MICRO-EPSILON

Operating Instructions

wireSENSOR, WPS
Draw-wire mechanics

WPS-2400-MK60-M
WPS-2300-MK88-M
WPS-3500-MK88-M
WPS-5000-MK88-M

Declaration of Incorporation

Declaration of incorporation according to the EC Machinery Directive 2006/42/EC, Annex II B

The manufacturer and person authorized to compile the relevant technical documents

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hereby declare that the machine designated below complies with the relevant fundamental health and safety requirements of the EC Machinery Directive, including modifications to it applicable at the time of this declaration, based on its design and construction and in the version put on the market by us – to the extent that the scope of supply allows.

Machine design: Draw-wire sensor (mechanics and models with potentiometer output)
Type designation: WDS-xxx, WPS-xxx

The following fundamental health and safety requirements according to Annex I of the directive specified above have been applied and complied with:

- No. 1.1.2. Principles of safety integration
- No. 1.7.3. Marking of machinery
- No. 1.7.4. Operating instructions

Furthermore, we declare compliance with the following directives and standards including the modifications applicable at the time this declaration is made:

- Directive 2006/42/EC (machinery)
  - EN ISO 13857: 2008 Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
  - EN 60204-1: 2006 + EN 60204-1: 2006/A1: 2009 Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- Directive 2011/65/EU (RoHS)
  - EN 50581: 2012 Technical documentation for the assessment of electrical and electronic devices with respect to the restriction of hazardous substances

We also declare that the special technical documentation for this partially completed machine has been created in accordance with Annex VII, Part B, and commit ourselves to disclose this to the market surveillance authorities upon request.

The commissioning of these partially completed machines is prohibited until the partially completed machine(s) has/have been installed in a machine that meets the requirements of the EC Machinery Directive and for which an EU Declaration of Conformity according to Annex II, Part A exists.

Ortenburg, May 22th 2019

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Contents

1. Safety

System operation assumes knowledge of the operating instructions.

1.1 Symbols Used

The following symbols are used in these operating instructions:

⚠ CAUTION	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a situation that may result in property damage if not avoided.
➔	Indicates a user action.
i	Indicates a tip for users.

1.2 Warnings

⚠ CAUTION

Do not open the sensor housing.
> Risk of injury from pre-tensioned spring motor

Do not let the measuring wire rewind without control (snap back).
> Risk of injury from whiplash effect of the wire with assembly bolts/clips

> Destruction of wire and/or of sensor

Do not pull or loop the measuring wire around unprotected parts of the body.
> Risk of injury

Connect the power supply in accordance with the safety regulations for electrical equipment.
> Risk of injury

> Damage to or destruction of the sensor

NOTICE

Do not pull the measuring wire over the specified measuring range.
> Destruction of the measuring wire and/or the sensor

The supply voltage must not exceed the specified limits.
> Damage to or destruction of the sensor

Avoid shocks and impacts to the sensor
> Damage to or destruction of the sensor

1.3 Intended Use

- Draw-wire sensors are used for
  - measuring displacement and distance.
  - measuring the position of parts or moving machine components.
- The sensors must only be operated within the limits specified in the technical data, see Chap. 2.
- Draw-wire sensors must be used in such a way that no persons are endangered or machines and other material goods are damaged in the event of malfunction or total failure of the sensor.
- Take additional precautions for safety and damage prevention in case of safety-related applications.

1.4 Proper Environment

- Protection class: Depending on the encoder [1]
- Temperature range:
  - Operation: -40 °C ... +85 °C (-40 °F ... +185 °F)
  - Storage: -40 °C ... +85 °C (-40 °F ... +185 °F)
- Humidity: 5 - 95 % (non-condensing)
- Ambient pressure: Atmospheric pressure

1) Not valid for mechanics!

1.5 Foreseeable Misuse

Do not pull the measuring wire over the specified measuring range. This may lead to damage of the measuring wire and also to uncontrollable snapping of the measuring wire. Risk of injury.

