

Description B

Load cell PD 25.., PD 26..

EN

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1. Safety instructions

1.1 Documentation

Keep this documentation in a safe place and accessible for the personnel at all times.

The documentation is part of the scope of delivery and must be read carefully prior to starting assembly, operation or maintenance work.

Proceed in accordance with the instructions in the documentation.

The documentation can comprise the higher level system description (A), the individual descriptions of the components (B, C, ... W), spare part lists (X), block diagrams and the wiring diagrams (Z). The documentation for systems planned includes a project-related system description (KDN).

All important processes are described in the system description. Where necessary, reference is made to the descriptions of the individual components.

In the block diagram you will find a schematic illustration of your system. The block diagram for systems planned also includes the address settings.

See "www.erhardt-leimer.com" for details.

1.2 Intended use

The load cell may only be used for the measurement of web tensions on moving webs.

The load cell is only allowed to be installed in the customer's machine as defined by E+L.

The load cell is not allowed to be modified.

The load cell is built to the state-of-the-art.

Despite this, during use of the device

- hazards for the user's health or
- damage to property may occur.

Only use the load cell

- if in perfect working order,
- paying due attention to safety and hazards while observing the locally applicable, statutory and customary safety regulations as well as the regulations for the prevention of accidents.

1.3 User groups

All the activities in this description are only allowed to be undertaken by the user groups listed in the following with the stated qualifications.

Activities	User groups	Qualification
Transport/assembly, commissioning, troubleshooting/repair, maintenance, disassembly	Specialist personnel	Technicians, industrial mechanics, fitters etc.
Installation, disassembly	Specialist personnel	Electrical connection only by electricians
Operation	Specialist personnel, unskilled personnel, trainees	Instruction by the operating organization

1.4 Explanation of symbols

DANGER!

Signifies that death or serious injury will occur immediately if the related safety measure is not taken.

WARNING!

Signifies that death or serious injury may occur if the related safety measure is not taken.

CAUTION!

Signifies that minor injury may occur if the related safety measure is not taken.

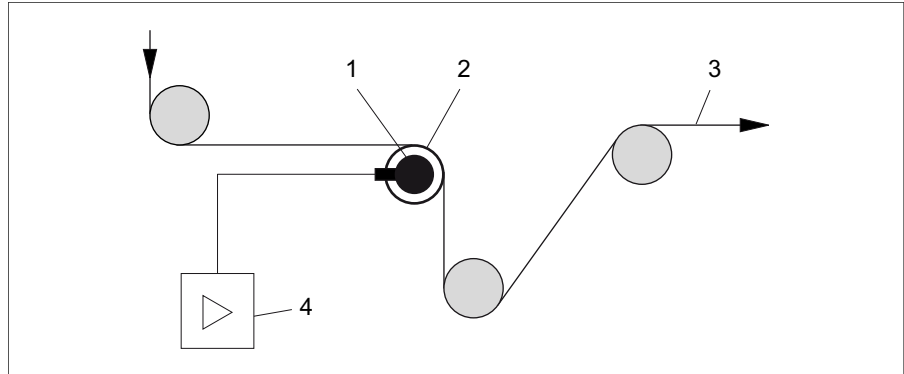
NOTICE

Signifies that a malfunction or damage may occur if the related measure is not taken.

► Jobs to be performed.

