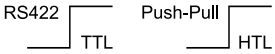
**Incremental magnetic measurement system sensor head, magnetic tape – programmable** | **Limes LIM2000 / B1** | **Push-pull / RS422**



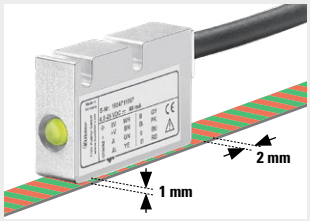
**High flexibility and higher performance through programmability.**
With a new technology approach based on digital signal processing independent of previous ASIC solutions, Kübler has expanded the range of applications for linear magnetic measurement systems. In conjunction with the available magnetic tapes, the best possible accuracy is now always achieved. Influences due to individual installation and temperature differences during operation are automatically compensated in the sensor head. This facilitates integration into applications and makes the overall system even more powerful.

RoHS




## Features and benefits

- **Maximum flexibility through programmability**
  - Programmable (also in the field) via programming device with touch display.
  - Highest possible resolution 0.1 µm - freely programmable in 1 nm steps.
- **Highest precision**
  Active offset, phase and amplitude control automatically optimizes the sensor to the current operating situation. Influences due to individual installation and temperature differences during operation are automatically compensated in the sensor head.
- **Optimized for best performance**
  2 mm pole length for high signal quality requirements. This requires a stable installation process that allows an air gap of up to 1 mm.




- **Fast and easy implementation**
  - For use in small installation spaces.
  - Mounting tolerance between magnetic tape and sensor head are compensated by the electronics.
  - Simple adjustment by fastening via slotted holes.
  - Function display via LED.
- **Resistant and robust**
  - Non-contact and wear-free measuring system for a long service life.
  - High shock and vibration resistance.
  - Sturdy housing with degree of protection IP67, optional: Special housing for high resistance to condensation (IP68 / IP69, Resistance to cyclical humidity acc. to EN 60068-2-38 and humidity-heat acc. to EN 60068-2-78).

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## Incremental magnetic measurement system sensor head, magnetic tape – programmable

**Limes LIM2000 / B1** | **Push-pull / RS422**

### Order code sensor head LIM2000

Only in conjunction with magnetic tape B1

Pole lenght 2 mm / distance sensor head–magnetic tape max. 1 mm

| 8.LIM2000 | . | X | 2 | X | A | . | XXXX.XXX | . | XXXX |
|---|---|---|---|---|---|---|---|---|---|
| Type | | a | b | c | d | | e | | f |

**a** *Model*
1 = IP67, standard
2 = IP68 / IP69 and humidity tested acc. to EN 60068-2-38, EN 60068-2-78

**b** *Reference signal*
2 = with reference signal evaluation [1)]

**c** *Output circuit / Supply voltage*
1 = RS422 / 4.8 ... 26.4 V DC
2 = Push-pull (HTL/TTL universal) / 4.8 ... 26.4 V DC

**d** *Type of connection*
A = radial cable, PUR (cable length see **f**)

**e** *Resolution in µm*
XXXX.XXX µm

Examples of standard resolutions:

| | |
|---|---|
| 0,1 µm = | 0000.100 (highest possible resolution) |
| 1 µm = | 0001.000 |
| 10 µm = | 0010.000 |
| 25,4 µm (0,001") = | 0025.400 |
| 2540 µm (0,1") = | 2540.000 |

Further examples:
300 dpi = 25,4 mm/300 = 0,084666 mm

| | |
|---|---|
| 84,6666 µm = | 0084.666 |

Resolution through 4-fold evaluation in following electronics.
(Only in conjunction with Limes magnetic tape B1)

**f** *Cable length (XXXX =* length in dm*)*
0020 = 2 m [6.56'] (standard)
0030 = 3 m [9.84']
0050 = 5 m [16.40']
0080 = 8 m [26.25'] (only with supply voltage > 6 V)
0100 = 10 m [32.80'] (only with supply voltage > 6 V)
0150 = 15 m [49.21'] (only with supply voltage > 6 V)
0200 = 20 m [65.62'] (only with supply voltage > 6 V)

### Order code magnetic tape B1

Only in conjunction with sensor head LIM2000

Pole lenght 2 mm / distance sensor head–magnetic tape max. 1 mm

| 8.B1 | . | 10 | . | 010 | . | XXXX |
|---|---|---|---|---|---|---|
| Type | | a | | b | | c |

