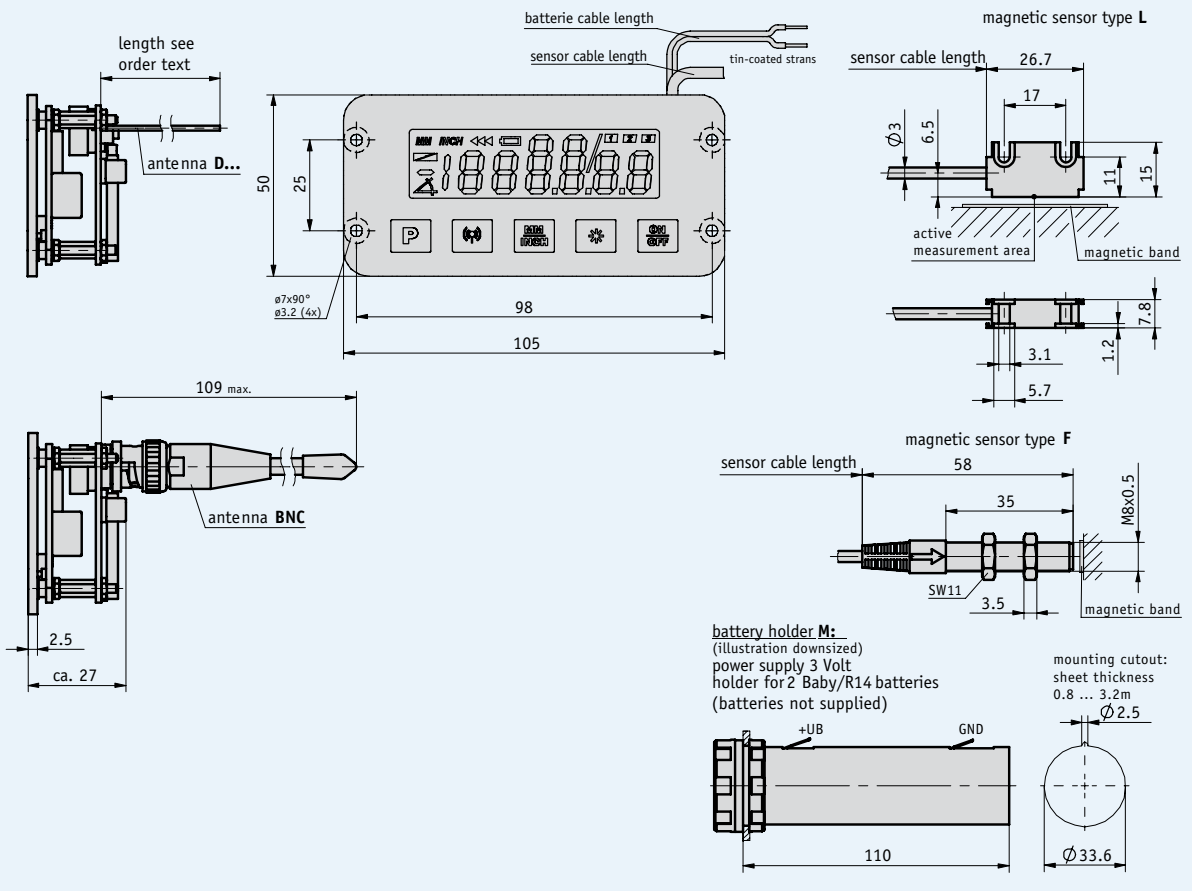
Subject to technical alterations 12/2010

Magnetic Display MA503WL

Quasi-absolute, mains-independent LCD display, radio transmission to RTX500

Profile

- Display accuracy max. 10 µm or 1/64 inch
- Repeat accuracy max. ±0.01 mm
- Low-power LCD with decimal and fraction-inch function
- Max. sensor/band reading distance 2 mm
- Battery-buffered memory
- Battery operation
- Works with receiver module RTX500



Mechanical data

Feature	Technical data	Additional information
System accuracy	±0.1 mm	
Repeat accuracy	max. ±0.01 mm	± 1 digit
Magnetic sensor	hard-wired	
Supply connection	strand led to the outside	external battery holder
Display/display range	-999 999 ... 999 999	
V_{max} of sensor	5 m/s	with reading distance of 0.1–2 mm
Design	installation kit	
Protection category	IP40 (display) IP67 (sensor)	
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +70 °C	
Humidity	condensation inadmissible	

Electrical data

Feature	Technical data	Additional information
Operating voltage	2 ... 3,5 V DC	
Current consumption	Display: max. 600 µA with 3 V DC send operation: 27 ... 55 mA with 3 V DC	
Interfaces/protocol	RS232/RS485	see RTX500 receive side
Resolution	max. 10 µm	

5.2

Pin assignment

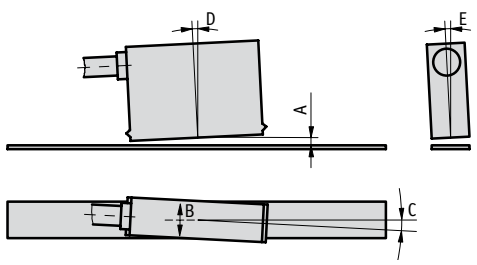
Signal	Cable color
GND	black
+UB	red

Mounting instruction

A, Sensor/band reading distance	max. 2 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

The connection must not be changed(e.g., different cable, cable length ...)

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Sensor design	L	A	rectangle with elongated hole	
	F		round design	
Sensor cable length	...	B	0.3 ... 2 m in steps of 0.1 m	
Battery cable length	...	C	0.2 ... 2 m in steps of 0.1 m	
Operating mode	TX	D	send	
	RX		receive	
Software	S	E		
	SW05		bi-directional communication	
Battery holder	M	F	with	provided in the accessories pack
	0		without	
Antenna	BNC	G		
	D82		wire length 82 mm	radio frequency 915
	D86		wire length 86 mm	radio frequency 869
	D120		wire length 120 mm	radio frequency 869 + 915
Radio frequency MHz	869	H	worldwide outside USA	
	915		USA	

5.2

Order code

MA503/WL- ES - [A] - [B] - [C] - [D] - [E] - SF-83606 - [F] - [G] - [H]

Scope of delivery: *MA503WL, User information*

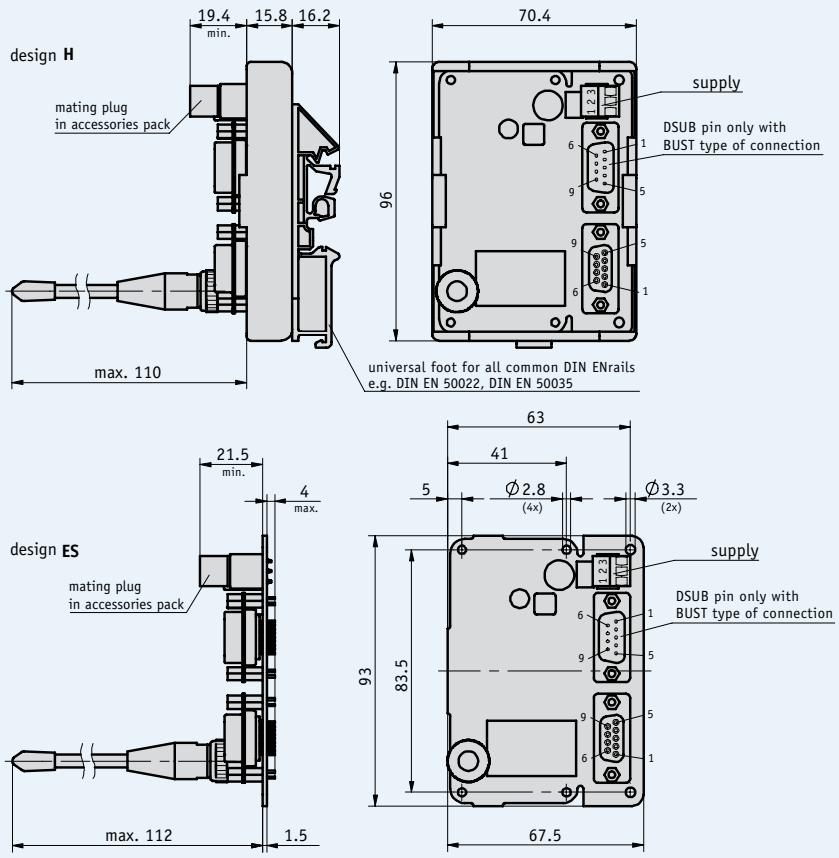
Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Profile

- Works with radio-based magnetic display MA503WL
- Mounting on top-hat rail or as an installation kit
- Pluggable BNC antenna
- 24 V DC supply
- RS232 or RS485 interface with ASCII-protocol



Mechanical data

Feature	Technical data	Additional information
Housing	Plastic	snap module for top-hat rail mounting
Electrical connection	3-pin screw-type terminal for supply	D-SUB 9-pin for signal output
Protection category	IP40	
Humidity of translation module	condensation inadmissible	
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +70 °C	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 %	
Power input	<1 VA	
Interfaces	RS232, RS485	
Receive sensitivity	-111 dbm	
Radio frequency	868 ... 870 MHz	
Interference protection class	3	according to IEC 801

Pin assignment

Supply

Signal	PIN
+UB	1
GND	2
PE	3

RS232,9-pin DSUB

Signal	PIN
N.C.	1
TXD	2
RXD	3
N.C.	4
GND	5
N.C.	6-9

RS485, 9-pin DSUB

Signal	PIN
DÜB (D-)	1
N.C.	2, 3
DÜA (D+)	4
GND	5
N.C.	6-9

5.2

Order

Order table

Feature	Order data		Specifications	Additional information
Design	H	A	top-hat rail mounting	
	ES		installation kit	
Type of connection	BU	B	9-pin DSUB-bush	
	BUST		2 x 9-pin DSUB-bush + pin	
Operating mode	TX	C	send	
	RX		receive	
Interface	RS232	D		
	RS485			
Software	S	E	standard	
	SW03		bi-directional communication	
Antenna	BNC	F		
Radio frequency	869	G		
	915		USA	

Order code

RTX500 - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ] - [ ]
A B C D E F G

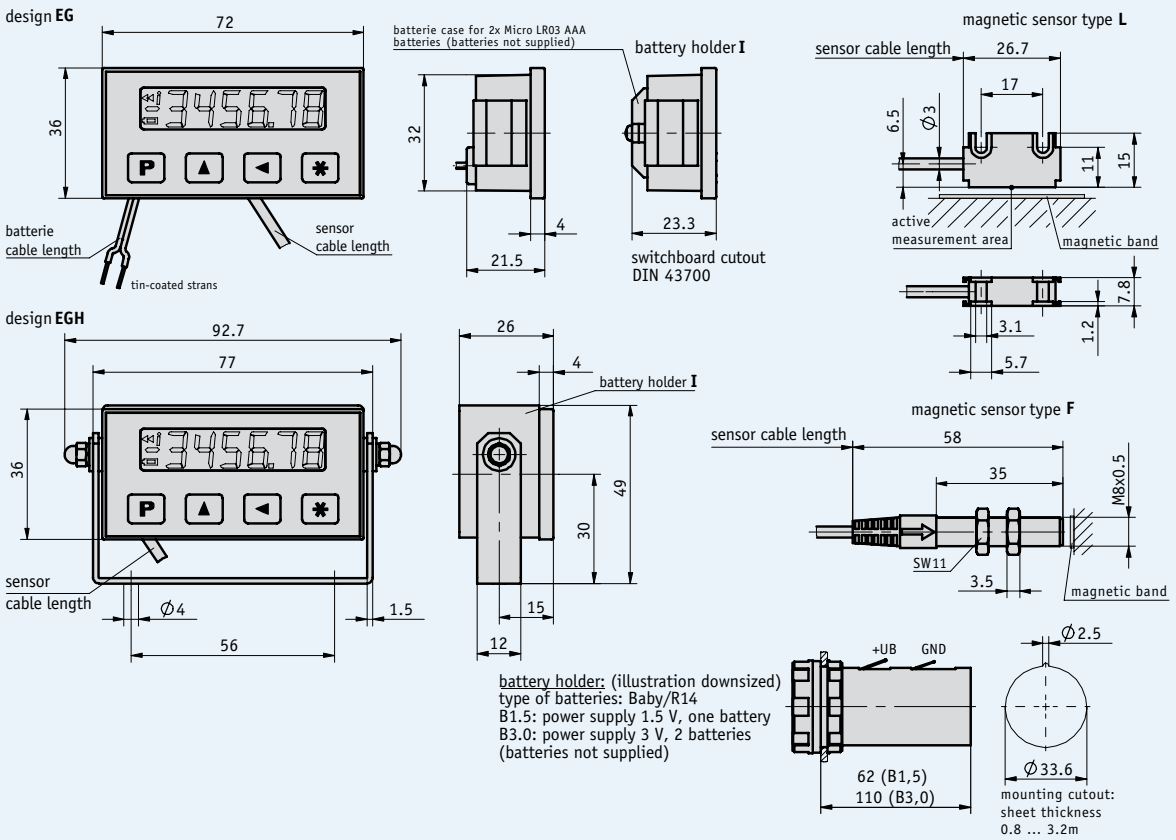
Scope of delivery: *RTX500, User information*

Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 10/2008

Profile

- Display accuracy max. of 10 µm
- Repeat accuracy max. ±0.01 mm
- Lowest-power LCD
- Metric or decimal-inch indication
- Incremental measurement and reset function
- Direct reference/offset value input
- Up to 3 years of service life without battery change



Mechanical data

Feature	Technical data	Additional information
System accuracy	±(0.1 +0.01 x L), L in m	with magnetic band MB500 at T_U = 20 °C
Repeat accuracy	max. ±0.01 mm	± 1 digit
Magnetic sensor	hard-wired	
Electrical connection	without connection strand	integrated battery holder external battery holder
Display/display range	6-digit LCD	-999 999 ... +999 999
Design	panel-mount housing panel-mount housing with shackle	
Housing	plastic (transparent)	
Protection category	IP40 whole device IP 54 front side IP67 sensor	
Operating temperature	0 ... +60 °C	
Storage temperature	-30 ... +80 °C	
Humidity	condensation inadmissible	
Travel speed	max. 5 m/s	

Electrical data

Feature	Technical data	Additional information
Operating voltage	1 ... 3.3 V DC	
Current consumption	max. 170 µA with 3 V DC max. 350 µA with 1.5 V DC	<50 µA standby <100 µA standby
Resolution	max. 10 µm	

5.2

Pin assignment

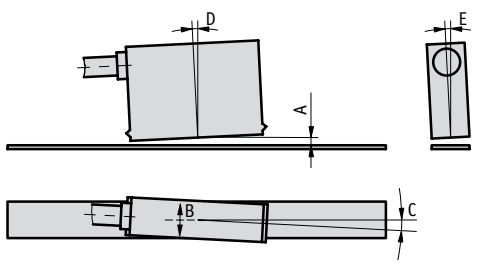
Signal	Cable color
GND	black
+UB	red

Mounting instruction

A, Sensor/band reading distance	max. 2 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

The connection must not be changed (e.g., different cable, cable length ...)

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Housing design	EG	A	panel-mount housing	
	EGH		panel-mount housing with shackle	
Sensor design	L	B	rectangle with elongated hole	
	F		round design	
Sensor cable length	...	C	0.3 ... 2 m in steps of 0.1 m	
Battery cable length	...	D	0.2 ... 2 m in steps of 0.1 m	
Electrical connection	OA	E	without external connection	integrated battery holder
	L		connection cables led through	external battery holder
Battery holder	I	F	integrated	
	B1.5		with external battery holder 1.5 V	only with electrical connection L
	B3.0		with external battery holder 3 V	only with electrical connection L
	0		without battery holder	only with electrical connection L

Order code

MA504 – [A] – [B] – [C] – [D] – [E] – [F]

5.2

Scope of delivery: *MA504 with sensor, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.8 mm*

Additional information:

Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

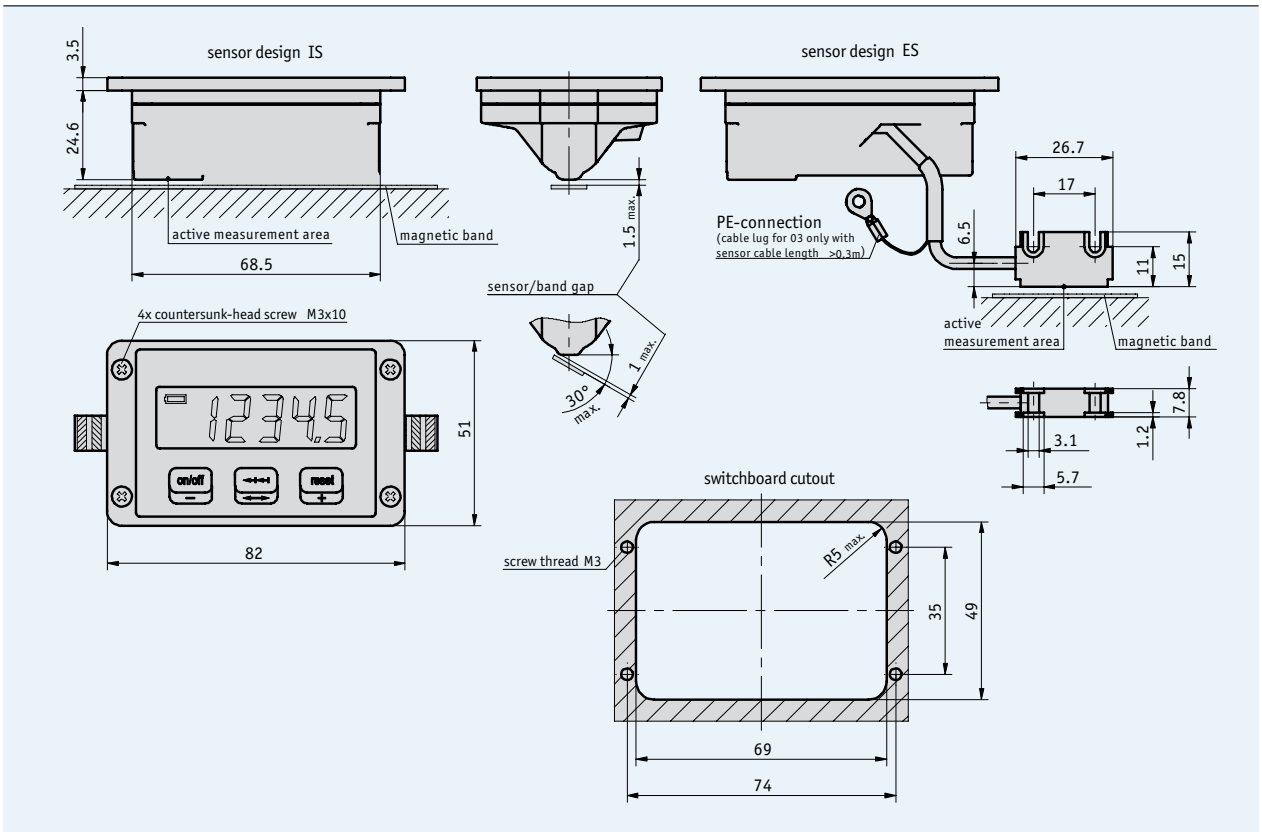
Subject to technical alterations 09/2010

Magnetic Display MA508

Quasi-absolute, mains-independent LCD display, robust metal housing

Profile

- Display accuracy max. 0.1 mm
- Repeat accuracy ±1 digit
- Lowest-power LCD with integrated sensor
- Incremental measurement and reset function
- Direct offset value input
- Supply via integrated battery with up to 10 years of service life
- Programmable via programming tool PTM



Mechanical data

Feature	Technical data	Additional information
System accuracy	±0.1 mm	
Repeat accuracy	±1 digit	
Magnetic sensor	hard-wired	
Display/display range	-99 999 ... +99 999	
Design	panel-mount housing	
Housing	zinc die-cast	
Protection category	IP20 whole device IP60 display side	
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ...+70 °C	
Humidity	95 % rh	condensation inadmissible
Travel speed	max. 3.5 m/s	

Electrical data

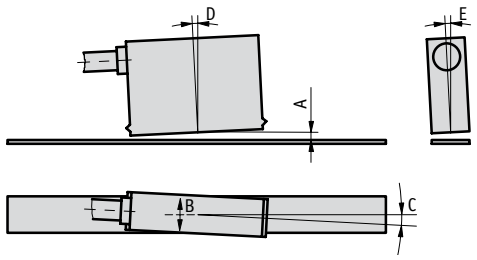
Feature	Technical data	Additional information
Interfaces/protocol	interface for PTM (programming tool)	
Resolution	0.1, 1, 1.25, 2, 2.5, 5, 10 mm	
Parameter settings	non-volatilely programmable	via external programming tool PTM

Mounting instruction

A, Sensor/band reading distance	max. 2 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

The connection must not be changed (e.g., different cable, cable length ...)