2. Function

2.1 Purpose

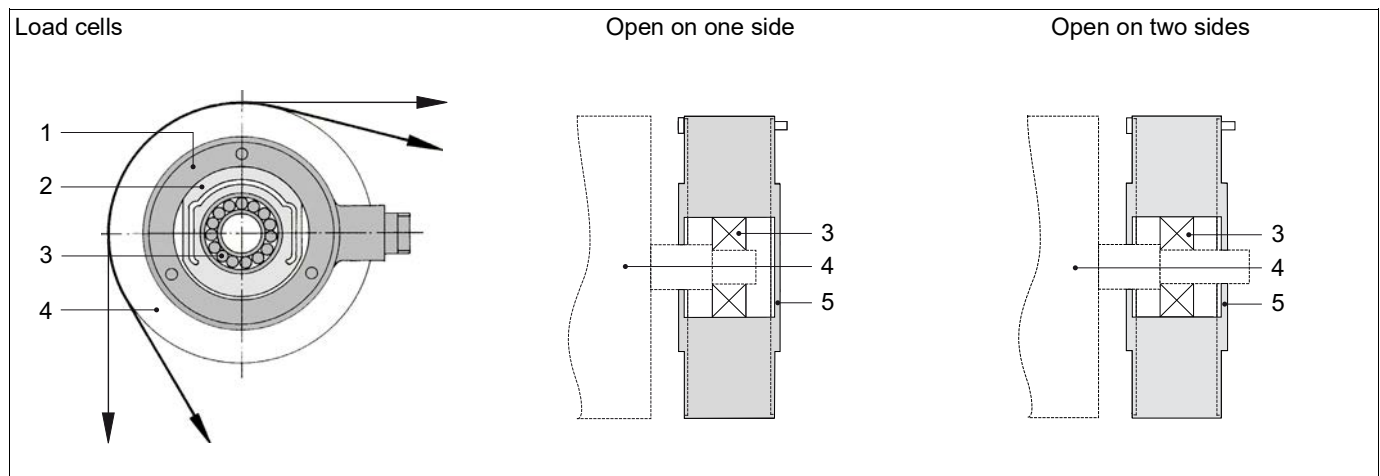


The load cell (1) measures the radial forces exercised by the web (3) in the measuring direction on a measuring roller (2). The web should wrap around the measuring roller between 60° and 180°.

The force can be measured using one or two load cells.

An amplifier (4) evaluates the signals.

2.2 Design



- 1 Outer ring
- 2 Inner ring
- 3 Self-aligning ball bearing

- 4 Measuring roller
- 5 Flange lid

The load cell consists of an outer ring, an inner ring and two flanges. The centering rings on both the flanges enable the load cells to be mounted exactly.

The measuring roller's ball bearing fits into the inner ring. The inner ring is also the measuring element: a double bending beam on which strain gauges, in the form of a full electrical bridge, are mounted.

Mechanical limits protect the load cell against overload. See chapter "Technical data".

The load cell

- PD 25.. is open on one side. Only one flange has a bore, the measuring roller's axle extends to the inner ring.
- PD 26.. is open on two sides. The measuring roller's axle extends through both flanges.

