

## Installation Instructions AL-Series

### Aluminum force measuring bearing

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Bitte kontaktieren Sie Ihre nächstgelegene FMS Vertretung.**

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## 2 Safety instructions

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to the equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not stress the equipment over the specification limits neither during assembly nor operation. To do so can be potentially harmful to persons or equipment in the event of a fault to the equipment.

### 2.1 Presentation of safety information

The following safety symbols appear in this manual.

#### 2.1.1 Danger that could result in minor or moderate injuries



Danger, warning, caution

Failure to follow wiring instructions in this manual may result in equipment damage or personal injury.

#### 2.1.2 Note regarding proper function



Note

Note regarding proper operation  
Simplification of operation  
Ensuring function

### 2.2 General safety information



The Force Measuring Rollers may not be stressed over the specification limits neither during assembly nor operation. The unit's overload protection value may not be exceeded.



The attachment points for the Force Measuring Rollers on the machine frame must be properly designed. The bearings need to be appropriately mounted.



For proper installation and operation, follow the electrical wiring diagram and instructions in this manual.

## 3 Product information

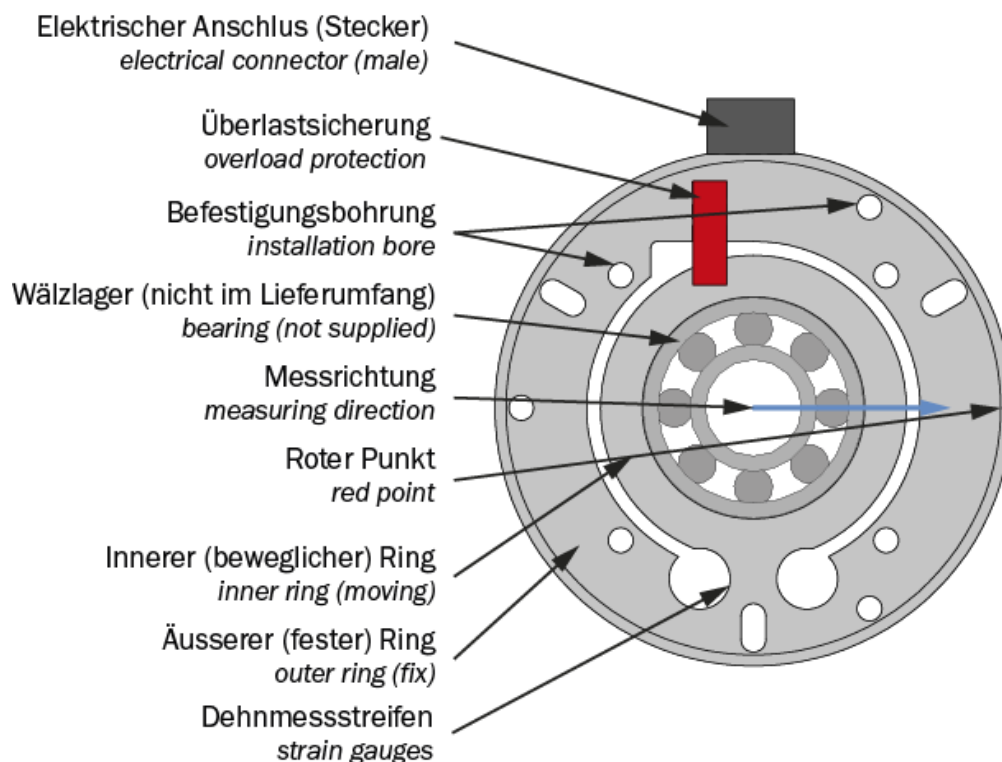
### 3.1 Product description

The Force Sensors of the AL-Series, designed for the measurement of tension on continuous material processing lines, include the bearing seat for life shaft rolls. This feature minimizes the space required at installation. The flexible installation options, including the standard 4-hole pitch circle and the optional 3-hole pitch circles, will allow for the straightforward replacement of existing flange style force sensors of other brands. With the superior performance of the AL-Series, accurate tension readings are obtained even with low web wrap angles and high roll weights.

### 3.2 Functional description

The AL-Series force measuring sensor combines the bearing seat and the force sensor within the same housing, thus minimizing the required installation space. The substantial overload protection translates to eliminated / minimized calibration issues due to machine upset conditions. The movement of the bending beam, which is proportional to the applied force, is detected by strain gauges arranged in a full bridge circuit and then converted into an electrical signal. This simple measurement principle delivers precise results even with low material tension and small web wrap angles. The Red Point, as located on the sensor body, should be aligned with the direction of the resultant force due to web tension.

