# HAEHNE

## Practice Guide

ISO 9001
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Quality Management System
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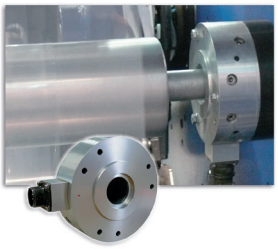
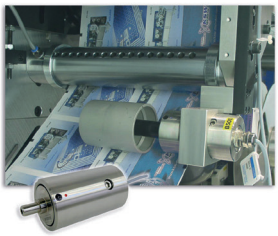
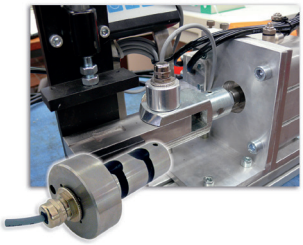
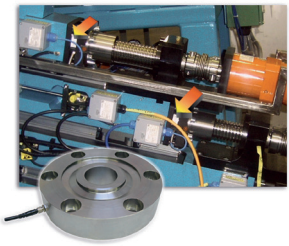
## Strip Tension Measurement





## Force Measurement Technology

## Evaluation


***for the plastics, foil, paper and textile industry, rolling mills and strip processing lines***

***ATEX possible***

***www.haehne.com***

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## Content



**Absolutely consider characterized passages in the text with this reference!**



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## *Safety Instructions*

**Generell**

**1. General**
All steps regarding transport, installation, commissioning as well as maintenance of force measurement systems have to be performed by qualified personnel. The qualified persons must be authorized by the supervisors responsible for safety measures to perform these functions. All safety measures and instructions for the prevention of accidents at the work place have to be observed.

**2. Unpacking**
All equipment should be carefully checked for any damages. If there is suspicion of any transportation damages, inform the logistic company immediately. In that case store the complete packaging material for a possibly necessary verification.

**3. Transport and Storage**
All electrical systems and sensors must be stored in dry places free of dust. The storage temperature should not exceed the operating temperature described in the corresponding product description. Transportation should be made with proper equipment in order to safeguard the systems against damage. Transportation of the equipment should be done only in the original or comparable packaging material.

**4. Installation and Mounting**
The installation of systems has to be made according to the instructions in the corresponding documentation.
All work steps on electrical equipment such as mounting, connection, opening of the system should be performed only when the system

- is disconnected from electrical power
- is guarded against inadvertent application of power
- all drives are in their stop position

**Before starting the installation all equipment should be checked with proper instrumentation for the presence of any electrical power.**

**5. Electrical Connection**
The electrical installation has to be made according to country specific instructions.

**6. Purposeful Use**
The safety of the delivered system is only warranted if used as intended. The limit values described in the documentation should not be exceeded. Commissioning (that means start of the ordinary operating process) is only allowed in conformity with the Electromagnetic Interference instructions.

If the sensors are exposed to forces beyond the specified absolute maximum force, then mechanical defects cannot be excluded. If in doubt contact the *HAEHNE* company to calculate the absolute maximum force based on the customer specific mounting situation.

**7. Operation**
Equipment containing *HAEHNE* measurement systems and sensors have to conform to the valid national safety instructions, e.g. laws about technical tools, accident prevention instructions, etc. according to the valid directives.

**8. Maintenance and Repair**
This work should be performed according to the documentation of the appropriate *HAEHNE* product.

**9. Disposal Notice**
Defective or unusable equipment should be disposed of according to the national and local directives or regulations for material recycling and environment protection separate from regular household waste.



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## Force Measurement with Strain Gauges

### Technical Information

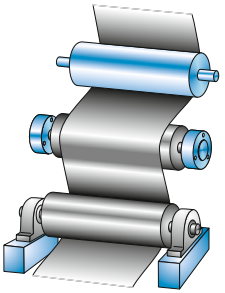
The strain gauge technology is the major method to measure forces. Various mechanical designs of compression or bending type sensors are being used to measure strain.

The translation of the elongation proportional to the force into a voltage signal is generally made with a full Wheatstone bridge in conjunction with appropriate amplifiers. Several sensors can be connected in parallel to obtain average values. The amplifiers are available as DIN rail mount versions or field enclosures to be mounted close to the point of measurement.

In addition to permanently mounted amplifiers a specifically designed portable analysis system is available for the continuous monitoring of force measurement values. The hand-held system PAD can e.g. capture compression forces and transmit them via an interface.

## Force Measurement with Strain Gauges

### Functional Principle and Circuitry Versions

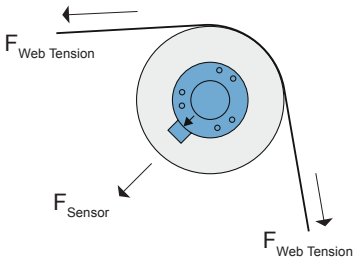


In processes where running webs of material are continuously manufactured with increasing process speeds and higher demands on quality it is necessary to measure and control the tension forces in the material. This applies equally well to the production and converting of plastic foil, textiles, paper, and metal as well as wires and cables.