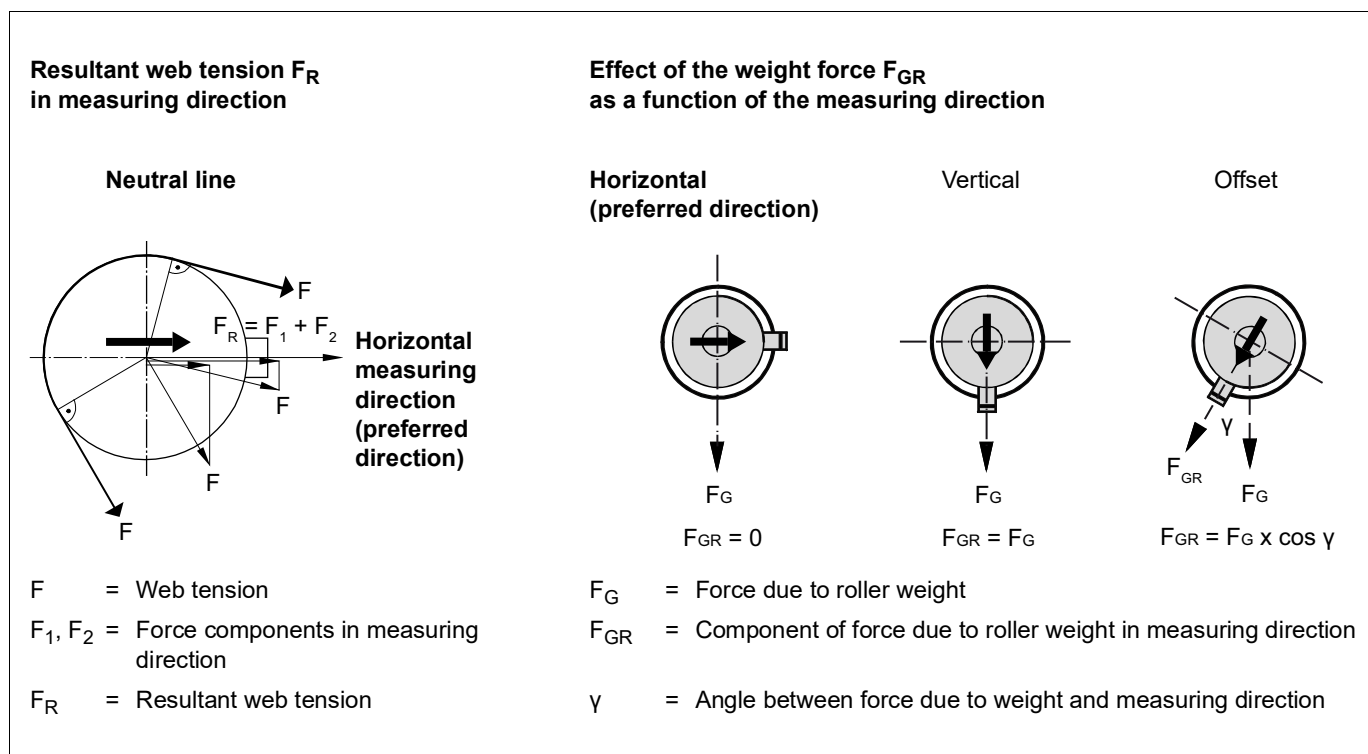
The third and fourth digit of the load cell identifier indicate the axle/shaft diameter and correspond to the inside diameter of the ball bearing.

2.3 Principle of operation

A stabilized DC voltage from the amplifier feeds the load cell's strain gauges connected in a full bridge. The action of the web tension produces a resistance change and as result a change in the electrical output signal from the load cell. The change is proportional to the web tension.

As necessary the output signals from the load cells can be evaluated separately or the arithmetic mean formed by connecting them in parallel.

2.4 Measuring principle



The measuring principle of the load cell is based on determining the radially aligned bearing forces on a measuring roller around which a web is wrapped.

Only the force components F_1 and F_2 acting in the measuring direction of the load cell are relevant for the measurement. The resultant web tension F_R is given by the sum of the two force components.

The connector on the load cell points in the measuring direction.

NOTICE

Forces perpendicular to the horizontal preferred direction are not measured.

If the measuring direction is not in the horizontal preferred direction, the force component F_{GR} due to the weight force F_G must be taken into account.

The higher the weight proportion of the roller, the smaller the load cell measuring range left for the measurement.

2.5 Calculation of resulting web tension

- Determine wrap angle.

Always aim for a wrap angle of 90° .

- Define measuring direction.

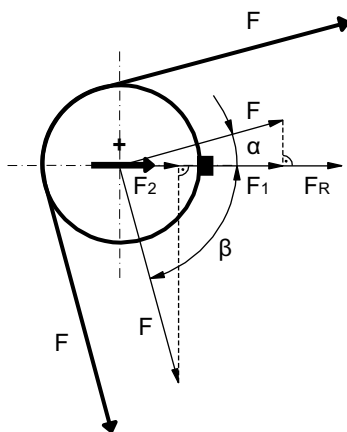
Always try to achieve a **horizontal measuring direction** as this ensures the roller weight is neutralized and thus has no effect on the load cell.

- Calculate resulting web tension.

You can undertake calculations for the load cell using our free program "**ELTENS-Calculator**". See "www.erhardt-leimer.com".