Make sure the sensor is not held by another person when the measuring wire is extracted. Risk of snapping and injury.

2. Functional Principle, Technical Data

2.1 Measuring Principle

With the draw-wire principle, a linear motion is transformed into a change in resistance.
A measuring draw-wire made of highly flexible stainless steel wires is wound onto a drum with the aid of a long life spring motor. The winding drum is coupled axially with an encoder.

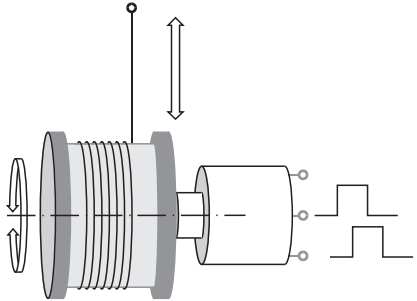


Fig. 1 Draw-wire displacement sensor with potentiometer

2.2 Structure

The draw-wire principle is applied in form of MK60 and MK88 housings with different measuring ranges from 2300 mm to 5000 mm. The sensors are designed to ensure simple installation of an incremental or absolute encoder. Individual selection of the interfaces, resolution and type of connection is thus possible.

2.3 Technical Data

2.3.1 MK60

Model		WPS-2400-MK60-M
Measuring range		2400 mm
Output type		Depending on the encoder
Linearity		±0.1% FSO (±2.4 mm)
Resolution		Depending on the encoder
Mean distance per rotation		150.75 mm ±0.4 mm
Typ. repeatability		±1 mm
Temperature range	Operation	-40 °C ... + 85 °C (-40 °F ... +185 °F)
	Storage	-40 °C ... + 85 °C (-40 °F ... +185 °F)
Material	Housing	Plastic, PBT GF 20
	Draw-wire	Polyamide-coated (ø 0.45 mm)
Wire mounting		Wire clip
Sensor mounting		Mounting holes
Wire acceleration (max)		5 g
Wire retraction force (min)		1 N
Wire extension force (max)		8 N
Shock (DIN-EN 60068-2-29)		50 g, 5 ms in 2 axes, 1 direction and 1000 shocks each
Vibration (DIN-EN 60068-2-6)		20 g/ 20 Hz ... 2 kHz in 2 axes and 10 cycles each
Suitable encoder		Synchro flange ø 58 mm; shaft ø 6 mm

FSO = Full Scale Output

2.3.2 MK88

Model		WPS-2300-MK88-M	WPS-3500-MK88-M	WPS-5000-MK88-M
Measuring range		2300 mm	3500 mm	5000 mm
Output type		Depending on the encoder		
Linearity		±0.1% FSO (±2.3 mm)	± 0.3 % FSO (± 10.5 mm)	±0.4% FSO (±20 mm)
Resolution		Depending on the encoder		
Mean distance per rotation		238.8 mm ±0.3 mm	239.7 mm ±0.8 mm	240.0 mm ±1 mm
Typ. repeatability		±1 mm	±3 mm	±8 mm
Temperature range	Operation	-40 °C ... + 85 °C (-40 °F ... +185 °F)		
	Storage	-40 °C ... + 85 °C (-40 °F ... +185 °F)		
Material	Housing	Plastic, PA 6 GF 30		
	Draw-wire	Polyamide-coated stainless steel (ø 0.45 mm)		
Wire mounting		Wire clip		
Sensor mounting		Mounting holes or mounting grooves		
Wire acceleration (max)		5 g		
Wire retraction force (min)		3 N		
Wire extension force (max)		9 N		
Shock (DIN-EN 60068-2-29)		50 g, 5 ms in 3 axes, 2 directions and 1000 shocks each		
Vibration (DIN-EN 60068-2-6)		20 g/ 20 Hz... 2 kHz in 3 axes and 10 cycles each		
Suitable encoder		Synchro flange ø 58 mm; shaft ø 6 mm		

FSO = Full Scale Output

3. Delivery

3.1 Unpacking, Included in Delivery

1 Sensor

1 Assembly Instructions

- Do not unpack the draw-wire sensors by pulling the wire or wire bolt / clip.
- Ensure that the goods are forwarded in such a way that no damage can occur.
- Check the delivery for completeness and shipping damage immediately after unpacking.
- If there is damage or parts are missing, immediately contact the manufacturer or supplier.

i The transport lock for the measuring wire may only be removed directly before installation and only by qualified personnel.