Because the forces cannot be measured directly in those in running webs it is necessary to measure the forces acting on the bearings of idler rolls. The measured values are proportional to web tension if the systems are correctly dimensioned.

Because of possible non symmetrical load distribution over the rolls it is customary to measure the forces in both bearings of the idler roll. The core of the web tension sensors are strain gauge transducers measuring the acting forces.

Amplifiers, increasingly common with digital fieldbus interfaces, raise the very low sensor signals to the appropriate levels.



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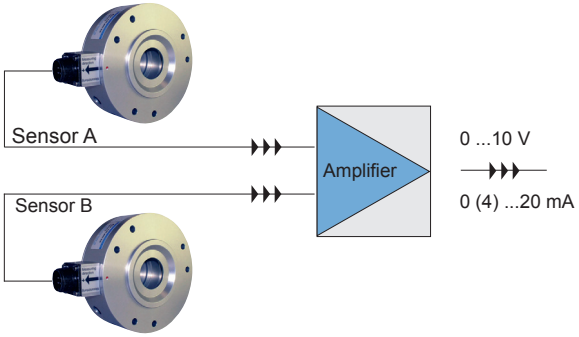
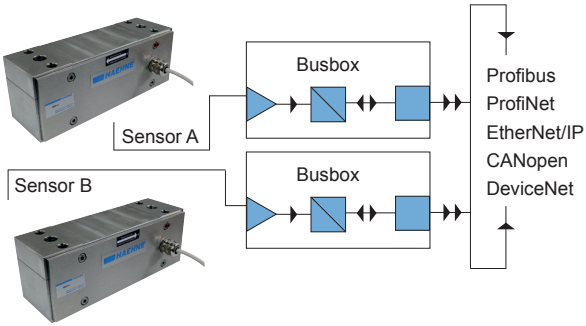
The „standard“ measuring system consists of two sensors and one amplifier. The second sensor is not necessary if the web runs steady in the middle of the rolls and the process does not require high precision web tension measurement.
The analog output of the amplifier can be either voltage or current signals. Depending upon the sensor cable length the amplifiers are either housed in field enclosures mounted close to the sensors or alternatively DIN rail enclosures are available for mounting in electrical cabinets.




The picture shows an example of the transmission of averages.

However, when using an additional fieldbus amplifier the force values of each sensor can be used to determine e. g. the differential web tension of the system.

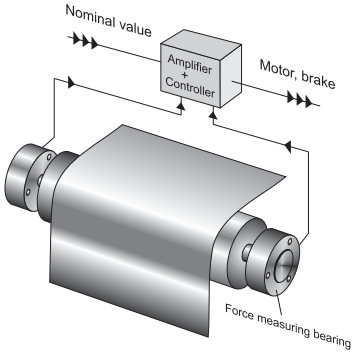
If fieldbus amplifiers are used, then the force values can be send directly onto the fieldbus.




## *Web Tension Measurement Systems*

### Closed Loop Control

Constant web tension is the most frequent requirement when processing webs. For this purpose the actual value of the amplifier is compared to the set point in the controller and the difference being used to adjust drives or act directly e.g. on brakes.
The available amplifier controller combination minimizes the number of required components and reduces also circuit design and wiring effort.



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# Web Tension Measurement Systems

## Force Sensor Design and Aeras of Application

In case of measurement at both ends of the idler roll, three basic design versions are available depending on the type of machinery and equipment environment:

**Flange Design**

For vertical machine frames this design offers mounting advantages. The measurement direction of the sensor can be moved to any angle in order to adjust it optimally to the web geometry and nominal force rating of the sensor. In general, however, the horizontal force measurement direction offers the advantage of eliminating the force component of the roll weight. In case of other geometries the force component of roll weight can be eliminated with the amplifier. The sensors are symmetrical and can measure tension as well as compression forces. Therefore, it is possible to use these sensors also e. g. for roll pressure measurement.

**Pillow Block Design**

For process lines with larger forces pillow block bearings are frequently used. The under pillow block sensors are specifically designed to fit the space between the actual pillow block bearing and the mounting frame. Horizontal mounting frames are most frequently used for pillow block bearings. There are two sensor versions available measuring either horizontal or vertical to assure the best fit for the varying web geometries .

**Hub Design**

The force sensor ZAK and the mounting accessories flange ring and clamping block allow mounting to both horizontal and vertical machine frames. For this reason the sensor is especially well suited for single-sided narrow web and wire applications.

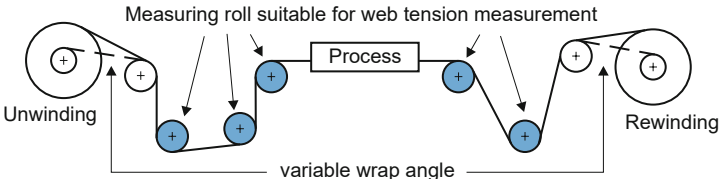
**Measuring Idler Rolls**

Complete measuring rolls are available for dual bearing support as well as single-sided bearing support e.g. for narrow web printing machines. The web tension measuring rolls MES and MWF contain integrated force sensors

# Location of Web Tension Measurement

## Selection Criteria

When selecting the position of web tension measurement in a machine care should be taken to use the rolls presently installed. Ensure that the wrap angle does not vary at the idler roll under consideration.



