

# Operating and Assembly Instructions

Magnetic incremental encoder without bearings

## Series MAG 200S

**Read the operating and assembly instructions prior to  
Assembly, starting installation and handling!  
Keep for future reference!**



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UL certificates can be requested from us.

An overview of our UL devices can be found at the following link:

**<https://iq.ulprospector.com/info>**

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## 1 General

### 1.1 Information about these Operating and Assembly Instructions

These Operating and Assembly Instructions contain important information about handling the device. Read these Operating and Assembly Instructions carefully before commencing any work; observe at all times.

In addition, you must observe all local accident prevention regulations as well as general health and safety rules that apply to the field of application of the device.

### 1.2 Scope of delivery

- Pulse wheel
- Scanning head/s
- Distance foil/s
- Fixing parts according to dimension drawing, if applicable
- Operating and Assembly Instructions
- EU Declaration of Conformity, UKCA Declaration of Conformity

### 1.3 Explanation of symbols

Warnings are indicated by symbols in these Operating and Assembly Instructions. The warnings are introduced by signal words that express the scope of the hazard. The warnings must be strictly heeded; you must act prudently to prevent accidents, personal injury, and property damage.



#### **WARNING!**

Indicates a possibly dangerous situation that can result in death or serious injury if it is not avoided.



#### **CAUTION!**

Indicates a possibly dangerous situation that can result in minor injury if it is not avoided.



#### **CAUTION!**

Indicates a possibly dangerous situation that can result in material damage if it is not avoided.



#### **NOTES!**

Indicates useful tips and recommendations as well as information for efficient and trouble-free operation.



#### **NOTES!**

Do not put out the pulse wheel to strong magnetic fields.

## Special Safety Notice



### **DANGER!**

#### **Life-threatening danger due to electric shock!**

Indicates a life-threatening situation due to electric shock. If the safety instructions are not complied with there is danger of serious injury or death. The work that must be executed should only be performed by a qualified electrician.

## 1.4 Disclaimer

All information and instructions in these Operating and Assembly Instructions have been provided under due consideration of applicable guidelines, as well as our many years of experience.

The manufacturer assumes no liability for damages due to:

- Failure to follow the instructions in the Operating and Assembly Instructions
- Non-intended use
- Deployment of untrained personnel
- Opening of the device or conversions of the device

In all other aspects the obligations agreed in the delivery contract as well as the delivery conditions of the manufacturer apply.

## 1.5 Copyright



### **NOTES!**

Content information, text, drawings, graphics, and other representations are protected by copyright and are subject to commercial property rights. It is strictly forbidden to make copies of any kind or by any means for any purpose other than in conjunction with using the device without the prior written agreement of the manufacturer. Any copyright infringements will be prosecuted.

## 1.6 Guarantee terms

The guarantee terms are provided in the manufacturer's terms and conditions.

## 1.7 Customer service

For technical information personnel is available that can be reached per telephone, fax or email. See manufacturer's address on page 2.

## 2 Safety



### **DANGER!**

This section provides an overview of all the important safety aspects that ensure protection of personnel, as well as safe and trouble-free device operation.

If these safety instructions are not complied with significant hazard can occur.

### 2.1 Responsibility of the owner

The device is used in commercial applications. Consequently, the owner of the device is subject to the legal occupational safety obligations, and subject to the safety, accident prevention, and environmental protection regulations that are applicable for the devices area of implementation.

### 2.2 Intended use

The device has been designed and constructed exclusively for the intended use described here.

Magnetic encoders are used for detection of angular movement and speed monitoring, for instance of electrical and mechanical drives, hoisting gear, and conveying machines.

Claims of any type due to damage arising from non-intended use are excluded; the owner bears sole responsibility for non-intended use.

**For UL and CSA:** For the use in NFPA 79 applications only.

### 2.3 Improper use

It is forbidden to use the device in explosive atmospheres.

The device must not be subjected to mechanical loads in addition to its own weight and unavoidable vibration and shock loads that arise during normal operations.

Examples for non-permitted mechanical loads (incomplete list):

- Fastening transport or lifting tackle to the device, for example a crane hook to lift a motor.
- Fastening packaging components to the device, for example ratchet straps, tarpaulins etc.
- Using the device as a step, for example by people to climb onto a motor.

It is not permitted to use the device in nuclear facilities and aircrafts.

### 2.4 Personal protective equipment

Wear personal protective equipment such as safety shoes and safety clothing to minimise risks to health and safety when carrying out work such as mounting, disassembly or commissioning. Adhere to all applicable statutory regulations as well as the rules and standards determined by the owner.

## 2.5 Personnel

Installation and commissioning must be carried out by skilled technical staff only.

## 2.6 Special dangers

The following section describes the residual risks as determined by a risk analyse.

## 2.7 Electric current



### **DANGER!**

#### **Life-threatening danger due to electrical shock!**

There is an imminent life-threatening hazard if live parts are touched. Damage to insulation or to specific components can pose a life-threatening hazard.

**Therefore:** Immediately switch off the device and have it repaired if there is damage to the insulation of the power supply.

De-energize the electrical equipment and ensure that all components are connected for all tasks on the electrical equipment.

Keep moisture away from live parts. Moisture can cause short circuits.

## 2.8 Rotating shafts



### **WARNING!**

#### **Danger of injury due to rotating shafts!**

Touching rotating shafts can cause serious injuries.

**Therefore:** Do not reach into moving parts/shafts or handle moving parts/shafts during operation.

Do not open covers during operation. Prior to opening the covers ensure that all parts have come to a standstill.

## 2.9 Safeguarding against restart



### **DANGER!**

#### **Life-threatening danger if restarted without authorization!**

When correcting faults there is danger of the power supply being switched on without authorization.