**a** *Width magnetic tape*
10 = 10 mm

**b** *Version*
010 = without reference track, with masking tape, self-adhesive

**c** *Tape length (XXXX = Length in dm)*
0010 = 1 m (stock type)
0020 = 2 m (stock type)
0030 = 3 m
0040 = 4 m
0050 = 5 m (stock type)
0060 = 6 m
0070 = 7 m
0080 = 8 m
0090 = 9 m
0100 = 10 m (stock type)
0200 = 20 m
0700 = 70 m

*Optional on request*
- other lengths up to 70 m
- magnetic tape with reference track
- magnetic tape without masking strip

1) The sensor head always includes the function of evaluating a reference signal (**b** = 2).
In order to provide a reference point as an output signal, a magnetic tape B1 with reference track is required.
For magnetic tapes with a reference track, one signal is detected for each reference point. For full-track magnetic tapes without a reference track, a signal is detected at every second pole.

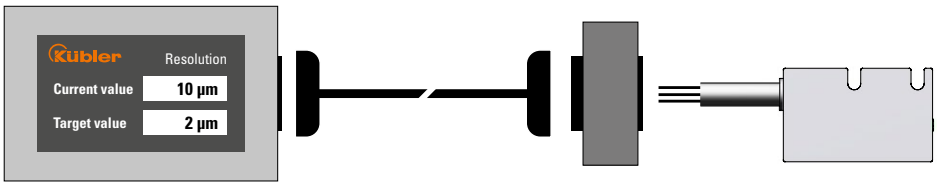

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| Incremental magnetic measurement system sensor head, magnetic tape – programmable | Limes LIM2000 / B1 | Push-pull / RS422 |
|---|---|---|

## Programming units / accessories for programming

Order no.

### Components for programming the sensor head




Programming device with touch display | Cable with Sub-D connectors | Connection adapter | Sensor head

### Programming unit with touch display EP1000



Programming unit for PC-independent use, even in the field
Dimensions 136 x 84 x 38 mm
Connection Sub-D female contacts
Scope of delivery Programming unit, plug-in power supply

The following is also required for programming:
Pre-assembled cable 05.00.60J1.L7L8.002M
Connection adapter 8.0010.9000.0100

**8.0010.9000.1000**

### Pre-assembled cable

For connecting the programming unit with the connection adapter
Sub-D male contacts, 15-pin
Sub-D female contacts, 15-pin
2 m PVC cable

**05.00.60J1.L7L8.002M**

### Connection adapter

For connecting the sensor head
Sub-D male contact, 15-pin
Spring clamp, 3-pin

**8.0010.9000.0100**

## Accessories / displays

Order no.

### Codix 560, preset counter 6-digit



- Counter, tachometer, time counter and position display in one device
- Scalable display
- Readable via RS232/485 interface or configurable via MODBUS or CR/LF protocol

**6.560.010.XXX**

Details s. datasheet >

### 571T touch, multifunction preset counters 8-digit



- Measuring function for RPM, speed, speed from elapsed time, machine cycle time, throughput time (reciprocal rotary speed), as well as numerous count functions such as position display
- Fast counting input (250 kHz/HTL, 1 MHz/RS422)
- 4 switching outputs as limit values (response time < 1 ms)
- Scalable analog output (response time < 150 ms), resolution 16 bit
- Serial interface RS232 or RS485 for reading in and out the data

**6.571T.01X.XXX**

Details s. datasheet >

Further Kübler accessories can be found at: kuebler.com/accessories
Further Kübler cables and connectors can be found at: kuebler.com/connection-technology

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# Incremental magnetic measurement system sensor head, magnetic tape – programmable

**Limes LIM2000 / B1** | **Push-pull / RS422**

## Technical data

### Mechanical characteristics sensor head

| | | |
|---|---|---|
| **Protection** | Model 1<br>Model 2 | IP67 acc. to EN 60529<br>IP68 / IP69 acc. to EN 60529<br>and humidity tested<br>acc. to EN 60068-2-38, EN 60068-2-78 |
| **Operating temperature** | | -20 °C ... +80 °C [-4 °F ... +176 °F] |
| **Shock resistance** | | 5000 m/s², 1 ms |
| **Vibration resistance** | | 300 m/s², 10 ... 2000 Hz |
| **Pole lenght** | | 2 mm |
| **Housing (sensor head)** | | aluminum |
| **Cable** | | 2 m [6.56'] long, PUR 8 x 0.14 mm² [AWG 26], shielded, may be used in trailing cable installations |
| **Status LED** | green<br>red | ready for operation<br>Magnetic field error, e.g:<br>- Distance between sensor head and magnetic tape too large<br>- Pole lenght of magnetic ring and sensor head do not match |