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- Equipment which changes the web tension such as brakes, driven rolls, cooling and heating rolls have to be considered.
- A change of the wrap angle has an effect on the measuring results. A larger wrap angle is advantageous.
- Unfavorable environmental conditions (heat, changing temperatures, contamination, liquids) should be avoided.

## *Web Tension Measurement Systems*

### Establishment of Nominal Force Rating

The *HAEHNE* web tension sensors are generally designed for a specific measuring direction marked in most cases by a red dot. Web forces in that measuring direction generate positive force signals. If the forces do not act exactly in the measuring direction, the sensor will display a lower force according to the angles of the acting forces.

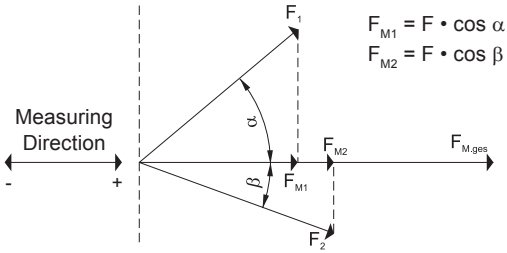
The measuring ranges follow a geometrical progression and enable a sensor selection most suitable for the actual web tension force situation. The necessary measuring range is determined by the largest expected web tension force and the web tension geometry (compare diagrams).

The machine design determines the infeed and runout web angles. This specifies also the direction of the force vectors $F_1$ and $F_2$. For the calculation it is assumed that the measuring roll is neither driven nor braked and that the bearing friction is negligible. Under this condition the values of the vectors are equal to the maximum web tension force. Trigonometric functions and the actual mounting situation of the sensors enable the calculation of the web tension force in the measuring direction. The sum of the two parts $F_{M1}$ and $F_{M2}$ acts on the roll and half of the total on each sensor. In case of horizontal measurement it is not necessary to account for the roll weight, because it acts only vertically. However, in case of horizontal measurement the maximum permitted transverse force according to the product specification has to be observed.

Roll weight forces in the measuring direction can be zero adjusted at the amplifier.

**Example**

Web tension F = 1000 N
Infeed angle $\alpha$ = 40 °
Runout angle $\beta$ = 20 °
Measuring direction M = horizontal




Force per sensor:

$$F_M = \frac{1}{2} (F_{M1} + F_{M2})$$

$$F_M = \frac{F}{2} (\cos \alpha + \cos \beta)$$

$$= \frac{1000\ N}{2} (0{,}766 + 0{,}94) \qquad F_M = 853\ N$$

In this example 1000 N Web tension result in 853 N on each sensor. With a correctly adjusted amplifier 1000 N Web tension result in an output signal of 10 V

## *Notice for Sizing*

### Web Tension Measurement Software

Please use the *HAEHNE* MKB Software for calculating the forces acting on the sensor in order to determine the sensor sizes. The software can be downloaded with the link: **http://www.haehne.com** or can be mailed on request.



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# *Electrical Engineering of HAEHNE Force Measurement Systems*

## Instructions for Electrical Devices

The *HAEHNE* force measuring systems consist of sensors and electronic modules to amplify low millivolt signals. In order to enable trouble free operation and adherence to electromagnetic interference precautions the following points have to be observed:

**Mounting instructions:**

1. Units that have been designed for DIN rail enclosure mounting, have to be placed in metal enclosures such as electrical cabinets.
2. The modules should be mounted away from strong noise generating sources such as power switches, frequency transformers or impedances.
3. Noise suppression measures should be used at the mounting place for such components as alternating or direct current coils, contactors, relays or varistors.
4. Electronic modules should not be mounted on top of each other in order to prevent heat accumulation.

**Wiring instructions:**

1. A potential equalization cable with sufficient cross section has to be provided between electrically conducting components. Electrically conducting mounting frames and DIN rails should be included in the potential equalization of the machine.
2. Use shielded cables for control and signal leads.
3. All signal inputs that are not used should be connected to a defined potential or ground earth.
4. Cable shields should be connected only single-sided and connected to the PE of the amplifier.

* In case of field enclosures the cable shield should be connected within the EMI glands to the metal enclosure.

* Electronic modules in DIN rail enclosures should be mounted in such a way that the cable shield is connected to the DIN rail via a PE terminal next to the module.



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5. Cable lengths between sensors and amplifier should be kept to a minimum.
6. By connecting components of a fieldbus system use only the specified cables and connectors of the respective bus system.
7. Do not place signal cables adjacent to power cables or signals with high step rising edge. A cross over at an 90° angle is permissible.
8. In order to avoid grounding problems it is useful to connect GND and PE at a defined point within the equipment. Additional connections (e.g. internal in individual modules) can lead to functional interference.