Calculation examples

Resultant web tension with
horizontal measuring direction

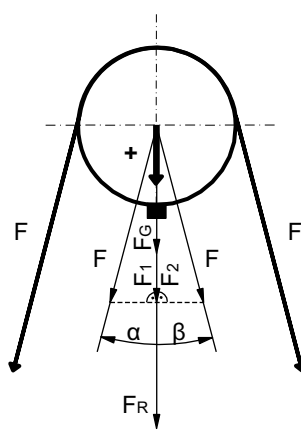


$$F_1 = F \cdot \cos \alpha$$

$$F_2 = F \cdot \cos \beta$$

$$F_{R/K} = \frac{F_1 + F_2}{2}$$

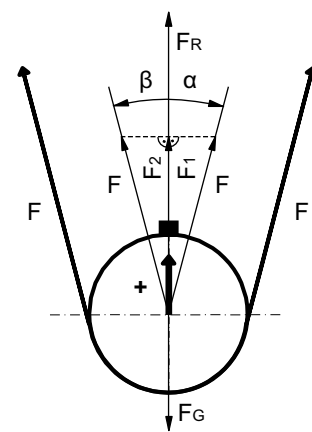
Resultant web tension with **vertical measuring direction**



$$F_1 = F \cdot \cos \alpha$$

$$F_2 = F \cdot \cos \beta$$

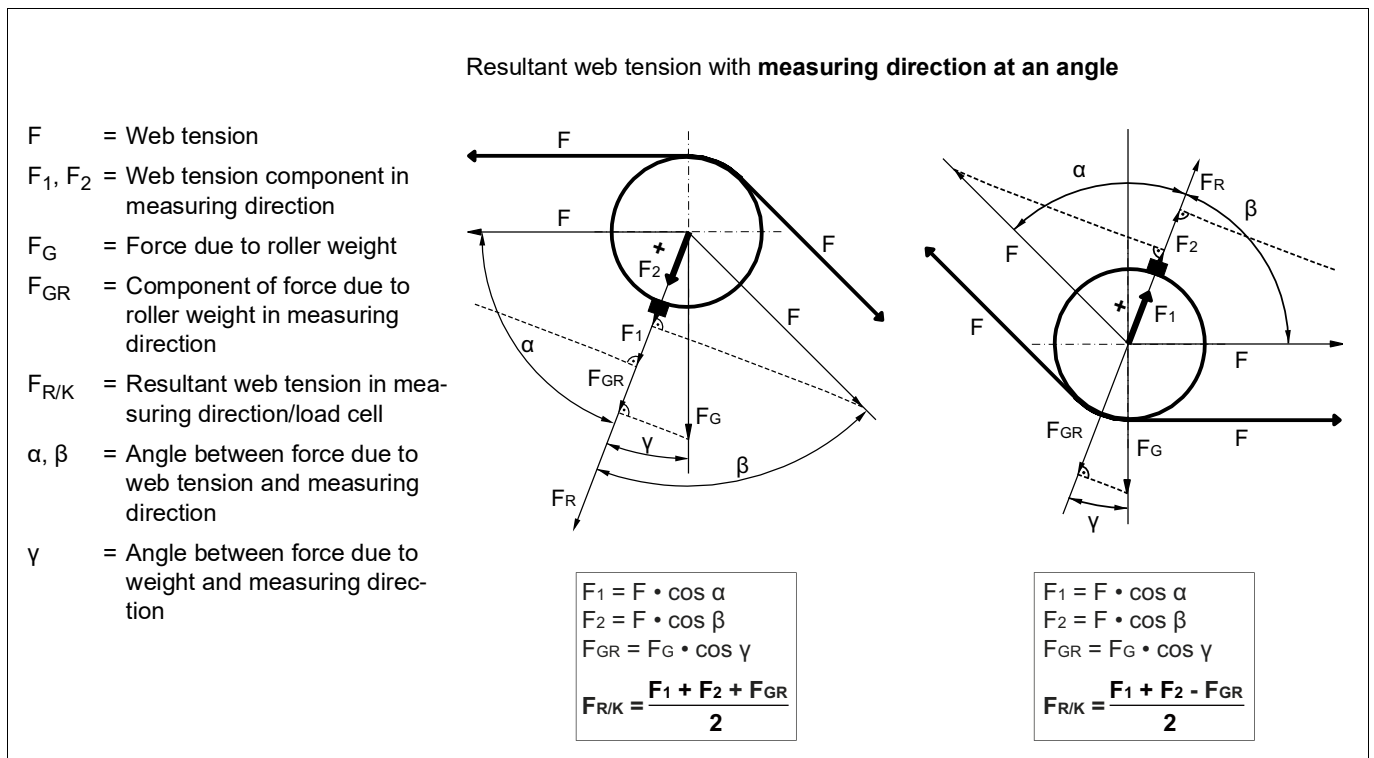
$$F_{R/K} = \frac{F_1 + F_2 + F_G}{2}$$



$$F_1 = F \cdot \cos \alpha$$

$$F_2 = F \cdot \cos \beta$$

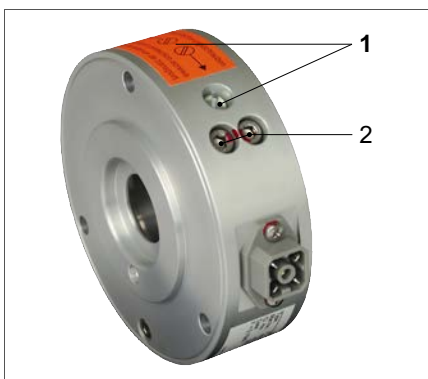
$$F_{R/K} = \frac{F_1 + F_2 - F_G}{2}$$



3. Transport

- ▶ Only transport load cell in the original packaging.
- ▶ Observe the transport instructions on the original packaging.
- ▶ Dispose of packaging material correctly.
- ▶ Check load cell for damage.

The load cell is secured for transport using two long transport screws (1). These two screws secure the measuring ring inside the load cell and thus protect it against knocks during transportation.



NOTICE

The transport screws must be replaced with the fastening screws supplied as accessories at the latest prior to commissioning. Otherwise it will not be possible to measure the web tension.

Do not open the screws (2) marked with red paint.

- ▶ See chapter "Assembly".

NOTICE