Sensor/band reading distance (symbolic sensor representation)



5.2

Order

Order table

Feature	Order data		Specifications	Additional information
Sensor design	IS	A	integrated sensor	
	ES		external sensor	
Sensor cable length	...	B	0.1 ... 2 m in steps of 0.1 m	only with sensor design ES

Order code

MA508 - EG - [ ] - L - [ ] - SF-83083
A B

Scope of delivery: *MA508 with sensor, User information*

Accessories:
Programming device PTM *Page 185*

Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

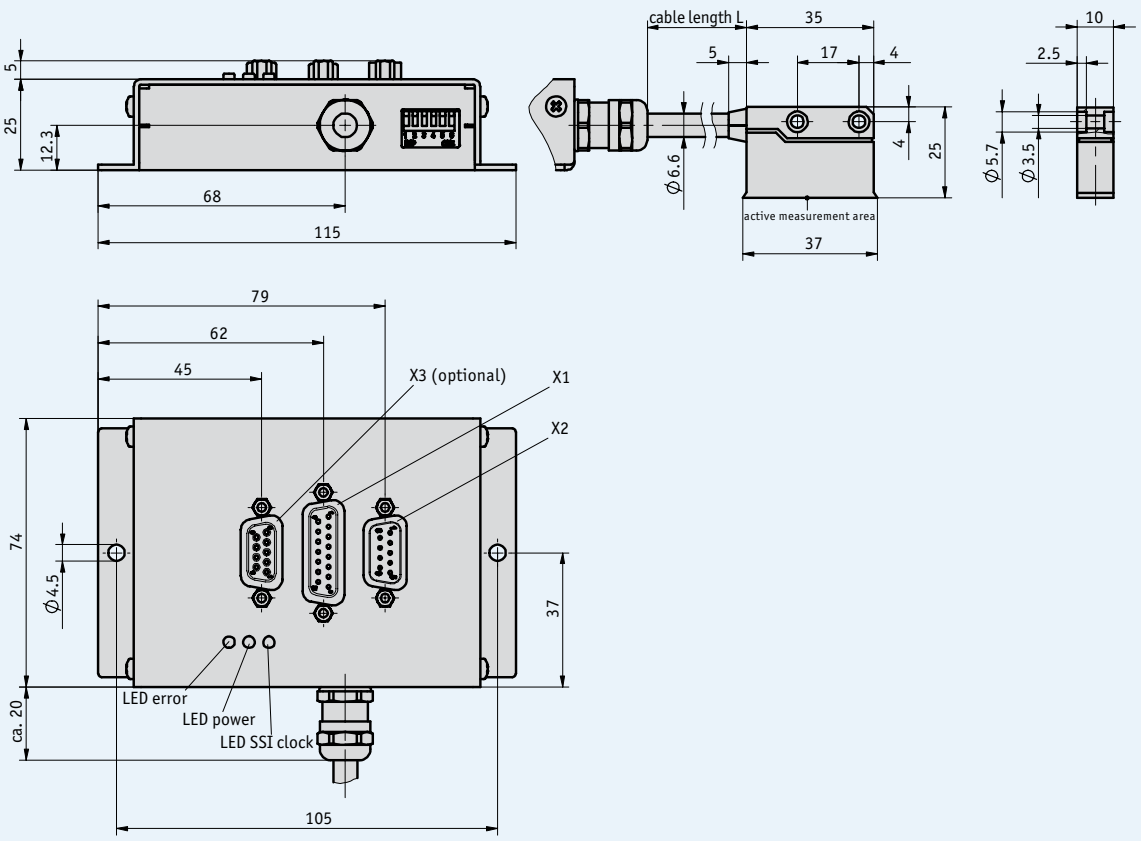
Subject to technical alterations 09/2010

Translation Module ASA510H

Quasi-absolute, battery-buffered translation module

Profile

- Max. resolution 1 µm (LD)
- Repeat accuracy ±0.005 mm
- SSI or RS485 interface
- Scale MB500
- Max. sensor/band reading distance 2 mm
- Compact, absolutely measuring unit with hard-wired sensor
- Max. measuring length ±655 m (RS485)
- Maintenance-free backup battery
- optional digital LD interface
- optional analog 1 V_{ss} or 2.2 V_{ss} interfaces (period length 5 mm)



5.2

Mechanical data

Feature	Technical data	Additional information
System accuracy	(0.025 + 0.01 x L) mm, L in m	at T_U = 20 °C; (L= length per each meter started)
Repeat accuracy	± 5 µm	
Resolution	SSI, 5 or 10 µm	selectable via DIP switch
	LD (RS422), max. 1 µm	
	1 V_{ss} period length 5 mm	
Sensor/band reading distance	0.1 ... 2 mm	over the whole measuring length
Measuring length	±655 000 mm	
Housing translation Module	sheet steel	electrogalvanized
Housing sensor	zinc die casting	
Cable length of sensor	max. 6 m	
Sensor cable sheath	PVC	
Drag chain suitability	min. 1000000 at bending radius = 8x cable diameter and 20 °C	
Travel speed of magnetic sensor	max. 3 m/s SSI	absolute value
	max. 8 m/s	
Protection category	IP20 (translation module)	according to DIN VDE 0470
	IP67 (sensor)	according to DIN 40050
Humidity of translation module	max. 95 % rh	condensation inadmissible
Humidity of sensor	max. 100 % rh	condensation permitted
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +70 °C	
Weight	approx. 420 g	

Travel speed

		Travel speed V_{max} (m/s)				
Resolution (µm)	**1**	4.00	1.60	0.72	0.32	0.12
	5	8.00	8.00	3.60	1.60	0.62
	10	8.00	8.00	7.20	3.20	1.25
	12.5	8.00	8.00	8.00	4.00	1.60
Pulse interval (µs)		0.2	0.5	1.1	2.5	6.3
Counting frequency (kHz)		1250.00	500.00	230.00	100.00	40.00

The internal translation module can generate fast counting pulses, the lengths of wich are limited by the pulse interval. The follower elctronics must be adjusted accordingly. Select the pulse interval in advance, if necessary.

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 %	with reverse-polarity protection
Current consumption	<150 mA	
Backup battery	service life ~ 10 years	at TU = 20 °C; according to manufacturer's specification
EMV	DIN EN 61000-6-2	
	DIN EN 61000-6-4	

Pin assignment

connector X1

SSI	PIN
+24 V DC	3
0 V	4
SSI_DATA	7
/SSI_DATA	8
SSI_GND	12
SSI_CLK	14
/SSI_CLK	15
N.C.	1, 2, 5, 6, 9, 10, 11, 13

connector X2

RS485	RS485 + LD	PIN
N.C.	A	1
N.C.	B	2
N.C.	N.C.	3
+24 V DC	+24 V DC	4
0 V	0 V	5
N.C.	/A	6
N.C.	/B	7
DÜA	DÜA	8
DÜB	DÜB	9

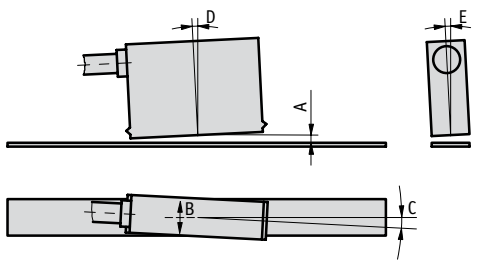
connector X3 (optional)

1 V_{SS} / 2.2 V_{SS}	PIN
sin	1
/sin	2
cos	3
ANA_GND	7
/cos	8
N.C.	4, 5, 6, 9

Mounting instruction

A, Sensor/band reading distance	0.1 ... 2.0 mm
B, Lateral offset	max. ±1 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±2°
E, Lateral tilt	<±2°

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Sensor cable length	...	A	1 ... 6 m in steps of 1 m	
Interface digital	LD	B	Line Driver (RS422)	
	0		without	
Resolution digital	...	C	1, 5, 10, 12.5	
Pulse interval (µs)	...	D	0.2, 0.5, 1.1, 2.5, 6.3	
Interface analog	1Vss	E	1 V_{SS}	
	2.2Vss		2.2 V_{SS}	
	0		without	

Order code

ASA510H - [A] - [B] - [C] - [D] - [E] - S

5.2

Scope of delivery: *ASA510H, User information, grounding material*

Accessories:
Mating plug *Page 176*

Additional information:
Short Description, Technical Details *Page 46 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

cm
5.3
MSK2000
20 mm

5.3 | MagLine Macro

Introduction

Designed for very long paths, the system measures paths of 160 meters and more – as an incremental or absolute system as required. Digital signal outputs forward the measured values via the respective interfaces with a resolution and accuracy of up to 1 mm to displays or higher-level controllers. With its high level of reliability, also in very rough environments, the MagLine Macro is mainly used in the storage and conveying sectors.

- Incremental and absolute measuring systems
- Resolutions of up to 0.25 mm
- Reproducibility and absolute accuracy up to 1 mm

System access

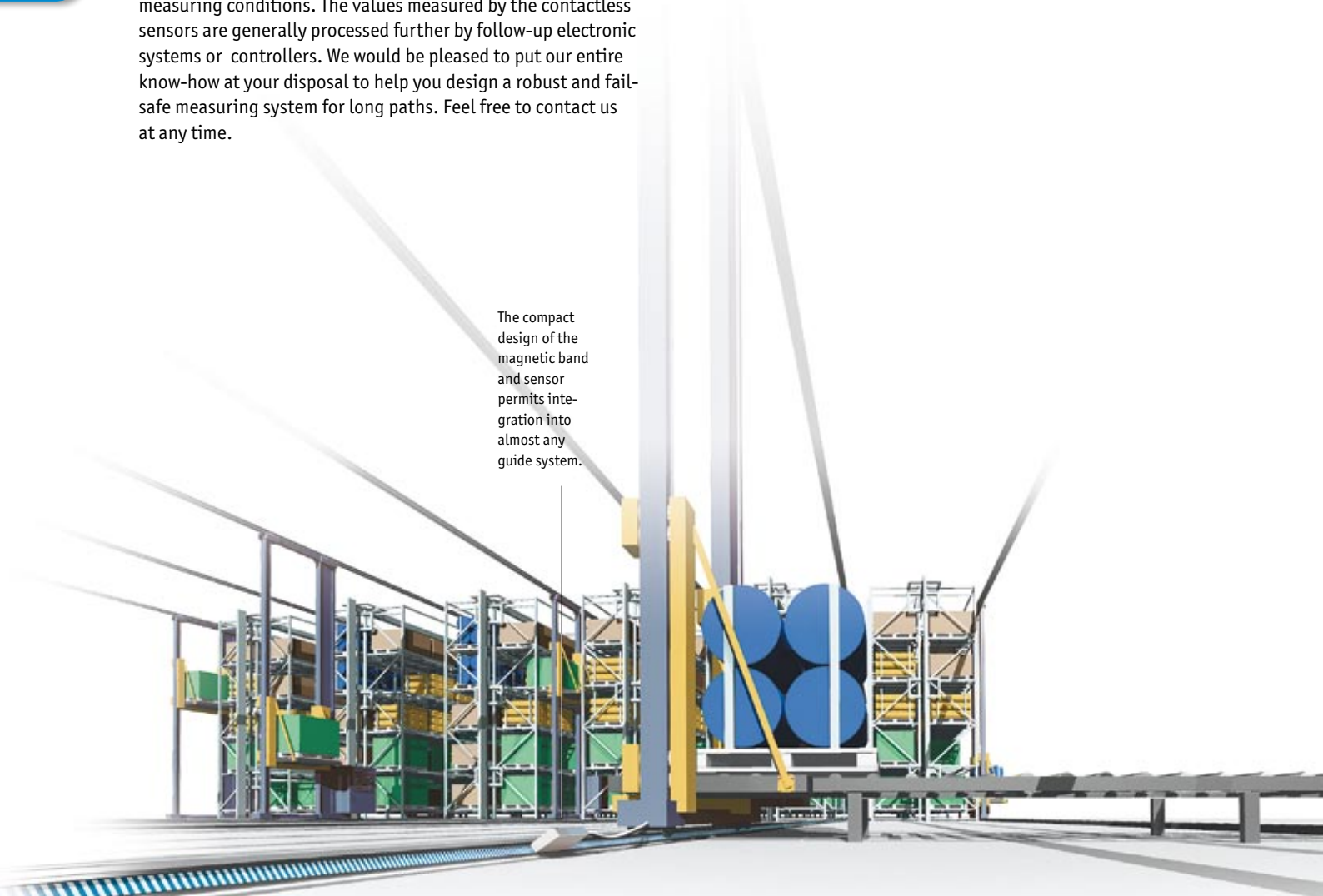
MagLine Macro is suitable for incremental and absolute magnetic measurement. A direct product comparison is possible in the matrix opposite. Macro measurement systems comprise the individual components sensor and magnetic band. The available sensors support signal evaluation via digital outputs (square wave signal, incremental systems) or standardized, digital interfaces (SSI or RS485 absolute systems).

Free and flexible integration into new or existing systems is its main application. Corresponding individual components can be customized and therefore adapted optimally to existing measuring conditions. The values measured by the contactless sensors are generally processed further by follow-up electronic systems or controllers. We would be pleased to put our entire know-how at your disposal to help you design a robust and fail-safe measuring system for long paths. Feel free to contact us at any time.

Magnetic bands
Measuring length up to 160 m (absolute), theoretically infinite (incremental)
Accuracy class up to 1 mm

Sensors
For direct connection to downstream electronics (e.g., PLC)
Max. tolerance of reading distance to scale 20 mm
Incremental und absolute interfaces

5.3



The compact design of the magnetic band and sensor permits integration into almost any guide system.

MagLine Macro

	Incremental systems			Absolute systems
Signal analysis via	**Output, digital**			**Interface**
System accuracy class (mm)	±1	±1	±2	±2.5
Maximum repeat accuracy (mm)	±1	±0.25	±0.5	±1
Maximum measurement length/magnetic display	infinite	infinite	infinite	163 m
Maximum reading distance (mm)	4.0	10.0	20.0	3.5

Resolution max. in mm	**Supply voltage**	**Output/ interface**	**Magnetic sensor**	**Page**				
1	24 V DC	PP	**MSK400/1**	126				
0.25	24 V DC 5 V DC	PP, LD	**MSK2000**	129				
0.25	24 V DC 5 V DC	PP, LD, TTL	**MSK4000**	132				
1	24 V DC	SSI, RS485	**MSA1000**	137				

Width in mm	**Available length** max. in m/piece		**Magnetic band**					
5 or 10	90.0		**MB400**	120				
10 or 20	90.0		**MB2000**	122				
20	90.0		**MB4000**	124				
10	163.0		**MBA1000**	135				

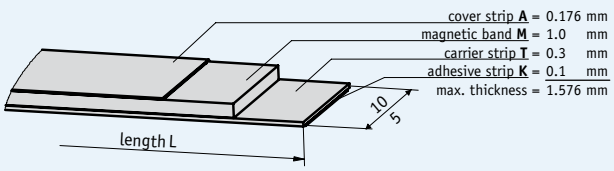
5.3

Subject to technical alterations 10/2008

Magnetic Band MB400
Incrementally coded scale, 4 mm pole length

Profile

- Easy adhesive mounting, self-assembly possible
- Pole length 4 mm
- System accuracy up to 1 mm



5.3

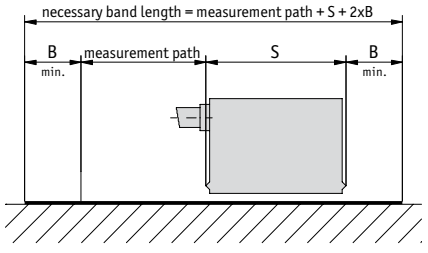
Mechanical data

Feature	Technical data	Additional information
Pole length	4 mm	
Measuring length	infinite	
Band width	10 mm 5 mm	
Thickness	1.4 mm	without cover strip
Temperature coefficient	(11 ±1) x 10^{-6}/K (16 ±1) x 10^{-6}/K	spring steel stainless steel
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 50 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Width	10	A	band width in mm	
	5		band width in mm	
Carrier strip material	St	B	spring steel	
	VA		stainless steel	
Length of magnetic band	...	C	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	D	with	
	TO		without	
Cover strip	AM	E	with	
	AO		without	

Order code

MB400 – [A] – [B] – [C] – [D] – [E]

Scope of delivery: *MB400, User information*

Accessories:

Profile rail PS	*Page 182*
Protective strip SB	*Page 183*
Cover rail PS1	*Page 181*

Additional information:

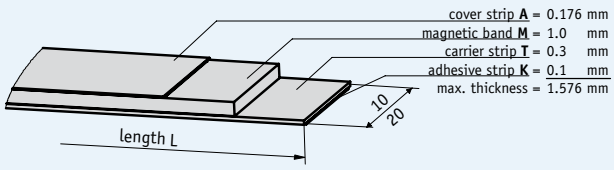
Short Description, Technical Details	*Page 118 cont.*
Product Overview	*Page 4 cont.*

Subject to technical alterations 10/2008

Magnetic Band MB2000
Incrementally coded scale, pole length 20 mm

Profile

- Easy adhesive mounting, self-assembly possible
- Pole length 20 mm
- System accuracy up to 1 mm



5.3

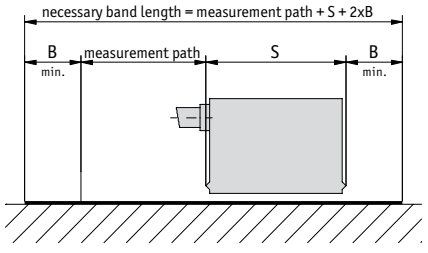
Mechanical data

Feature	Technical data	Additional information
Pole length	20 mm	
Measuring length	infinite	
Band width	10 mm 20 mm	
Thickness	1.4 mm	without cover strip
Temperature coefficient	(11 ±1) x 10^{-6}/K (16 ±1) x 10^{-6}/K	spring steel stainless steel
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 50 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Width	10	A	band width in mm	
	20		band width in mm	
Carrier strip material	St	B	spring steel	
	VA		stainless steel	
	TBO		without steel carrier strip	
Length of magnetic band	...	C	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	D	with	only possible with carrier strip material "St" or "VA"
	TO		without	
Cover strip	AM	E	with	
	AO		without	

Order code

MB2000 – [A] – [B] – [C] – [D] – [E]

Scope of delivery: *MB2000, User information*

Accessories:

Profile rail PS *Page 182*
Protective strip SB *Page 183*
Cover rail PS1 *Page 181*

Additional information:

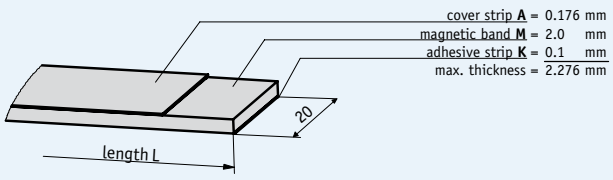
Short Description, Technical Details *Page 118 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 10/2008

Magnetic Band MB4000
Incrementally coded scale, pole length 40 mm

Profile

- Easy adhesive mounting, self-assembly possible
- Without carrier strip
- Pole length 40 mm
- System accuracy up to 2 mm