## *Safety Instruction*

1. If damage is visible or the unit malfunctions switch off power immediately.
2. Before opening a unit switch off the power supply.
3. Opening of the unit and making adjustments within the unit should be made only by trained personal.
4. Touching printed circuits and electronic components should be avoided because of the danger of destruction by electrostatic energy.
5. All applicable guidelines and safety instructions relating to electrical and electronic systems as well as country specific safety instructions should be observed.



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# Electrical Connections for HAEHNE Sensors

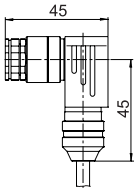
## Connections and Wire Assignment

### Electrical Connections

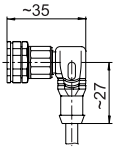
Depending on the sensor type various versions of electrical connections are offered. The corresponding variants are listed in the respective product descriptions.

The standard cable length for all options is 5 meters. Cable lengths up to 20 meters are available on request.

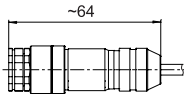
### S1, S2, N1, N2



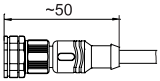

Variant S1
Plug connection
right-angled, M12, metal




Variant S2
Plug connection
right-angled, M12, moulded

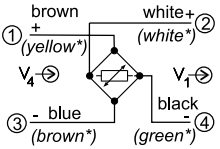



Variant N1
Plug connection,
straight, M12, metal




Variant N2
Plug connection
straight, M12, moulded

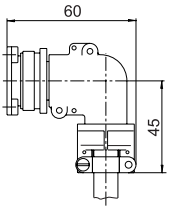
Wire assigment



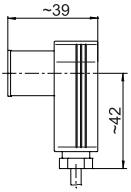

$V_4$: Supply voltage
$V_1$: Signal voltage

** Alternative color coding*

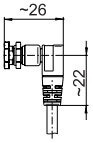
### S, S3, S4, N3



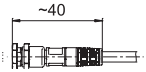

Variant S
Plug connection
right-angled, MIL




Variant S4
Plug connection
right-angled, C091

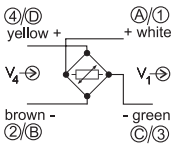



Variant S3
Plug connection
right-angled, M8,
moulded



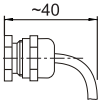

Variant N3
Plug connection
straight, M8,
moulded

Wire assignment

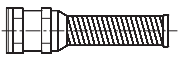



$V_4$: Supply voltage
$V_1$: Signal voltage

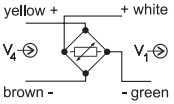
### T







Cable gland, design dependent on sensor type.




$V_4$: Supply voltage
$V_1$: Signal voltage



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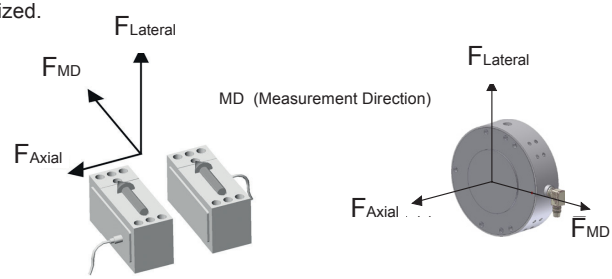
# Mounting of Web Tension Sensors

## Direction of Force

The sensors must be mounted according to the calculated web geometry and used only as intended. See also “Safety Instructions”.

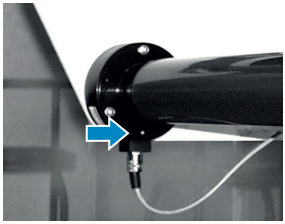
*HAEHNE* force sensors are designed for a particular Web tension direction. Of the acting forces only the component acting in the measurement direction is analyzed.

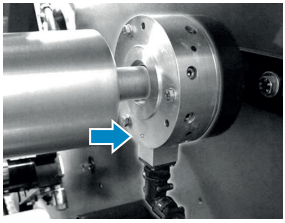
Forces acting perpendicular to the measurement direction ($F_{Lateral}$ / $F_{Axial}$) have to be considered and should be minimized.

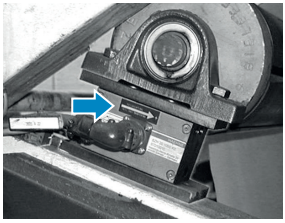



**Measuring Direction ($F_{MD}$)**

The measuring direction of the sensors is indicated with a red dot or marked by an arrow (See arrow in the picture). At the installation this marking must point towards the measuring direction. Mount the sensors at measuring rolls in such a way, that the arrow or red dot of both sensors point in the same direction.







**Lateral Force ($F_{Lateral}$)**

A lateral force describes the force which is acting at a 90° angle relative to the measurement plane. This is caused by the roll weight or some other component of the forces acting on the sensor. The lateral force need not to be analyzed, but the value should **not exceed** the nominal force of the sensor.

