Read this manual before installing the sensor and placing it in operation.

1.1 Intended use

The BML displacement sensor is installed for use in a machine or system. Together with a controller (PLC) it comprises a displacement measurement system and may be used only for this purpose.

Unauthorized modifications and non-allowed use will result in loss of guarantee and warranty.

1.2 Qualified personnel

This manual is intended for technical personnel who are involved in installation and setup.

1.3 Use and testing

Prevailing safety regulations and codes must be observed for using the displacement sensor. In particular, measures must be taken to ensure that a defect in the displacement sensor will not result in hazards to persons or equipment. This includes installation of additional safety limit switches, emergency stop switches, and the maintaining of permissible ambient conditions.

BML displacement sensors may not be used in life-saving systems, in aircraft, etc.

1.4 Validity

This manual is applicable to displacement sensors of type BML-S1B...-KAxx.

An overview of the various versions can be found in section 11 "Versions" (refer to part label).
2 Functional variants of the BML-S1B displacement sensor

The BML is a non-contacting, incremental displacement measurement system which in addition to a counting function is available with a reference point and limit switch function. All functions are implemented by means of magnetic sensing. The reference position is integrated in the tape, and limit switches can be attached at any desired position.

The following table show the functional variants with their possibilities.

<table>
<thead>
<tr>
<th>Output signal</th>
<th>Reference signal</th>
<th>Limit switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/B</td>
<td>periodic</td>
<td>front and back</td>
</tr>
<tr>
<td></td>
<td>one</td>
<td>none</td>
</tr>
<tr>
<td></td>
<td>none</td>
<td>none</td>
</tr>
</tbody>
</table>

Fig. 2-1: Displacement system with incremental sensors

Fig. 2-2: Displacement system with incremental and reference point sensors

Fig. 2-3: Displacement system with incremental, reference point and limit switch sensors
3 Function and Characteristics

3.1 Characteristics
BML displacement sensors are characterized by:
- High system accuracy of 50 µm
- High resolution of up to 5 µm
- High traverse speed of up to 10 m/s
- Position signal in real-time
- Insensitive to shock, vibration, and contamination such as dust and oil
- Wear- and maintenance-free
- Rugged
- Enclosure rating IP 67 per IEC 60529

3.2 Principle of operation
The sensing head is attached to the machine member whose position is to be determined, while the magnetic tape is mounted along the direction of travel. The tape contains alternating magnetic north- and south poles.

The two incremental sensors in the sensing head measure the magnetic alternating field.

As the sensing head travels over the tape the two incremental sensors pick up the magnetic periods so that the controller can determine the distance traveled.

3.3 Interface signals
The sensing head can convert the sinusoidal and cosinusoidal signals either into A/B pulses and send them to the controller (RS422). The digital A/B pulses are interpolated in the sensing head.

The two digital pulses A and B are 90° phase-shifted, with the sign of the phase shift determined by the direction of travel of the sensor (Fig. 3-1).

Each edge change from A or B represents a counting step for the period counter (UP/DOWN counter). When Signal A is ahead, the counting state increases, and when Signal B is ahead the count decreases. The controller thus always knows the increment-precise position without having to periodically poll the sensor (real-time capability).

3.4 Limit switch function
When limit switch functionality is needed, sensing heads can be equipped in addition with a limit switch sensor which senses opposite pole permanent magnets at the ends of the measuring range and sends the signals to the controller (Fig. 3-2).

The limit switch sensors function then even if the rest of the sensor fails (security function).

If the actuation range of the limit switches needs to be longer than their length (20 mm), multiple limit switches of the same type can be mounted in rows.
3.5 Reference point function

The reference position is always required as the starting point for the count for each incremental displacement system. How the reference position is determined depends on the sensor type, the tape and on the controller.

In the simplest system the sensing head with the sinusoidal and cosinusoidal sensors can count only the magnetic periods. The tape contains only one track with magnetic north and south poles (Fig. 3-3).

In this case the displacement measuring system does not know the absolute position. This is determined by the controller by adding the counted increments. First however the reference position must be determined by a homing move to the reference switch.