### 3.3 Overview and designation



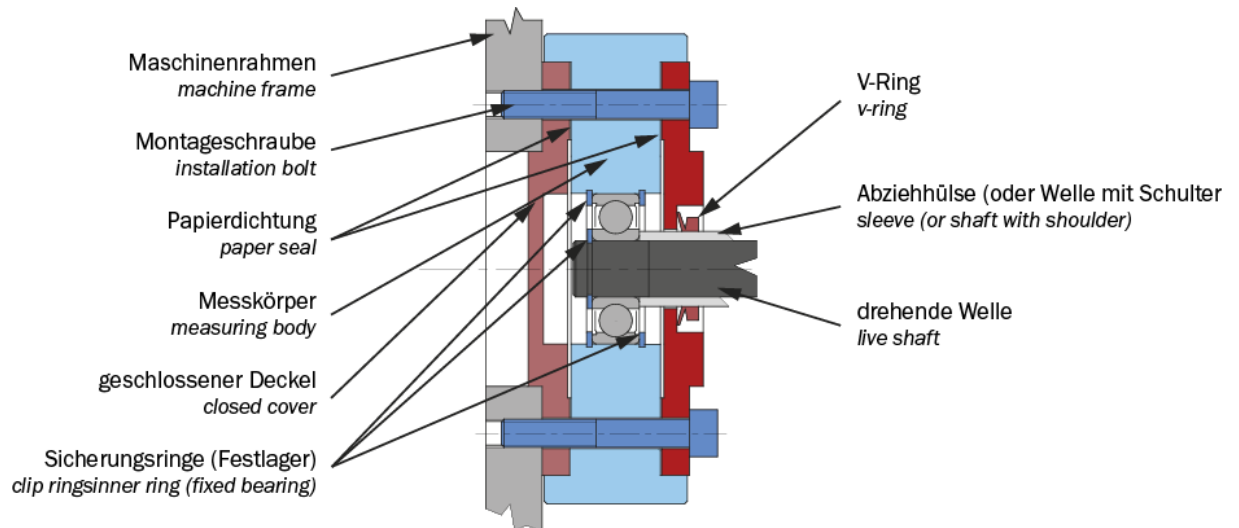


Figure 1: Overview and designation

AL\_BA\_Manual.ai

### 3.4 Order code

AL-Series : Order code					
AL	203	.250	.17	.C01	.H13.H14
					Options
				Installation with 3 hole pattern	
			Shaft diameter in mm		
		Nominal force rating in N			
					Size
Series					

Figure 2: order code

Datasheet\_AL.series.indd

### 3.5 Scope of delivery

#### Included in scope of delivery

force sensor, straight connector (female), open cover, closed cover, V-ring, clip ring

#### Options

H13 open covers for both sides, additional scope of supply 1 pcs. V-ring

H14 right-angle connector in scope of supply, replaces straight connector

H16 temperature range up to 120 °C (248 °F)

H19 grease nipple

**H31** for vacuum applications to 10<sup>-7</sup> hPa , 10<sup>-5</sup> Torr, connector conditionally suitable for vacuum; temperature range up to 120 °C (248 °F)

**Installation options**

**C01** 3 hole pattern (AL203 ø 90, AL204/AL205 ø 105, AL307/AL308 ø 150 mm)

**C02** 3 hole pattern ( AL307/AL308 ø 155 mm)

**C03** 3 hole pattern ( AL307/AL308 ø 167 mm)

**Accessories**

Bearing, installation bracket, prefabricated cable (specify length) with connector (straight or right-angle)

## 4 Installation

### 4.1 Installation conditions

The Force Measuring Roller are defined as “partly completed machinery” according to the Directives 2006/42/EC, article 2. In order to assure a proper functionality of the parts and assure the essential safety requirements of operators working with it, the following conditions for the assembly must be met:



The Force Measuring Rollers may not be stressed over the specification limits neither during assembly nor operation. The unit's overload protection value may not be exceeded.



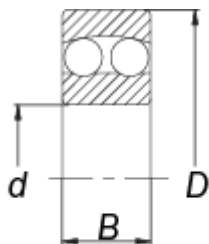
The mounting points for the Force Measuring Rollers on the machine frame must be properly designed. The bearings need to be appropriately mounted.



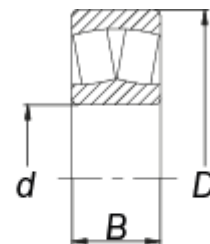
For proper installation and operation, follow the electrical wiring diagram and instructions in this manual.

### 4.2 Bearings

We recommend the use of self-aligning ball bearings or spherical roller bearings.



**Bauart 1 Pendelkugellager**  
type 1 self-aligning ball bearing



**Bauart 2 Pendelrollenlager**  
type 2 spherical roller bearing

**Figure 3: bearing types**

*AL\_BA\_Manual.ai*

AL-Series : Possible bearing types, available as accessories					
Size	Bearing	d Shaft diameter mm (in.)		D Outer diameter bearing mm (in.)	
AL 203(.C01)	1203	17	(0.67)	40	(1.57)
AL 204(.C01)	1304	20	(0.79)	52	(2.05)
AL 205(.C01)	1205	25	(0.98)	52	(2.05)
AL 307(.C01/02/03)	1307	35	(1.38)	80	(3.15)
AL 308(.C01/02/03)	1208	40	(1.57)	80	(3.15)
					b2
					12 (0.47)
					15 (0.59)
					15 (0.59)
					21 (0.83)
					18 <sup>1)</sup> (0.71)

1) distance ring, in scope

Figure 4: Sizes and bearing dimensions

Datasheet\_AL\_series.indd

### 4.3 Shaft ends

The shaft ends which receive the inner rings of the rolling bearings must be manufactured as follows.

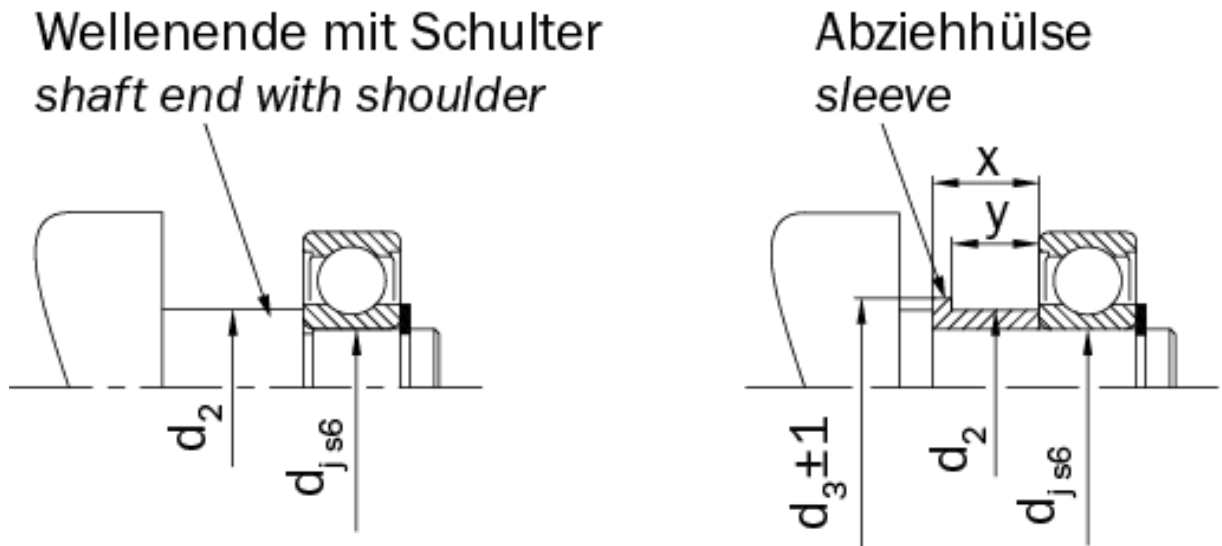


Figure 5: shaft end

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Dimensions machine frame 3-bores (in mm)			
Size	$d_j$	$d_2$	$d_3$
AL203	17	22	32
AL204	20	31	41
AL205	25	31	41
AL307	35	44	60
AL308	40	48	60

The sleeve ensures that the occurring force during the removal of the bearing is only applied to the inner ring of the bearing. The sleeve is not included in the scope of delivery.