3.2 Storage

⚠ CAUTION

Store the sensors only with mounted transport lock. This prevents the measuring wire from being pulled out as well as accidental wire snapping.
> Risk of injury from whiplash effect of the wire with assembly bolts/clips

- Temperature range storage: -40 °C ... +85 °C (-40 °F ... +185 °F)
- Humidity: 5 - 95 % (non-condensing)
- Atmospheric pressure

⚠ CAUTION

Uncontrolled retraction of the measuring wire is not permitted!

> Risk of injury from whiplash effect of the wire with assembly bolts/clips

> Destruction of wire and/or of sensor.

Secure the wire during installation work.

4. Installation and Assembly

4.1 Precautionary Measures

Do not pull the measuring wire over the measuring range.
> Damage to or destruction of the sensor is possible.

Do not damage the measuring wire.

Do not oil or grease the measuring wire.

Do not bend the measuring wire.

Do not pull the measuring wire at an angle.

Do not allow to loop the measuring wire around objects.

Fix the measuring wire to the target when wound up.

Do not loop the measuring wire around parts of the body.

4.2 Sensor Mounting

➡ Mount the sensor according to the following table:

Model	Screws	Mounting clamp
WPS-2400-MK60	3 x M3	no
WPS-2300-MK88	3 x M4	yes
WPS-3500-MK88	3 x M4	yes
WPS-5000-MK88	3 x M4	yes

The sensor does not have to be oriented in a special way.

➡ Choose the installation position so that damage and soiling of the measuring wire is avoided.

i If possible, choose an installation position with measuring wire outlet facing downwards. This prevents liquids penetrating the measuring wire outlet.

i Do not let the measuring wire snap!
Damage caused by snapping is not covered by the liability for material defects.

⚠ CAUTION

A measuring wire under tension where operators are standing can lead to injuries.

> Risk of damage to wire and sensor.

NOTICE

Do not twist the measuring wire.

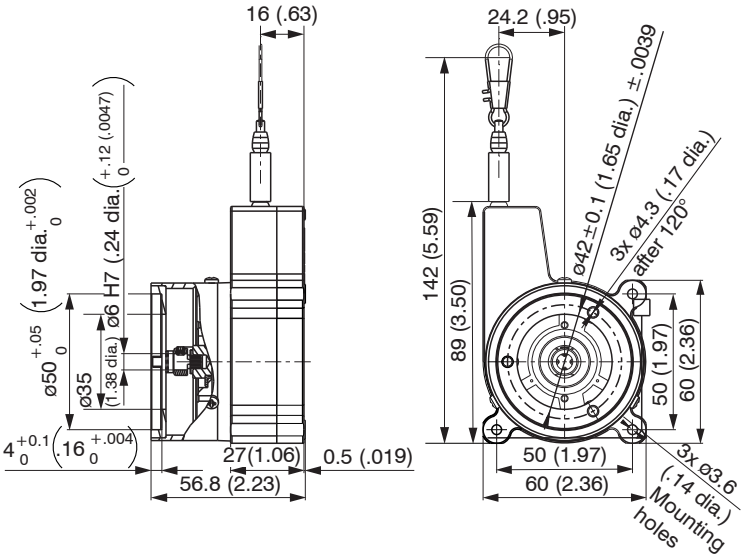


Fig. 2 Dimensional drawing WPS-2400-MK60-M, dimensions in mm (inches), not to scale

⚠ CAUTION

A measuring wire under tension where operators are standing can lead to injuries.

> Risk of damage to wire and sensor.

NOTICE

Do not twist the measuring wire.