The transport lock must be used each time the load cell is transported. This statement also applies if the load cell is in a machine and the machine is transported. No liability is accepted for any damage during transport without the transport lock.

4. Assembly

4.1 Accessory kits for mounting

E+L supply all the necessary parts for mounting the load cell in the form of accessory kits. An accessory kit contains the parts for **one** load cell. The accessory kits consists of:

Type PD	Open on one side				Open on two sides	
	1	2	3	4	5	6
Steel accessory kits (consisting:)						
1 self-aligning ball bearing	x	x	x	x	x	x
1 locking ring / shaft	x	x	x	x		
2 locking rings / bore	x	x	x	x	x	x
1 distance sleeve		x		x	x	
2 distance sleeves						x
1 set collar		x			x	
2 set collars						x
1 rotary locking ring			x	x		

The accessory kits differ according to:

- roller axle type (continuous or offset),
- roller bearings (inner or outer mounted),
- roller side (moveable or fixed bearing side),
- axle/shaft diameter.

Accessory kits for load cells open on **one side** and rollers with **inner mounting**:

	Moveable bearing side	Fixed bearing side
 Offset axle	Accessory kit 1*	Accessory kit 3
 Continuous axle	Accessory kit 2*	Accessory kit 4

Accessory kits for load cells open on **one side** and rollers with **outer mounting**:

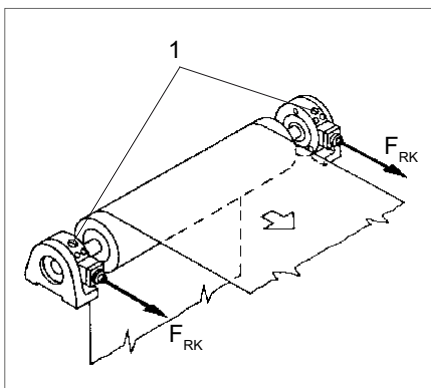
	Moveable bearing side	Fixed bearing side
 Offset shaft	Accessory kit 1*	Accessory kit 1
 Continuous shaft	Accessory kit 2*	Accessory kit 2