If a shaft with shoulder is used, the rolling bearing may be damaged while removing it from the shaft. In that case, a new rolling bearing must be used after each removal.

### 4.4 Machine frame

The force sensors are centered with a pilot in the machine frame. 4 threaded bore are required for each force sensor.

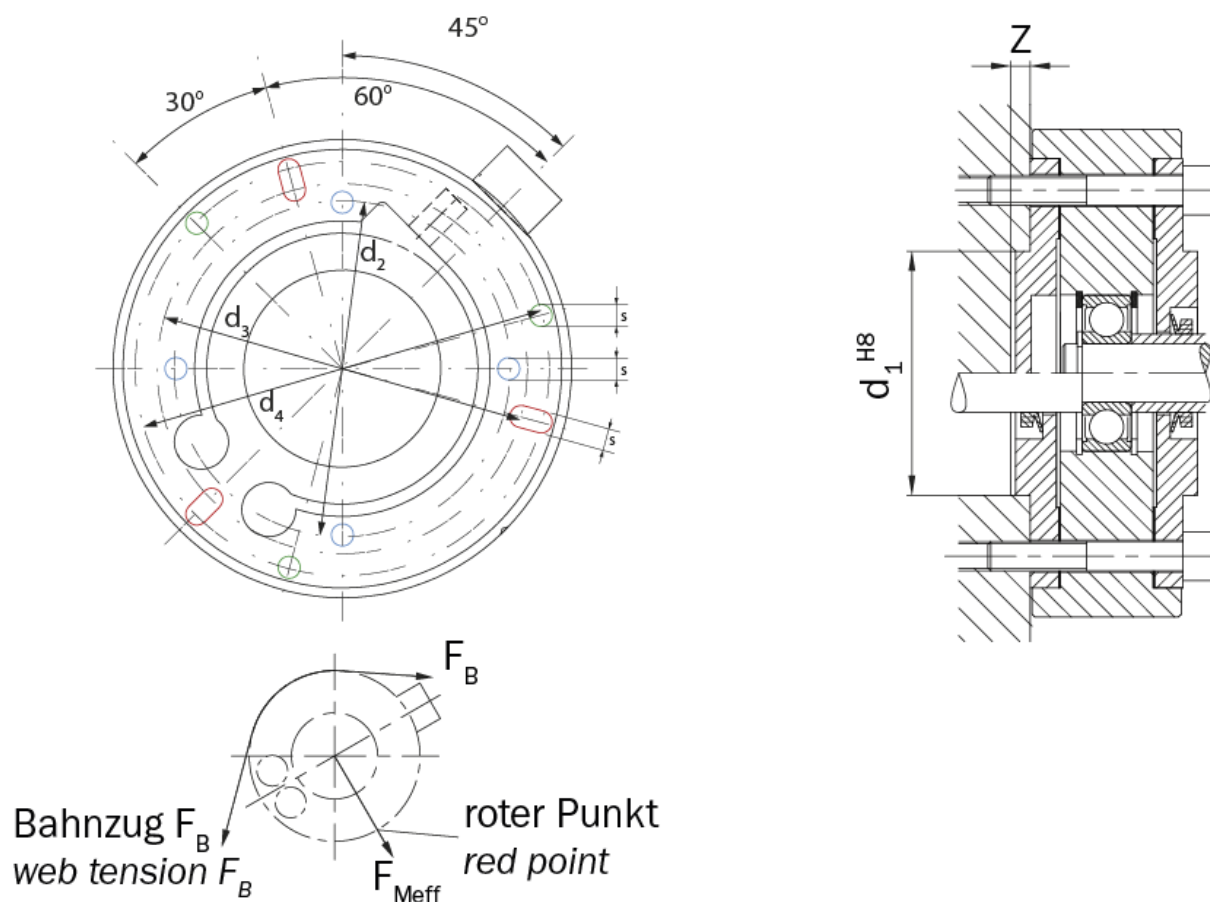


Figure 6: dimensions machine frame

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Dimensions machine frame 4-bore in mm (in.)					
Baugrösse	$d_j$	$d_1$	4-bore $d_2$	s	Z min.
AL203	17	60	75	6.6	2.5
AL204	20	70	95	6.6	3
AL205	25	70	95	9	4
AL307	35	100	135	9	4
AL308	40	100	135	9	4