This poses a life-threatening hazard for persons in the danger zone.

**Therefore:** Prior to starting work, switch off the system and safeguard it from being switched on again.

## 2.10 Exceeding the maximum speed



### **WARNING!**

If the maximum speed is exceeded it is possible that the resulting centrifugal force could cause the pulse wheel to lose its mechanical integrity.

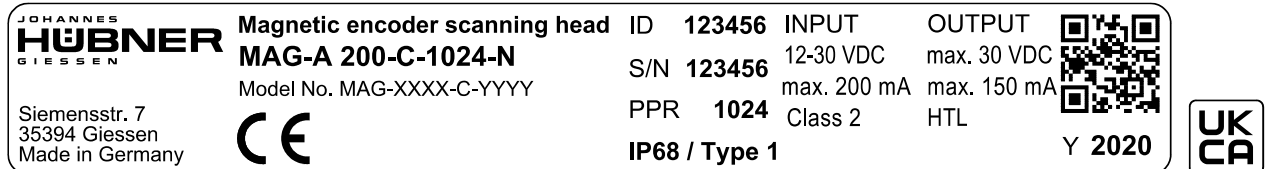


### 3 Technical data

#### 3.1 Name plate

##### Scanning head

Example name plate:



- Manufacturer, address, CE marking, UKCA marking
- Type
- For UL and CSA: Model No.
- Item No. (ID)
- Serial number (S/N)
- Pulses per revolution (PPR)
- Degree of protection (IP)
- Supply voltage (INPUT)
- OUTPUT
- QR code
- Year of manufacture (Y)

##### Pulse wheel

On the front side of the pulse wheel the following information is engraved:

- Serial number (S/N)
- Item No. (ID)
- Max. speed in 1/min (rpm)

### 3.2 Type key – pulse wheel

	MAG-P	200S	128	N	/50	R
Pulse wheel for magnetic incremental encoder without bearings						
Series						
Number of magnetic poles						
Marker pulse track						
Centering diameter						
Pulse wheel with cone clamping element						

### 3.3 Type key – scanning head

	MAG-A	200S	C	1024	N
Scanning head for magnetic incremental encoder without bearings					
Series					
Connection type: C = Cable with free cable ends R = 12-pole M23 round connector					
Pulses per revolution (PPR)					
Marker pulse output					

### 3.4 Electrical characteristics

Electrical characteristics		
Supply voltage	12 ... 30 V DC	For UL and CSA: Class 2
No-load current consumption	max. 50 mA at 24 V DC	
Max. frequency	200 kHz	
Connection type (see chapter 6)	Cable with free cable ends	
	12-pole M23 device connector incl. 12-pole M23 cable connector	
Connection positions (see chapter 7)	right	Standard
	left	Option
Output signals	0° - signal (A) and inverted signal 90° - signal (B) and inverted signal Marker pulse (N) and inverted signal Error output (ERR) and inverted signal	
Signal amplitudes (see name plate)	HTL (approx. same as supply voltage) Output current: 60 mA	Standard
	TTL (5 V acc. to RS 422)	Option
Duty cycle	1:1 ± 3%	
Phase shift 0°, 90°	90° ± 5%	
Number of pulses (see name plate)	512, 1024, 2048, 4096, 8192 square wave pulses per revolution (PPR)	Standard
	bis max. 32768 square wave pulses per revolution (PPR)	

#### Information for UL and CSA applications

Max. input current	200 mA
Max. output voltage (see name plate)	30 V DC (HTL) or 5 V DC (TTL)
Max. output current	150 mA

### 3.5 Mechanical characteristics

Mechanical characteristics		
Dimension drawings	see chapter 7	
Degree of protection of scanning head acc. to EN 60529	IP 68 (for UL and CSA: Type 1)	
Max. speed (see pulse wheel marking)	Pulse wheel without CFRP wrapping	2600 1/min (rpm)
	Pulse wheel with CFRP wrapping	4000 1/min (rpm)
Axial tolerance (Displacement of pulse wheel and scanning head)	± 3 mm	
Radial tolerance (Air gap between pulse wheel and scanning head)	Pulse wheel without CFRP wrapping	0.1 ... 2.0 mm
	Pulse wheel with CFRP wrapping	0.1 ... 1.7 mm
Temperature range Scanning head	Connection type Cable	-40 ... +85 °C (for UL and CSA: -40 ... +80 °C)
	Connection type M23 connector	-40 ... +85 °C
Temperature range Pulse wheel	-40 ... +85 °C	

## 4 Safety information concerning transport



### CAUTION!

#### Material damage caused by improper transport!

Observe the symbols and information on the packaging:

- Do not throw - risk of breakage
- Keep dry
- Do not expose to heat above 40 °C or direct sunlight.

### 4.1 Goods inward inspection

Check the delivery immediately upon receipt for transit damage or short delivery. Inform the carrier immediately on receipt if you determine that damage has occurred during transit (take photos as proof).

### 4.2 Packaging (Disposal)

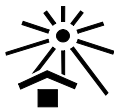
The packaging is not taken back; dispose of according to the respective valid statutory provisions and local regulations.

### 4.3 Storing packages (devices)



#### Keep dry

Keep packages dry and free from dust; protect from moisture.



#### Protect against heat

Protect packages from heat above 40 °C and direct sunlight.

If you intend to store the device for a longer period of time (> 6 months) we recommend you use protective packaging (with desiccant).

## **5 Mounting**

### **5.1 Safety notes for mounting**

#### **Risk of destruction by mechanical shock**

- Powerful impacts such as blows with a hammer can destroy the scanning head.
- Never use force. Everything fits together easily when fitted properly.
- Use appropriate puller tools to disassemble.