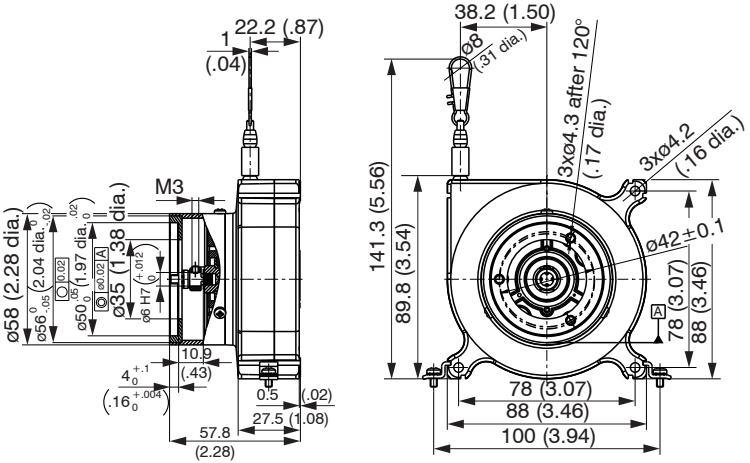


Fig. 3 Dimensional drawing WPS-xxxx-MK88-M, dimensions in mm (inches), not to scale

4.3 Installing the Encoder

Make sure that the measuring wire is always tensioned by the spring motor in order to prevent it from jumping off the pulley.

- Mount the encoder/adapter flange assembly on the draw-wire mechanism.
- Fasten the coupling and the encoder shaft with the supplied hexagon socket screw.
- Press the supplied cap into the opening in the adapter flange housing.

Make sure that the encoder shaft is not rotated during installation! Follow the installation instructions issued by the manufacturer of the encoder.