Table 1: dimensions machine frame 4-bore

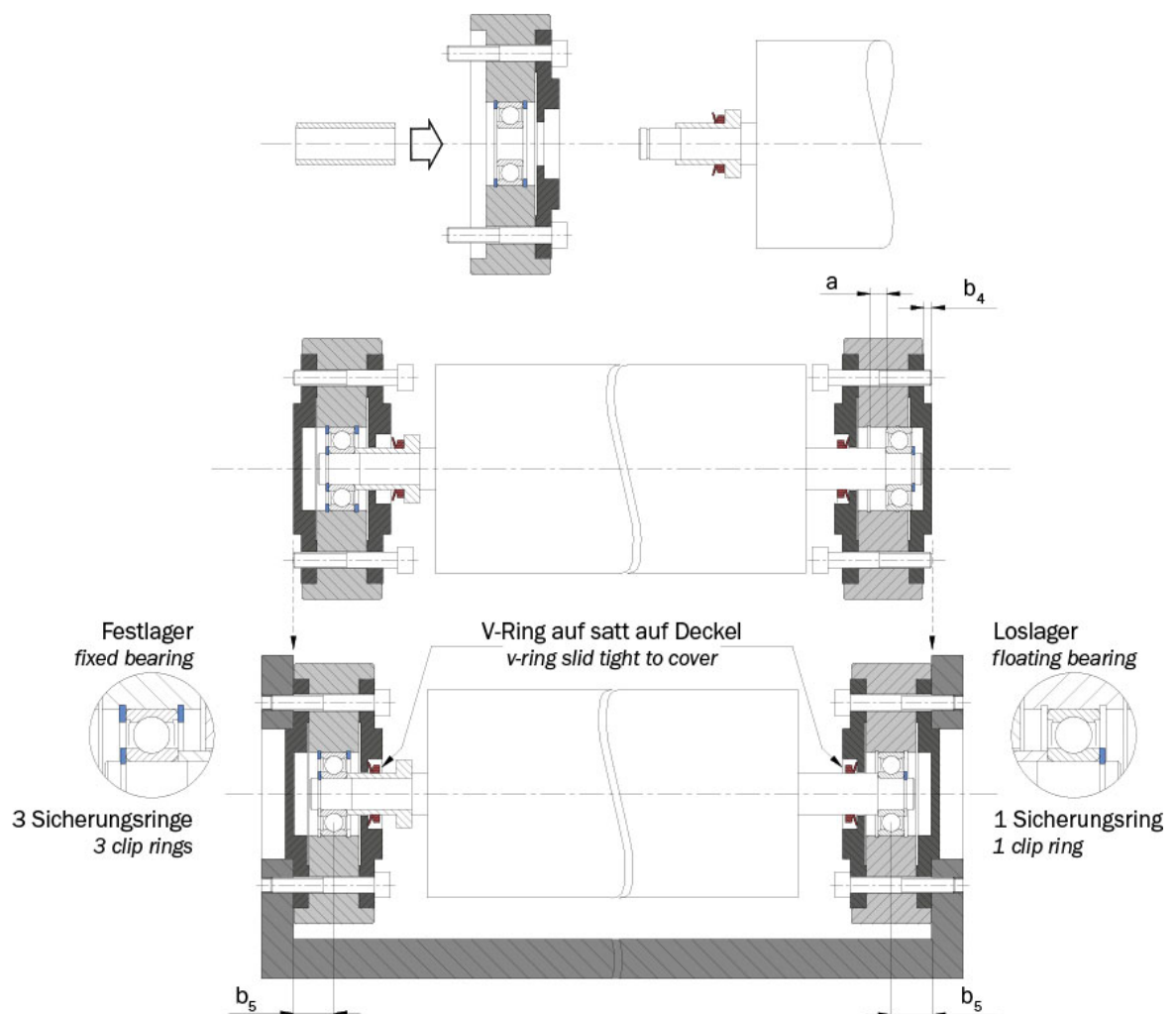
Dimensions machine frame 3-bore in mm (in.)						
Baugrösse	$d_j$	$d_1$	3-bore $d_3$	3-bore $d_4$	S	Z min.
AL203.C01	17	60	90		6.6	2.5
AL204.C01	20	70	105		6.6	3
AL205.C01	25	70	105		6.6	3
AL307.C01	35	100	150		9	4

AL307.C02	35	100		155	9	4
AL307.C03	35	100		167	9	4
AL308.C01	40	100	150		9	4
AL308.C02	40	100		155	9	4
AL308.C03	40	100		167	9	4

**Table 2: dimensions machine frame 3-bore**

The option C03 offers another 30° offset installation orientation.

## 4.5 Installation inside



**Figure 7: Installation inside**

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### Fixed bearing

- Clean the shaft, check tolerance and cylindric shape of the bearing seat.
- Slide sleeve with v-ring onto to the shaft or slide v-ring onto the shaft end.
- Check for correct orientation of the sealing lip.
- Remove both covers from the force sensor.

- Insert bearing into the force sensor.
- Fixate bearing by installing 2 clip rings on each side of the bearing. The second clip ring can be taken from the force sensor of the floating bearing.
- Set open cover and paper seal into the correct side of the force sensor, so that the orientation of red point and connector correspond to the required installation position.
- Insert screws into the force sensor.
- Press the bearing with force sensor onto the shaft. The force should only be applied to the inner ring of the bearing. Use a short length of mild steel tube as tool.
- Fixate the bearing to the shaft with a clip ring.
- Mount closed cover and paper seal to the force sensor.
- Fasten the covers and the force sensor with the mounting screws.

#### Floating bearing

- Clean the shaft; check tolerance and cylindric shape of the bearing seat
- Slide sleeve with v-ring onto to the shaft or slide v-ring onto the shaft end.
- Check for correct orientation of the sealing lip.
- Remove both covers from the force sensor.
- Remove clip ring from the force sensor. Insert bearing loosely into force sensor.
- Set open cover and paper seal into the correct side of the force sensor, so that the orientation of red point and connector correspond to the required installation position.
- Insert screws into the force sensor.
- Press the bearing with force sensor onto the shaft. The force should only be applied to the inner ring of the bearing. Use a short length of mild steel tube as tool.
- Fixate the bearing to the shaft with a clip ring.
- Types with overload protection with pins: Insert 2 straight pins into force sensor.
- Mount closed cover and paper seal to the force sensor.
- Fasten the covers and the force sensor with the mounting screws.

#### Inserting the roll in the machine frame

- Slide floating force sensor towards the roll as far as possible
- Insert roll with force sensors into the machine frame.
- Align fixed bearing force sensor in regards of the orientation of the red point and place shoulder into the pilot.
- Tighten screws.
- Align floating bearing force sensor in regards of the orientation of the red point and place shoulder into the pilot.
- Tighten screws.
- Check for free spinning roll.
- Slide the two v-rings tight to the opened covers.