A sensing head with an additional reference point sensor can output a reference point signal as soon as it reaches the magnetically encoded reference point on the second track of the tape (Fig. 3-4). Then an reference switch is not needed.

In another sensing head version a reference point signal is output with each magnetic pole. This signal is repeated every 5 millimeters. The tape does not require a second track with a magnetically encoded reference point.

In this case an reference switch needs to be used for the selected reference signal. The controller precisely evaluates the reference position when the switch and the reference point signal of the sensing head are active.

The accuracy requirement for this switch is not especially great.
4 Installation

4.1 Distances, tolerances

The following distances and tolerance must be observed when installing the sensing head and tape:

- The distance (air gap) between sensing head and tape as per Fig. 4-2
- The horizontal offset between sensing head and tape as per Fig. 4-3
- The angle tolerances as per Fig. 4-4. Any tilt along the longitudinal axis of the sensing head must still maintain the nominal distance to the tape in the center of the head. The two incremental sensors are located there on the underside.

Note:

Even slight tolerance deviations can affect the measuring result.

The specified system accuracy applies only if the tape is installed parallel to the direction of travel.
4 Installation (cont.)

4.2 Determining orientation

The orientation with respect to front, back, right and left is used in the installation description and is critical for correct installation of the sensing head and tape. Starting from the travel direction of the sensing head the orientations are defined in Fig. 4-5.

Installation options (Figs. 4-6):
- Pos. 1: For normal ambient conditions glue the tape down to a level surface. Optionally the cover band can be glued on for protection.
- Pos. 2: For harsh ambient conditions embed the tape fully in a somewhat deeper channel so that it does not extend over the top. Optionally the cover band can be glued on for protection.
- Pos. 3: For harsh ambient conditions embed the tape fully in a somewhat deeper channel and fill with non-magnetizable material (such as adhesives). The fill material can be leveled by lightly sanding.

Fig. 4-5: Orientation

4.3 Attaching sensing head

The sensing head is attached with M3 screws at its right or left side to the machine member whose position you are sensing.

4.4 Gluing the tape

Note:
Attach the tape parallel to the direction of travel and completely flat on the mounting surface. Wavy or tilted tapes will affect the measuring accuracy.

Never stretch or crimp the tape while installing, otherwise non-linear measurements will result. Once glued do not remove (even partially) the tape. Strong non-linearity effects will be observed at the place where the tape was lifted.

Keep magnetized parts away from the tape to prevent non-linear effects.

For optimum gluing an ambient temperature of 0 to 40 °C is recommended.

For tapes with a reference track you should identify the front and back end so that the tape is installed appropriately to the count direction of the sensing head. The reference point is visually marked (Fig. 4-5).

Installing the tape

Note
The tape must always be mounted flush with the left and right side of the sensing head.

1. Thoroughly remove any oil, grease, dust, etc. (use acetone or similar) from the mounting surface and allow to dry completely.
2. For tapes with a reference position, identify front and back end: the reference point is visually marked and is located on the right side of the tape in its own track. For the system to function the reference track of the tape must lie on the right side of the sensing head (Fig. 4-5).
3. Position the sensing head at the back end of the tape (start of the measuring range).
4. Pull back the film from the back end of the tape and lightly attach the tape.
5. Remove another section of film.
6. Move the sensing head a short distance further while aligning the tape flush with the left and right side of the sensing head.
7. Gently press the tape behind the sensing head.

Caution! Do not use a hard tool, otherwise the magnetic surface may be damaged!

8. Optional: To protect the tape from mechanical and chemical effects, glue the stainless steel cover in place (details see section 7.2).

Fig. 4-6: Installation options for the tape
4.5 Installing limit switches

The front and rear limit switch magnets must always be installed on the right side of the sensing head.

When the limit switch is in a housing always attach the front magnet with its nose facing back and the rear magnet with its nose facing front.

When the limit switch is not in a housing install the rear magnet with its N pole (marked by a line) facing the sensing head and the front magnet with its S pole facing the head (Figs. 4-7, 4-9).