#### **Risk of destruction by mechanical overloading**

- Never position the magnetic incremental encoder upright on the magnetic band.
- Ensure the magnetic band is not subjected to mechanical force.

#### **Risk of destruction by sticky liquids**

- Sticky liquids can damage the scanning head and the pulse wheel.  
Dismantling a magnetic incremental encoder glued to the shaft can lead to its destruction.

#### **Risk of destruction by external magnetic fields**

- External magnetic fields can destroy the magnetisation of the encoder.  
Consequently, do not use magnetic holders, in particular during fitting/dismantling procedures.

#### **Avoiding disturbances**

- Use a shielded encoder cable.
- Avoid laying of disturbing cables (e.g. motor cables) in parallel to the encoder cable or keep as short as possible.
- Maintain the largest possible distance between disturbing cables and the encoder cable

#### **Risk of damage by ferromagnetic particles**

- Ferromagnetic particles (for example metallic dust) can become deposited on the pulse wheel and lead to a loss of measurements.  
Use protective casing, if necessary.

#### **Danger of explosion**

- The magnetic encoder may not be used in explosion-threatened areas.

## 5.2 Mounting of pulse wheels for screw mounting



Note also the information provided by the dimension drawing before mounting (see chapter 7).

### Mounting preparation

Inspect the shaft carefully before mounting. Clean the shaft and remove any deformations or burrs that may be present.

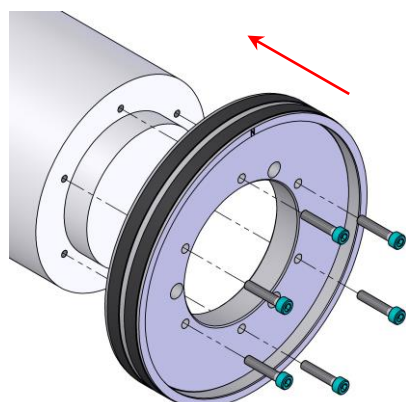
The max. permissible run-out error is 0.6 mm.

**Secure all screw connections with Loctite® 243 (medium-strength)!**

**A torque wrench has to be used for all screws!**



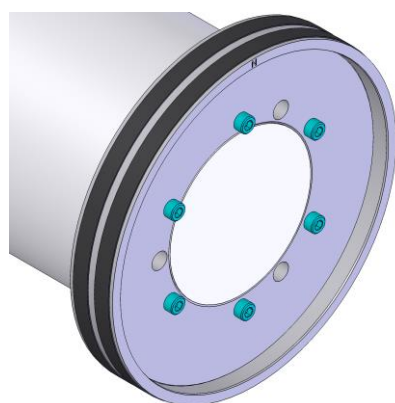
Die beiden Symbole TOP auf Polrad und Abtastkopf müssen in die gleiche Richtung zeigen.



#### Step 1:

Mount the pulse wheel on the shaft and secure it with the screws supplied.

The number and size of the screws supplied depend on the pulse wheel variant delivered.



#### Step 2:

Tighten the screws crosswise with the appropriate tightening torque from the following table:

Screw size	Property class	Tightening torque
<b>M5</b>	8.8	<b>5 Nm</b>
<b>M6</b>	8.8	<b>8 Nm</b>
<b>M8</b>	8.8	<b>20 Nm</b>
<b>M10</b>	8.8	<b>40 Nm</b>
<b>M12</b>	8.8	<b>70 Nm</b>

### 5.3 Mounting of pulse wheels with cone clamping element



Note also the information provided by the dimension drawing before mounting (see chapter 7).

#### Mounting preparation

Inspect the shaft carefully before mounting. Clean the shaft and remove any deformations or burrs that may be present.

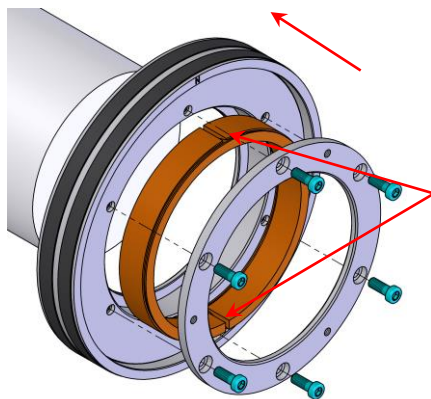
The max. permissible run-out error is 0.6 mm.

**Secure all screw connections with Loctite® 243 (medium-strength)!**

**A torque wrench has to be used for all screws!**



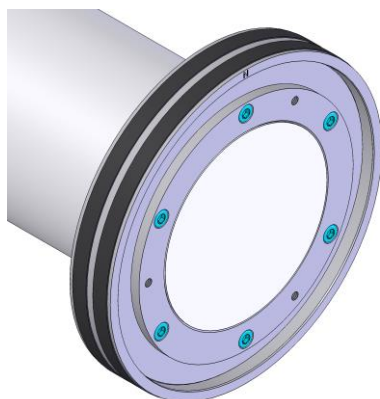
Die beiden Symbole TOP auf Polrad und Abtastkopf müssen in die gleiche Richtung zeigen.



#### Step 1:

Mount the pulse wheel with the unclamped clamping ring on the motor shaft.

The clamping element inside the pulse wheel consists of two slotted tapered rings. Minimize the unbalance of the pulse wheel by ensuring that both slots have an offset of 180°



#### Step 2:

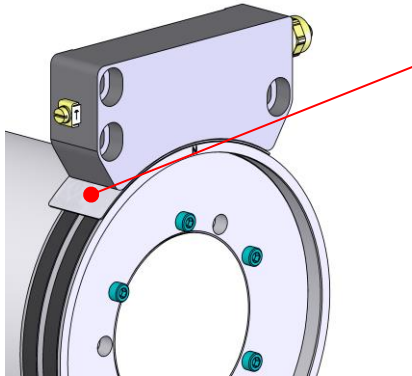
Align the pulse wheel in the axial direction to the scanning head as shown on the dimension drawing (see chapter 7).