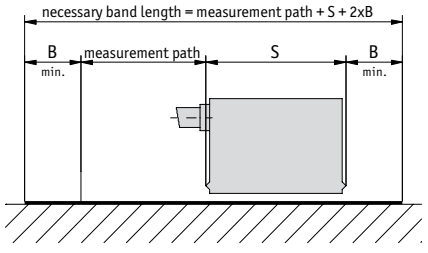
Mechanical data

Feature	Technical data	Additional information
Pole length	40 mm	
Measuring length	infinite	
Band width	20 mm	
Thickness	2 mm	without cover strip or adhesive strip
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 100 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	0.1 ... 90 m, in steps of 0.1 m	Order information, see "Determination of band length"
Adhesive carrier strip	TM	B	with adhesive strip	
	TO		without adhesive strip	
Cover strip	AO	C	without	
	AM		with	

Order code

MB4000 – 20 – [A] – [B] – [C]

5.3

Scope of delivery: *MB4000, User information*

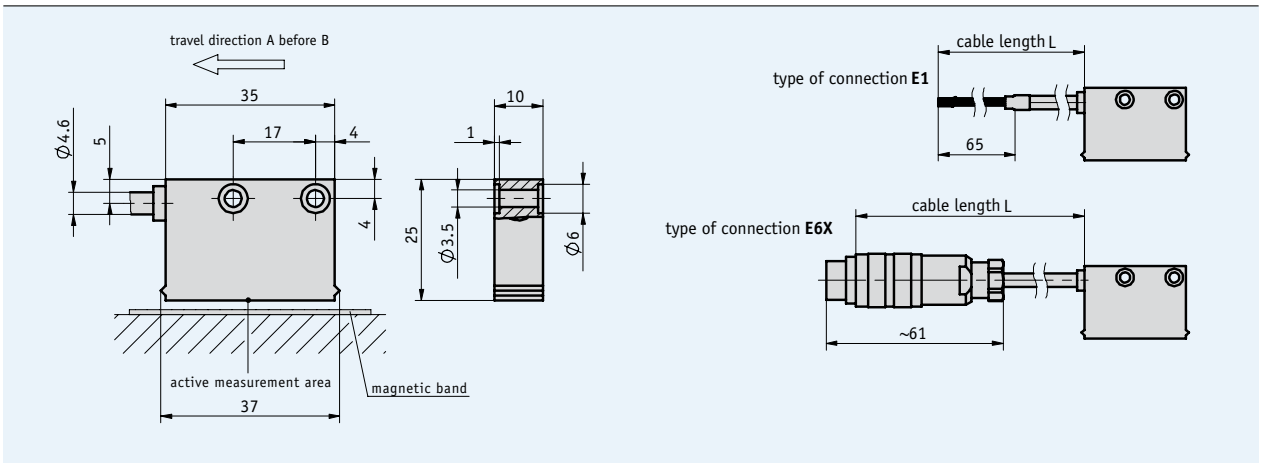
Additional information:
Short Description, Technical Details *Page 118 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 10/2008

Magnetic Sensor MSK400/1
Incremental, digital interface, resolution 1 mm

Profile

- Max. resolution 1 mm
- Repeat accuracy ±1 mm
- Max. sensor/band reading distance 4 mm



5.3

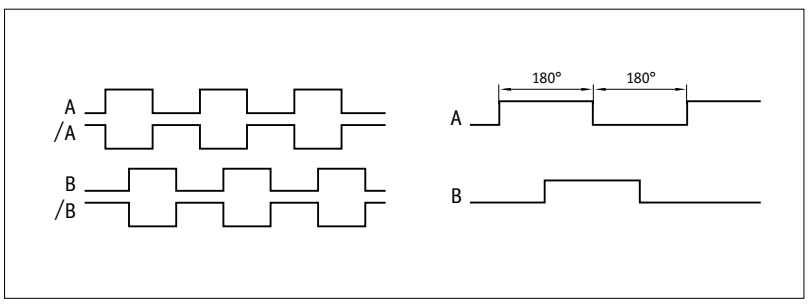
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB400	
System accuracy	±(1 + 0.03 x L) mm	L = magnetic band length in m (at 20 °C)
Repeat accuracy	±1 mm	
Sensor/band reading distance	max. 4mm	
Travel speed	<10 m/s	
Housing	plastic, white	
Sensor cable	PUR, oil-resistant	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ± 20 %	reverse-polarity protection on UB
Current consumption	<20 mA off-load	
Type of connection	flying leads round connector	
Output circuit	PP	
Output signals	A,B	90° phase-shifted
Resolution	1 mm	with quadrature evaluation
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal level high	UB -2.5 V	
Signal level low	<0.8 V	

Signal forms



Pin assignment

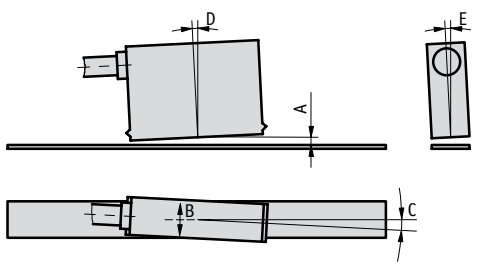
non-inverted

Signal	E1	E6X
GND	black	1
A	red	2
B	orange	3
+UB	brown	5
Screen	white	
N.C.		4, 6, 7

Mounting instruction

A, Sensor/band reading distance	max. 4 mm
B, Lateral offset	max. ±2 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±3°
E, Lateral tilt	<±3°

Sensor/band reading distance (symbolic sensor representation)



Magnetic Sensor MSK400/1
Incremental, digital interface, resolution 1 mm

Order

Order table

Feature	Order data		Specifications	Additional information
Type of connection	E1	A	flying leads, 2 m cable	
	E6X		round connector without mating connectors	
			cable extensions on request	
Cable length L	...	B	1 ... 20 m, in steps of 1 m	
			others on request	

Order code

MSK400/1 – [A] – [B]

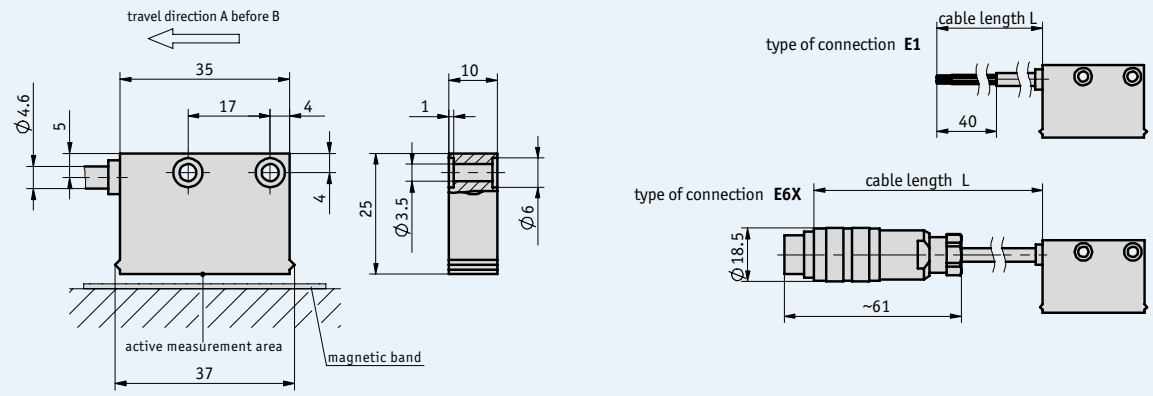
Scope of delivery: *MSK400/1, User information, Allen fastening screws M3 x 14 mm ISO 4762, strain relief for sensor cable, distance gage*

Additional information:
Short Description, Technical Details *Page 118 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Profile

- Linear resolution 0.25 mm
- Repeat accuracy ±1 increment, max. ±0.25 mm
- Operating voltage 5 or 24 V
- Max. sensor/band reading distance 10 mm



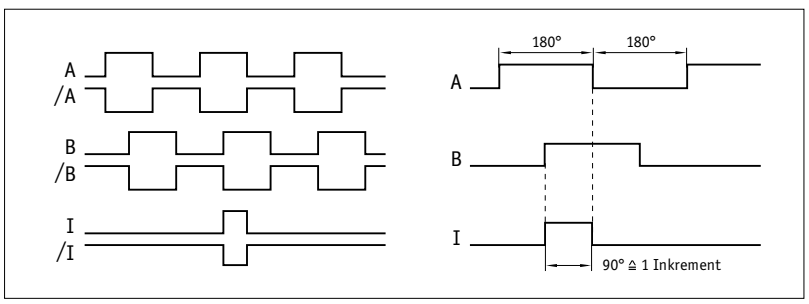
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB2000	
System accuracy	± (1 + 0.03 x L) mm	L = magnetic band length in m (at 20 °C)
Repeat accuracy	± 1 increment	max. ±0.25 mm
Sensor/band reading distance	max. 10 mm	
Travel speed	<10 m/s	
Housing	plastic, light-green	
Sensor cable	PUR, oil-resistant	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... + 80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	according to DIN 40050 (Housing)
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 5 V DC ±5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<50 mA (PP), <25 mA (LD)	without load
Type of connection	flying leads round connector	
Output circuit	PP LD (RS422)	
Output signals	A,B, option: /A,/B, I, /I	90° phase-shifted
Length of reference signal	1 increment	
Resolution	0.25, 1 mm	
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal level high	UB – 2.5 V PP	LD according to RS422 specific
Signal level low	<0.8 V PP	LD according to RS422 specific

Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

Pin assignment

non-inverted

Signal	E1	E6X
A	red	3
B	orange	4
+UB	brown	2
GND	black	1
N.C.		5,6,7

inverted

Signal	E1	E6X
A	red	1
B	orange	2
+UB	brown	4
GND	black	5
A/	yellow	6
B/	green	7
N.C.		3

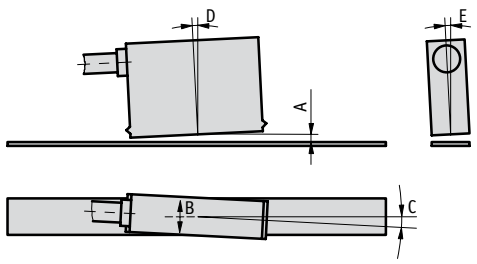
inverted with reference signal

Signal	E1	E6X
A	red	1
B	orange	2
I	blue	3
+UB	brown	4
GND	black	5
A/	yellow	6
B/	green	7
I/	violet	8

Mounting instruction

A, Sensor/band reading distance	max. 10 mm
B, Lateral offset	max. ±2 mm (10 mm band) max. ±5 mm (20 mm band)
C, Misalignment	<±3°
D, Longitudinal tilt	<±3°
E, Lateral tilt	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	24 V DC ±20 %	reverse-polarity protection
	5		5 V DC ±5 %	no reverse-polarity protection
Type of connection	E1	B	flying leads, 2 m cable	
	E6X		round connector without mating connectors	
			cable extensions on request	
Cable length L	...	C	1 ... 20 m, in steps of 1 m	
			others on request	
Output circuit	PP	D	push-pull	only with operating voltage 4
	LD		line driver	
Output signal	NI	E	non-inverted	
	I		inverted	
Reference signal	0	F	without	
	I		index periodic	only with output signal I
Resolution	...	G	0.25, 1	

Order code

MSK2000 – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]
A B C D E F G

Scope of delivery: *MSK2000, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable*

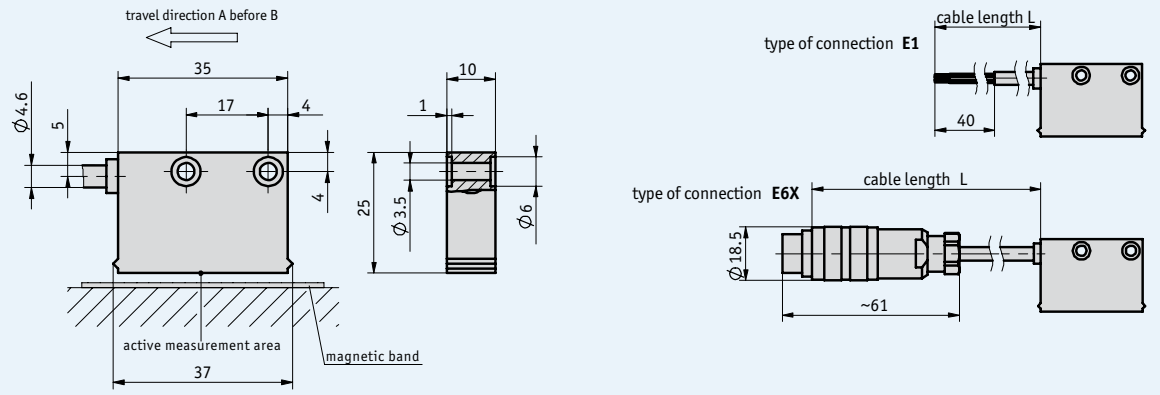
Additional information:
Short Description, Technical Details *Page 118 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Sensor MSK4000
Incremental, digital interface, reading distance 20 mm

Profile

- Max. resolution of 0.25 mm
- Repeat accuracy ±2 increments (max. ±0.5 mm)
- Insensitive to dust, shavings, humidity, etc.
- Max. sensor/band reading distance 20 mm



5.3

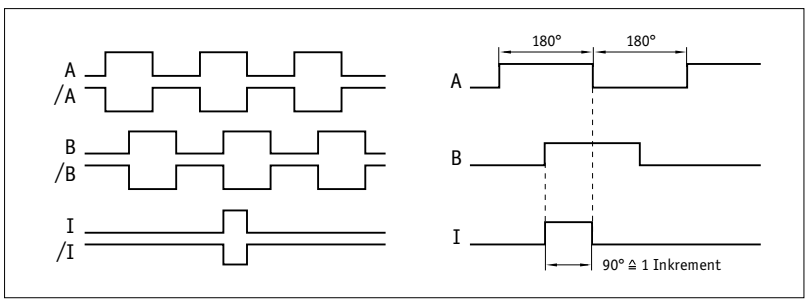
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MB4000	
System accuracy	±2 mm, with nominal distance of 15 mm	length-dependent error depends on the mounting situation
Repeat accuracy	2 increments	max. ±0.5 mm
Sensor/band reading distance	max. 20 mm, min. 5 mm	
Travel speed	<15 m/s	
Housing	plastic ABS, gray	
Sensor cable	PUR, oil-resistant	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ± 20 % 5 V DC ± 5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<50 mA (PP) <25 mA (LD)	off-load
Type of connection	flying leads, round connector	
Output circuit	PP, LD (RS422), TTL	
Output signals	A,B, option: /A,/B, I, /I	90° phase-shifted
Length of reference signal	1 increment	
Resolution	0.25, 0.5, 1, 2 mm	
Interference protection class	3	IEC-61000-6-2
Real-time requirement	real-time signal processing	
Signal level high	UB – 2.5 V PP	LD according to RS422 specific, TTL>2.4 V
Signal level low	<0.8 V	LD according to RS422 specific, TTL<0.4 V

Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

Pin assignment

non-inverted

Signal	E1	E6X
A	red	3
B	orange	4
+UB	brown	2
GND	black	1
N.C.		5,6,7

inverted

Signal	E1	E6X
A	red	1
B	orange	2
+UB	brown	4
GND	black	5
A/	yellow	6
B/	green	7
N.C.		3

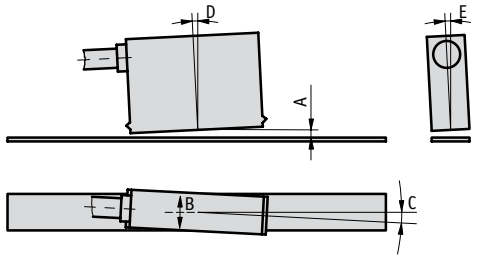
inverted with reference signal

Signal	E1	E6X
A	red	1
B	orange	2
I	blue	3
+UB	brown	4
GND	black	5
A/	yellow	6
B/	green	7
I/	violet	8

Mounting instruction

A, Sensor/band reading distance	5 ... 20 mm
B, Lateral offset	max. ±5 mm
C, Misalignment	<±10°
D, Longitudinal tilt	<±3°
E, Lateral tilt	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	10 ... 30 V DC	reverse-polarity protection
	5		5 V DC ±5 %	no reverse-polarity protection
Type of connection	E1	B	flying leads	
	E6X		round connector without mating connectors	
			cable extensions on request	
Cable length L	...	C	1 ... 20 m, in steps of 1 m	
			others on request	
Output circuit	PP	D	push-pull	only with operating voltage 4
	LD		line driver (RS422)	
	TTL			only with output signal NI
Output signal	NI	E	non-inverted	
	I		inverted	not with output circuit TTL
Reference signal	0	F	without	
	I		index periodic	only with output signal I
Resolution	...	G	0.25, 0.5, 1, 2	

Order code

MSK4000 – [A] – [B] – [C] – [D] – [E] – [F] – [G]

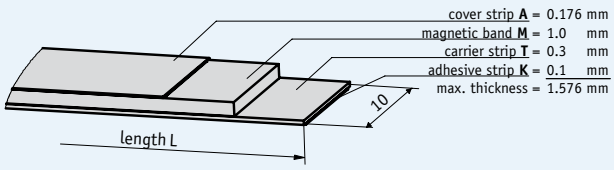
Scope of delivery: *MSK4000, User information*

Additional information:
Short Description, Technical Details *Page 118 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Profile

- Easy adhesive mounting
- Easy self-assembly possible



5.3

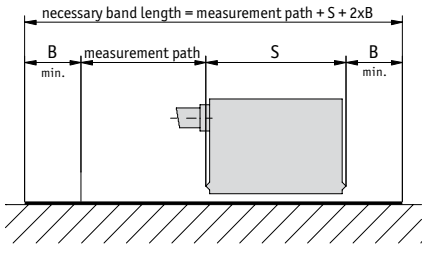
Mechanical data

Feature	Technical data	Additional information
Measuring length	163 m	
Band width	10 mm	
Thickness	1.4 mm	without cover strip
Temperature coefficient	(11±1) x10^{-6}/K, spring steel (16±1) x 10^{-6}/K, stainless steel	
Operating temperature	-20 ... +70 °C	
Storage temperature	-40 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	pre-assembled double-sided adhesive strip
Cover strip material	stainless steel	

Order

The necessary band length is calculated as follows:
Measured path + sensor length "S" + (2 x lead-in and lead-out "B"). Sensor length "S" refer to the drawing of the employed sensor, lead-in and lead-out "B" = 5 mm.