The following applies to both limit switch types: If the E-stop travel exceeds the length of the limit switch magnet, multiple magnets may be installed in a row (Fig. 4-7). The limit switch sensor becomes active as soon as it begins to enter the magnetic field of the limit switch magnet (Fig. 4-8).

Fig. 4-7: Installing the limit switch magnets

The limit switch is active at about this point

Fig. 4-8: Traverse and E-stop distances for limit switches with and without housing

Fig. 4-9: Installation example for limit switch without housing
5 Wiring

Note the following when making electrical connections:

- The system and the control cabinet must be at the same ground potential.
- To ensure EMC, which Balluff confirms with the CE Marking, the following instructions must be followed.
- The cable shield must be grounded on the controller side, i.e., connect to the protection ground.

The connection on the sensor side depends on the configuration.

When routing the cable between the transducer, controller and power supply avoid proximity to high-voltage lines due to noise coupling.

Especially critical are stray coupling caused by AC harmonics (e.g., from phase controls), against which the cable shield offers little protection.

5.1 Cable assignments

12-conductor cable with Sense line for preventing voltage drop in the line.

<table>
<thead>
<tr>
<th>Cable</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>WH</td>
<td>white</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
</tr>
<tr>
<td>GN</td>
<td>green</td>
</tr>
<tr>
<td>YE</td>
<td>yellow</td>
</tr>
<tr>
<td>GY</td>
<td>gray</td>
</tr>
<tr>
<td>PK</td>
<td>pink</td>
</tr>
<tr>
<td>BU</td>
<td>blue</td>
</tr>
<tr>
<td>RD</td>
<td>red</td>
</tr>
<tr>
<td>BK</td>
<td>black</td>
</tr>
<tr>
<td>VT</td>
<td>violet</td>
</tr>
<tr>
<td>GYPK</td>
<td>gray/pink</td>
</tr>
<tr>
<td>RDBU</td>
<td>red/blue</td>
</tr>
</tbody>
</table>

- WH white A
- BN brown /A or n.c.*
- GN green B
- YE yellow /B or n.c.*
- GY gray Z
- PK pink /Z or n.c.*
- BU blue GND
- RD red +5 V or 24 V
- BK black GND Sense
- VT violet +5 V/24 V Sense
- GYPK gray/pink Limit switch front
- RDBU red/blue Limit switch back

* only for BML-S1B0-Q53

5.2 Connecting the Sense line

To avoid a voltage drop in the line a regulated power supply with Sense input should be used (Fig. 5-1). If that is not possible or desired, the Sense lines in the 12-conductor cable should be connected parallel to the +5 V and GND line (Fig. 5-2). When operating at 10...30 V you must ensure that the voltage does not drop below 10 V. Such a power supply does not normally possess a Sense line.

Important:
In spite of a voltage drop in the line a nominal operating voltage of 10 bis 30 V or 5 V ±5% must be ensured (see 5.2).

Calculating the voltage drop in the line

For the 5 V version of the BML the supply voltage must be 5 V ±5%. The power supply must ensure this voltage and also compensate for the voltage drop in the line. When operating at 10...30 V the voltage must be ≥10 V.

Use the following formula to calculate the voltage drop in the line:

\[ U_{\text{line}} = R_{\text{d}} \times I \times \left[ n \times \frac{3.1}{R_{\text{st}}} + 0.03 \right] \]

where:

- \( U_{\text{line}} \) = Voltage drop in the line in Volt
- \( R_{\text{d}} \) = 0.23 for the parallel wiring of the Sense lines with the supply lines (Fig. 5-2)
- \( I \) = Cable length in m
- \( n = 3 \), if the reference pulse is processed in the controller
- \( n = 2 \), if the reference pulse is not processed in the controller
- \( R_{\text{st}} \) = Input impedance of the controller in Ohm

Sample calculation

Under the following conditions:
- cable length 5 m
- Reference pulse is evaluated
- Control input impedance = 120 Ω

Resulting voltage drop is:

\[ U_{\text{line}} = 0.23 \times 5 \times \left[ 3 \times \frac{3.1}{120} + 0.03 \right] = 0.112 \text{ V} \]
5.3 Interfaces

Digital incremental system

The sensor transmits the measured variable to the controller as a digital differential voltage signal (RS422) or as an operating voltage signal (HTL).