Secure the pulse wheel on the motor shaft by tightening the 6 clamping screws **M6 x 16 – A2-70** of the clamping ring with a tightening torque of **7 Nm**.

A torque wrench must be used for tightening to avoid excessive stress on the screws and the pulse wheel!



#### 5.4 Mounting of scanning heads



##### Step 1:

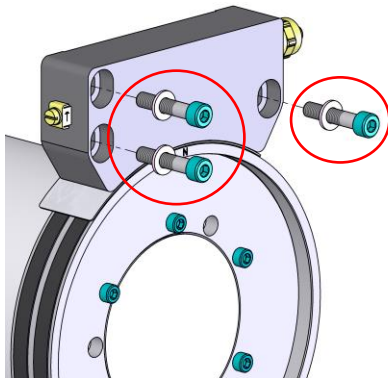
Use the supplied distance foil to align the scanning head to the pulse wheel.

Depending on the pulse wheel variant, use the appropriate distance foil from the following table:

Pulse wheel variant	Distance foil
without CFRP wrapping	Thickness 1,0 mm
with CFRP wrapping	Thickness 0,7 mm

For alignment, place the distance foil between the scanning head and the pulse wheel.

Do not let any dirt get between the scanning head, distance foil and pulse wheel until the alignment is complete.



##### Step 2:

Attach the scanning head to a fixed part of the machine using the 3 supplied screws **M8 x 40 – 8.8** and the corresponding washers!

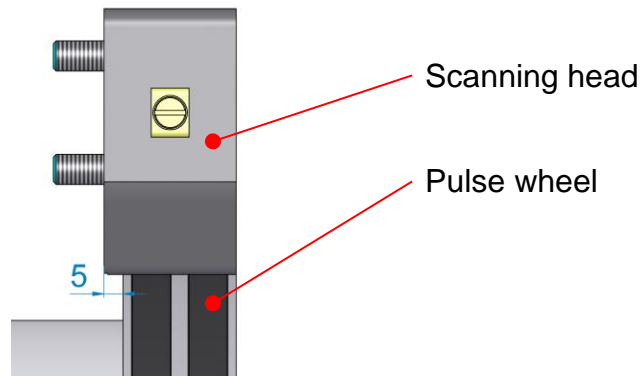
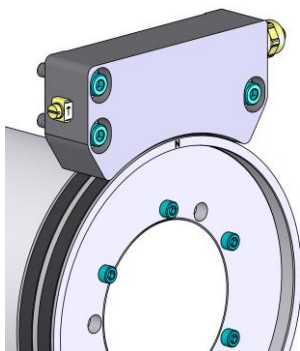
##### Tightening torque: 20 Nm

If the attachment point does not provide a good electrical connection to earth potential, use the protective conductor terminal for earthing the scanning head.

Make sure when mounting the scanning head that the distance foil can be removed easily (max. 0.1 mm play).

**Remove the distance foil.**

#### Correct axial alignment of the scanning head:



## 6 Connection diagrams

### 6.1 Scanning head with connection cable

Anschlusskabel <i>Connection cable</i>		Anschlussplan PN109-485d <i>Connection diagram PN109-485d</i>					
1		weiß	<i>white</i>	0V		GND	<i>GND</i>
2		braun	<i>brown</i>	+UB		Versorgungsspannung	<i>Power Supply</i>
3		braun	<i>brown</i>	0°		Inkr. Ausgang 0°	<i>Incr. Output 0°</i>
4		grün	<i>green</i>	$\overline{0^\circ}$		Inkr. Ausgang 0° Invers	<i>Incr. Output 0° Inverse</i>
5		grau	<i>grey</i>	90°		Inkr. Ausgang 90°	<i>Incr. Output 90°</i>
6		rosa	<i>pink</i>	$\overline{90^\circ}$		Inkr. Ausgang 90° Invers	<i>Incr. Output 90° Inverse</i>
7		rot	<i>red</i>	N *		Nullimpuls	<i>Reference</i>
8		schwarz	<i>black</i>	$\overline{N}$ *		Nullimpuls Invers	<i>Reference Inverse</i>
9		violett	<i>violet</i>	ERR *		Fehlerausgang (Low aktiv)	<i>Error Output (Low activ)</i>
10		blau	<i>blue</i>	$\overline{ERR}$ *		Fehlerausgang (High aktiv)	<i>Error Output (High activ)</i>

Anschlusskabel  
4x2x0,25+2x0,5 paarig verseilt, geschirmt  
*Connection cable*  
4x2x0.25+2x0.5 twin-stranded, shielded

Querschnitt: 0,25 mm<sup>2</sup> / 0,5 mm<sup>2</sup>  
*Cross-section:* 0.25 mm<sup>2</sup> / 0.5 mm<sup>2</sup>  
Aussendurchmesser: 8,5 mm  
*Outside dia:* 8.5 mm

Typ / Type :

Zulassungen / Approvals:

Beispiele / Examples :

UL AWM Style 20236 or 21209

1. ÖLFLEX® SERVO FD 798 CP

CSA

LAPP 0036927

Schirm ist mit Gehäuse verbunden

2. TOPGEBER® 512 PUR

*shield is connected to casing*

HELU 78080

\* optionale Ausführung

\* *optional output*



#### NOTES for UL and CSA!

Do only use copper cables!