### Magnetic tape B1

| | | |
|---|---|---|
| **Pole length** | | 2 mm |
| **Tape length max.** | | 131 m |
| **Dimensions** | width<br>thickness | 10 mm<br>1.97 mm incl. masking tape |
| **Temperature coefficient** | | 16 x $10^{-6}$/K |
| **Working temperature** | | |
| without adhesive tape | | -20 °C ... +80 °C [-4 °F ... +176 °F] [1] |
| with adhesive tape | | -20 °C ... +65 °C [-4 °F ... +149 °F] |
| **Mounting** | | adhesive joint |
| **Measuring** | | 0.1 m (to receive an optimal result of measurement, the magnetic tape should be ca. 0.1 m longer than the desired measuring length) |
| **Bending radius** | | ≥ 150 mm (when mounted solely with adhesive tape) |
| **Material metal tape** | | precision steel strip 1.4310 acc. to EN 10088-3 |

### Electrical characteristics

| | | | |
|---|---|---|---|
| **Output circuit** | | **RS422** | **Push-pull** |
| **Supply voltage** | | 4.8 ... 26.4 VDC | 4.8 ... 26.4 VDC |
| **Power consumption** (no load) | | max. 80 mA | max. 80 mA |
| **Permissible load / channel** | | 120 Ohm | +/- 20 mA |
| **Output frequency max.** | | 300 kHz | 100 kHz<br>300 kHz (for supply voltage ≤ 8 V) |
| **Signal level** | HIGH<br>LOW | min. 2.5 V<br>max. 0.5 V | min. +V - 2.0 V<br>max. 0.5 V |
| **Reference signal** | | For magnetic tapes with a reference track, a reference signal is output for each reference position. For magnetic tapes without a reference track, a reference signal is output at every second pole. | |

### Accuracy

| | | |
|---|---|---|
| **Magnetic tape** | ± (0,025 + 0,02 x L) mm<br>up to $L_{max}$ = 70 m / L in [m] | |
| **Sensor head** | ± 0.01 mm interpolation error accuracy, at T = 20 °C and gap sensor head/magnetic tape 0.4 mm | |
| **Repeat accuracy** | ±1 increment | |
| **Resolution / Speed** | | |
| resolution (4-fold) | speed at output frequency $f_{max.}$ = 100 kHz | speed at output frequency $f_{max.}$ = 300 kHz |
| 0,1 µm | 0,04 m/s | 0,12 m/s |
| 5,0 µm | 2,00 m/s | 6,00 m/s |
| 25,0 µm | 10,00 m/s | 30,00 m/s |

### Approvals

**CE compliant** acc. to
EMV-Richtlinie 2014/30/EU
RoHS-Richtlinie 2011/65/EU

## Terminal assignment

| Output circuit | Type of connection | Cable (insulate unused cores individually before initial start-up) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1, 2 | A | Signal: | 0 V | +V | A | $\overline{A}$ | B | $\overline{B}$ | 0 | $\overline{0}$ | ⏚ |
| | | Aderfarbe: | WH | BN | GN | YE | GY | PK | BU | RD | shield |

+V: Supply voltage sensor +V DC
0 V: Supply voltage sensor ground GND (0 V)
A, $\overline{A}$: Incremental output channel A / cosine signal
B, $\overline{B}$: Incremental output channel B / sine signal
0, $\overline{0}$: Reference signal
⏚: Sensor housing (shield)

1) Magnetic tape (ends) attached by screwing, clamping or equvalent.

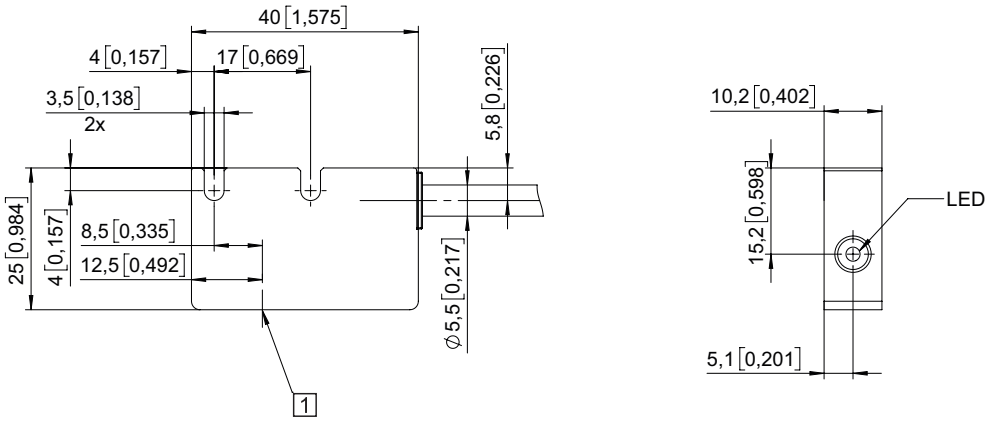

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**Incremental magnetic measurement system sensor head, magnetic tape – programmable** | **Limes LIM2000 / B1** | **Push-pull / RS422**