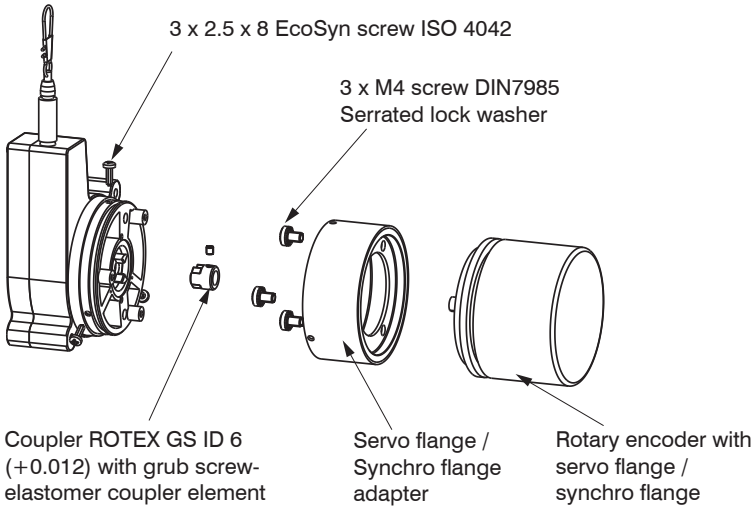


Fig. 4 Mounting of adapter flange and encoder, WPS-2400-MK60-M

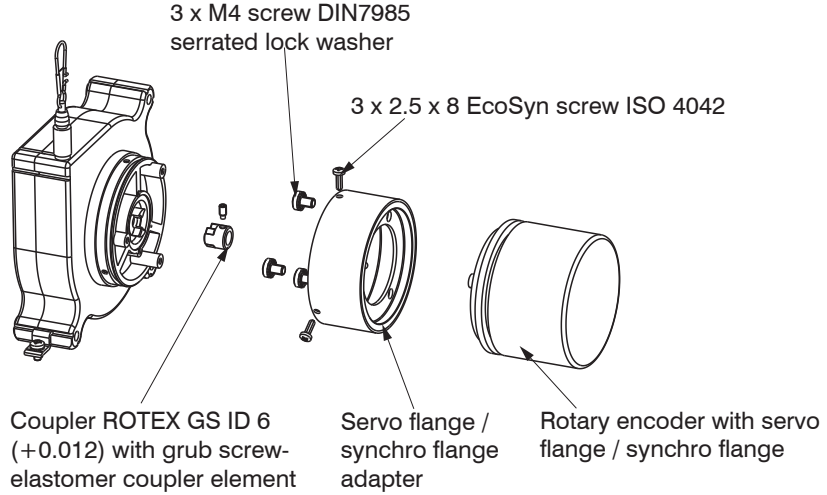


Fig. 5 Mounting of adapter flange and encoder, WPS-xxxx-MK88-M

⚠ CAUTION

A measuring wire under tension where operators are standing can lead to injuries.

> Risk of damage to wire and sensor.

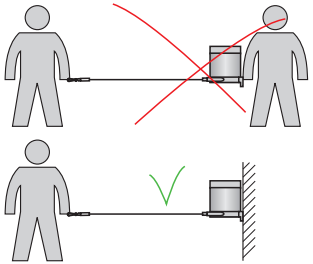
NOTICE

Do not twist the measuring wire!

4.4 Wire Guide and Fastening

If the measuring wire has to be extracted from the sensor to guide the wire or to fix it to the target,

- the sensor may not be held by another person
- the measuring wire may not be further extracted but only to the specified measuring range
- the surroundings of the sensor have to be protected against snapping of the measuring wire



➡ Fix the measuring wire to the target using an wire clip.

➡ Guide the measuring wire vertically out of the sensor housing.

Misalignment is only permissible up to 3 degrees.

Dragging of the measuring wire on the inlet hole or other objects leads to damage and/or breakage of the measuring wire.

i If the measuring wire cannot be fed vertically out of the housing, it is essential to use a guide pulley (accessory TR1-WDS or TR3-WDS), see Chapter Accessories.

➡ Keep measuring wire in an area where it cannot be snagged or otherwise be violated.

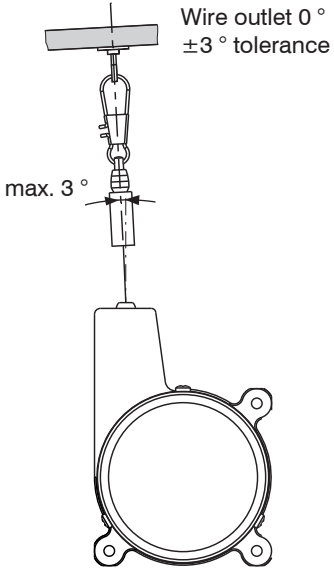


Fig. 6 Wire fastening and misalignment

4.5 Sensitivity Characteristics

Designed with a single-layered wire wound onto the drum, the WPS-2300-MK88-M draw-wire mechanics provides high measurement accuracy. The WPS-3500-MK88-M and WPS-5000-MK88-M models have a double-layered wire which enables a larger measuring range while maintaining the same housing size.

Models with a multi-layer/double-layer winding provide reduced measurement accuracy at the start of the measuring range which is why they are primarily recommended as wire pre-extension.

The sensitivity curve throughout the entire measuring range is shown in the diagram, see Fig. 7.