## 6.2 Scanning head with M23 round plug

M23-Stecker		Anschlussplan		PN141-427
M23 plug		Connection diagram		PN141-427
1	0V		GND	<i>GND</i>
2	+UB		Versorgungsspannung	<i>Power Supply</i>
3	0°		Inkr. Ausgang 0°	<i>Incr. Output 0°</i>
4	$\overline{0^\circ}$		Inkr. Ausgang 0° Invers	<i>Incr. Output 0° Inverse</i>
5	90°		Inkr. Ausgang 90°	<i>Incr. Output 90°</i>
6	$\overline{90^\circ}$		Inkr. Ausgang 90° Invers	<i>Incr. Output 90° Inverse</i>
7	N *		Nullimpuls	<i>Reference</i>
8	$\overline{N}$ *		Nullimpuls Invers	<i>Reference Inverse</i>
9	ERR		Fehlerausgang (Low aktiv)	<i>Error Output (Low active)</i>
10	$\overline{ERR}$		Fehlerausgang (High aktiv)	<i>Error Output (High active)</i>
11	-	-	nicht belegt	<i>not connected</i>
12	-	-	nicht belegt	<i>not connected</i>

\* optionale Ausführung

\* *optional output*

Ansicht auf Geräteanschluss

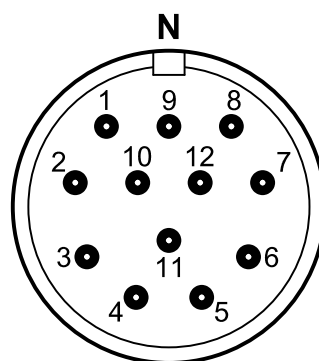
*Socket insert view*

Schirmung:

Der Schirm der Signalleitung ist direkt mit dem Steckergehäuse zu verbinden.