Determination of band length (symbolic sensor representation)



Order table

Feature	Order data		Specifications	Additional information
Length of magnetic band	...	A	1 ... 163 m, in steps of 0.1 m	Order information, see "Determination of band length"
Carrier strip material	St	B	spring steel	
	VA		stainless steel	
Adhesive carrier strip	TM	C	with	
	TO		without	
Cover strip	AM	D	with	
	AO		without	

5.3

Order code

MBA1000 – 10 – [A] – [B] – [C] – [D]

Scope of delivery: *MBA1000, User information*

Accessories:

Profile rail PS *Page 182*
Protective strip SB *Page 183*
Cover rail PS1 *Page 181*

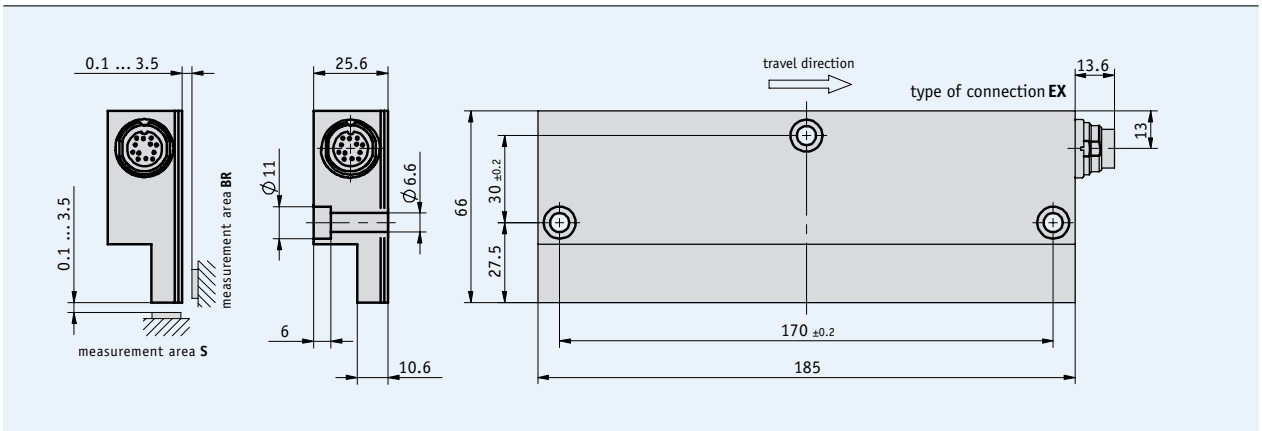
Additional information:

Short Description, Technical Details *Page 118 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 10/2008

Profile

- Resolution of 1 mm
- Repeat accuracy ±1 mm
- SSI or RS485 interfaces
- Max. sensor/band reading distance of 3.5 mm



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MBA1000	
System accuracy	±(2.5 + 0.03 x L) mm, L in m	
Repeat accuracy	±1 mm	
Sensor/band reading distance	0.1 ... 3.5 mm	
Travel speed	5 m/s	real-time behavior up to 0.5 m/s
Housing	aluminum	
Operating temperature	-20 ... +55 °C	
Storage temperature	-20 ... +85 °C	
Humidity	100 % rh	condensation only permissible with completely encapsulated version
Protection category	IP65	
Vibration resistance	10 g/50 Hz	
Max. measuring length	≤163 m	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 %	reverse-polarity protection on UB
Current consumption	<500 mA	
Power input	<10 VA	
Type of connection	without connector	
Interfaces	SSI or RS485	
Resolution	1 mm	
Interference protection class	3	according to DIN EN 50081-2 and DIN EN 50082-2
Real-time requirement	up to v = 0.5 m/s	
Baud rate	at 200 m max. SSI baud rate 125 kHz (10 x 0.25 mm)	

Pin assignment

Signal	EX
SSI data-	A
SSI data+	B
SSI clock-	C
SSI clock+	D
+24 V DC	E
RS485 GND	F
RS485 DÜA	G
RS485 DÜB	H
GND	J
GND	K
Configuration	L
N.C.	M

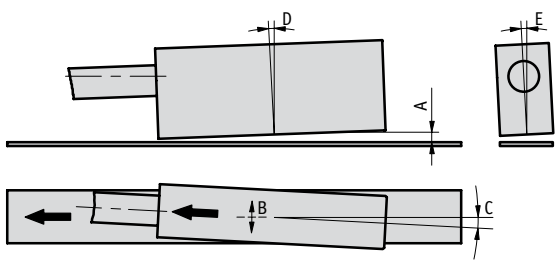
5.3

Mounting instruction

When installing the sensor and magnetic band, always ensure that both system components are correctly aligned. The arrows marked on the band and sensor must point in the same direction during installation.

A, Sensor/band reading distance	max. 3.5 mm
B, Lateral offset	max. ±1.5 mm
C, Misalignment	<±3°
D, Longitudinal tilt	<±1°
E, Lateral tilt	<±3°

Sensor/band reading distance (symbolic sensor representation)



Order

Order note

This sensor is sold in Switzerland and Austria under the product name “AMSA1000“.

Order table

Feature	Order data		Specifications	Additional information
Measurement area	S	A	narrow side	
	BR		wide side	
Electronics unit encapsulated	NV	B	not encapsulated	
	EV		electronics unit completely encapsulated	for outdoor applications

Order code

MSA1000 – [ ] (A) – EX – OK – [ ] (B)

Scope of delivery: *MSA1000, User information*

Accessories:

Mating connectors *Page 176*

Additional information:

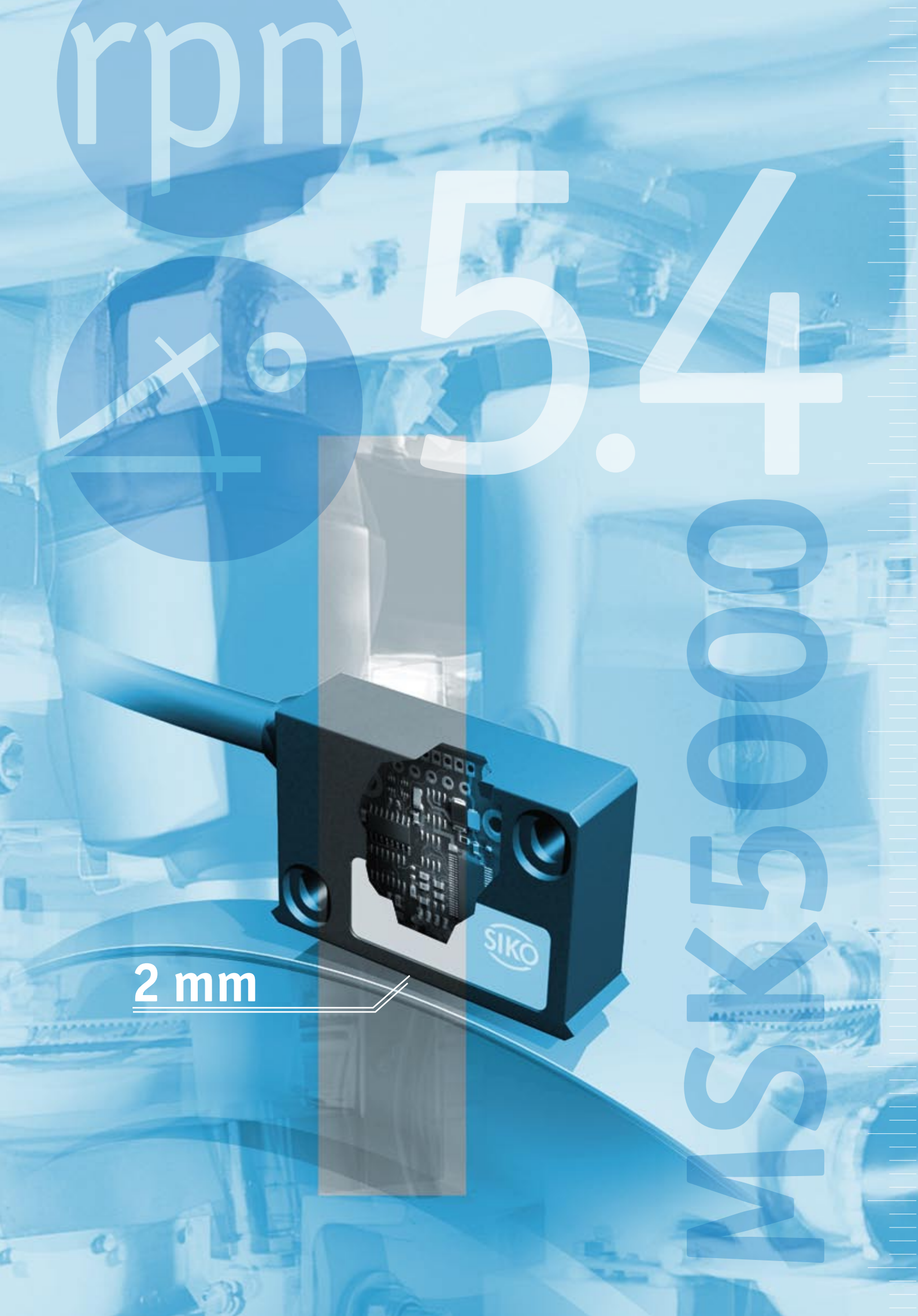
Short Description, Technical Details *Page 118 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

rpm

5.4

MSK5000



5.4 | MagLine Roto

Introduction

With all the advantages of magnetic, contactless scanning, MagLine Roto is designed for direct angle and speed measurement. Special sensors scan the incremental graduation of magnetic rings and supply a resolution of up to 200 000 pulses per minute.

Typical applications of the system are speed measurement on drive units or angle measurement, for example on rotary tables. The compact design permits integration either directly or next to the control or machining process.

- Resolutions up to 0.0018°
- System accuracy ± 0.1°
- Rotary encoder system with protection category IP67

Magnetic ring
Up to 200 000 pulses/rev.
Accuracy up to 0.1°

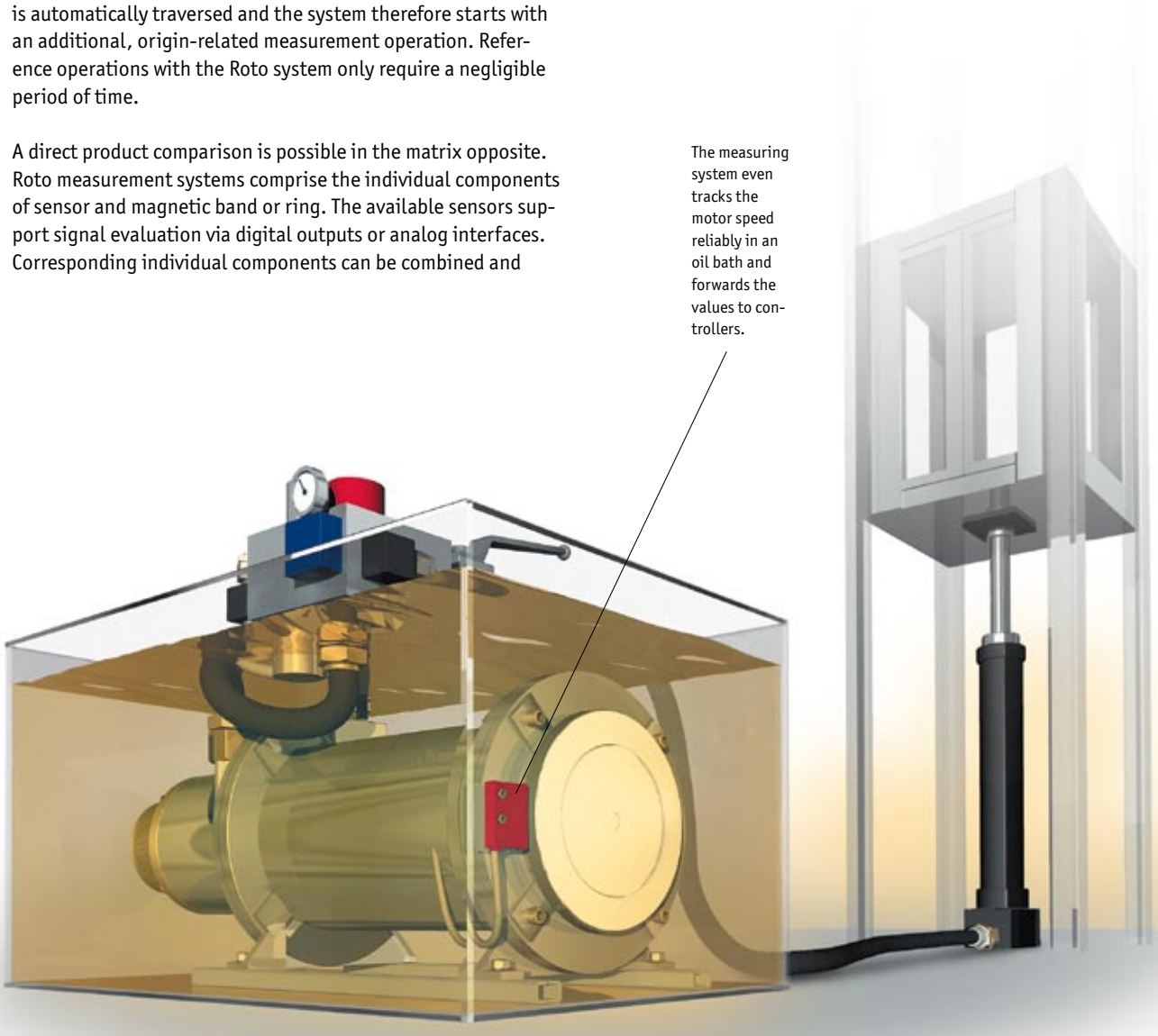
Sensors
Direct connection to translation module and magnetic displays
Max. tolerance of reading distance to scale 2 mm

Translation module
Incremental position tracking
Real-time signal processing
Resolutions up to 0.0018°

Introduction to the rotary system

MagLine Roto is an incremental measuring system. For this reason a wide range of magnetic band and ring diameters are possible. In a system with a set referencing point (ordering option) re-referencing is performed after each full rotation (360°) due to the rotary magnetic measurement, as the reference point is automatically traversed and the system therefore starts with an additional, origin-related measurement operation. Reference operations with the Roto system only require a negligible period of time.

A direct product comparison is possible in the matrix opposite. Roto measurement systems comprise the individual components of sensor and magnetic band or ring. The available sensors support signal evaluation via digital outputs or analog interfaces. Corresponding individual components can be combined and therefore adapted optimally to existing measuring conditions. Values obtained in a rotary system are either displayed directly (e.g., speed monitoring) or can be processed in follow-on electronic units or higher-level controllers.



The measuring system even tracks the motor speed reliably in an oil bath and forwards the values to controllers.

MagLine Roto

	Incremental systems							
Signal analysis via	**Output, analog**	**Output, digital**						
System accuracy class (mm)	*)	*)	±0.1°	±0.1°	±0.5°	*)	±0.1°	*)
Maximum repeat accuracy (increment)	–	±1	±1	±1	±1	±1	±1	±1
Maximum reading distance (without reference point, mm)	0.4	0.8	0.8	2.0	2.0	2.0	2.0	2.0

Supply voltage	Output/ interface	Magnetic sensor	Page	
10.5 ... 30 V DC 5 V DC	1 V_{SS}	**LE100/1**	160	
24 V DC 5 V DC	PP, LD, TTL	**MSK210**	163	
24 V DC 5 V DC	PP, LD, TTL	**MSK320**	166	
6.5 ... 30 V DC 4.75 ... 6 V DC	PP, LD	**MSK5000**	170	

Max. number of poles	Max. pulses/ revolution	Magnetic ring	Page	
100	2 000	**MR200**	144	
250	5 000	**MR320**	146	
160	200 000	**MR500**	148	
64	1 280	**MRI01**	150	
1120	1 120 **)	**MBR100**	152	
230	4 600	**MBR200**	154	
250	5 000	**MBR320**	156	
210	262 500	**MBR500**	158	

*) depends on mounting type **) Periods/revolution

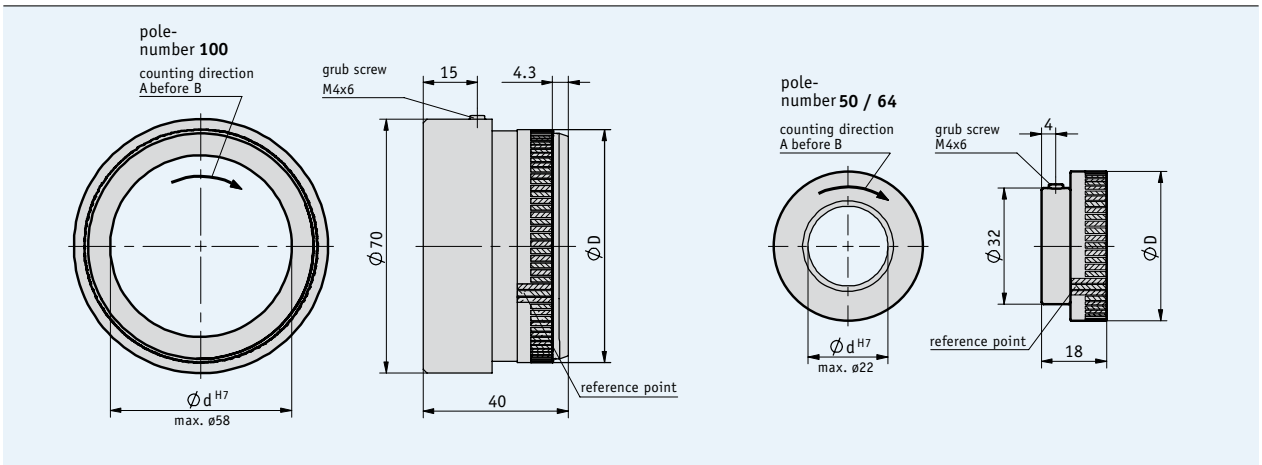
5.4

Subject to technical alterations 10/2008

Magnetic Ring MR200
Incrementally coded ring with permanently connected flange, pole length 2 mm

Profile

- Easy hollow-shaft mounting
- Rotary encoder system with IP67 protection category (in combination with MSK210)
- Up to 2000 pulses/revolution
- With reference point as an option



5.4

Mechanical data

Feature	Technical data	Additional information
Pole length	2 mm	
Measurement range	360°	
System accuracy	±0.1°	
Operating temperature	0 ... +60 °C, with number of poles 50, 60	others on request
	-20 ... +70 °C, with number of poles 100	others on request
Storage temperature	-20 ... +70 °C	others on request
Protection category	IP67 according to DIN VDE 0470	
Humidity	100 % rh	condensation permitted
Flange material	aluminum	

Dimensions

Poles	50	64	100
Diameter D (mm)	32.3	41.2	64.14
Circumference (mm)	100	130	200
Max. Speed n (rpm)	15000	11500	7500

Pulses/revolution

		Number of poles 50	Number of poles 64	Number of poles 100
Scaling factor	**20**	1000	1280	2000
Sensor	**16**	800	1024	1600
	10	500	640	1000
	8	400	512	800
	5	250	320	500
	4	200	256	400
	1	50	64	100

The table applies to the combination of MR200 with MSK210

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	50	A	poles distributed on circumference	hard ferrite
	64		poles distributed on circumference	hard ferrite
	100		poles distributed on circumference	flexible magnetic band
			others on request	
Bore diameter	20	B	20 H7	
			others on request	
Fastening type	MNG	C	hub thread	
	ONG		without hub thread	
Reference point	0	D	without	
	M		with	

Order code

MR200 – [ ] – [ ] – [ ] – [ ]
A B C D

Scope of delivery: *MR200, User information*

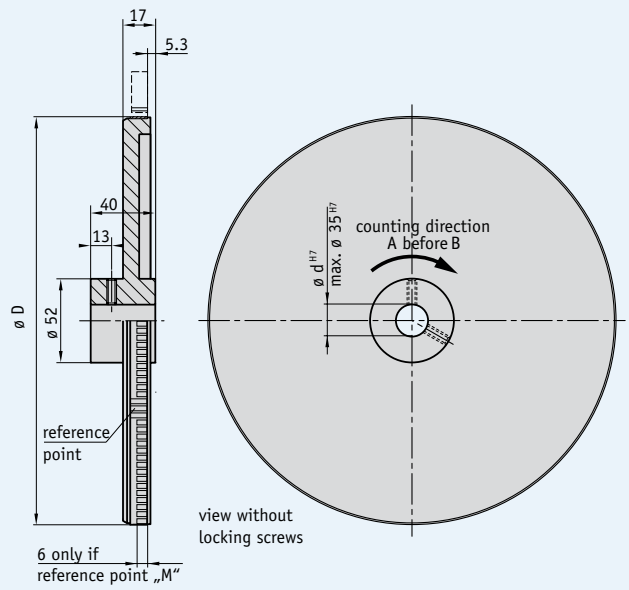
Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Ring MR320
Incrementally coded ring with permanently connected flange, pole length 3.2 mm

Profile

- Easy hollow-shaft mounting
- Rotary encoder system with IP67 protection category (in combination with MSK320)
- Up to 5000 pulses/revolution (≙20 000 increments)
- With reference point as an option



Mechanical data

Feature	Technical data	Additional information
Pole length	3.2 mm	
Measurement range	360°	
System accuracy	±0.1°	
Operating temperature	-20 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Flange material	aluminum	

- **Dimensions**

Pole	100	150	180	250
Diameter D (mm)	100	151	181	253
Circumference (mm)	320	480	570	800
Max. Speed n (rpm)	4680	3120	2630	1870

Pulses/revolution

		Number of poles 100	Number of poles 150	Number of poles 180	Number of poles 250
Scaling factor of sensor	**20**	2000	3000	3600	5000
	16	1600	2400	2880	4000
	10	1000	1500	1800	2500
	8	800	1200	1440	2000
	5	500	750	900	1250
	4	400	600	720	1000
	1	100	150	180	250