The edge separation A/B corresponds to the resolution of the sensing head.

**only for BML S1B0-Q61...**  
**only for BML S1B0-Q51...**

The 24 V inputs are connected to digital inputs on the controller.

The requirements for your controller (counting frequency) and for the traverse speed of your system can be determined from the BML model used (see part numbering code, p. 15).

Note the values from the following table.

<table>
<thead>
<tr>
<th>Resolution (µm)</th>
<th>min. possible edge separation (µs) for BML model:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;slow&quot; (V&lt;sub&gt;max&lt;/sub&gt; approx. 1 m/s)</td>
<td>&quot;fast&quot; (V&lt;sub&gt;max&lt;/sub&gt; approx. 10 m/s)</td>
</tr>
<tr>
<td>5</td>
<td>3.1</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>25</td>
<td>15.8</td>
</tr>
<tr>
<td>30</td>
<td>15.8</td>
</tr>
</tbody>
</table>

Example for table line 1: Using a BML with a resolution of 5 µm and a max. speed around 1 m/s ("slow" model) the results are as follows:

- The smallest edge separation which your controller must be able to count is 3.1 µs.

**Relationship between mechanical resolution and max. frequency**

- Depending on the model, the sensor sends either no reference signal, a single reference signal which is magnetically encoded in the tape, or a periodic reference signal (period = 5 mm, width of the reference signal = edge separation, Fig. 5-3). In the latter case an external reference switch must be attached to the desired reference signal. The accuracy requirements of this switch are not especially high.

- Note: The reference signals from the limit switch area are not allowed to be processed.

**Circuit for reference position**

- Depending on the model, the sensor sends either no reference signal, a single reference signal which is magnetically encoded in the tape, or a periodic reference signal (period = 5 mm, width of the reference signal = edge separation, Fig. 5-3). In the latter case an external reference switch must be attached to the desired reference signal. The accuracy requirements of this switch are not especially high.

- Note: The reference signals from the limit switch area are not allowed to be processed.

- Depending on the model, the sensor sends either no reference signal, a single reference signal which is magnetically encoded in the tape, or a periodic reference signal (period = 5 mm, width of the reference signal = edge separation, Fig. 5-3). In the latter case an external reference switch must be attached to the desired reference signal. The accuracy requirements of this switch are not especially high.

- Note: The reference signals from the limit switch area are not allowed to be processed.

**Circuit for limit switch front and back**

- The opposite poled permanent magnets at the ends of the measuring range are each sensed by a limit switch sensor.

- The sensor has a normally closed function, so that cable break can be detected.

- The opposite poled permanent magnets at the ends of the measuring range are each sensed by a limit switch sensor.

- The sensor has a normally closed function, so that cable break can be detected.

**Fig. 5-5: Reference position circuit**

**Fig. 5-7: Limit switch signals**
6 Startup

6.1 Check connections

**Caution!** The connections are not protected against polarity reversal or short circuit! Before turning on power, check the connections carefully to prevent components from being destroyed by incorrect connections or overvoltage.

6.2 Turn on system

Bear in mind that the system may make an uncontrolled move when first powered up, especially at initial startup and if the displacement sensor is part of a control system whose parameters are not yet set. Therefore be sure that no hazards could result from an unpredictable start.

6.3 Check system function

After installing the transducer system or replacing the sensing head, check all functions as follows:

1. Turn on power to the sensing head.
2. Move the sensing head along the entire measuring range.
3. Check whether all signals are output.
4. Check whether the count direction agrees with the direction of travel. If not, reverse connections A and /A.

6.4 Regular checking

The functionality of the transducer system and all its associated components should be checked and logged at regular intervals.

6.5 Malfunction

If there is any indication that the transducer system is not functioning properly, remove it from service and secure it against unauthorized use (see also Troubleshooting).