*Shield:*

*The shield of the signal cable is connected at the socket housing.*

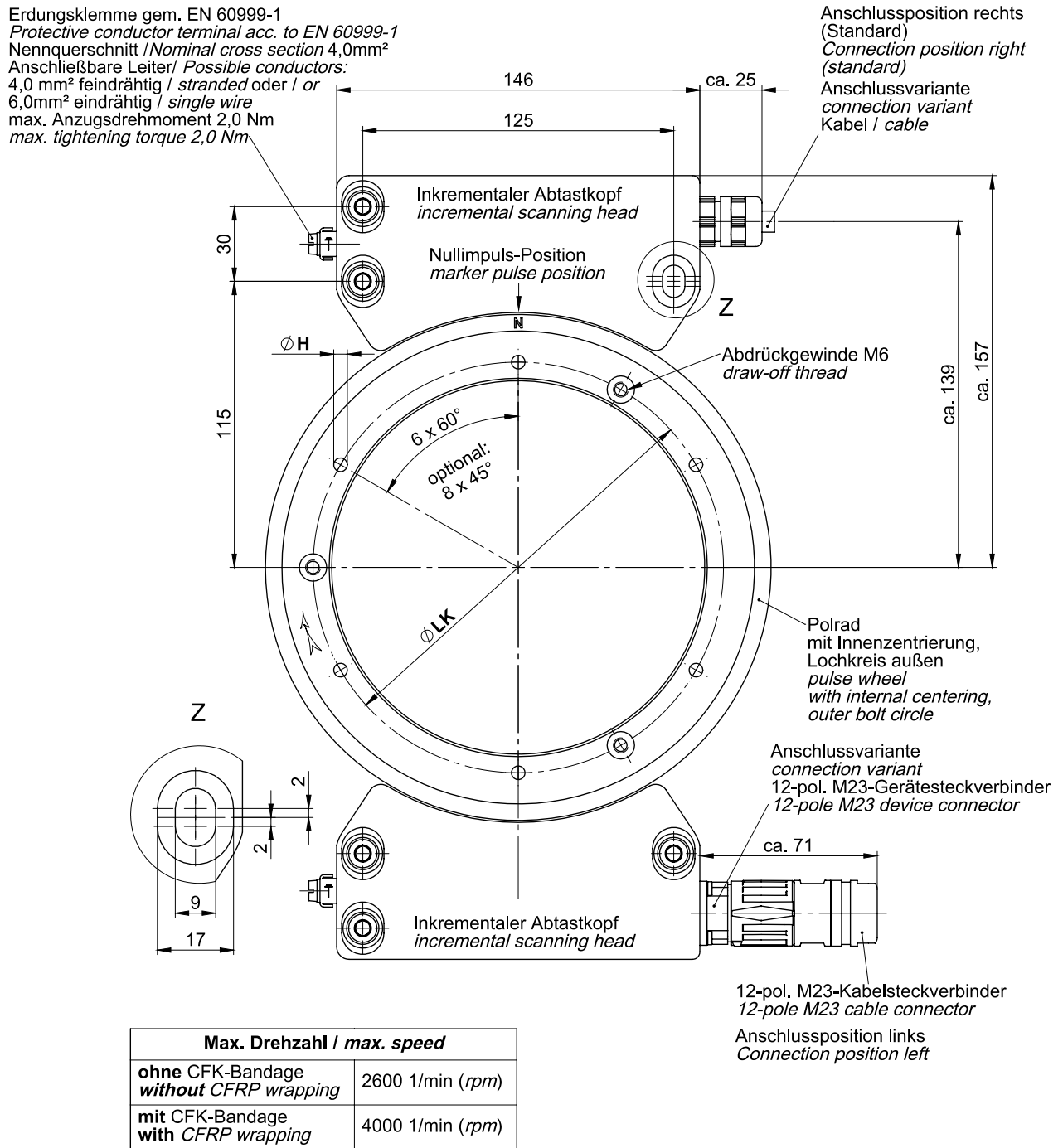


### NOTES for UL and CSA!

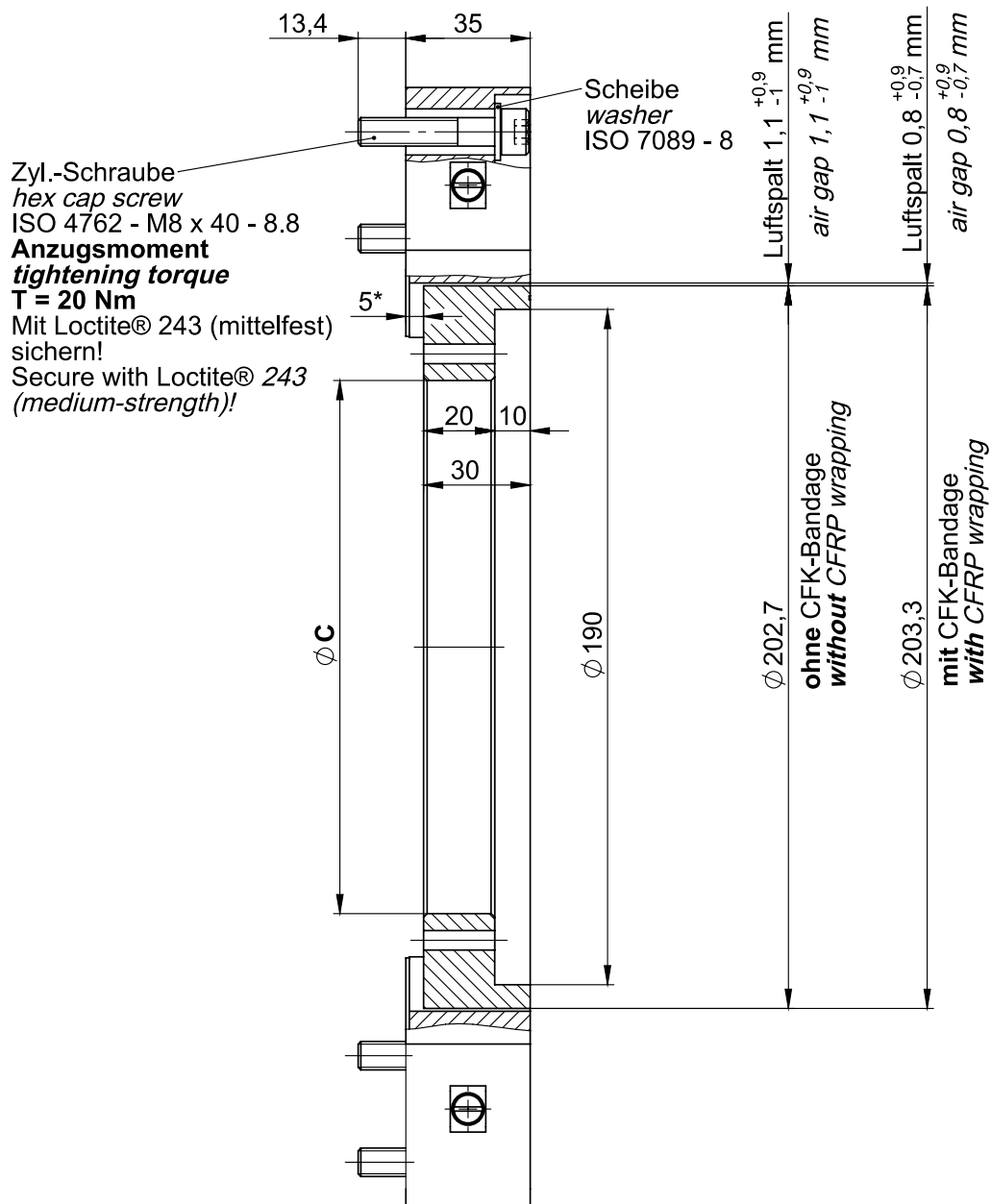
Do only use copper cables!

## 7 Dimension drawings

### 7.1 Screw mounting with internal centering and bolt circle outside



MAG 200S Screw mounting - internal centering - bolt circle outside HM 22 M 117671



\* Max. axiale Verschiebung des Polrads:  $\pm 3$  mm  
Max. axial tolerance of pulse wheel:  $\pm 3$  mm

Parameter / parameters	Bereich / range
Ø C	Zentrierung / centering 50 ... 160 mm
Ø H	Bohrungen / holes 5,5 ... 13,5 mm
Ø LK	Lochkreis / bolt circle

MAG 200S Screw mounting - internal centering - bolt circle outside HM 22 M 117671