***Attention!***

$F_{Lateral} < F_{Nominal}$

***Attention!***

**Use spherical or joint bearing**

Unavoidable mounting inaccuracies or roll bending results in strains in the sensor and incorrect measurement results can destroy the component. The use of spherical bearings in case of life shafts or joint bearings in case of fixed shafts can provide relief.



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## Mounting of the Web Tension Sensors

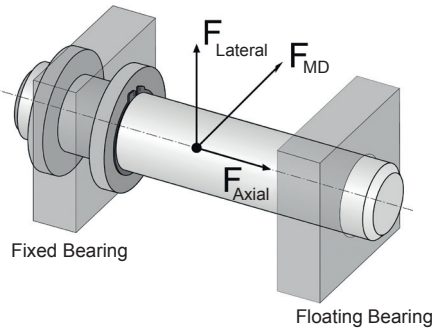
### Fixed- /Floating Bearing

**Axial Force ($F_{Lateral}$)**

Increasing temperature results in lateral expansion of the roll. This is compensated by applying the principle of fixed/floating bearings. The fixed bearing is absorbing the lateral and radial forces and should be placed close to the application of the operational force. The floating bearing should absorb radial forces only. The bearing must be free to move in the lateral direction, in order to allow temperatures induced expansion of the shaft. This expansion has no influence on the measurement precision.

***Attention!***

**Use fixed- /floating bearing**




**Principle of fixed- /floating bearing as simplified sketch**

## Mounting of the Web Tension Sensors

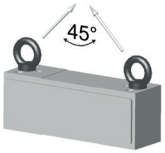
### Tightening Torque

The surfaces of the upper and lower mounting surface must be clean and free of foreign material. Mount the sensor only with the designated bore holes.

**Pillow Block Design**

Under no circumstance should the side covers be damaged. The gaskets are integrated in these covers.

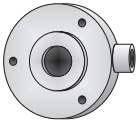
Use ring bolts for safe transport (see pic.)




| Screw size | Tightening Torque [Nm] |
|---|---|
| M16 | 210 |
| M20 | 410 |
| M30 | 2000 |

**Flange Design**

Shaft or axle must not affect the cover.



| Sensor Size | Tightening Torque [Nm] | |
|---|---|---|
| | Fixing screws | Cover screws |
| 1 | 7 | hand tight |
| 2 | 7 | hand-tight |
| 3 | 16 | 5 |
| 4 | 32 | 5 |



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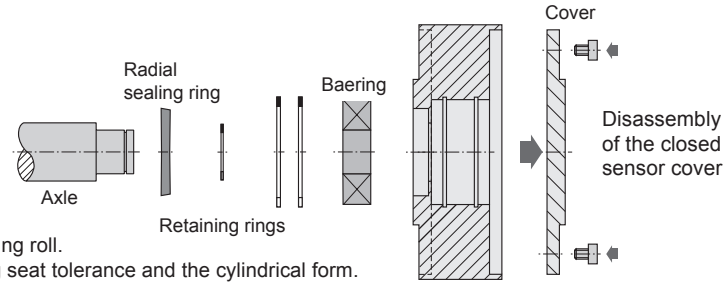
# Mounting Instruction Bearing Support - Flange Design

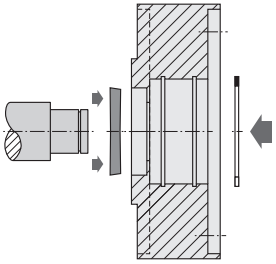
**Fixed Bearing**

**1**



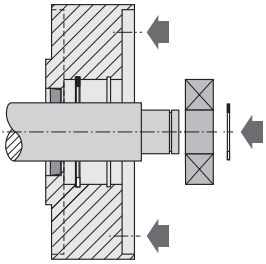

Clean the bearing seat of the measuring roll. Inspect the bearing seat tolerance and the cylindrical form. All components should be mounted without excessive force. If necessary re-work.

**2**



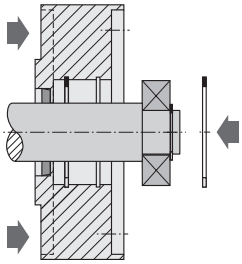
Insert radial sealing ring (optional) into the sensor cover. First insert retaining ring (DIN 472) into the inner part of sensor. Push the sensor onto the axle.

**3**



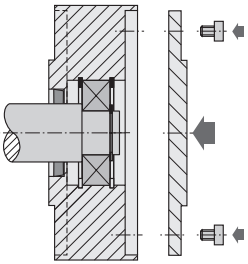
Mount the bearing on the shaft and lock with retaining ring (DIN 471) on the axle. The assembly force should act only at the inner part of the bearing. Control the axial clearance. If necessary insert a shim (DIN 988) between bearing and retaining ring.