## Dimensions

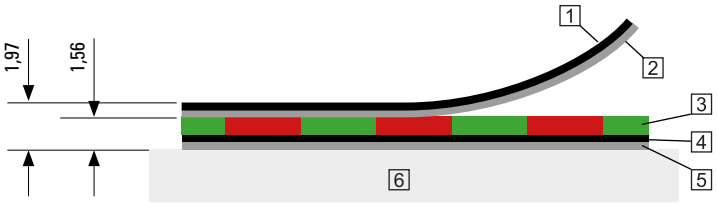
Dimensions in mm [inch]

### Sensor head




1 Active measuring area

### Magnetic tape B1




1 Stainless steel cover strip
2 Double-sided adhesive tape
3 Magnetized plastic tape
4 Stainless steel carrier strip
5 Double-sided adhesive tape
6 Mounting surface

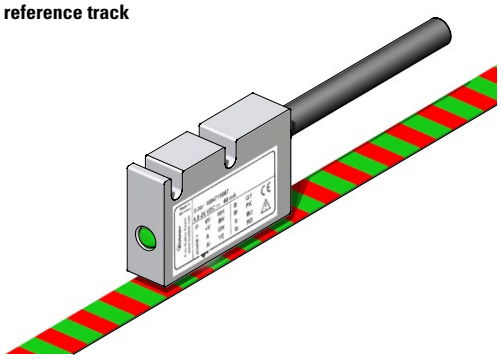
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**Incremental magnetic measurement system sensor head, magnetic tape – programmable** | **Limes LIM2000 / B1** | **Push-pull / RS422**

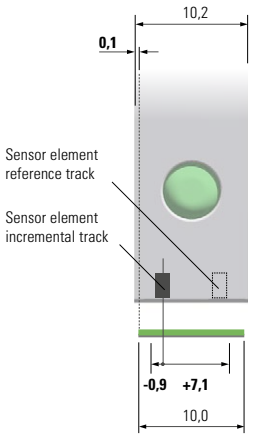
## Technology in detail

### Permissible mounting tolerances

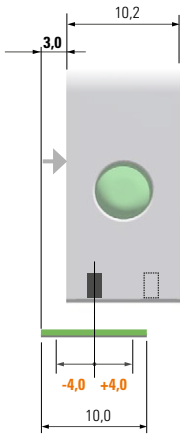
**Lateral offset when using a magnetic tape without an additional reference track**



When using the sensor without reference signal evaluation, the lateral tolerance of -0.9 mm in one direction is very restricted for operation. By mounting the sensor head offset by 3.0 mm to the magnetic tape, a tolerance range of ±4.0 mm in both directions can be achieved.

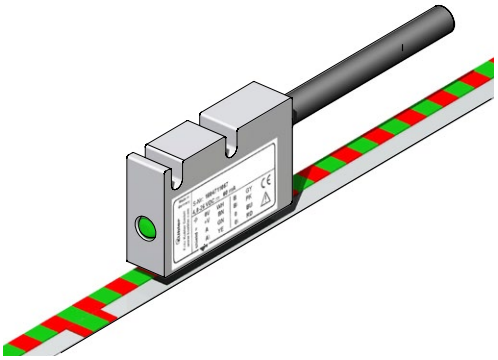


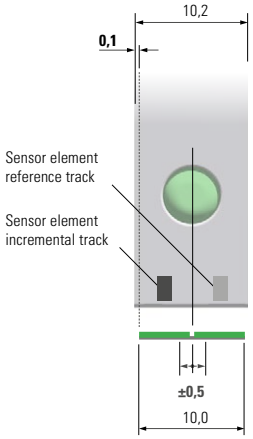

Tolerances for operation -0,9/+7,1 mm




Tolerances for operation -4,0/+4,0 mm

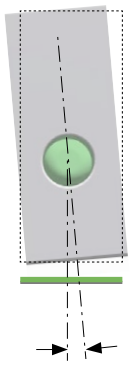
**Lateral offset when using a magnetic tape with an additional reference track**