## 4.6 Installation Outside

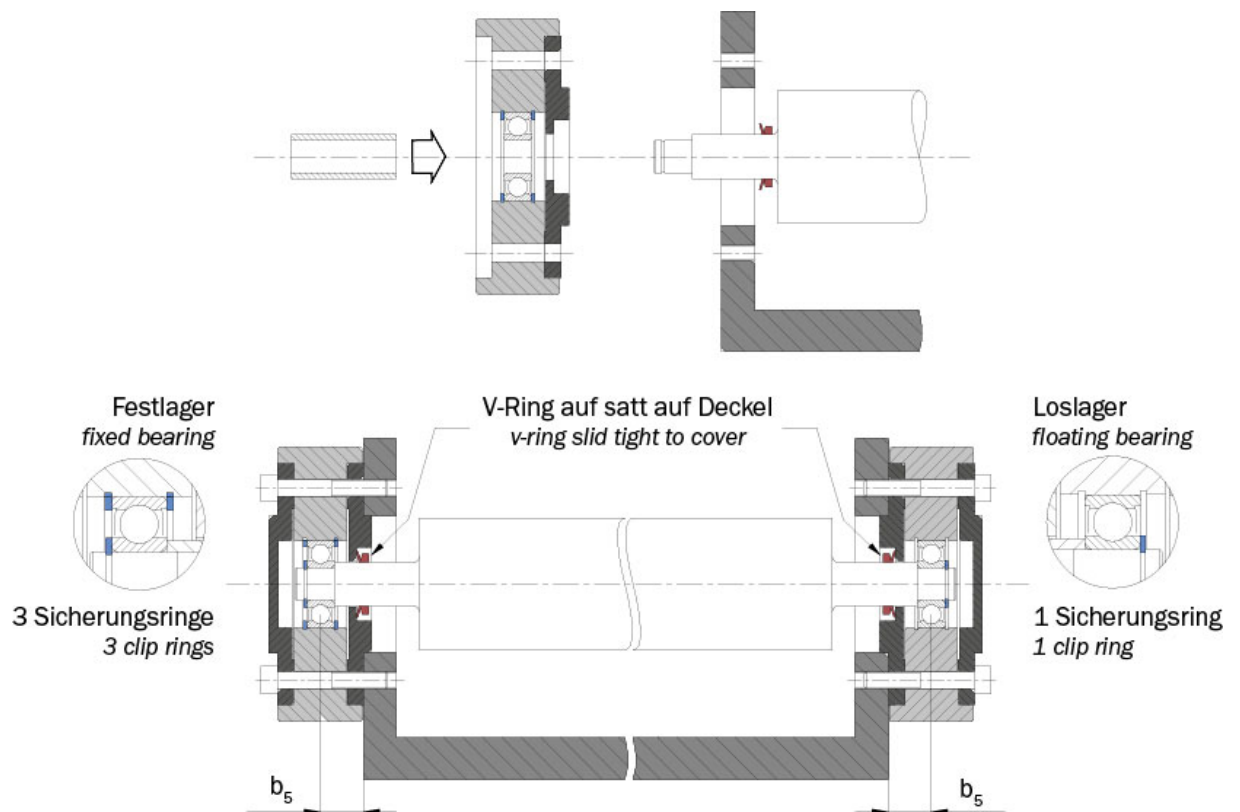


Figure 8: Installation outside

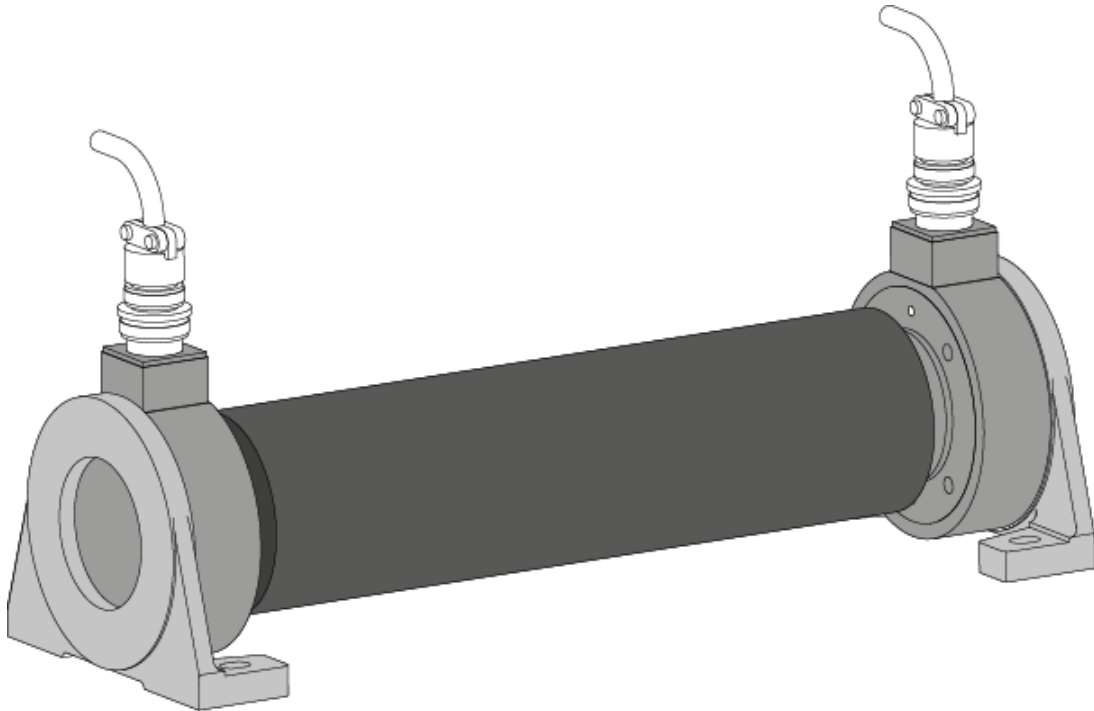
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First, place the roll in the machine frame and shift it at the appropriate position.