**4**



Push the sensor over the bearing and lock with second retaining ring (DIN 472)

**5**



Mount closed sensor cover.
(Tightening torque see table on page 12)



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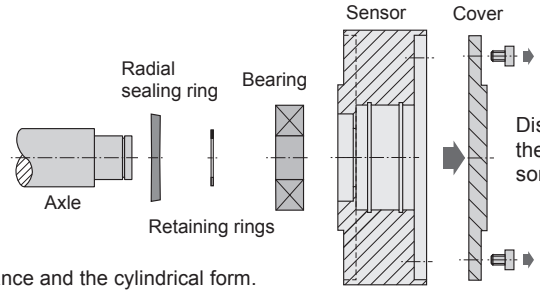
# Mounting Instruction Bearing Support - Flange Design

## Floating Bearing

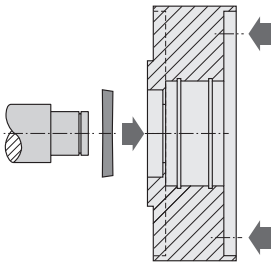
**1**




Disassembly of the closed sensor cover

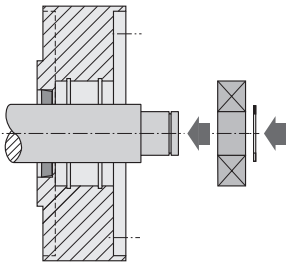
Clean the bearing seat of the measuring roll.
Inspect the bearing seat tolerance and the cylindrical form.
All components should be mounted without excessive force. If necessary re-work.

**2**



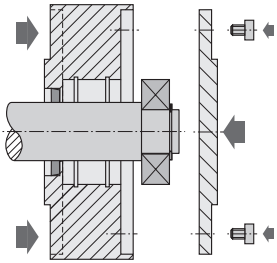
Insert radial sealing ring (optional) into the sensor cover. Push the sensor onto the axle.

**3**



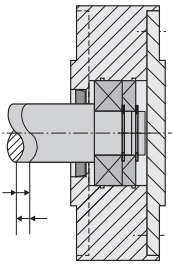
Mount the bearing on the shaft and lock with retaining ring (DIN 471) on the axle. The assembly force should act only at the inner part of the bearing. Control the axial clearance. If necessary insert a shim (DIN 988) between bearing and retaining ring.

**4**



Push the sensor over the bearing.
Do not clamp the bearing in the sensor.
Mount closed sensor cover.
(Tightening torque see table on page 12)

**5**



The thermal expansion occur with the traverse movement of the bearing



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As a rule the measuring chain does not have to be calibrated. The sensors are adjusted with a certain sensitivity and the analog amplifiers have been adjusted accordingly.

When desired we supply calibration certificates for the sensors. For the digital amplifiers the amplification is individually adjustable (DMA) or given (bus amplifiers).

If a calibration should be necessary after a regular inspection or in case of a fault HAEHNE recommends the following approach:

Preparation:

- For analog amplifiers: Connect a digital volt meter with sufficient accuracy and resolution to the voltage output
- Energize the device and await the operating temperature
- Take the load off the sensor
- Adjust zero point

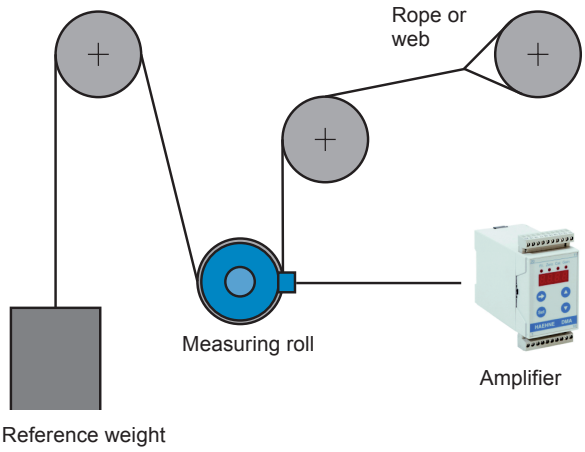
## Web Tension Calibration

### Variant A - Loading with Reference Weight

Model the web geometry with a belt or rope in the middle of the measuring roll.

Please ensure that the Web geometry in front and back of the measuring roll is identical to the operating conditions. The wrapped rolls must turn easily (e.g. not driven rolls).

- Connect one end of the rope to a fixed point. Apply a precisely determined reference weight at the other end of the roll. The weight force should be 70 to 100% of the nominal force. A calibration force closer to the nominal force leads to a more precise calibration result.
- Check the values and adjust if necessary.