7 Accessories (order separately)

7.1 Limit switch magnets

**(BML-Z0006)**

The magnets can be used with or without housing. The through-holes make it easy to precisely install these limit switch magnets (Fig. 4-8). The housing should be fitted with a magnet only on its side facing the sensor.

The space-saving magnets can be glued or attached using customer-supplied holders. The upper side is marked with a notch.

If the E-stop travel exceeds the length of the limit switch magnet, multiple magnets may be installed in a row (for installation see 4.5). The scope of delivery includes:

- 2 magnets with housing
- 2 magnets without housing, and
- 1 installation guide

7.2 Tape cover

To prevent damage to the tape from things like chips or chemicals, it may be covered with a strip of stainless steel.

Note that the permissible air gap between the sensing head and tape is reduced now by the thickness of the cover strip with adhesive film (0.15 mm) (Fig. 4-2).

Before adhering the cover strip, thoroughly clean the surface of the tape (acetone, terpentine, mild plastic cleaner, no gasoline).

Ship configurations:

1. Tape cover and tape can be ordered together in the appropriate length. See ordering code p. 16.
2. The tape cover may be ordered in 3 defined lengths. See ordering code p. 15.
<table>
<thead>
<tr>
<th>Error</th>
<th>Possible causes</th>
<th>Remedy/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The controller is not getting (in places) any information</td>
<td>The necessary supply voltage is not present</td>
<td>PCheck whether voltage is present and the BML is properly connected</td>
</tr>
<tr>
<td></td>
<td>The voltage drop is too high (see calculation formula on page 9)</td>
<td>The transducer system requires a supply voltage of 10...30 V or 5 V ±5%. Check the voltage on the Sense line or by using the formula (page 9)</td>
</tr>
<tr>
<td></td>
<td>The lines are not correctly connected</td>
<td>Check the lines according to the schematic diagrams</td>
</tr>
<tr>
<td></td>
<td>The orientation of the 2-track tape is incorrect</td>
<td>The reference point marking must be on the right side of the Sensinghead (Fig. 4-5). Correctly install a new tape.</td>
</tr>
<tr>
<td>At certain points the controller does not get any distance information</td>
<td>The distance between the sensing head and tape is (in parts) incorrect</td>
<td>Adjust the height of the sensor. To check, manually move the sensing head over the entire measuring range</td>
</tr>
<tr>
<td></td>
<td>The magnetic poles of the tape are damaged in places from the effect of strong external magnets</td>
<td>Replace the tape</td>
</tr>
<tr>
<td>Position signal very noisy</td>
<td>Distance between sensing head and tape is too great</td>
<td>Attach the sensing head closer to the tape</td>
</tr>
<tr>
<td>Limit switches not switching</td>
<td>The distance between the limit switch magnets and the sensing head is incorrect</td>
<td>Check distance to sensing head and angle to tape (Fig. 4-7) and correct as necessary.</td>
</tr>
<tr>
<td></td>
<td>The limit switch magnets are installed with the wrong side facing the sensing head (wrong polarity)</td>
<td>Check position of the limit switch magnets with respect to the travel direction (Fig. 4-7) and correct as necessary</td>
</tr>
<tr>
<td>Reference point signal not output</td>
<td>The orientation of the 2-track tape is incorrect</td>
<td>The reference point marking must be on the right side of the Sensinghead (Fig. 4-5). Correctly install a new tape.</td>
</tr>
<tr>
<td>The linearity deviation is outside the tolerance</td>
<td>The sensor head does not move parallel to the tape (see Fig. 4-4 for tolerances)</td>
<td>Correctly position the sensing head (section 4)</td>
</tr>
<tr>
<td></td>
<td>The distance between the sensing head and the tape is too large</td>
<td></td>
</tr>
</tbody>
</table>
9 Technical Data