Accessory kits for load cells open on **two sides** and rollers with **outer mounting**:

	Moveable bearing side	Fixed bearing side
 Offset shaft	Accessory kit 5	Accessory kit 5
 Continuous shaft	Accessory kit 6	Accessory kit 6

**NOTICE**

* The accessory kits 1 and 2 contain locking rings for the bore hole and the shaft. The locking rings for the bore hole (DIN 471) must **not** be mounted on the moveable bearing side. It must be possible to move the outer ring of the self-aligning ball bearing on the movable bearing side by hand.

4.2 Application notes

- During mounting, take into account the measuring direction of the load cell as per the planning/calculation.
- Observe the dimension drawings.
- If the mounting position is horizontal, the transport screws (1) should point upwards, see figure alongside.
- Protect load cell against coarse soiling and moisture.

4.3 Load cell mounting**NOTICE**

During mounting it is to be ensured that no mechanical stress is produced. Mechanical stress will affect the function of the load cell and, in extreme cases, can result in damage!

- ▶ Clean the journal on the measuring roller and check the dimensions.
- ▶ Support measuring roller.
- ▶ Lubricate self-aligning ball bearings.

Lubricant recommendation: The most suitable lubricant for lubrication has the designation K 2 K, temperature range from -35 °C to +135 °C (in accordance with DIN 51 502).

4.3.1 Load cell, fixed bearing side**NOTICE**

Improper mounting of the self-aligning ball bearings can permanently deform the inner ring of the load cell. This can lead to a lasting zero point shift and incorrect measurements.

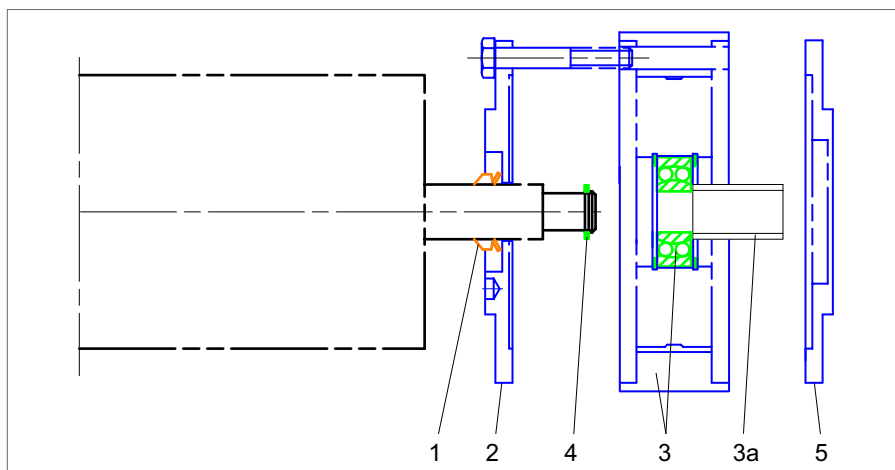
- ▶ Dismantle both flange lids.
- ▶ Mount the first securing ring for the bore hole in the load cell.

Fig. 4-1 Example



- Lay the load cell with the inner ring on a round piece of material. See figure on the left.
The load cell may **not** rest on the outer ring.
- Press the self-aligning ball bearing in properly. See figure on the left.
- Mount the second securing ring for the bore hole in the load cell.
- Mount the load cell on the axis of the measuring roller according to the dimension drawings and application information.