The table applies to the combination of MR320 with MSK320

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	100	A	100 poles, distributed on circumference	
	150		150 poles, distributed on circumference	
	180		180 poles, distributed on circumference	
	250		250 poles, distributed on circumference	
			others on request	
Bore diameter	20	B	20 H7	
			others on request	
Reference point	0	C	without	
	M		with	

Order code

MR320 – [A] – [B] – MNG – [C]

5.4

Scope of delivery: *MR320, User information*

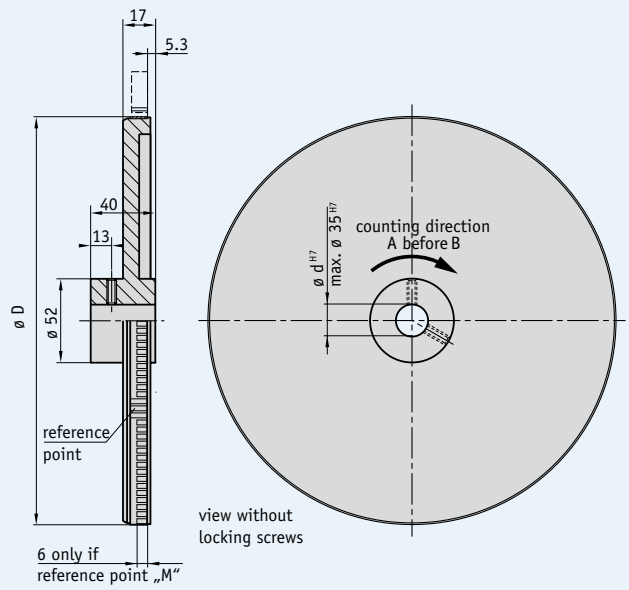
Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Ring MR500
Incrementally coded ring with permanently connected flange, pole length 5 mm

Profile

- Easy hollow-shaft mounting
- Rotary encoder system with IP67 protection category (in combination with MSK500)
- Up to 200 000 pulses/revolution (≙800 000 increments)
- With reference point as an option



Mechanical data

Feature	Technical data	Additional information
Pole length	5 mm	
Measurement range	360°	
System accuracy	±0.1°	
Operating temperature	-20 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Flange material	aluminum	

- **Dimensions**

Pole	64	96	160
Diameter D (mm)	102	153	255
Circumference (mm)	320	480	800

Pulses/revolution

		Number of poles 64	Number of poles 96	Number of poles 160
Scaling factor of sensor	**1250**	80000	120000	200000
	250	16000	24000	40000
	125	8000	12000	20000
	50	3200	4800	8000
	25	1600	2400	4000
	12.5	800	1200	2000

The table applies to the combination of MR500 with MSK5000

Speed

The maximum speeds are calculated in reference to the circumferential speed, whereby the circumference of the fitted magnetic ring is decisive. On the MSK5000 sensor, the circumferential speed is variable; it results from the selection of the pulse interval and the scaling factor (refer to table MSK5000). The speed is calculated with the following formula:

Number of poles	**U** (m)	**n** (rpm)
64	0.32	variable
96	0.48	variable
160	0.80	variable

Speed n $= \frac{v \times 60}{U}$

v = circumferential speed (m/s); U = circumference (m)
60 = extension factor (60 s/min)

Example:

MSK5000 $n = \frac{6 \times 60}{0.32} = 1125$ (rpm)

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	64	A	64 poles, distributed on circumference	
	96		96 poles, distributed on circumference	
	160		160 poles, distributed on circumference	
			others on request	
Bore diameter	20	B	20 H7	
			others on request	
Reference point	0	C	without	
	M		with	

Order code

MR500 – [ ] – [ ] – MNG – [ ]
A B C

Scope of delivery: *MR500, User information*

Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

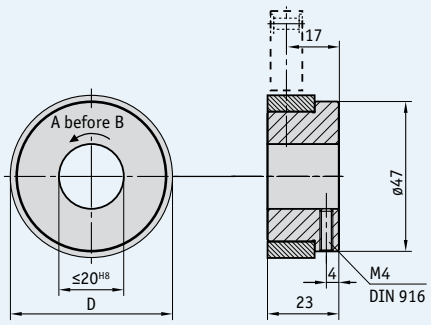
Subject to technical alterations 09/2010

Magnetic Ring MRIO1

Incrementally coded ring with permanently connected flange, 64 poles

Profile

- Easy hollow-shaft mounting
- Rotary encoder system with IP67 protection category (in combination with MSK320)
- Up to 1280 pulses/revolution (≙5120 increments)



5.4

Mechanical data

Feature	Technical data	Additional information
Pole length	2.453 mm	
Measurement range	360°	
System accuracy	±0.5°	
Operating temperature	0 ... +60 °C	
Storage temperature	-20 ... +85 °C	
Humidity	100 % rh	condensation permitted
Flange material	aluminum	

- **Dimensions**

Pole	64
Diameter D (mm)	50
Circumference (mm)	157
Max. Speed n (rpm)	9550

- **Pulses/revolution**

		Number of poles 64
Scaling factor of sensor	**20**	1280
	16	1024
	10	640
	8	512
	5	320
	4	256
	1	64

The table applies to the combination of MRIO1 with MSK320

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	64	A	64 poles distributed on circumference	
			others on request	
Bore diameter	20	B	20^{H8}	
	9		9^{H8}	
			others on request	max. 35^{H8}

Order code

MRIO1 – [ ] – [ ] – MNG

A B

Scope of delivery: *MRIO1, User information*

Additional information:

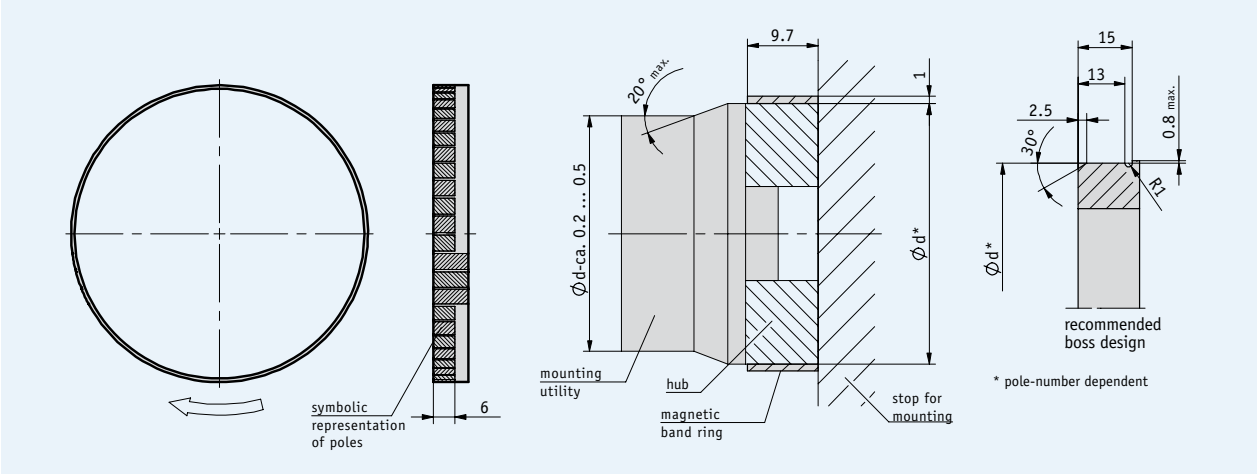
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Ring MBR100
Incremental, flexible magnetic band ring for self-assembly, pole length 1 mm

Profile

- With reference point as an option
- Easy mounting on self-made carrier



5.4

Mechanical data

Feature	Technical data	Additional information
Pole length	1 mm	
Measuring length	360°	
Band width	10 mm	
Thickness	1 mm	without cover and adhesive carrier strip
Operating temperature	-20 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	recommended two-component adhesive: Uhu Plus 300 Endfest
Minimum diameter	40 mm	
Maximum diameter	400 mm	

- **Dimensions** for magnetic band ring accommodation

Poles	460	540	720	1120
Diameter d (mm)	144.7 ±0.03	170.1 ±0.03	227.4 ±0.03	354.74 ±0.03
Diameter with MBR100 (mm)	146.7	172.1	229.4	356.74
Circumference with MBR100 (mm)	460.87	540.67	720.68	1120.73
Max. Speed n (rpm)	2600	2210	1660	1070

- **Periods/revolution**

Number of poles	460	540	720	1120
Period	460	540	720	1120

The table applies to the combination of MBR100 with LE100/1

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	460	A	460 poles	
	540		540 poles	
	720		720 poles	
	1120		1120 poles	
			others on request	
Reference point	0	B	without	
	M		with	

Order code

MBR100 – [A] – [B]

Scope of delivery: *MBR100, User information*

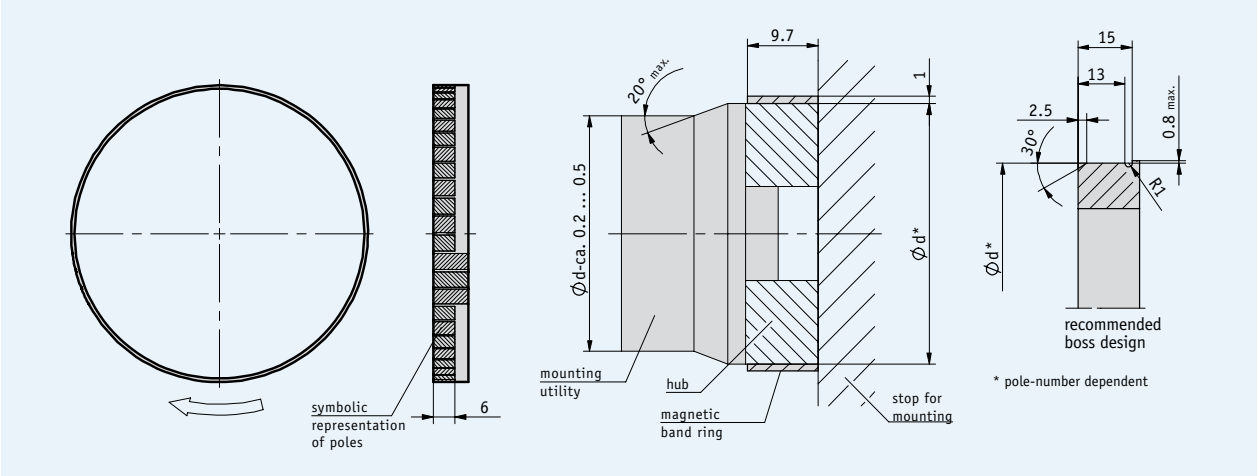
Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Ring MBR200
Incremental, flexible magnetic band ring for self-assembly, pole length 2 mm

Profile

- With reference point as an option
- Easy mounting on self-made carrier



Mechanical data

Feature	Technical data	Additional information
Pole length	2 mm	
Measuring length	360°	
Band width	10 mm	
Thickness	1 mm	without cover and adhesive carrier strip
Operating temperature	-20 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	recommended two-component adhesive: Uhu Plus 300 Endfest

- **Dimensions** for magnetic band ring accommodation

Poles	50	64	100	230
Diameter d (mm)	30.7 ±0.03	39.6 ±0.03	62.6 ±0.03	144.7 ±0.03
Diameter with MBR200 (mm)	32.7	41.6	64.6	146.7
Circumference with MBR200 (mm)	102.73	130.69	202.95	460.87
Max. Speed n (rpm)	14560	11450	7380	3250

Pulses/revolution

		Number of poles 50	Number of poles 64	Number of poles 100	Number of poles 230
Scaling factor of sensor	**20**	1000	1280	2000	4600
	16	800	1024	1600	3680
	10	500	640	1000	2300
	8	400	512	800	1840
	5	250	320	500	1150
	4	200	256	400	920
	1	50	64	100	230

The table applies to the combination of MBR200 with MSK210

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	50	A	50 poles	
	64		64 poles	
	100		100 poles	
	230		230 poles	
			others on request	
Reference point	0	B	without	
	M		with	

Order code

MBR200 – [A] – [B]

5.4

Scope of delivery: *MBR200, User information*

Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

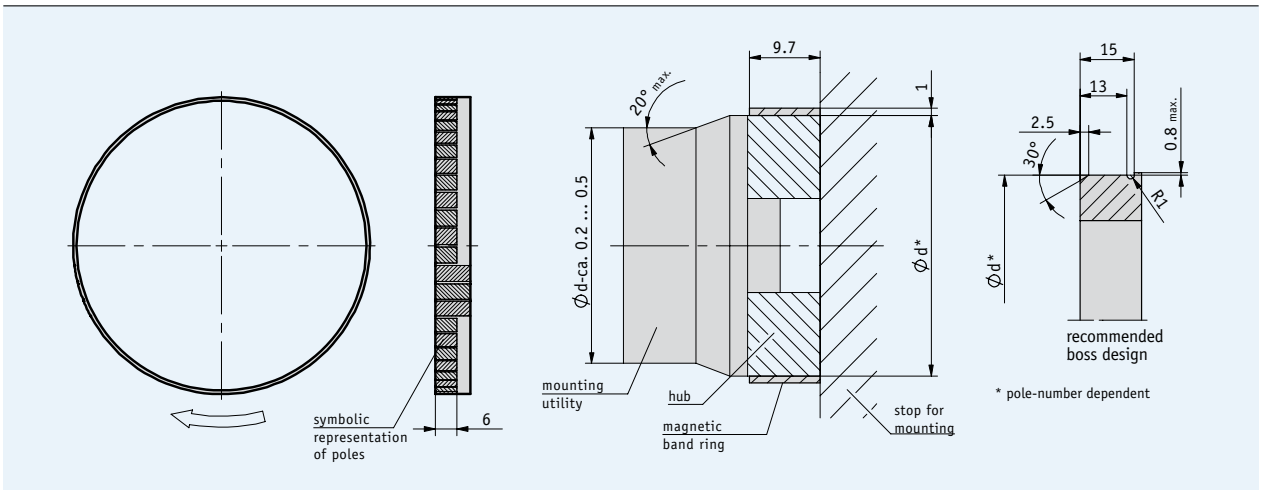
Subject to technical alterations 09/2010

Magnetic Ring MBR320

Incremental, flexible magnetic band ring for self-assembly, pole length 3.2 mm

Profile

- With reference point as an option
- Easy mounting on self-made carrier



5.4

Mechanical data

Feature	Technical data	Additional information
Pole length	3.2 mm	
Measuring length	360°	
Band width	10 mm	
Thickness	1 mm	without cover and adhesive carrier strip
Operating temperature	-20 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	recommended two-component adhesive: Uhu Plus 300 Endfest

- **Dimensions** for magnetic band ring accommodation

Poles	36	50	100	150	180	250
Diameter d (mm)	35.7 ±0.03	49 ±0.03	100.9 ±0.03	151.8 ±0.03	182.4 ±0.03	253.7±0.03
Diameter with MBR320 (mm)	37.7	51	102.9	153.8	184.4	255.7
Circumference with MBR320 (mm)	118.44	160.22	323.27	483.18	579.31	803.31
Max. Speed n (rpm)	12710	9370	4640	3100	2590	1860

Pulses/revolution

		Number of poles 36	Number of poles 50	Number of poles 100	Number of poles 150	Number of poles 180	Number of poles 250
Scaling factor of sensor	**20**	720	1000	2000	3000	3600	5000
	16	576	800	1600	2400	2880	4000
	10	360	500	1000	1500	1800	2500
	8	288	400	800	1200	1440	2000
	5	180	250	500	750	900	1250
	4	144	200	400	600	720	1000
	1	36	50	100	150	180	250

The table applies to the combination of MBR320 with MSK320

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	36	A	36 poles	
	50		50 poles	
	100		100 poles	
	150		150 poles	
	180		180 poles	
	250		250 poles	
			others on request	
Reference point	0	B	without	
	M		with	

Order code

MBR320 – [ ] – [ ]
A B

Scope of delivery: *MBR320, User information*

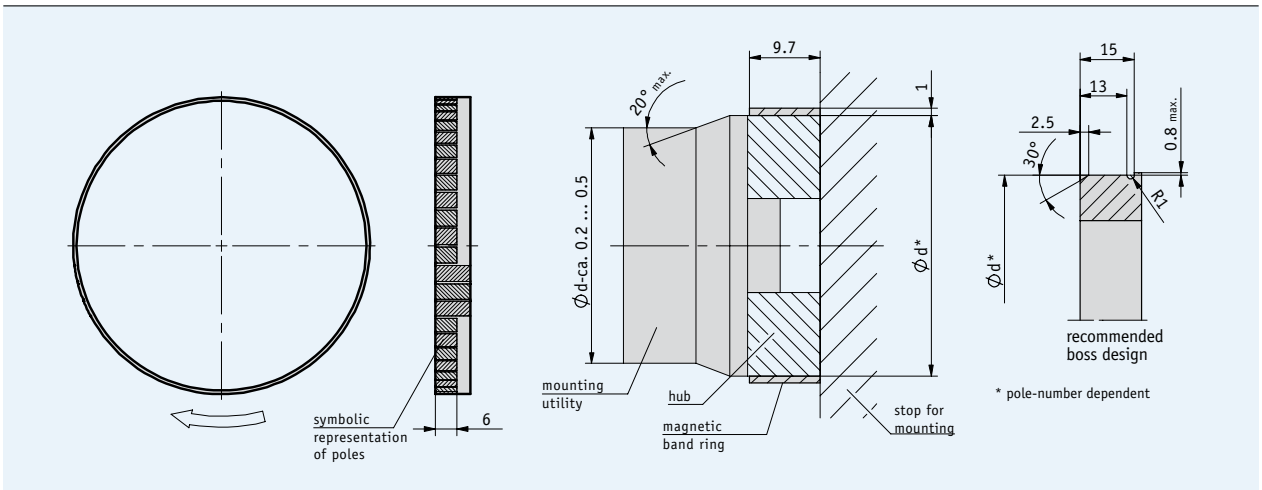
Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Ring MBR500
Incremental, flexible magnetic band ring for self-assembly, pole length 5 mm

Profile

- With reference point as an option
- Easy mounting on self-made carrier



5.4

Mechanical data

Feature	Technical data	Additional information
Pole length	5 mm	
Measuring length	360°	
Band width	10 mm	
Thickness	1 mm	without cover and adhesive carrier strip
Operating temperature	-20 ... +70 °C	
Storage temperature	-20 ... +70 °C	
Humidity	100 % rh	condensation permitted
Mounting type	glued joint	recommended two-component adhesive: Uhu Plus 300 Endfest

- **Dimensions** for magnetic band ring accommodation

Poles	36	50	64	96	160	188
Diameter d (mm)	57.5 ±0.03	79.8 ±0.03	102 ±0.03	153 ±0.03	254.8 ±0.03	299.4 ±0.03
Diameter with MBR500 (mm)	59.5 ±0.03	81.8 ±0.03	104 ±0.03	155 ±0.03	256.8 ±0.03	301.4 ±0.03
Circumference with MBR500 (mm)	186.93	256.98	326.73	486.95	806.76	946.88

Pulses/revolution

		Number of poles 36	Number of poles 50	Number of poles 64	Number of poles 96	Number of poles 160	Number of poles 188
Scaling factor of sensor	**1250**	45000	62500	80000	120000	200000	235000
	250	9000	12500	16000	24000	40000	47000
	125	4500	6250	8000	12000	20000	23500
	50	1800	2500	3200	4800	8000	9400
	25	900	1250	1600	2400	4000	4700
	12.5	450	625	800	1200	2000	2350

The table applies to the combination of MBR500 with MSK5000

Speed

The maximum speeds are calculated in reference to the circumferential speed, whereby the circumference of the fitted magnetic ring is decisive. On the MSK5000 sensor, the circumferential speed is variable; it results from the selection of the pulse interval and the scaling factor (refer to table MSK5000). The speed is calculated with the following formula:

$$\text{Speed } n = \frac{v \times 60}{U}$$

v = circumferential speed (m/s); U = circumference (m)
60 = extension factor (60 s/min)