### Electrical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type BML-S1B0-Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>digital RS422 or supply voltage level (HTL)</td>
</tr>
<tr>
<td>Output signal</td>
<td>A-Signal, B-Signal, reference signal</td>
</tr>
<tr>
<td>Reference signal</td>
<td>no, one, periodic signal</td>
</tr>
<tr>
<td>Resolution</td>
<td>5 µm, 10 µm, 25 µm, 50 µm, 100 µm, 200 µm, 500 µm, 1000 µm, 2000 µm</td>
</tr>
<tr>
<td>Output voltage</td>
<td>Differential signal per RS422 or same as operating voltage (HTL)</td>
</tr>
<tr>
<td>Limit switch</td>
<td>$U_{\text{max}} = 28 \text{ V}$, $I_{\text{max}} = 20 \text{ mA}$, N.C., GND switching (cable break monitor)</td>
</tr>
<tr>
<td>System accuracy</td>
<td>±50 µm up to 1 mm distance, above that ±60 µm</td>
</tr>
<tr>
<td>Hysteresis depends on air gap</td>
<td>3 to 7 µm</td>
</tr>
<tr>
<td>max. non-linearity of the processing electronics unidirectional</td>
<td>±20 µm</td>
</tr>
</tbody>
</table>
| max. non-linearity of the overall system (sensing head + tape) | ±50 µm within any one meter at a distance range up to 1 mm
|                                         | ±60 µm within any one meter at a distance range 1 ... 2 mm                     |
| Temperature coefficient of overall system like steel | 10.5 x 10^{-6} K^{-1}                                                            |
| Max. traverse speed                     | depends on model, see table p. 10                                              |
| Reverse polarity protected              | no                                                                              |
| Overvoltage protected                   | no                                                                              |
| Supply voltage                          | 5 V ±5% or 10...30 V                                                            |
| Current draw at 5 V operating voltage   | <50 mA + current draw of controller (depending on internal resistance)         |
| Current draw at 10...30 V operating voltage | <40 mA + current draw of controller (depending on internal resistance)         |
| Shock load per IEC 60068-2-27           | 100 g/6 ms                                                                     |
| Continuous shock per IEC 60068-2-29     | 100 g/2 ms                                                                     |
| Vibration per IEC 60068-2-6             | 12 g, 10...2000 Hz                                                             |

### Ambient conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-20 °C...80 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-30 °C...85 °C</td>
</tr>
<tr>
<td>Degree of protection per IEC 60529</td>
<td>IP67</td>
</tr>
</tbody>
</table>

### Mechanical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing head to tape gap</td>
<td>0.01...2 mm</td>
</tr>
<tr>
<td>Housing material</td>
<td>plastic</td>
</tr>
<tr>
<td>Connection</td>
<td>12-conductor cable</td>
</tr>
<tr>
<td>Weight</td>
<td>11 g without cable</td>
</tr>
</tbody>
</table>

1 Individually determined as per Balluff Factory Standard
## Technical Data (cont.)

### Tape BML-M01-...

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy class</td>
<td>±18 μm</td>
</tr>
<tr>
<td>Thickness</td>
<td></td>
</tr>
<tr>
<td>without cover strip</td>
<td>1.75 ±0.05 mm</td>
</tr>
<tr>
<td>with cover strip</td>
<td>1.90 ±0.05 mm</td>
</tr>
<tr>
<td>Width</td>
<td>10 mm</td>
</tr>
<tr>
<td>Length depending on tape type</td>
<td>max. 24 m</td>
</tr>
<tr>
<td>Pole width (distance north-south pole)</td>
<td>5 mm</td>
</tr>
<tr>
<td>Single reference mark</td>
<td>optional</td>
</tr>
<tr>
<td>max. non-linearity</td>
<td>±18 μm within any one meter</td>
</tr>
<tr>
<td>Weight</td>
<td>70 g/m</td>
</tr>
<tr>
<td>Recommended operating temperature</td>
<td>0...40 °C</td>
</tr>
<tr>
<td>Chemical resistance</td>
<td>Resistant to oils (motor oil, transmission fluid, hydraulic fluid), terpentine, antifreeze, water, kerosene. Not resistant to aromatic and chlorinated hydrocarbons, ketones, inorganic acids</td>
</tr>
</tbody>
</table>