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## Variant B - Loading with Stroke Cylinder

- Selection of a reference sensor with an Analysis/Display System. The accuracy of this reference sensor must be higher than the mounted web tension sensor, because the accuracy of the reference sensor determines the total accuracy

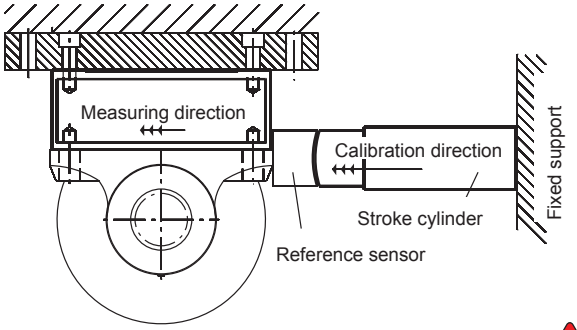
- Use a stroke cylinder to gradually apply at least the nominal force to the sensor

- Attach a reference sensor to the cylinder and mount both into the machine in such a way that the force direction corresponds to the measuring direction. Ensure that lateral and axial acting forces are excluded.
- Other preparations see “Calibration Variant A”

**Alignment for horizontal measuring direction**

***Attention!***

**Ensure the correct measuring direction!**




***Attention!***

**Risk of accident!**



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## Inspection of Measuring Chain

If the measurement results do not appear plausible, then it is possible to verify the results with the same procedure that was used for the Web tension calibration. A few measuring points are sufficient for that: 0, 50, 100% of the nominal force increasing and decreasing as shown in the table below.

For the verification of the linearity, it is necessary to measure the amplifier input voltage with a high resolution digital voltmeter with a mV-scale and high input resistance. We recommend for this procedure a 10% increase or decrease of the force.

It is not so important to perform this procedure exactly in steps of 10 %. Important is the simultaneous capture of the corresponding values:

- Measured force of the reference sensor
- Output signal of the sensor in mV
- Amplifier output voltage

With such a protocol the HAEHNE telephone support is in a better position to help you with fault localization:

| **Reference Sensor** | |
|---|---|
| Nominal force | |
| Combined error | |
| Manufacturer | |

| **Web Tension Sensor** | |
|---|---|
| Supply voltage ($V_{4+}$ , $V_{4-}$) | |
| Mounting area | |
| Serial number | |

| **Measured Force Reference sensor [in % of nominal force]** | **Measured Force of Reference sensor [kN]** | **Output Signal of Full Bridge Strain Gauge V1+ , V1- [mV]*** | **Direct Voltage Output V2+ , V2- [V]** | **Display of Web Tension [kN]** |
|---|---|---|---|---|
| 0 | | | | |
| 50 | | | | |
| 100 | | | | |
| 50 | | | | |
| 0 | | | | |

* Digital multi meter with resolution and input resistance as high as possible

| Date: | Tester: |
|---|---|



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**Maintenance**

The systems do not require any maintenance under normal operating conditions. In case of overload, however, check the zero force value. The equipment should not be opened. The systems do not contain any parts that can wear out. For critical applications it is recommended to have sensors and electrical modules as spare parts on hand. The devices should be recalibrated according to defined cycles / intervals.

**Fault Notes**

Additional acting forces such as lateral, friction and torque can produce measuring errors. The occurrence of lateral forces can be avoided by following the instruction in the mounting section. Friction and torque have to be considered separately.

Web tension sensors capture the sum of the force components in the measuring direction of both the infeed and runout web portions. The exact determination of the web tension force is only possible if the measuring idler roll turns very easily creating the same force components in the infeed and runout web portions.

**Repairs**

- Repairs to the sensors may only be carried out by specialist personnel authorized by the manufacturer be carried out with original spare parts.
- Improper repairs can pose significant risks to the user.
- Improper opening of the sensor leads to loss of explosion protection.
- Immediately disconnect defective devices from the mains and replace them immediately

**Possible Reasons for Measuring Errors:**

- Higher friction forces by damaged roll bearings
- Friction by rotary connection or feed-through, e.g. with chill rolls
- Contact of the measuring roll with pressure rolls, strippers, or brushes
- Drives or brakes are connected to measuring roll
- Acceleration and deceleration forces acting at the measuring roll during speed changes
- Bending forces in the web when winding and unwinding
- The actual mounting position is different from the design
- Torque of mounting screws not according to specification
- Fixed and floating bearing not correctly mounted
- Liquids entered the cavities of the sensors



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## *Declaration of Conformity, CE Designation*

**for HAEHNE Measurement Systems**

The *HAEHNE* Company declares, that all of their manufactured force measurement equipment are in conformity with the basic protection requirements, that are defined in the

Directive 2014/30/EC (EMI Directive)

for harmonization of laws of the Member States regarding

electromagnetic compatibility in order to obtain

**CE Marking**

in accordance to the labeling obligation.

For the evaluation of the products regarding the electromagnetic compatibility the following harmonized standards are applied:

| | |
|---|---|
| **EMI-Emission:** | **EN 61000-6-4** |
| **EMI-Immunity:** | **EN 61000-6-2** |

## *Declaration of Incorporation, Machinery Directive*

**for HAEHNE Measurement Systems**

The *HAEHNE* Company declares, that the

**Machinery Directive 2006/42/EC**

do not apply to their products (Force measurement systems)

When mounting these products into machines to which the EC directive applies then it is necessary to ensure - before commissioning the machines - that the machines are built according to the standards of the EC directives 2006/42/EC.