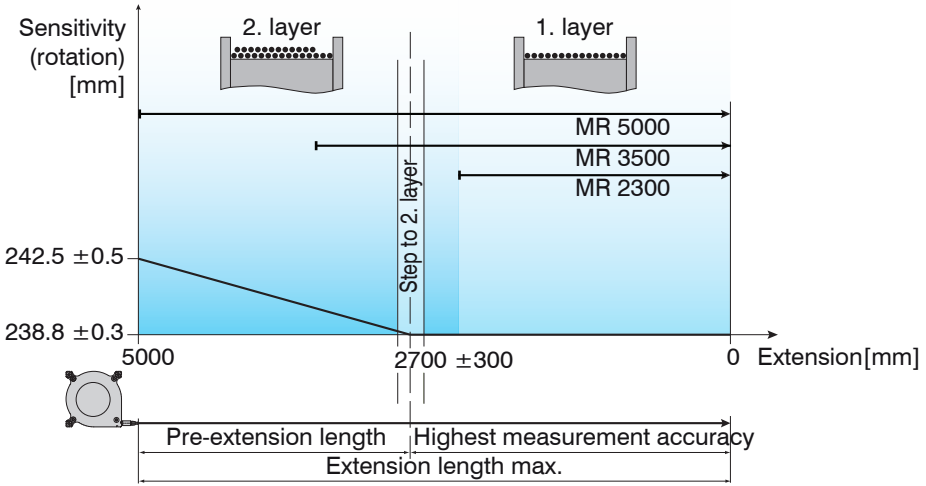


Fig. 7 Sensitivity characteristics draw-wire mechanics WPS-xxxx-MK88-M, dimensions in mm

5. Operation and Maintenance

The measuring wire, the wire drum, the spring motor and the potentiometer may not be greased or oiled.

The notes on wire guiding, see Chap. 4.4, must be observed during operation.

Imperfect wire guiding can lead to increased wear and premature defects.

The warranty and all liability claims are null and void if the device is manipulated by unauthorized persons. Repairs are to be made exclusively by Micro-Epsilon, see Chap. 8.

6. Liability for Material Defects

All components of the device have been checked and tested for functionality at the factory. However, if defects occur despite our careful quality control, MICRO-EPSILON or your dealer must be notified immediately.

The liability for material defects is 12 months from delivery.

Within this period, defective parts, except for wearing parts, will be repaired or replaced free of charge, if the device is returned to MICRO-EPSILON with shipping costs prepaid. Any damage that is caused by improper handling, the use of force or by repairs or modifications by third parties is not covered by the liability for material defects. Repairs are carried out exclusively by MICRO-EPSILON. Further claims can not be made. Claims arising from the purchase contract remain unaffected. In particular, MICRO-EPSILON shall not be liable for any consequential, special, indirect or incidental damage. In the interest of further development, MICRO-EPSILON reserves the right to make design changes without notification.

For translations into other languages, the German version shall prevail.

7. Decommissioning, Disposal

- Remove the power supply and output cable from the sensor.
- Release the measuring wire from the measuring object. Do not let the measuring wire rewind without control (snap back).

Incorrect disposal may cause harm to the environment.

- Dispose of the device, its components and accessories, as well as the packaging materials in compliance with the applicable country-specific waste treatment and disposal regulations of the region of use.

8. Service, Repair

If the sensor is defective, please send us the affected parts for repair or exchange.

If the cause of a fault cannot be clearly identified, please send the entire measuring system to:

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Appendix

Accessories and Spare Parts

TR1-WDS	Guide pulley with mounting socket, see Fig. 8
TR3-WDS	Guide pulley with mounting socket, see Fig. 9
WE-xxxx-CLIP	Wire extension with wire clip and eyelet, see Fig. 10, wire length in millimeters for xxxx, max. 10.000 mm (33 ft)