Example: Mounting with accessory set 1



- | | | | |
|---|---|----|---------------|
| 1 | Sealing ring | 3a | Pressing tool |
| 2 | Flange lid | 4 | Locking ring |
| 3 | Load cell with self-aligning ball bearing | 5 | Flange lid |

- Push sealing ring (1) onto the axle/shaft.
- Push flange lid (2) with the fastening screws onto the axle/shaft.
- Press the load cell (3) with the pre-mounted self-aligning bearing onto the axle/shaft correctly using a pressing tool (3a).
- Mount the securing ring (4) on the axle/shaft.
- Mount the flange lid (2, 5) on the load cell.
- Move the sealing ring (1) until it is up against the open flange.

4.3.2 Load cell, moveable bearing

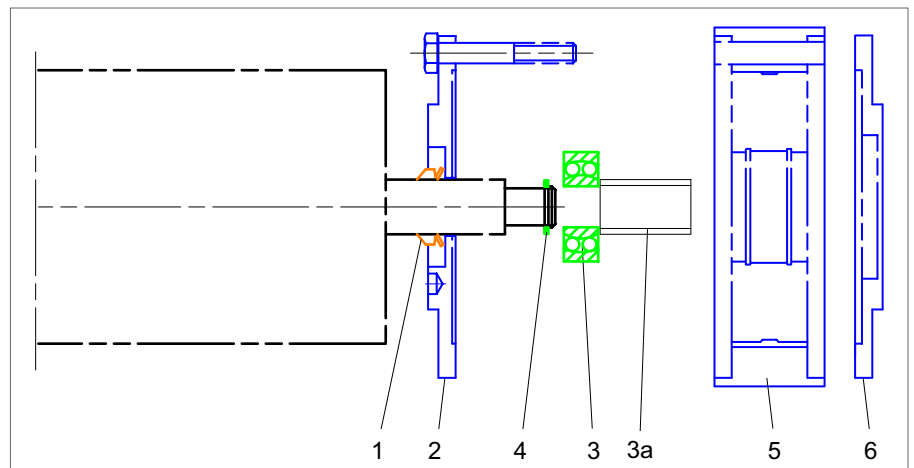
NOTICE

The locking rings for the bore in the load cell inner ring must **not** be mounted on the moveable bearing side.

On the moveable bearing side, it must be possible to move the self-aligning ball bearing in the inner ring of the load cell by hand.

- ▶ Dismantle both flange lids.
- ▶ Measure the inner ring of the load cell and grind as necessary.
- ▶ Mount the load cell on the axis of the measuring roller according to the dimension drawings and application information.

Example: Mounting with accessory set 1



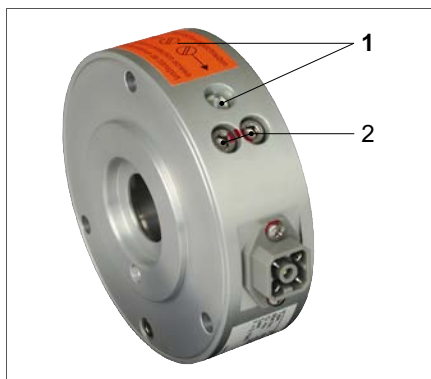
- | | |
|------------------------------|----------------|
| 1 Sealing ring | 4 Locking ring |
| 2 Flange lid | 5 Load cells |
| 3 Self-aligning ball bearing | 6 Flange lid |
| 3a Pressing tool | |

- ▶ Push sealing ring (1) onto the axle/shaft.
- ▶ Push flange lid (2) with the fastening screws onto the axle/shaft.
- ▶ Press the self-aligning ball bearing (3) onto the axle/shaft correctly using the pressing tool (3a)
- ▶ Mount the securing ring (4) on the axle/shaft.
- ▶ Push the load cell (3) onto the self-aligning ball bearing correctly.
- ▶ Mount the flange lid (2, 5) on the load cell.
- ▶ Move the sealing ring (1) until it is up against the flange lid (2).

4.4 Mounting the measuring roller

- ▶ Install the measuring roller with its load cells in the machine.

4.5 Removing transport lock



The load cell is secured for transport using two long transport screws (1). These two screws secure the measuring ring inside the load cell and thus protect it against knocks during transportation.