Example:

$$\text{MSK5000} \quad n = \frac{6 \times 60}{0.32} = 1125 \text{ (rpm)}$$

Number of poles	**U** (mm)	**n** (rpm)
36	180	variable
50	250	variable
64	320	variable
96	480	variable
160	800	variable
188	940	variable

Order

Order table

Feature	Order data		Specifications	Additional information
Number of poles	36	A	36 poles	
	50		50 poles	
	64		64 poles	
	96		96 poles	
	160		160 poles	
	188		188 poles	
			others on request	
Reference point	0	B	without	
	M		with	

Order code

MBR500 – [A] – [B]

Scope of delivery: *MBR500, User information*

Additional information:

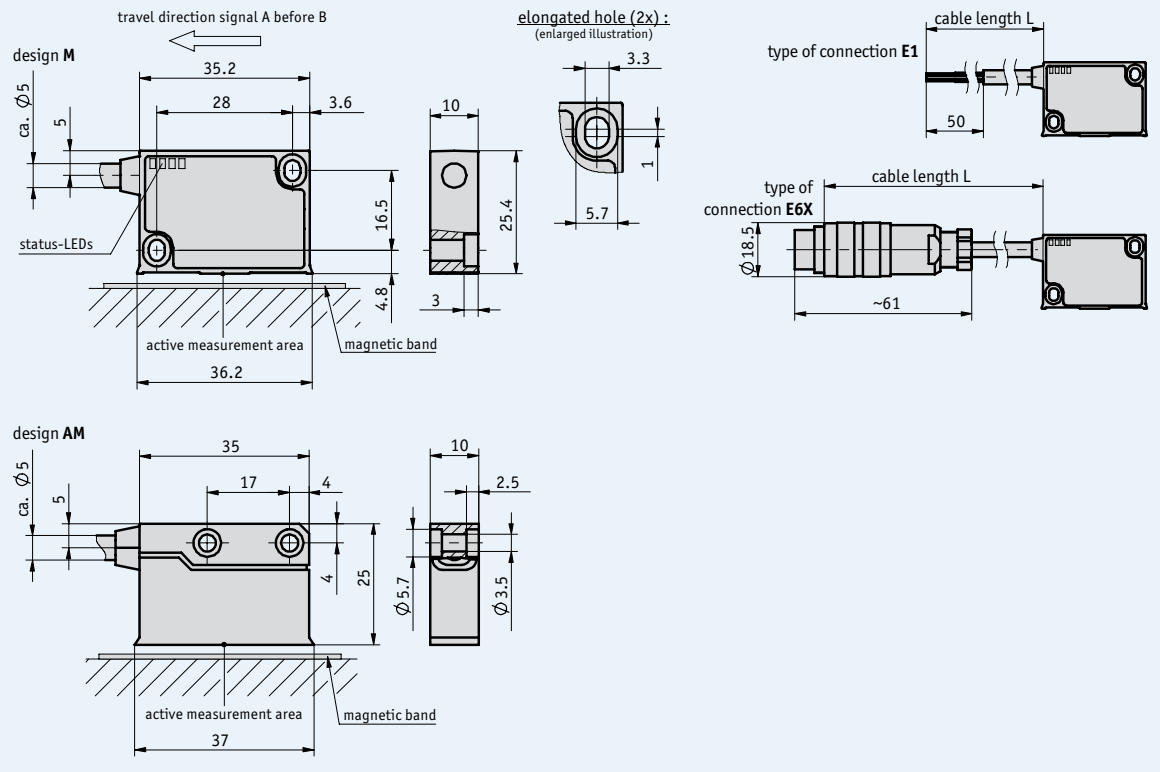
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 09/2010

Magnetic Sensor LE100/1
Incremental, analog interface 1 V_{SS}

Profile

- Accuracy class ±0.1°
- Output circuit sin/cos 1 V_{SS}
- Status LED display
- Robust metal housing
- Scale MBR100
- Signal period 1000 µm



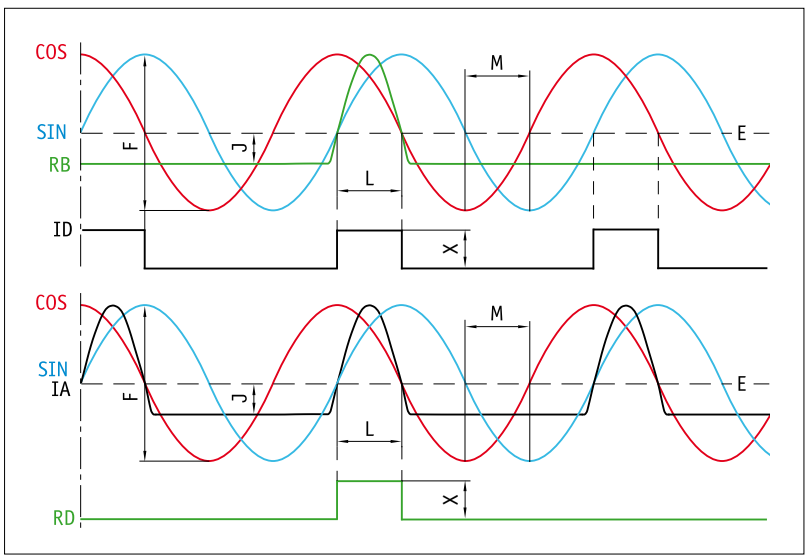
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MBR100	
System accuracy	max. 1 % related to division period	
Sensor/ring reading distance	0.1 ... 0.4 mm 0.1 ... 0.2 mm	with reference signal 0, IA, ID with reference signal RB
Circumferential speed	max. 20 m/s	
Housing	zinc die-cast	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	<200 m/s² (50 ... 2000 Hz)	

Electrical data

Feature	Technical data	Additional information
Operating voltage	10.5 ... 30 V DC 5 V DC ±5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<25 mA <50 mA	with 24 V with 5 V
Type of connection	flying leads round connector	
Output circuit	1 V_{SS}	
Output signals	sin, cos, /sin, /cos, I, /I, or R, /R	
Pulse width of reference signal	see the drawing of the signal shape	
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal amplitude	1 V_{SS} ±10 %	at 0-70 °C with RA = 120 Ohm to 1 kOhm
Output impedance	0 Ohm (Rload >75 Ohm)	short-circuit-proof
Offset sine/cosine	2.5 V ±100 mV UB/2 ±100 mV	
Phasing sine/cosine	90° ±1°; < ±3° (20 kHz)	
Phasing of reference signal	sin 45, cos 135°	
Signal period	1000 µm	

Signal forms



E: reference voltage 2.5 V
F: 1 V_{SS} ±10 %
J: ≥0.2 V
L: 100° ±20°
M: 90° ±1.0°/< ±3° (25 kHz)
X: 1 V_{SS}

Pin assignment

without reference signal

Signal	E1	E6X
GND	black	1
sin	red	2
/sin	orange	3
cos	yellow	4
/cos	green	5
+UB	brown	6
N.C.		7

with reference signal

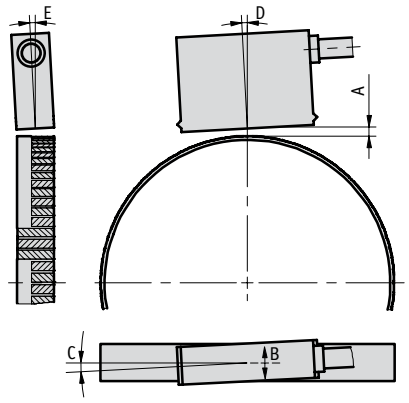
Signal	E1	E6X
sin	red	1
cos	yellow	2
index	blue	3
+UB	brown	4
GND	black	5
/sin	orange	6
/cos	green	7
/index	violet	8

Mounting instruction

On systems with reference points on the magnetic ring, please ensure the correct alignment of the sensor and band.

Reference signal	0, IA, ID	RB, RD
A, Sensor/band reading distance	max. 0.4 mm	max. 0.2 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±1°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±1°

Sensor/ring reading distance (symbolic sensor representation)



Order

Order note

For the “AM” design feature with reference signal “0”, a special version, SA09, is available on request. Housing connected to screen, twisted-pair sensor cable.

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	10	A	10.5 ... 30 V DC	
	5		5 V DC ±5 %	
Design	M	B	metal housing with status LEDs	
	AM		metal housing without status LEDs	
Type of connection	E1	C		
	E6X			
			cable extensions on request	
Cable length L	...	D	1 ... 20 m, in steps of 1 m	
			others on request	
Reference signal	0	E	without	
	IA		index periodic (analog)	index signal every 1 mm
	ID		index periodic (digital)	index signal every 1 mm
	RB		fixed, band side (analog)	
	RD		fixed, band side (digital)	

Order code

LE100/1 - [A] - [B] - [C] - [D] - [E] - S

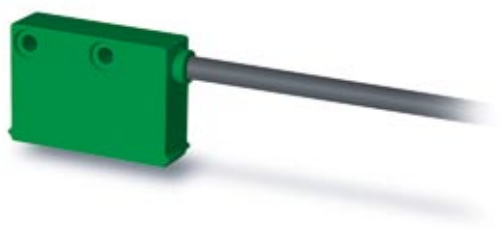
Scope of delivery: *LE100/1, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.2 mm*

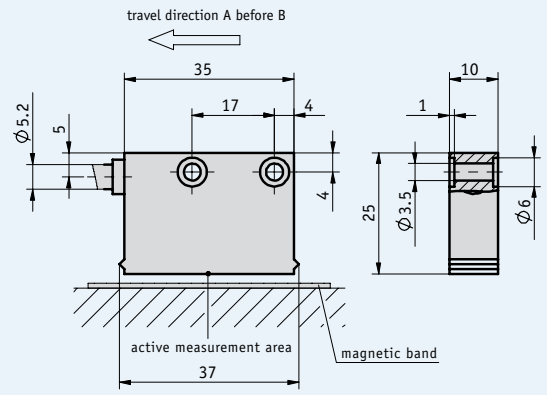
Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

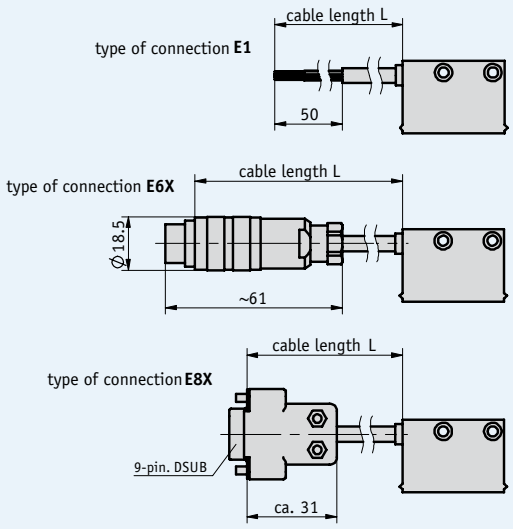
Subject to technical alterations 09/2010

Profile

- Resolution 0.045° with MR200 and MBR200 (100 poles)
- Max. 4600 pulses/revolution with MBR200 (230 poles)
- Max. 18 400 increments/revolution
  with quadrature evaluation
- Repeat accuracy ±1 increment







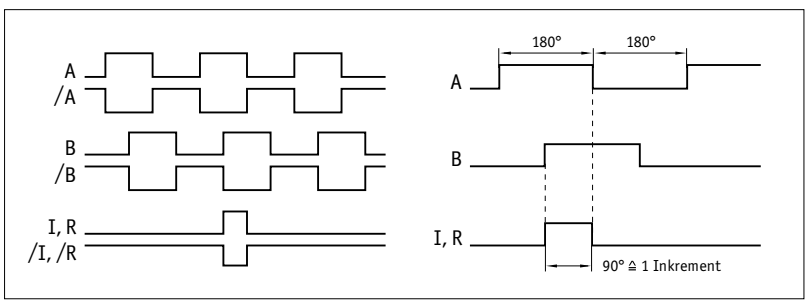
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MR200 MBR200	
System accuracy	±0.1°	
Repeat accuracy	±1 increment	
Sensor/ring reading distance	0.1 ... 0.8 mm 0.1 ... 0.4 mm	with reference signals 0, I with reference signal R
Circumferential speed	max. 25 m/s	max. referencing speed 2 m/s
Housing	plastic, green	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measurement range	infinite	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 5 V DC ±5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<20 mA off-load <75 mA loaded	at 24 V
Type of connection	flying leads round connector D-SUB 9-pin	
Output circuit	PP LD (RS422) TTL	PP only with 24 V
Output signals	A,B A, /A, B, /B, option: I, /I, or R, /R	quadrature signal
Max. pulses/revolution rotary	max. 2000 pulses/revolution	with MR or MBR200
Pulse width of reference signal	1 increment	
Scaling factor	1, 4, 5, 8, 10, 16, 20	
Jitter	<15 % with reading distance of 0.5 mm	sensor/magnetic ring reading distance 0.5 mm
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	
Signal level high	>UB – 2.5 V >2.5 V >2.4 V	with PP with LD with TTL
Signal level low	<0.8 V <0.5 V <0.4 V	with PP with LD with TTL

Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

Pin assignment

non-inverted

Signal	E1	E6X	E8X
A	red	3	3
B	orange	4	4
+UB	brown	2	2
GND	black	1	1
N.C.		5,6,7	5,6,7,8,9

inverted

Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
N.C.		3	3, 8, 9

inverted with reference signal

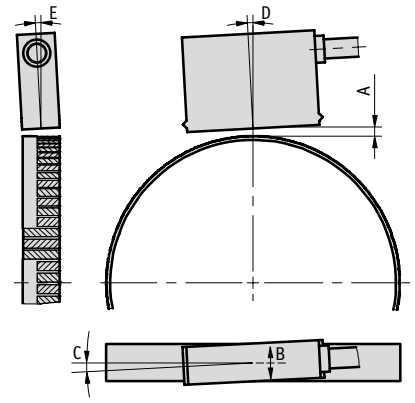
Signal	E1	E6X	E8X
A	red	PIN 1	PIN 1
B	orange	2	2
I	blue	3	3
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
I/	violet	8	8
N.C.			9

Mounting instruction

On systems with reference points on the magnetic ring, please ensure the correct alignment of the sensor and band.

Reference signal	0, I	R
A, Sensor/band reading distance	max. 0.8 mm	max. 0.4 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±1°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/ring reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	24 V DC ±20 %	reverse-polarity protection
	5		5 V DC ±5 %	
Type of connection	E1	B	flying leads	
	E6X		round connector without mating connectors	
	E8X		D-SUB 9-pin without mating connectors	
			cable extensions on request	
Cable length L	...	C	1 ... 20 m, in steps of 1 m	
			others on request	
Output circuit	PP	D	push-pull	only with operating voltage 4
	LD		line driver	
	TTL			only with non-inverted output signal, max. 5 m cable length
Output signal	NI	E	non-inverted	
	I		inverted	with reference signal I or R
Reference signal	0	F	without	
	I		index periodic	
	R		index fixed	not with scaling factor 1
Scaling factor	...	G	1, 5, 10, 20	

Order code

MSK210 – [ ] – A – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]
A B C D E F G

Scope of delivery: *MSK210, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.3 mm*

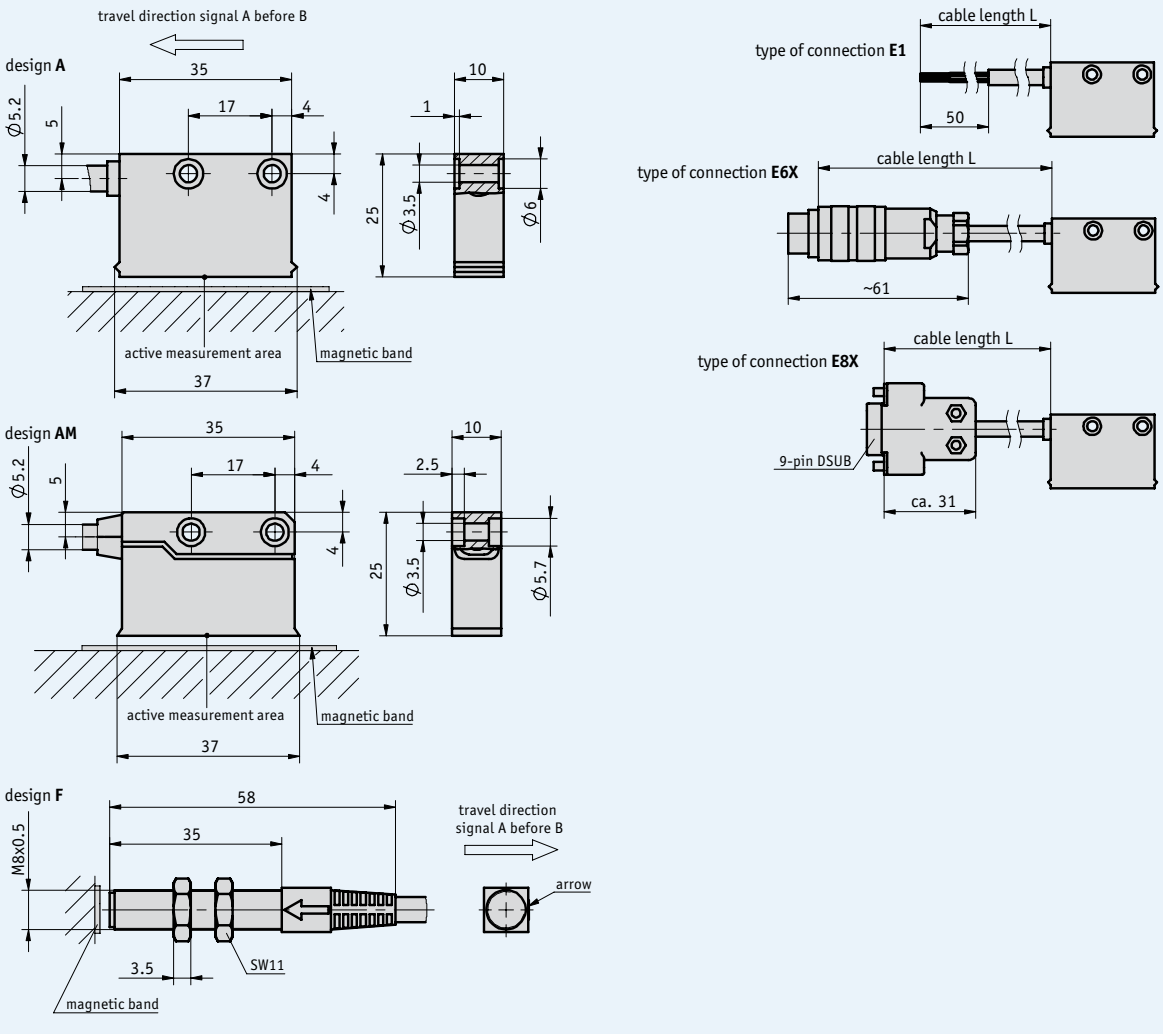
Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Sensor MSK320
Incremental, digital interface, scaling factor 20

Profile

- Max. resolution 0.018° with MR320
- Max. 5000 pulses/revolution with MR320 and MBR320 (250 poles)
- Max. 20 000 increments/revolution with quadrature evaluation
- Repeat accuracy of ±1 increment



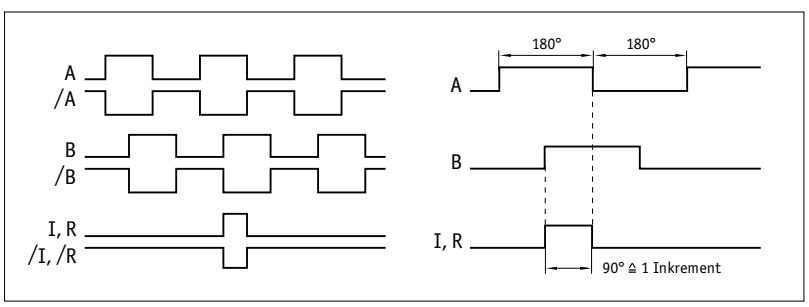
Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MR320 MBR320 MRI01	
System accuracy	± 0.1°	
Repeat accuracy	± 1 increment	
Sensor/ring reading distance	0.1 ... 2 mm 0.1 ... 1 mm	with reference signals 0, I with reference signal R
Circumferential speed	max. 25 m/s	max. referencing speed 3.2 m/s
Housing	rectangular housing, plastic red; round housing, steel	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70 °C	
Storage temperature	-30 ... +80 °C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	

Electrical data

Feature	Technical data	Additional information
Operating voltage	24 V DC ±20 % 5 V DC ±5 %	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<20 mA off-load <75 mA loaded	at 24 V
Type of connection	flying leads round connector D-SUB 9-pin	
Output circuit	PP LD (RS422) TTL	PP only with 24 V
Output signals	A, /A, B, /B, option: I, /I, or R, /R	quadrature signal
Max. pulses/revolution	max. 5000 pulses/revolution max. 20000 increments/revolution	number of poles 250 when combined with MR/MBR 320
Pulse width of reference signal	1 increment	
Scaling factor	1, 4, 5, 8, 10, 16, 20	
Jitter	<15 %	with reading distance of 0.5 mm
Interference protection class	3	according to IEC 801
Real-time requirement	real-time signal processing	

Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

5.4

Pin assignment

non-inverted

Signal	E1	E6X	E8X
A	red	3	3
B	orange	4	4
+UB	brown	2	2
GND	black	1	1
N.C.		5,6,7	5,6,7,8,9

inverted

Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
N.C.		3	3, 8, 9

inverted with reference signal

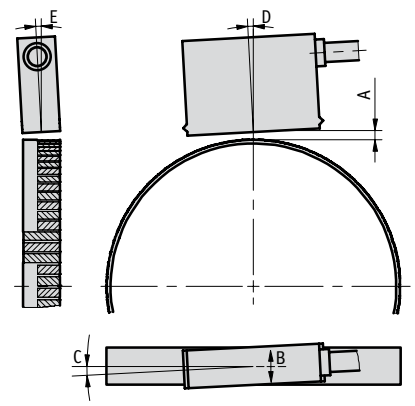
Signal	E1	E6X	E8X
A	red		
B	orange	2	2
I	blue	3	3
+UB	brown	4	4
GND	black	5	5
A/	yellow	6	6
B/	green	7	7
I/	violet	8	8
N.C.			9

Mounting instruction

On systems with reference points on the magnetic ring, please ensure the correct alignment of the sensor and band.