The other installation steps are similar to the installation inside.

## 4.7 Mounting brackets

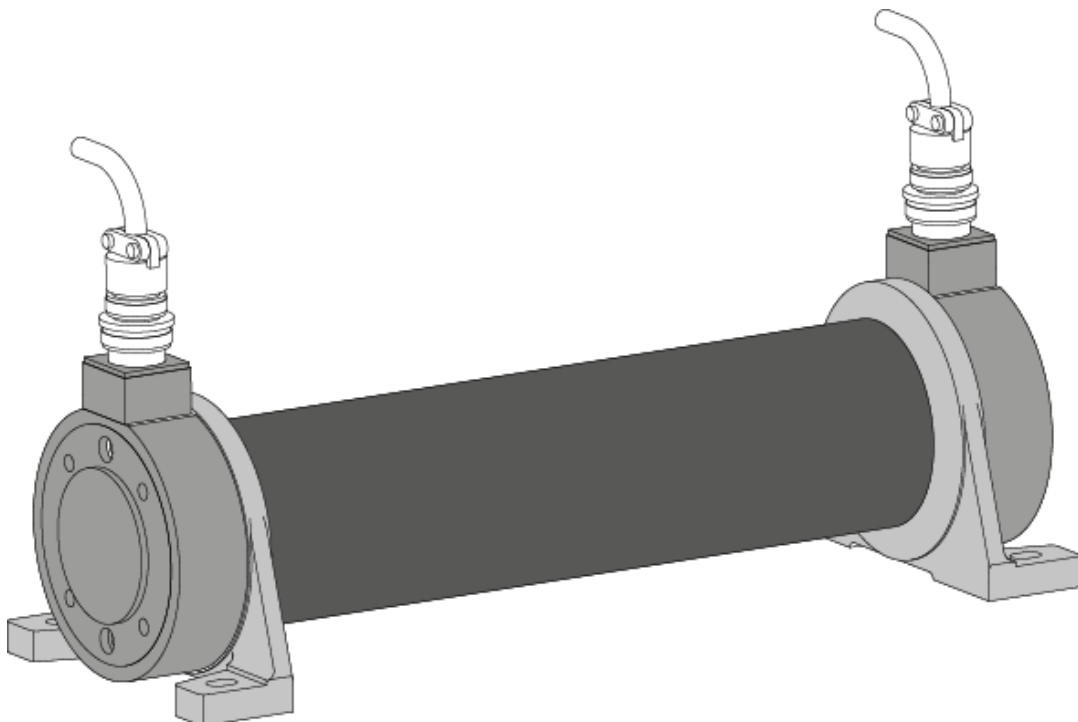
Mounting brackets GMGZ are available as accessories for the AL-series.



**Figure 9: bracket installation inside**

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- The force sensors are mounted to the roll as described earlier
- The brackets are mounted to the force sensors with screws
- The complete assembly is installed on the machine frame.



**Figure 10: bracket installation outside**

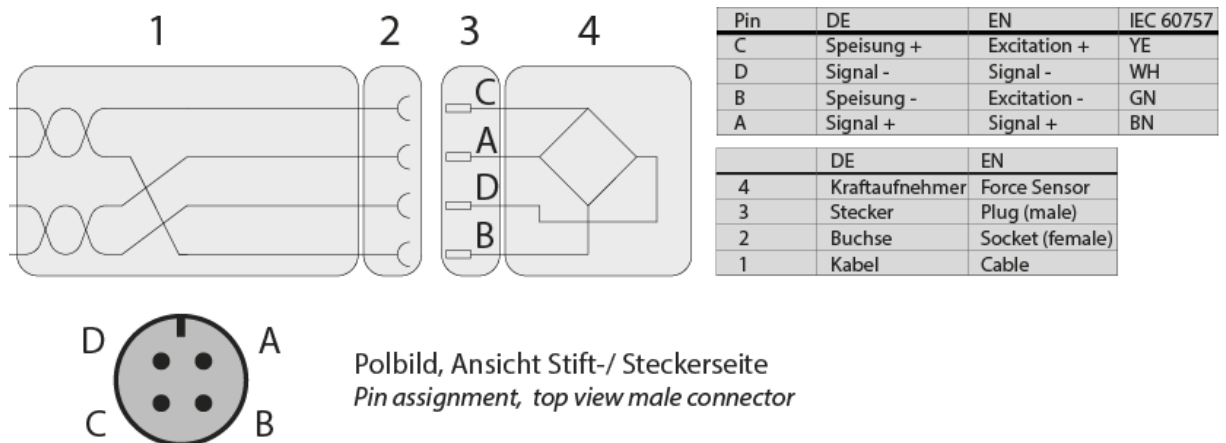
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- Slide the brackets onto the roll
- The force sensors are mounted to the roll as described earlier
- The brackets are mounted to the force sensors with screws
- The completely assembly is installed on the machine frame.

## 4.8 Electrical connections

Connection between force sensor and measuring amplifier is realized by means of a 2 x 2 x 0.25mm<sup>2</sup> shielded, twisted-pair cable. The cable must be installed separate from power lines.

Connect the shielding only on the side of the measuring amplifier.



Farbangaben (IEC60757) und Codierung gelten nur für FMS Komponenten!  
 Color scheme (IEC60757) and pin codes are valid for FMS components, only!

**Figure 11: pin assignment Amphenol 4-pole**

**Pin\_Assignment\_Sensorkabel\_Farben\_Stecker.ai**

## 5 Maintenance

FMS force sensors are maintenance free. Depending on the applied type of bearing, it may be necessary to re-lubricate them.

Therefore, the closed covers have to be removed.

If the force sensors are installed inside, the complete roll has to be removed from the machine to access the closed covers.