July 01, 2022 Erkrath

Dr. Frederic Goronzy
General Manager



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ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Management Service

# CERTIFICATE

**The Certification Body**
**of TÜV SÜD Management Service GmbH**

certifies that

**HAEHNE Elektronische Messgeräte GmbH**
**Heinrich-Hertz-Str. 29**
**40699 Erkrath**
**Germany**

has established and applies
a Quality Management System for

**Development, manufacturing, maintenance, service and sales of force measuring systems and electronic measuring devices including force sensors in protection type „i" to use in Cat. 2G as well as calibration services.**

An audit was performed, Order No. **70056354**.

Proof has been furnished that the requirements
according to

**ISO 9001:2015**

are fulfilled.

The certificate is valid from **2022-01-24** until **2025-01-23**.

Certificate Registration No.: **12 100 21548 TMS**.

Head of Certification Body
Munich, 2022-02-01

DAkkS Deutsche Akkreditierungsstelle D-ZM-14143-01-00

MS/01-01/2019

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www.tuev-sued.de/certificate-validity-check

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TÜV SÜD Product Service

## Product quality assurance notification
## No. EX3A 052103 0006 Rev. 00

**Holder of Certificate:** HAEHNE

**Haehne**
**Elektronische Messgeräte GmbH**
Heinrich-Hertz-Str. 29
40699 Erkrath
GERMANY

**Factory(ies):**
Haehne Elektronische Messgeräte GmbH
Heinrich-Hertz-Str. 29, 40699 Erkrath, GERMANY

**Scope of Certificate:** Ex

**Force Measurement Sensors to be used in Cat. 2G and 2D in Type of Protection "i"**

The certification body of TÜV SÜD Product Service GmbH certifies that the certificate holder maintains a quality system which fulfils the requirements of Annex VII of Directive No. 2014/34/EU for Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX). The Validity of this Certificate requires periodical surveillance. See also notes overleaf.

**Report no.:** 713168912

**Valid until:** 2022-10-31

**Date,** 2020-02-20 ( Norbert Thimm )

Page 1 of 1
TÜV SÜD Product Service GmbH is a Notified Body in accordance with Directive 2014/34/EU for equipment and protective systems intended for use in potentially atmospheres with the identification number 0123.

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# *Terms and Definitions of Characteristics*

**for *HAEHNE* Force Measurement Devices**

| Terms | Unit | Definition |
|---|---|---|
| Nominal Force Fnom) | N / kN / MN | The force for which the sensor has been designed. |
| Measuring Range | N / kN / MN | The force range for the intended use of the sensor. The accompanying error limits should not be exceeded within the range. |
| Operating Force | % | The maximum force in the measuring direction that a sensor with overload protection can be exposed to without loosing its measuring properties. The operating force of sensors without overload protection equals the absolute maximum force. |
| Absolute Max. Force | % | The maximum permissible force for the sensor which does not damage its measuring characteristics. The specified error limits do not apply to this force. |
| Nominal Rating | mV/V | The nominal characteristic value of a force transducer describes the output signal when loaded with nominal force depending on the bridge excitation voltage. A force transducer with a sensitivity of 1.5 mV/V delivers an output signal of 15 mV with a 10 V bridge supply and a load with nominal force (100%). |
| Combined Error | % | The largest single error of the sensor output is smaller than the error value of this combined error class. |
| Reproducibility | % | Deviation of the output signal after repeated application of the same force or after an extended period of time or variations of the applied force. |
| Linearity Deviation | % | Maximum deviation of the output signal from the straight line of best fit under continuously increasing force in relation to the final value of the measuring range. |
| Hysteresis | % | Relative difference of the measurement values between increasing and decreasing application of the load. |
| Nominal Ambient Temperature | °C | The temperature range in which the sensor functions within the limits of specified technical data and the error limits. |
| Operational Temperature Range | °C | The temperature range in which the sensor functions without permanent damage to the measurement properties. The specific error limits do not apply, however, to this temperature range. |
| Nominal Resistance of Strain Gauge | Ω | The ohmic resistance of the total full bridge is used to determine the load of the supply voltage resulting from the force sensor. |
| Supply Voltage | V DC | Supply voltage of the force sensor to ensure error and fault free operation. The highest value specified for the force sensor should not be exceeded to avoid excessive increase in temperature of the strain gauge. |
| Enclosure Protection Ratings | IP | 1st number: 5 = dust protected 6 = dust tight<br>2nd number: 4 = protection against splashing water, 5 = against water jets<br>6 = against powerful water jets, 7 = against effects of immersion<br>8 = against submersion. |



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*Practice Guide 0222 DE6PLFDO24NA5*

Your Representative

HAEHNE

Elektronische Messgeräte GmbH
Heinrich-Hertz-Str. 29
D-40699 Erkrath

Tel +49 (0)2 11 / 9 25 91 - 0
Fax +49 (0)2 11 / 9 25 91 - 20

http://www.haehne.com
E-mail: info@haehne.de