Reference signal	O, I	R
A, Sensor/band reading distance	max. 2 mm	max. 1.0 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±3°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/ring reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	4	A	24 V DC ±20 %	reverse-polarity protection
	5		5 V DC ±5 %	
Design	A	B	rectangular	
	AM		metal housing without status LEDs	
	F		round	only with output signal NI, reference signal 0 and scaling factor 8
Type of connection	E1	C	flying leads	
	E6X		round connector without mating connectors	
	E8X		D-SUB 9-pin without mating connectors	
			cable extensions on request	
Cable length L	...	D	1 ... 20 m, in steps of 1 m	
			others on request	
Output circuit	PP	E	push-pull	only operating voltage 4
	LD		line driver	
	TTL			only with non-inverted output signal, max. 5 m cable length
Output signal	NI	F	non-inverted	
	I		inverted	only with design A or AM and reference signal I or R
Reference signal	0	G	without	
	I		index periodic	only with design A or AM
	R		index fixed	only with design A or AM , not with scaling factor 1
Scaling factor	...	H	1, 4, 5, 8, 10, 16, 20	

Order code

MSK320 – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]
A B C D E F G H

Scope of delivery: *MSK320, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable*

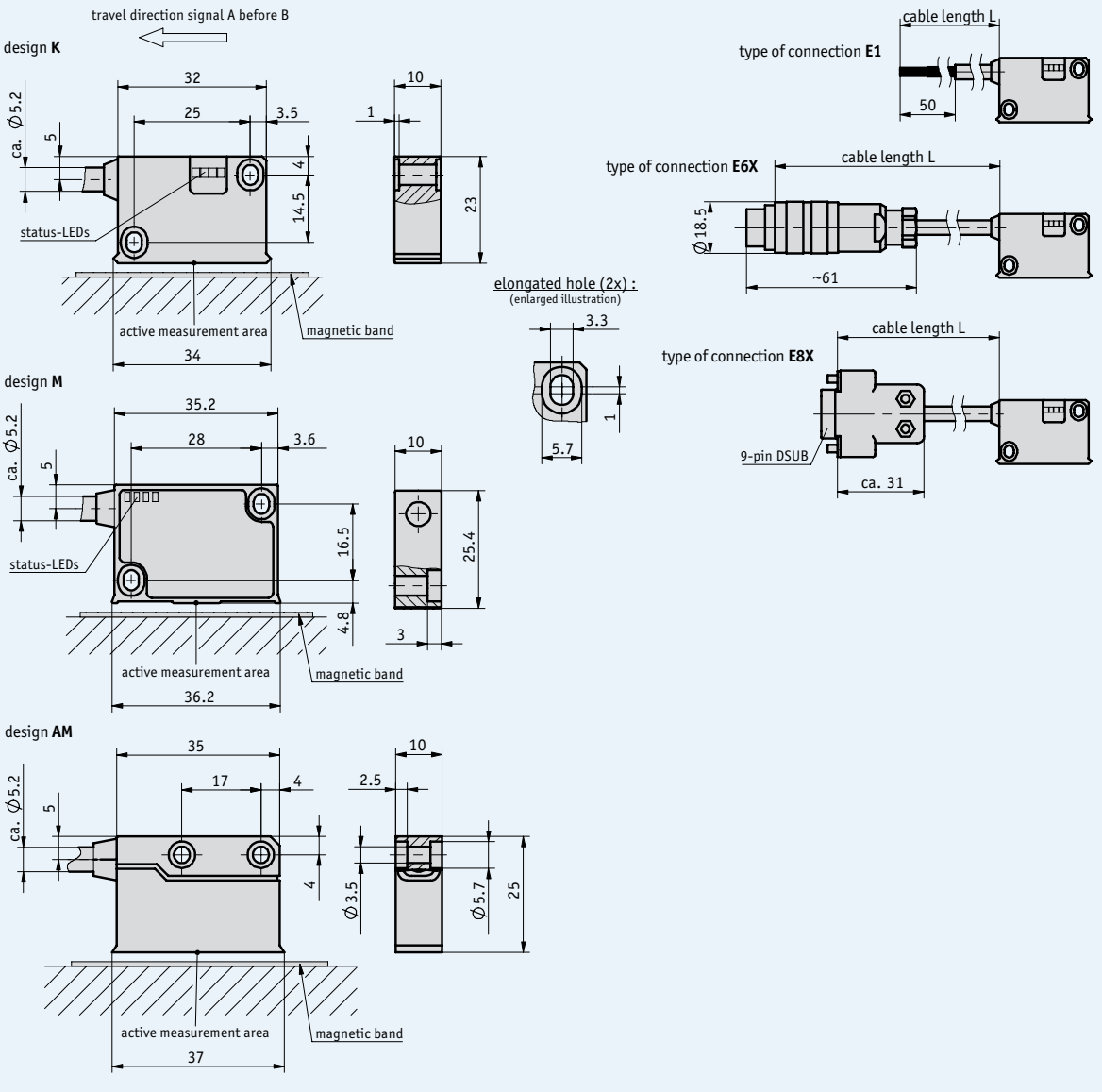
Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

Magnetic Sensor MSK5000
Incremental, digital interface, scaling factor 1250

Profile

- Max. resolution up to 262 500 pulses/revolution in combination with MR500 and MBR500 (188 poles)
- Max. 800 000 increments/revolution with 4-fold evaluation for MR500 and MBR500 (188 poles)
- Repeat accuracy of ±1 increment
- Status LED display



Mechanical data

Feature	Technical data	Additional information
Scale embodiment	MR500 MBR500	
System accuracy	±0.1°	
Repeat accuracy	max. ±10 µm	
Sensor/ring reading distance	0.1 ... 2 mm 0.1 ... 1.5 mm	with reference signals 0, I with reference signal R
Circumferential speed	depends on resolution and pulse interval	see table
Housing	plastic, black	
Sensor cable	PUR	drag chain-compatible
Operating temperature	-10 ... +70°C	
Storage temperature	-30 ... +80°C	
Humidity	100 % rh	condensation permitted
Protection category	IP67	
Vibration resistance	10 g/50 Hz	
Max. measuring length	infinite	

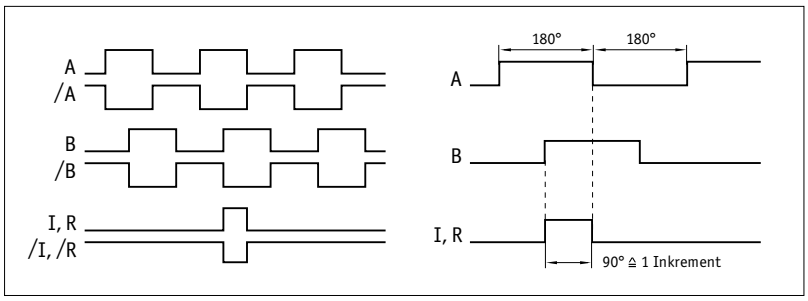
Circumferential speed

		circumferential speed V_{max} (m/s)								
Scaling factor	**1250**	4.00	1.60	0.80	0.32	0.20	0.10	0.05	0.03	0.01
	250	20.00	8.00	4.00	1.60	1.00	0.50	0.25	0.13	0.06
	125	25.00	16.00	8.00	3.20	2.00	1.00	0.50	0.25	0.12
	50	25.00	25.00	20.00	8.00	5.00	2.50	1.25	0.63	0.30
	25	25.00	25.00	25.00	16.00	10.00	5.00	2.50	1.25	0.61
	12.5	25.00	25.00	25.00	25.00	20.00	10.00	5.00	2.50	1.21
Pulse interval (µs)		0.20	0.50	1.00	2.50	4.00	8.00	16.00	32.00	66.00
Counting frequency (kHz)		1250.00	500.00	250.00	100.00	62.50	31.25	15.63	7.81	3.79

Electrical data

Feature	Technical data	Additional information
Operating voltage	6.5 V DC ... 30 V DC 4.75 V DC ... 6 V DC	reverse-polarity protection on UB no reverse-polarity protection on UB
Current consumption	<20 mA off-load <75 mA loaded	at 24 V
Type of connection	flying leads round connector D-SUB 9-pin	
Output circuit	PP LD (RS422)	
Output signals	A, /A, B, /B, option: I, /I or R, /R	
Max. pulses/revolution	max. 262500 pulses/revolution	
Pulse width of reference signal	1 or 4 increments	
Scaling factor	1250, 250, 125, 50, 25, 12.5	
Interference protection class	3	IEC-61000-6-2
Real-time requirement	real-time signal processing	
Signal level high	>UB – 2.5 V >2.5 V	with PP with LD
Signal level low	<0.8 V	

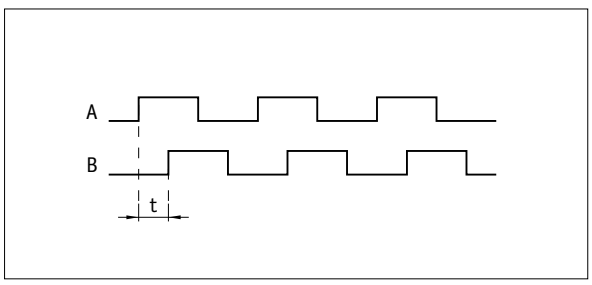
Signal forms



The logical condition of signals A and B is not defined in reference to the index signal I or the reference signal R. It can deviate from the signal form.

Reference or index signal with 4 increments (360°) signal length is only valid from the 5th counting step onwards. A corresponding delay should be taken into consideration after switching on the operating voltage.

Pulse interval



Example: Pulse interval t = 1 µs
(i.e., the downstream unit must be able to process 250 kHz)

Formula for counting frequency $= \frac{1}{1\ \mu s \times 4} = 250\ kHz$

Pin assignment

5.4

inverted without index signal

Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
+UB	brown	4	4
GND	black	5	5
/A	yellow	6	6
/B	green	7	7
N.C.		3	3, 8, 9

inverted with index signal

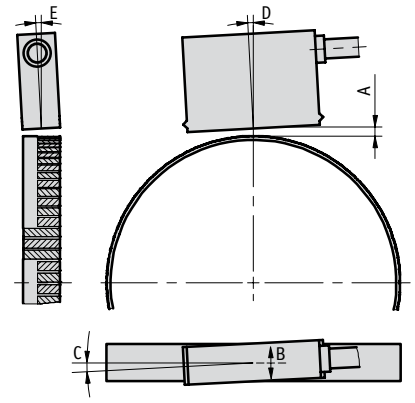
Signal	E1	E6X	E8X
A	red	1	1
B	orange	2	2
I,R	blue	3	3
+UB	brown	4	4
GND	black	5	5
/A	yellow	6	6
/B	green	7	7
/I, /R	violet	8	8
N.C.			9

Mounting instruction

On systems with reference points on the magnetic ring, please ensure the correct alignment of the sensor and band.

Reference signal	0, I	R
A, Sensor/band reading distance	max. 2 mm	max. 1.5 mm
B, Lateral offset	max. ±2 mm	max. ±0.5 mm
C, Misalignment	<±3°	<±3°
D, Longitudinal tilt	<±1°	<±1°
E, Lateral tilt	<±3°	<±3°

Sensor/ring reading distance (symbolic sensor representation)



Order

Order table

Feature	Order data		Specifications	Additional information
Operating voltage	**10**	A	6.5 ... 30 V DC	
	11		4,75 ... 6 V DC	
Design	**K**	B	plastic housing	
	M		metal housing with status LEDs	
	AM		metal housing without status LEDs	
Type of connection	**E1**	C	flying leads	
	E6X		round connector without mating connectors	
	E8X		D-SUB 9-pin without mating connectors	
			cable extensions on request	
Cable length L	**...**	D	**1 ... 20** m, in steps of 1 m	
			others on request	
Output circuit	**PP**	E	push-pull	only operating voltage 10
	LD		line driver	
Reference signal	**0**	F	without	
	I		index periodic	
	R		fixed reference	
Scaling factor	**...**	G	**12.5, 25, 50, 125, 250, 1250**	
Pulse interval in µs	**...**	H	**0.2, 0.5, 1, 2.5, 4, 8, 16, 32, 66**	

Order code

MSK5000 – [A] – [B] – [C] – [D] – [E] – [F] – [G] – [H]

Scope of delivery: *MSK5000, User information, Allen fastening screws M3 x 14 mm ISO 4762, lock washers M3 DIN 7980, strain relief for sensor cable, distance gage 0.8 mm*

Additional information:
Short Description, Technical Details *Page 142 cont.*
Product Overview *Page 4 cont.*

Subject to technical alterations 12/2010

5.5

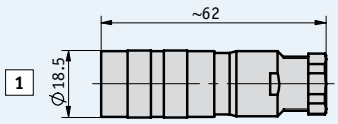
5.5 | Accessories

Profile

- Mating connectors, straight
- Mating connectors, offset

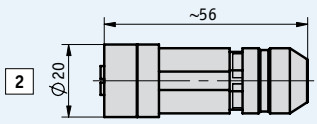
Mating connectors, straight

1



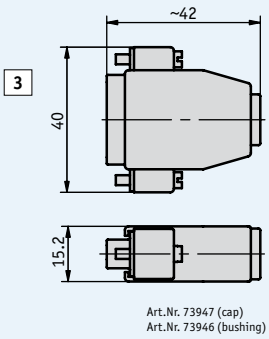
Art.Nr. 76572

2



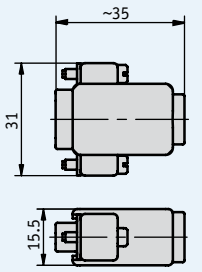
Art.Nr. 83525

3



Art.Nr. 73947 (cap)
Art.Nr. 73946 (bushing)

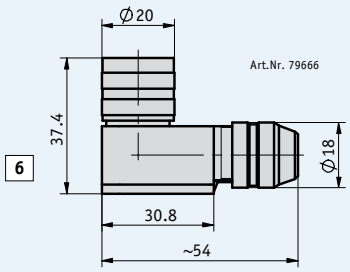
4



Art.Nr. 71365 (cap)
Art.Nr. 71366 (bushing)
Art.Nr. 71364 (connector)

Mating connectors, offset

6



Art.Nr. 79666

Order

Order matrix

					Sensors					Translation Module	
					MSA111C	MSA501	MSA511	MSA1000	MSK5000R	ASA110H	ASA510H
	Pict.	PIN	Cable Ø	Order data							
Mating connectors, straight											
Encoder	1	12	6 ... 8	76572			•	•			
Encoder	2	12	6 ... 8	85277	•	•					
Encoder	2	8	6 ... 8	83525					•		
Encoder	2	5	6 ... 8	84109					•		
X1	3	15	≤8.5	73947 + 73946						•	•
X2	4	9	≤8.5	71366 + 71365						•	•
X3	4	9	≤8.5	71364 + 71365						•	•
Mating connectors, offset											
Encoder	6	12	6 ... 8	79666			•	•			
Encoder	6	12	6 ... 8	85278	•	•					

Order code (see Product Matrix)

Scope of delivery: *Mating connector*

5.5

Subject to technical alterations 12/2010

Accessories MagLine

- **Matrix for cable extension**
  Cable extensions are offered for a range of sensors. For appropriate pin assignments, refer to the data sheets of the individual cable extensions (see matrix).