NOTICE

Do not open the screws (2) marked with red paint.

- ▶ Replace transport screws (1) with the fastening screws supplied as accessories.
- ▶ Tighten fastening screws to the appropriate torque, see table.

Load cell Ø axle journal in mm	12/15/17	20/25	30/35	40/45/50	55/60/65
Transport screw DIN EN ISO 1207 (slot)	M5 x 20	M6 x 25	M8 x 35	M10 x 45	M10 x 45
Fastening screw DIN EN ISO 4762 (hex socket)	M5 x 12	M6 x 20	M8 x 25	M10 x 30	M10 x 35
Torque	5 Nm	10 Nm	25 Nm	50 Nm	50 Nm

5. Installation



WARNING!

Electric shock!

Live parts can cause an electric shock.

- ▶ Never touch electrically live parts.
- ▶ Connect electrical cables as per the circuit diagram, during this task pay attention to the information on cross-section and screening.
- ▶ Lay signal cable separate from cables carrying interference or high currents (for example motor cables).
- ▶ Ensure the insulation is not damaged and the cables are properly fixed and protected.

NOTICE

In case it becomes necessary for space reasons to turn the right angle plug on the connecting cable by 180° before inserting it into the socket, the plug insert on the right angle plug can be turned carefully.

Under no circumstances should the socket on the load cell be turned.

- ▶ Ensure the insulation is not damaged.

6. Commissioning

- ▶ See description of the E+L or customer-provided amplifier/controller.

7. Troubleshooting/repair

If a fault should occur on the load cell, it is necessary to replace the load cell and send it to the factory. No parts can be replaced on-site.

- ▶ For information on the removal of the load cell, see chapter "Disassembly".

8. Maintenance



WARNING!

Risk of injury!

Maintenance work is only allowed to be undertaken with the machine switched off.

- ▶ Switch off machine.
- ▶ Secure machine against switching back on.

- ▶ Re-lubricate self-aligning ball bearings as necessary.

Lubricant recommendation: the most suitable lubricant for lubrication is a grease with the designation K 2 K, temperature range from -35 °C to +135 °C (in accordance with DIN 51 502).

9. Disassembly



WARNING!

Risk of injury!

Disassembly is only allowed to be undertaken with the machine switched off.

- ▶ Switch off machine.
- ▶ Secure machine against switching back on.

- ▶ Disassemble in the reverse order of assembly as described in chapter "Assembly".



During this process follow all instructions that are given in the chapters "Transport", "Assembly" and "Installation", in particular on the attachment of transport locks.

10. Technical data

Accuracy class	1
Nominal characteristic value (sensitivity)	1 mV/V
Combined error (hysteresis/non-linearity)	< 1%
Characteristic value tolerance	0.2%
Measuring principle	Full bridge strain gauge
Nom. resistance of strain gauge bridge	700 Ω
Bridge supply voltage	
Nominal value	10 V
Max. permissible range	14 V
Output voltage	
Nominal range	0 to 10 mV (with nominal force and a bridge supply voltage of 10 V)
Maximum range	0 to 18/24 mV (with 1.8/2.4 x nominal force and a bridge supply voltage of 10 V)
Mechanical stop	1.8 to 2.4 F_N depending on type
Operating load	1.8 to 2.4 F_N
Limit load	10 x F_N
Maximum permissible axial lateral force	1 x F_N
Nominal measuring deflection	0.1 to 0.25 mm depending on type
Nominal temperature range	-10 to +60 °C
Operating temperature range	-10 to +90 °C
Temperature coefficient of characteristic value	$\pm 0.5\%/10$ K
of the zero signal	$\pm 0.5\%/10$ K
Protection rating	IP 54 with suitable connector, inserted
Weight (D = Diameter of the axle/shaft)	0.8 kg (D = 17 mm) 1.25 kg (D = 25 mm) 2.94 kg (D = 35 mm)
Material	Anodized aluminum with stainless steel screws

Subject to technical change without notice