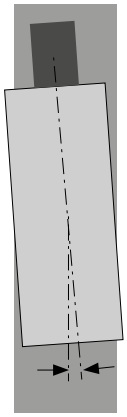

Tolerances for operation -0.5/+0.5 mm

**Tilting**



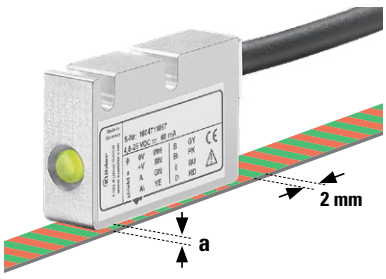
Tolerances for operation ±3°

**Torsion**



Tolerances for operation ±3°

**Distance sensor magnetic tape**




**a** =
Distance sensor head / magnetic tape (pole length 2 mm): 0.1 ... 1.0 mm (0.4 mm recommended)

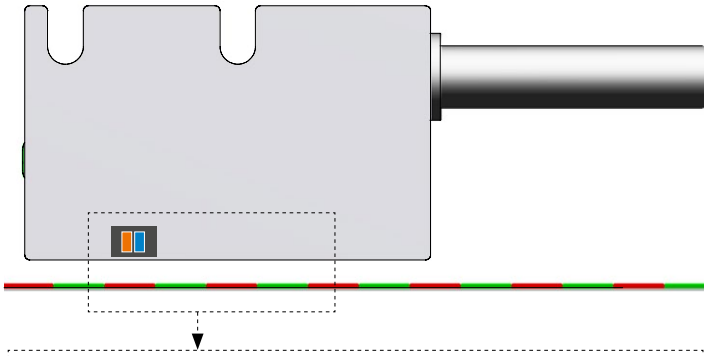

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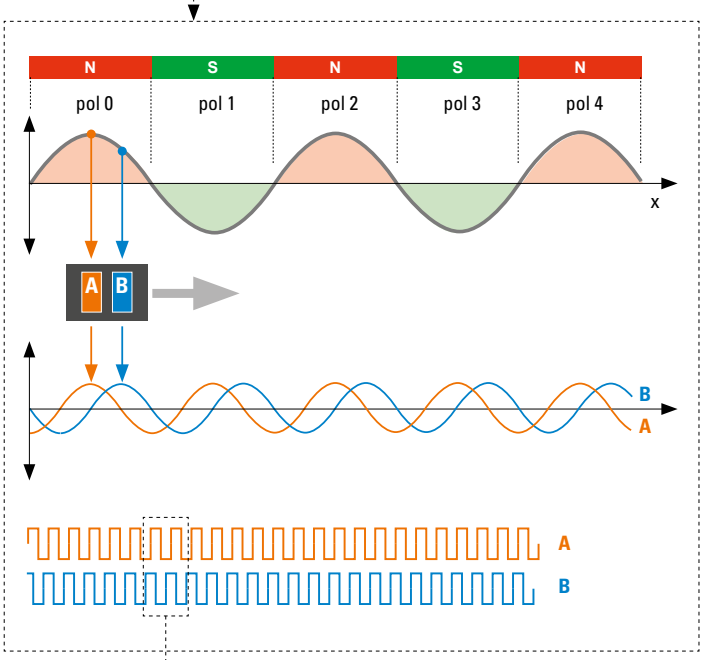
**Incremental magnetic measurement system sensor head, magnetic tape – programmable** | **Limes LIM2000 / B1** | **Push-pull / RS422**

## Technology in detail

### Functional principle

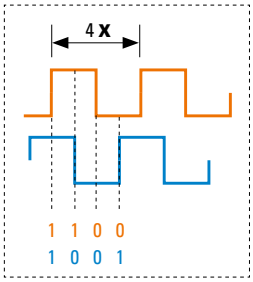
The sensor element for the incremental track records 2 signal periods, which are offset by 1/4 of the pole length, as input signals A and B.
–> 90° phase shift






### Higher resolution through 4-fold evaluation

The offset of the two square-wave signal periods results in 4 different states of signal A and B per period




**Example:**

| | | |
|---|---|---|
| Resolution set in the sensor head = **x** | ex. | 0.1 mm |
| Period of the square wave **A** und **B** signals generated in the sensor head = 4 x resolution | ex. | 4 x 0.1 mm = 0.4 mm |
| The resolution x is achieved by 4-fold evaluation in the electronics downstream of the sensor head | ex. | 0.4 mm / 4 = 0.1 mm |

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