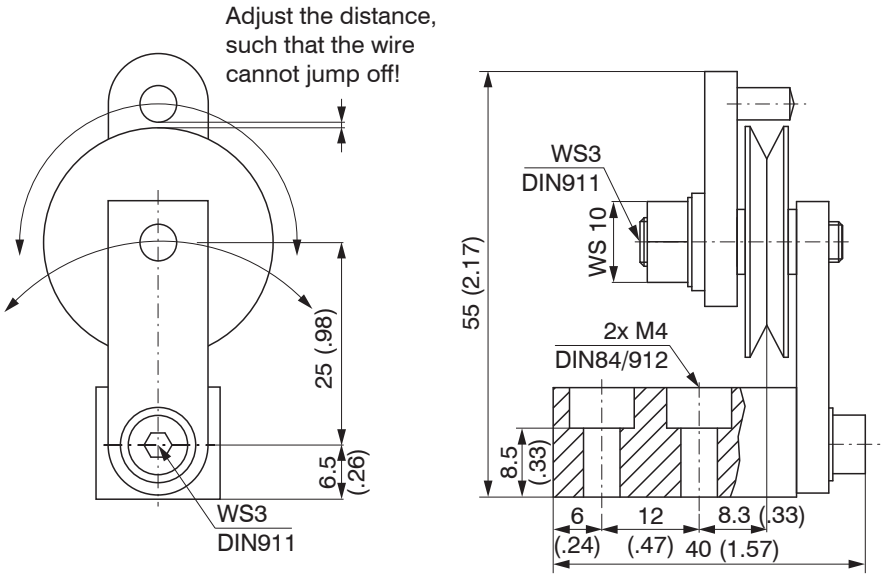

Fig. 8 Guide pulley TR1-WDS with mounting socket, dimensions in mm (inches), not to scale

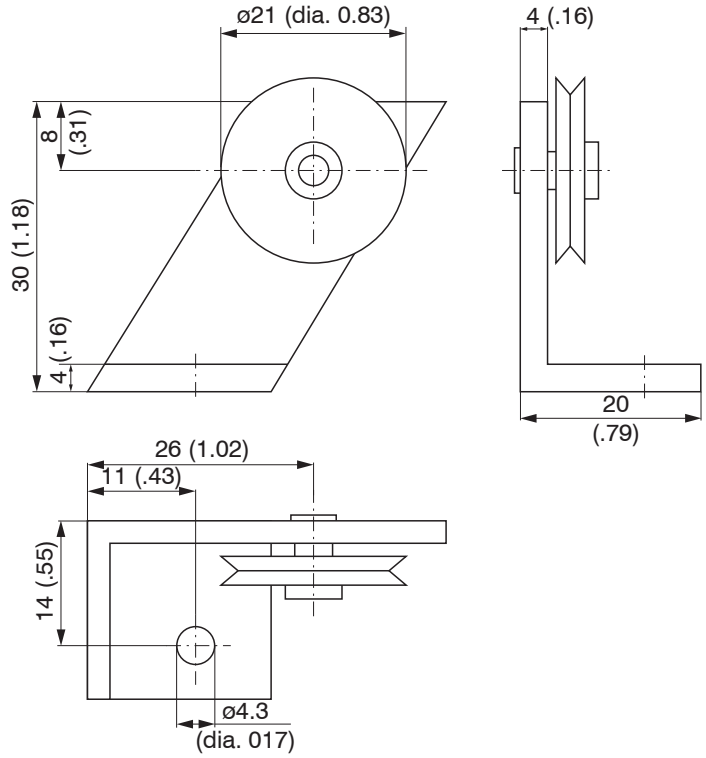

Fig. 9 Guide pulley TR3-WDS with mounting socket, dimensions in mm (inches), not to scale

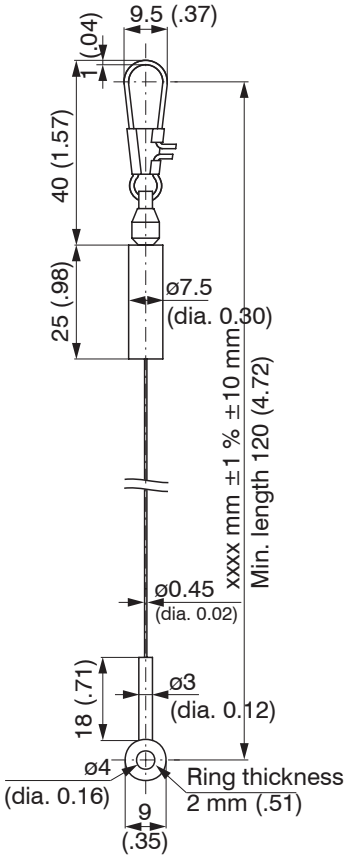

Fig. 10 Wire extension WE-xxxx-CLIP, dimensions in mm (inches), not to scale

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