## 6 Technical data

Technical data	
Sensitivity	1.8 mV/ V
Tolerance of sensitivity	< $\pm 2 \%$
Accuracy class	$\pm 0.5 \%$ ( $F_{\text{Nenn}}$ )
Measuring range	30:1
Temperature coefficient	$\pm 0.1 \%$ / 10 K
Temperature	-10 bis +60 °C
Protection rating	IP42
Input resistance	350 $\Omega$
Power supply	1 bis 7 VDC
Overload protection	10-fache Nennkraft
Max. axial load	20 % Nennmesskraft
Material	Hochfestes Aluminium
Electrical connection	Flanschstecker Amphenol, 4-polig

**Table 3: technical data**

AL-Series : Nominal forces, Deflection, Weight				
Size Type	Nominal force N, kN (lbf.)	Deflection mm (in.)	Weight kg (.lbs)	
AL203	50, 125, 250, 500, 1000 (11, 28, 56, 112, 225)	0.15 (0.0059)	0.85 (1.87)	
AL204	125, 200, 375, 750, 1500 (28, 45, 84, 169, 337)	0.2 (0.0079)	1.25 (2.76)	
AL205	125, 200, 375, 750, 1500 (28, 45, 84, 169, 337)	0.2 (0.0079)	1.25 (2.76)	
AL307	375, 750, 1500, 3000 (84, 169, 337, 674)	0.2 (0.0079)	3.75 (8.27)	
AL308	375, 750, 1500, 3000 (84, 169, 337, 674)	0.2 (0.0079)	3.75 (8.27)	