**7.2 Screw mounting with internal centering and bolt circle inside**

Erdungsklemme gem. EN 60999-1

Protective conductor terminal acc. to EN 60999-1

Nennquerschnitt / Nominal cross section 4,0mm<sup>2</sup>

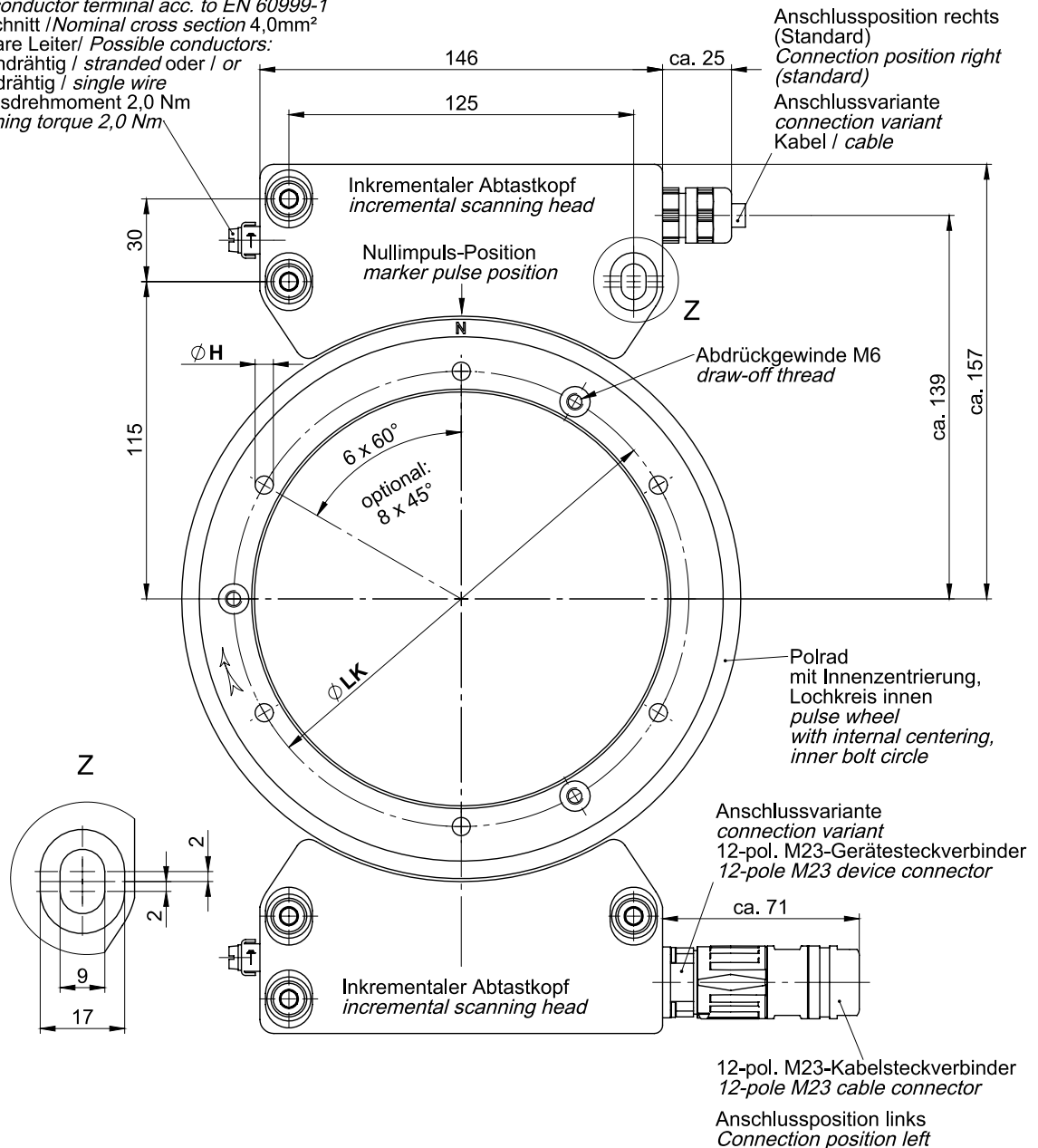
Anschließbare Leiter / Possible conductors:

4,0 mm<sup>2</sup> feindrähtig / stranded or / or

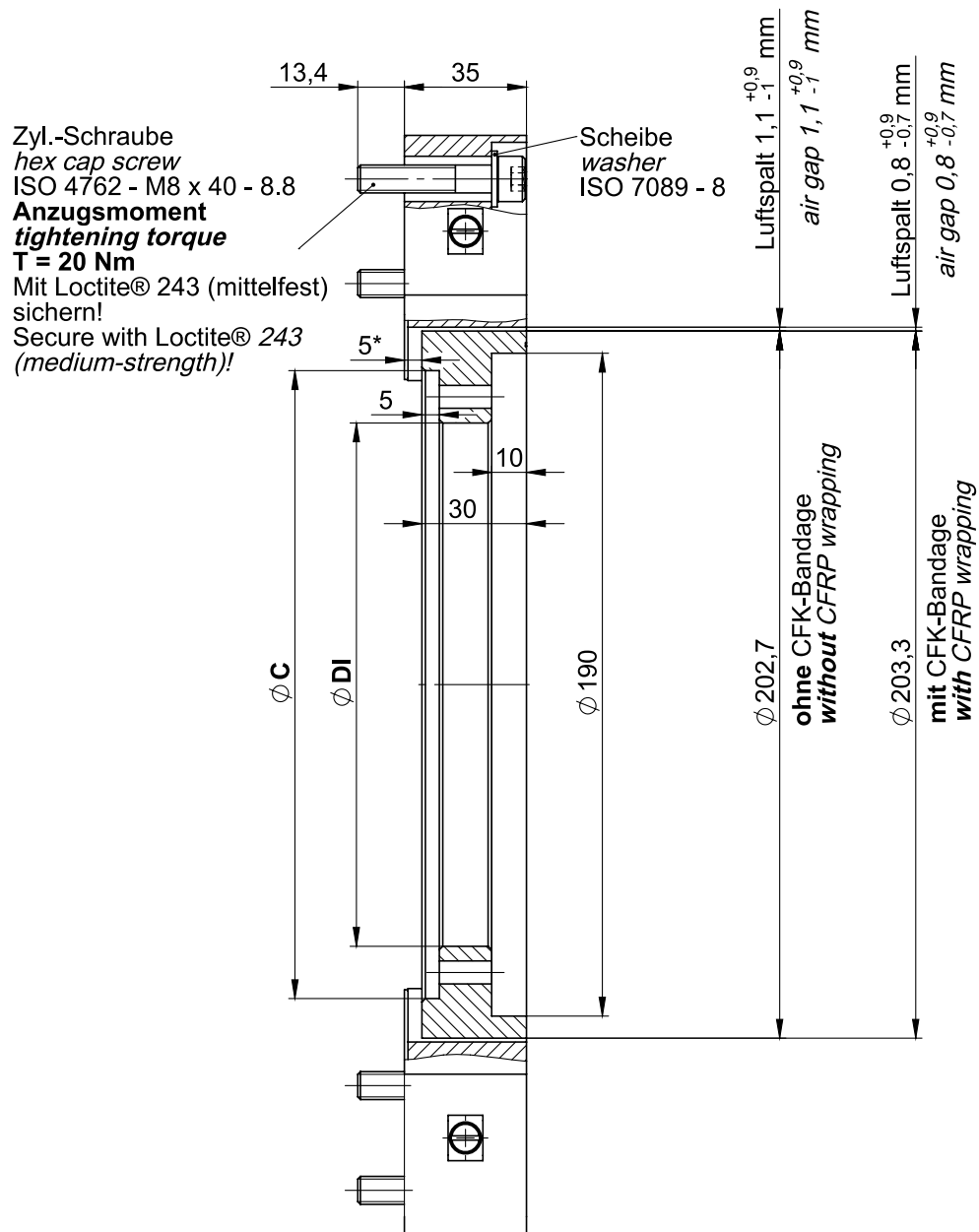
6,0mm<sup>2</sup> eindrähtig / single wire