### Stainless steel cover strip BML-A...

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>approx. 0.15 mm (incl. adhesive film)</td>
</tr>
<tr>
<td>Width</td>
<td>10 mm</td>
</tr>
<tr>
<td>Length</td>
<td>Same as tape length, or fixed lengths</td>
</tr>
</tbody>
</table>

### Limit switch magnet BML-Z0006

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions L x W x H</td>
<td></td>
</tr>
<tr>
<td>Magnet housing</td>
<td>20 x 12 x 9.5 mm</td>
</tr>
<tr>
<td>Limit switch magnet</td>
<td>20 x 2 x 5 mm</td>
</tr>
</tbody>
</table>

### Cable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>PU cable:12-conductor, drag chain compatible</td>
</tr>
<tr>
<td>Operating temperature</td>
<td></td>
</tr>
<tr>
<td>Flexed</td>
<td>−20...80 °C</td>
</tr>
<tr>
<td>Fixed</td>
<td>−40...90 °C</td>
</tr>
<tr>
<td>Cable diameter</td>
<td>5.4 ±0.2 mm</td>
</tr>
<tr>
<td>Cable bending radius</td>
<td></td>
</tr>
<tr>
<td>Flexed</td>
<td>81 mm</td>
</tr>
<tr>
<td>Fixed</td>
<td>41 mm</td>
</tr>
</tbody>
</table>
11 Versions

Part numbering for sensing head (printed on part label)

**BML - S1B0-Q_ _ _-M_ _ _-0-KA_ _** (example)

- **Connection:**
  - KA05 = Cable 5 m
  - Possible cable lengths: 2, 5, 10, 15, 20 m
- **max. traverse speed:**
  - 1 = 1 m/s (slow)
  - 2 = 10 m/s (fast)
- **Limit switch**
  - 0 = no limit switch
  - 3 = two limit switches
- **Reference signal**
  - 0 = no signal
  - 1 = single signal
  - 2 = periodic signal
- **Pole width**
  - 4 = 5 mm
- **Resolution (edge separation A/B)**
  - F = 5 µm
  - G = 10 µm
  - H = 25 µm
  - K = 50 µm
  - L = 100 µm
  - M = 200 µm
  - N = 500 µm
  - P = 1000 µm
  - R = 2000 µm
- **Output voltage**
  - 1 = digital differential signal RS422
  - 3 = level same as supply voltage (only for 10...30 V)
- **Supply voltage**
  - 5 = 24 V (10...30 V)
  - 6 = 5 V

Part numbering for tape cover strip without tape

**BML - A013-T0500** (example)

- **Available lengths:**
  - 0500 = 5 m
  - 1000 = 10 m
  - 2400 = 24 m
- **Form factor, width**
  - 01 = incremental 10 mm wide
Part numbering for pre-assembled tapes, optional with tape cover (indicated on packaging)

**Example:**

```
BML - M 0 1 - I 4 5 - A3 - M 0106 - R 0020
```

- Reference point position only for single reference signal in sensing head:
  - `xxxx` = for `xxxx` cm from rear (in example `20 cm*`)
  - `0000` = no reference point

- Length in cm:
  - Order length = effective measuring length + 6 cm (here `100 + 6 cm`)

- Tape cover:
  - `0` = no cover
  - `3` = with cover

- Accuracy class:
  - `5` = `18 µm` (overall accuracy ±`20 µm`)

- Pole width
  - `4` = `5 mm`

- Type
  - `I` = incremental

- Form factor
  - `01` = linear, incremental `10 mm` wide

*The reference point in the example is physically located approx. `25 cm` from the beginning of the tape

Part numbering tapes from a roll, without cover (indicated on packaging)

**Example:**

```
BML - M 0 1 - I 4 5 - A0 - T 0500 - R 0000
```

- Reference point position:
  - `0000` = no reference point possible

- Available lengths:
  - `0500` = `5 m`
  - `1000` = `10 m`
  - `2400` = `24 m`

- Accuracy class:
  - `5` = `18 µm` (overall accuracy ±`20 µm`)

- Pole width
  - `4` = `5 mm`

- Type
  - `I` = incremental

- Form factor
  - `01` = linear, incremental `10 mm` wide