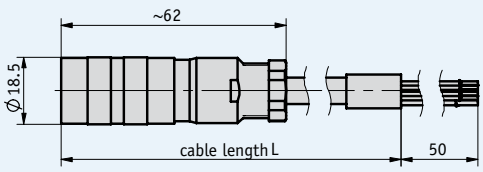
				Sensors		
				MSA501	MSA111C	MSA511
	Page	Cable sheath	Products			
Cable extension						
	179	PUR	KV12S0			•
	180	PUR	KV12S2	•	•	

5.5

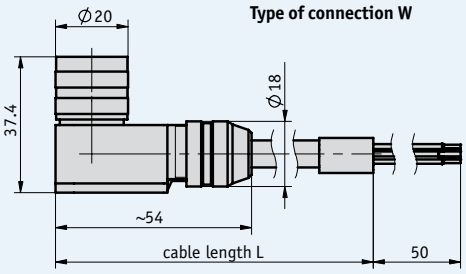
Profile

- Ready-to-use cable connection
- Cable lengths up to 20 m

Type of connection GE



Type of connection W



Mechanical data

Feature	Technical data	Additional information
Cable sheath	PUR	
Temperature range	-30 ... +100 °C	

5.5

Pin assignment

- **KV12S0**

Cable color	PIN
blue	A
violet	B
green	C
red	D
yellow	E
pink	F

Cable color	PIN
red-blue	G
white	H
gray-pink	J
gray	K
black	L
brown	M

Order

- **Order table**

Feature	Order text		Specification	Additional information
Type of connection	GE	A	straight connector	
	W		angle connector	
Cable length	...	B	1 ... 20 m, in steps of 1 m	

- **Order code**

KV12S0 – [ ] – [ ]
A B

Scope of delivery: *KV12S0, User information*

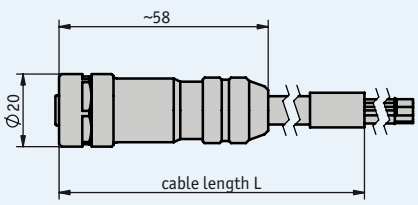
Subject to technical alterations 12/2010

Cable Extension KV12S2
Accessories

Profile

- Ready-to-use cable connection
- Cable lengths up to 20 m

Type of connection GE



Mechanical data

Feature	Technical data	Additional information
Cable sheath	PUR	
Temperature range	-30 ... +100 °C	

5.5

Pin assignment

- **KV12S2**

Cable color	PIN
violet	1
pink	2
blue	3
black	4
white-red	5
yellow	6

Cable color	PIN
grey	7
brown	8
green	9
white	10
red	11
white-green	12

Order

- **Order table**

Feature	Order text	Specification	Additional information
Cable length	... A	1 ... 20 m, in steps of 1 m	

- **Order code**

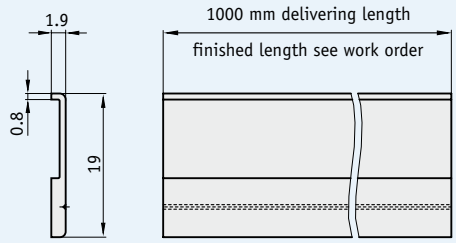
KV12S2 - GE - [ ] A

Scope of delivery: *KV12S2, User information*

Subject to technical alterations 12/2010

Profile

- Aluminum cover for mechanical protection of magnetic strips with widths up to 10 mm (except MB100 and MBA111)
- Easy mounting owing to the V-notch for drilling holes



Mechanical data

Feature	Technical data	Additional information
Material	aluminum	

5.5

Order

- **Order code**

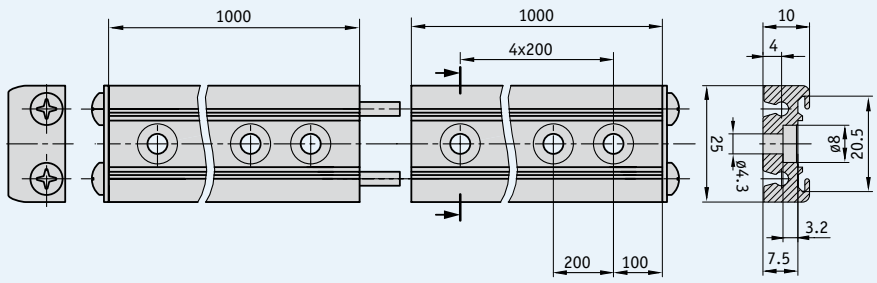
PS1 – **1.0**

Scope of delivery: *PS1*

Subject to technical alterations 10/2008

Profile

- Robust mounting unit for magnetic bands with 10 mm width
- No adhesive joints
- Perfect accommodation for magnetic bands
- Extensible plug-in modules
- Easy mounting



Mechanical data

Feature	Technical data	Additional information
Material	aluminum	

5.5

Order

Order table

Feature	Order data		Specification	Ergänzungen
Length	1.0	A	1 m	
	...		0.3 ... 10 m, in steps of 0.1 m	

Order code

PS – [ ]
A

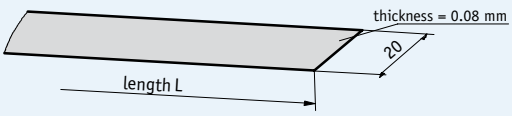
Scope of delivery: *PS, coupling pins, closing panel, User information*

Accessories:
Protective strip SB *Page 183*

Subject to technical alterations 10/2008

Profile

- Easy mounting
- For sliding into profile rail PS
- No adhesive joints



Mechanical data

Feature	Technical data	Additional information
Material	stainless steel	

5.5

Order

- **Order table**

Feature	Order data		Specification	Ergänzungen
Length	1.0	A	1 m	
	...		0.3 ... 10 m, in steps of 0.1 m	required length = profile rail + 36 mm

- **Order code**

SB - 20 - [ ] - without

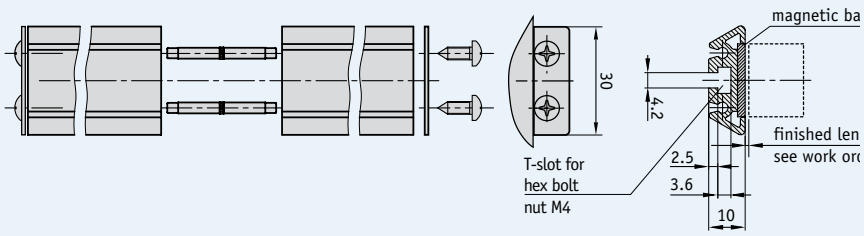
A

Scope of delivery: SB

Subject to technical alterations 10/2008

Profile

- Robust mounting unit for magnetic bands with 20 mm width
- Extensible via plug-in modules
- Easy mounting



Mechanical data

Feature	Technical data	Additional information
Material	aluminum	

5.5

Order

Order table

Feature	Order data		Specification	Ergänzungen
Length	0.5	A	profile rail: 0.5 m ±0.5 mm	
	...		0.15 ... 3 m, in steps of 0.15 m	

Order code

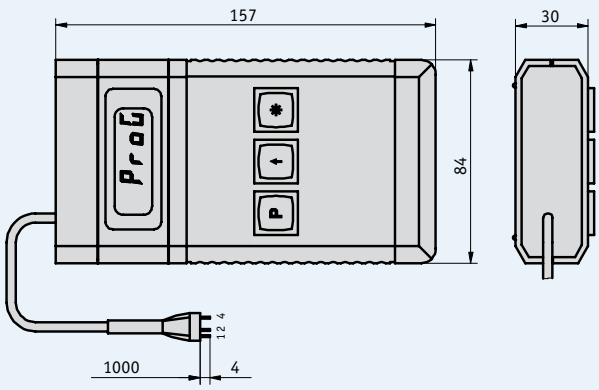
PSA – [ ]
A

Scope of delivery: *PS, closing unit, connection parts*

Subject to technical alterations 10/2008

Profile

- Easy handling
- No additional accessories required
- Battery operation with 9 V block battery
- For programming MA508: LC display mode, resolution, decimal point position, counting direction, reset delay



5.5

Mechanical data

Technical data		Additional information
Supply	9 V block battery	exchangeable with standard connector, reverse-polarity protection
Display	7 segments, 4-digit	digit height 9 mm
Temperature range	0 ... +50 °C	

Pin assignment

Signal	PIN
CLK	1
DATA	2
GND	3

Order

- **Order code**

PTM

Scope of delivery: *PTM, Benutzerinformationen*

Subject to technical alterations 10/2008

5.6

5.6 | Appendix

Accuracy comparison (MB100, MB500)

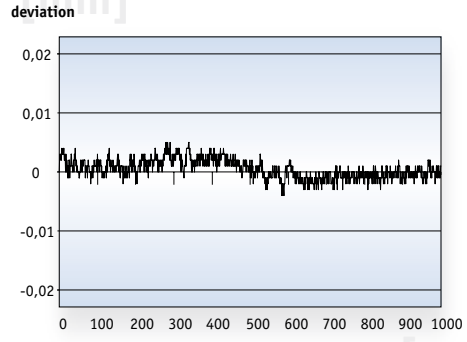
The diagrams opposite show typical measurement curves. Measurement is based on combinations of magnetic band and the corresponding sensor.

Picture 1 (MagLine Micro)
- MB100 (10 µ)
- MSK1000
- Increment 1.1 mm, measuring length 1000 mm

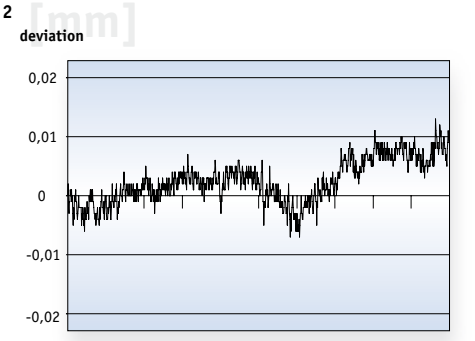
Picture 2 (MagLine Micro)
- MB100 (50 µ)
- MSK1000
- Increment 1.1 mm, measuring length 1000 mm

Picture 3 (MagLine Basic)
- MB500 (100 µ)
- MSK5000
- Increment 5.1 mm, measuring length 1900 mm

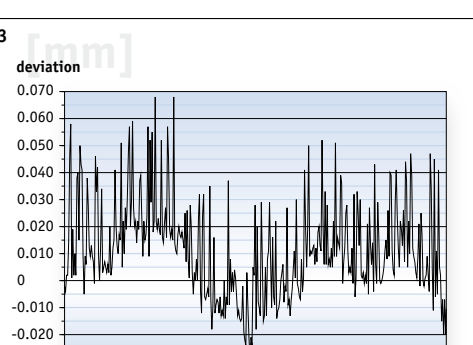
Pict. 1



Pict. 2



Pict. 3



5.6

Subject to technical alterations 10/2008

Technical data

Mechanical data		
Dimensions	see data sheets	MB100, MB200, MB320, MB400, MB500, MB2000, MBA, MBA511, MBA111, MBA1000, MB4000
Bend radius	>50 mm	
Available length	max. 90 m	

Band/strip materials		
Carrier strip	spring steel	
	VA (stainless steel strip)	
Magnet material	plastic-bonded ferrite	
Cover strip	stainless steel	

Environmental conditions		
Operating temperature	-40 ... + 80 °C	option: -40 ... +120 °C
Storage temperature	-40 ... + 80 °C	

Resistance to chemicals, dirt, and liquids (qualitative allocation)

high	**medium**	**low** (can be enhanced by additional protective measures)
water/water vapor	acetone	xylol/toluol
formic acid	stearic acid 70 °C, anhydrous	trichlorethylene
formaldehyde, 40 %,	oleic acid	tetrahydrofuran
glycerin 98 °C	diisopropyl ether	tetrachloromethane
N-hexane	acetic acid	turpentine
iso-octane	benzine	nitric acid
lactic acid	kerosene	nitrobenzene
mineral oil	ammonia	lacquer solvent
linseed oil	acetylene	benzene
cotton seed oil	seawater	aromatic hydrocarbons
plant oils		ketones
wood dust/chips		anorganic acids (HCL, H_2SO_4)
stone dust		drilling emulsions
metal dust/chips		

Field strength (typical values, measured on the band surface with hall-effect probe)

MB100	30 kA/m	
MB200	28 kA/m	
MB320	40 kA/m	
MB400	38 kA/m	
MB500	36 kA/m	

Accuracy data		
	Accuracy classes	
MB100	10 µm	
	50 µm	
MB200	50 µm	
MB320	100 µm	
MB400	1 mm	
MB500	50 µm	
	100 µm	
MB2000	1 mm	
MB4000	1 mm	
MBA111	10 µm	
MBA	50 µm	
MBA511	100 µm	
MBA1000	1 mm	

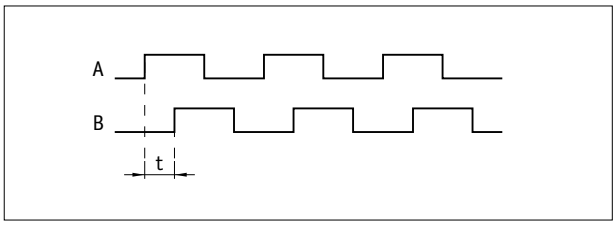
	Expansion coefficients	
	spring steel	11 µm/K
	VA carrier	16 µm/K

	Typical accuracy curves	
MB100	10 µm	Picture 1
	50 µm	Picture 2
MB500	100 µm	Picture 3

5.6

Relation between resolutions and pulse interval

The resolution and pulse interval parameters can be selected on the sensors of MSK range. The interfaces of these sensors supply digital output signals (counting pulses), which can be processed in a higher-level controller with a counter input.



Definition: Pulse interval
The pulse interval "t" is the smallest period of time between two edges which can occur during sensor motion. Micro-vibrations can also act as triggers.

The calculation formula

Resolution and pulse intervals must be coordinated with the maximum possible counting frequency of the controller. With the **maximum travel speed** of the system, the **counting frequency** of the follow-up electronic system can be determined with the gray highlighted formulas. An example calculation with these formulas is shown below.

$$\text{Pulse interval} = \frac{\text{resolution}}{\text{max. travel speed}} \times 0.8$$

$$\text{Counting frequency} = \frac{1}{\text{pulse interval} \times 4}$$

Calculation example
A path should be measured with a resolution of 0.025 mm. The maximum traversing speed is 15 m/s; the pulse interval and counting frequency must be determined. The values for these calculation examples are shown in the table below (highlighted in blue).

1. Determining the pulse interval:
The next lower, programmable value is selected, in this case **1 µs.**

$$\text{Pulse interval} = \frac{0.025\ \text{mm}}{15\ \text{m/s}} \times 0.8 = 1.33\ \mu\text{s}$$

2. Determining the counting frequency of the follow-up electronic system:
The downstream electronics unit must be able to recognize a frequency of **250 kHz** at the input.

$$\text{Counting frequency} = \frac{1}{1\ \mu\text{s} \times 4} = 250\ \text{kHz}$$

Table for MSK5000 (example)

Resolution (mm)	**Travel speed** V_{max} (m/s)								
0.001	0.01	0.03	0.05	0.10	0.20	0.32	0.80	1.60	4.00
0.005	0.06	0.13	0.25	0.50	1.00	1.60	4.00	8.00	20.00
0.010	0.12	0.25	0.50	1.00	2.00	3.20	8.00	16.00	25.00
0.025	0.30	0.63	1.25	2.50	5.00	8.00	20.00	25.00	25.00
0.050	0.61	1.25	2.50	5.00	10.00	16.00	25.00	25.00	25.00
0.100	1.21	2.50	5.00	10.00	20.00	25.00	25.00	25.00	25.00
Pulse interval (µs)	66.00	32.00	16.00	8.00	4.00	2.50	1.00	0.50	0.20
Counting frequency (kHz)	3.79	7.81	15.63	31.25	62.50	100.00	250.00	500.00	1250.00

5.6

Subject to technical alterations 10/2008

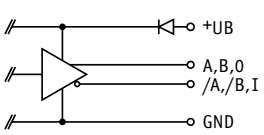
Sensors MSK

Design rectangular

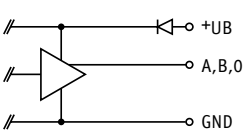
Output circuit	PP	LD	TTL
Output signals	**A, B, I reverse-plaity protection**	**A, B, I inverted**	**A, B**
Load resistance	**—**	**120 Ohm***	**—**
Operating voltage	**24 V**	**5 V and 24 V**	**5 V and 24 V**
U_{High}	>UB - 1.5 V	RS422 spez.	>3.4 V
U_{Low}	<1 V	RS422 spez.	<0.4 V
I_{max} (each channel)	<25 mA	RS422 spez.	<5 mA

* MSK2000, MSK4000: 470 Ohm

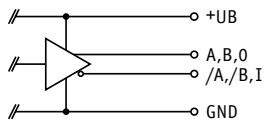
PP (Push Pull), inverted



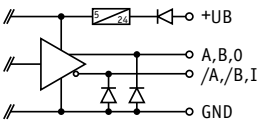
PP (Push Pull), non-inverted



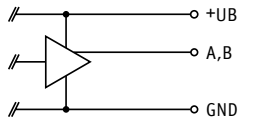
LD (5 V), inverted



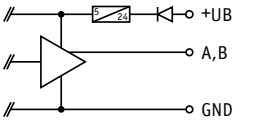
LD (24 V), inverted



TTL (5 V), non-inverted



TTL (24 V), non-inverted



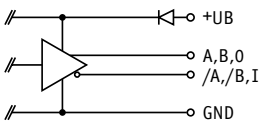
Design round MSK320

Output circuit	PP
Output signals	**A, B, I reverse-plaity protection**
Operating voltage	**24 V**
U_{High}	>UB - 2.5 V
U_{Low}	<2.5 V
I_{max} (each channel)	<5 mA

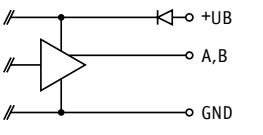
Design round MSK5000R

Output circuit	PP	LD	TTL
Output signals	**A, B, I reverse-plaity protection**	**A, B, I inverted**	**A, B**
Load resistance	**—**	**120 Ohm** (5 V) **700 Ohm** (24 V)	**—**
Operating voltage	**24 V**	**5 V and 24 V**	**5 V and 24 V**
U_{High}	>UB	RS422 spez.	>UB
U_{Low}	<0.8 V	RS422 spez.	<0.8 V
I_{max} (each channel)	<30 mA	RS422 spez.	<30 mA

PP (Push Pull), inverted
LD (5 V, 24 V), inverted



TTL (5 V, 24 V), non-inverted



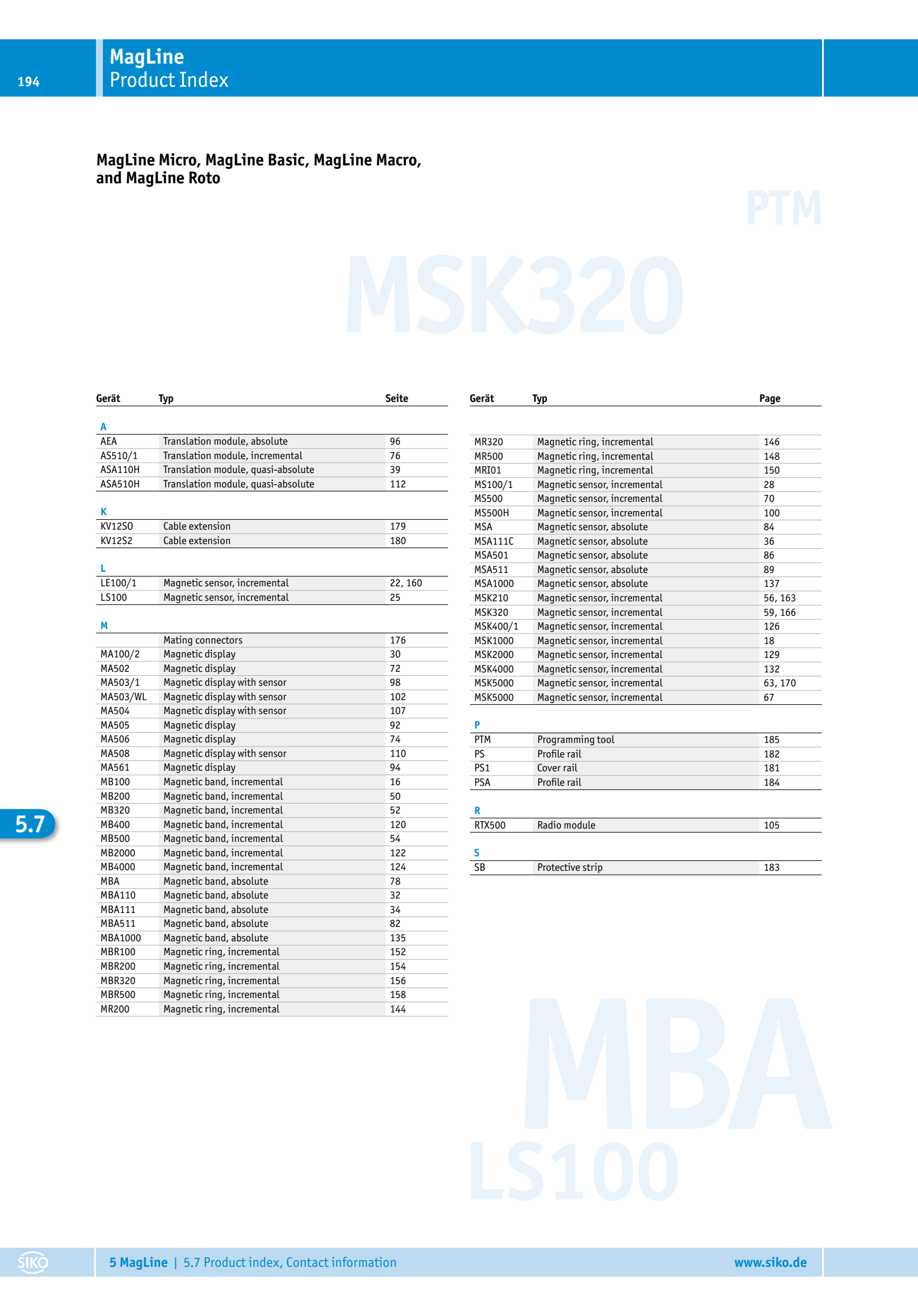
Sensors LE and LS

Signal differential 1 V_{ss} ±10 %

	5 V	24 V
Referece voltage	UB/2 ±200 mV	2.5 V ±200 mV
Temperatur	bei 20 °C	bei 20 °C

5.7

MagLine Micro, MagLine Basic, MagLine Macro, and MagLine Roto



5.7

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Subject to technical alterations 01/2011 – Nr. 84815