**Figure 12: technical data**

**Datasheet\_AL\_series.indd**

## 7 Dimensions

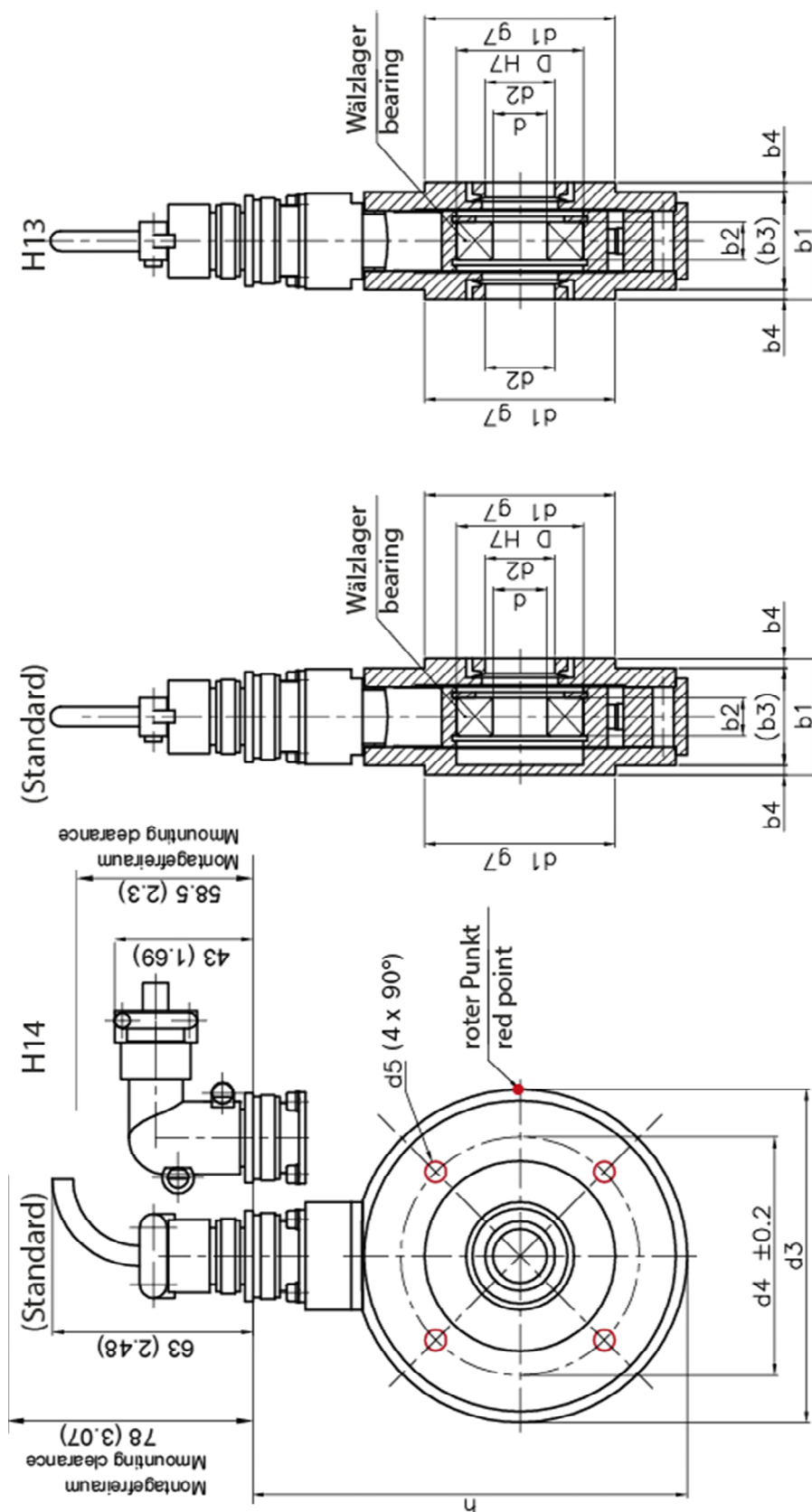


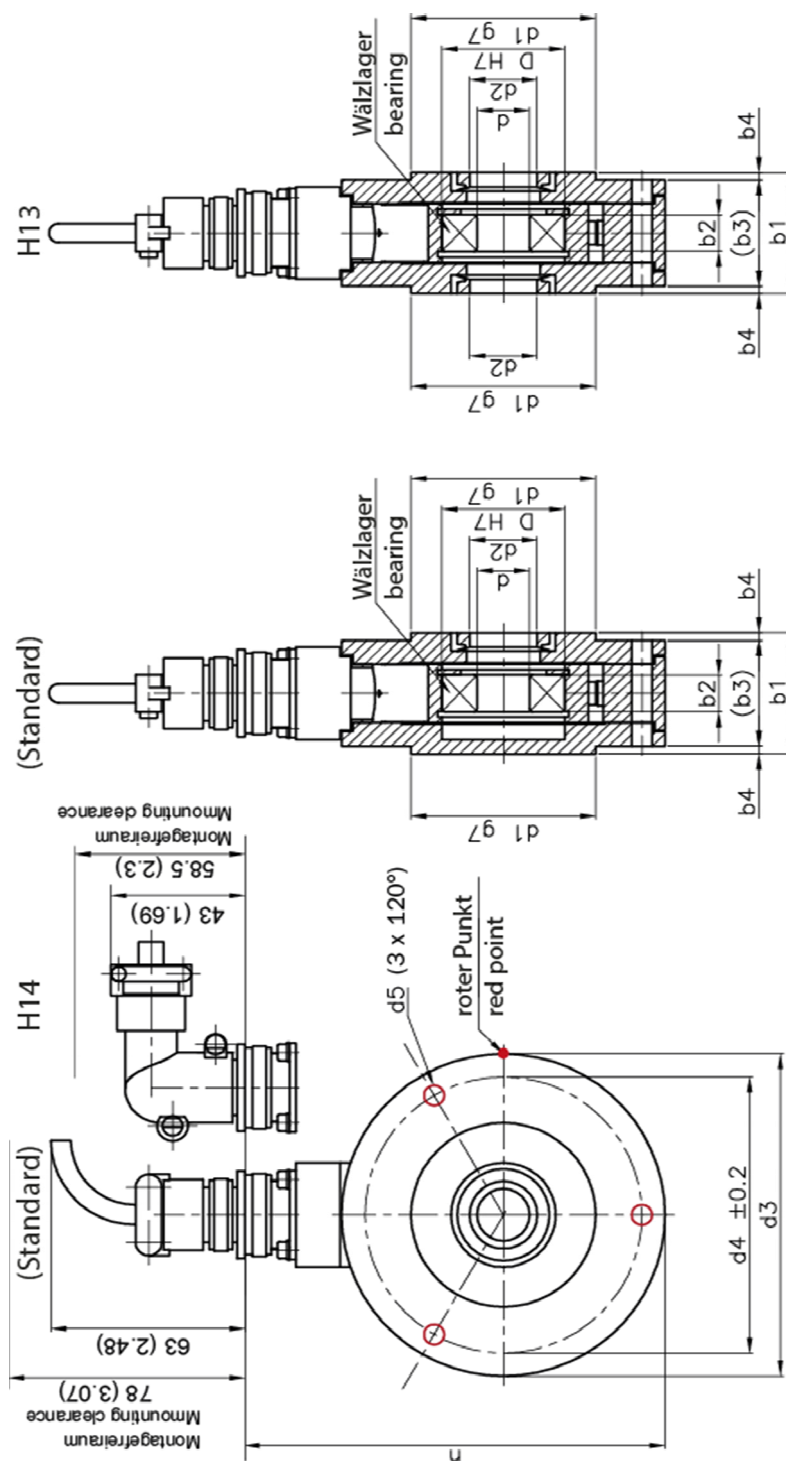
Figure 13: dimensions, 4-bore

AL\_BA\_Manual.ai

AL-Series : Dimensions 4-hole pitch circle in mm (in.)										
Size	d1	d2	d3	d4	d5	b1	b2	b3	b4	h
AL203	60 (2.36)	22 (0.87)	105 (4.13)	75 (2.95)	6.6 (0.26)	37 (1.46)	12 (0.47)	30.7 (1.21)	3 (0.12)	137 (5.39)
AL204/205	70 (2.76)	32 (1.26)	125 (4.92)	95 (3.74)	6.6 (0.26)	48 (1.89)	15 (0.59)	40 (1.57)	4 (0.15)	157 (6.18)
AL307	100 (3.94)	45 (1.77)	186 (7.32)	135 (5.31)	9.0 (0.35)	66 (2.60)	21 (0.83)	58 (2.28)	4 (0.15)	219 (8.62)
AL308	100 (3.94)	50 (1.97)	186 (7.32)	135 (5.31)	9.0 (0.35)	66 (2.60)	18 (0.71)	58 (2.28)	4 (0.15)	219 (8.62)

**Figure 14: dimensions, 4-bore**

**Datasheet\_AL\_series.indd**



**Figure 15: dimensions, 3-bore**

***AL\_BA\_Manual.ai***

<b>AL-Series : Dimensions 3-hole pitch circle (C-option) in mm (in.)</b>										
Size	d1	d2	d3	d4	d5	b1	b2	b3	b4	h
<b>AL203.C01</b>	60 (2.36)	22 (0.87)	105 (4.13)	90 (3.53)	6.6 (0.26)	39.5 (1.56)	12 (0.47)	34.5 (1.36)	2.5 (0.10)	137 (5.39)
<b>AL204.C01</b> <b>AL205.C01</b>	70 (2.76)	32 (1.26)	125 (4.92)	105 (4.13)	6.6 (0.26)	48 (1.89)	15 (0.59)	42 (1.63)	3 (0.12)	157 (6.18)
<b>AL307.C01</b> <b>AL308.C01</b>	100 (3.94)	45 (1.77) 50 (1.97)	186 (7.32)	150 (5.90)	9.0 (0.35)	68 (2.68)	21 (0.83) 18 (0.71)	60 (2.36)	4 (0.15)	219 (8.62)
<b>AL307.C02</b> <b>AL308.C02</b>	100 (3.94)	45 (1.77) 50 (1.97)	186 (7.32)	155 (6.10)	9.0 (0.35)	68 (2.68)	21 (0.83) 18 (0.71)	60 (2.36)	4 (0.15)	219 (8.62)
<b>AL307.C03</b> <b>AL308.C03</b>	100 (3.94)	45 (1.77) 50 (1.97)	186 (7.32)	167 (6.57)	9.0 (0.35)	68 (2.68)	21 (0.83) 18 (0.71)	60 (2.36)	4 (0.15)	219 (8.62)

Figure 16: dimensions, 3-bore

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