max. Anzugsdrehmoment 2,0 Nm

max. tightening torque 2,0 Nm



Max. Drehzahl / max. speed	
ohne CFK-Bandage without CFRP wrapping	2600 1/min (rpm)
mit CFK-Bandage with CFRP wrapping	4000 1/min (rpm)



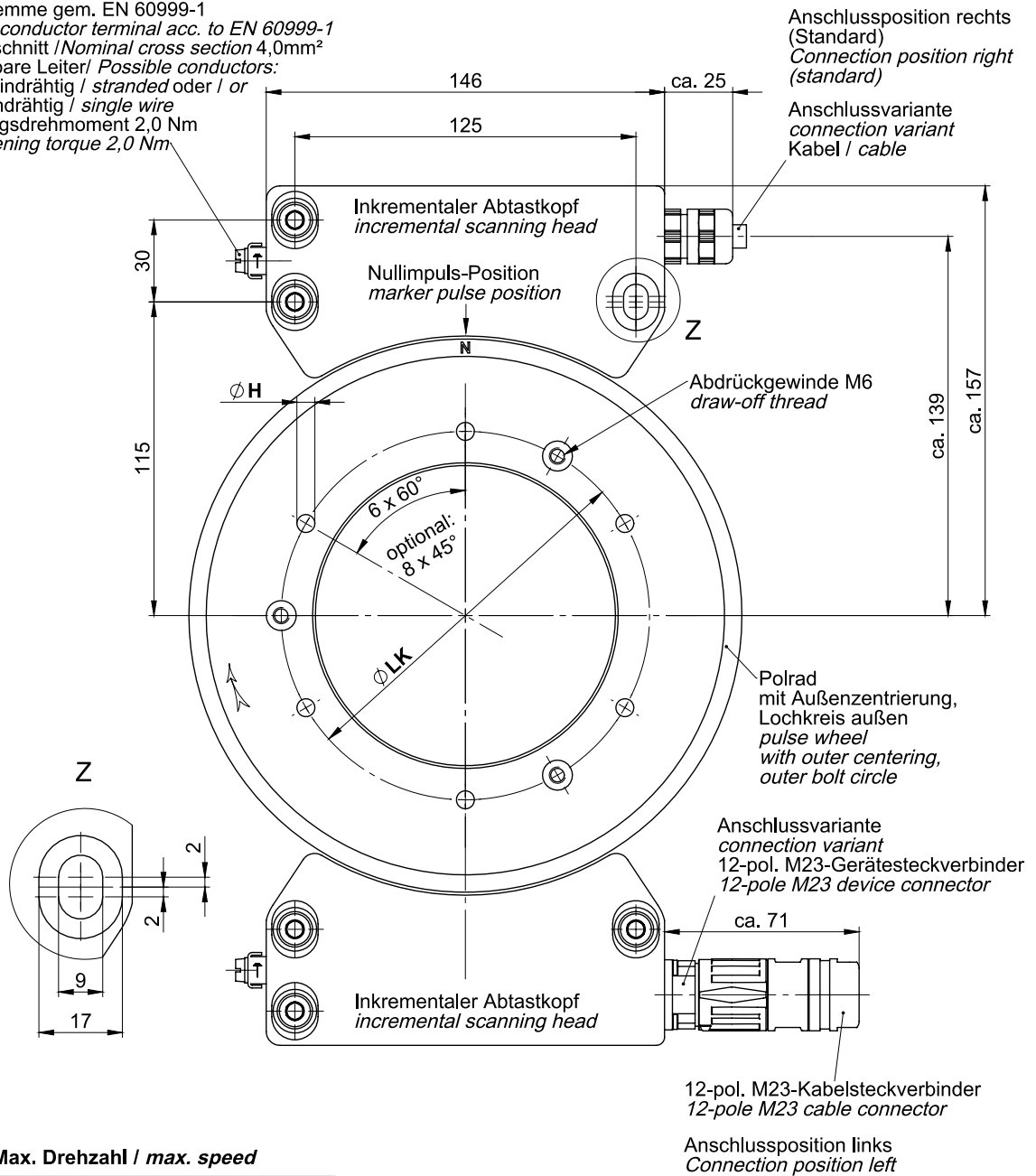
\* Max. axiale Verschiebung des Polrads:  $\pm 3$  mm  
Max. axial tolerance of pulse wheel:  $\pm 3$  mm

Parameter / parameters		Bereich / range
Ø C	Zentrierung / centering	80 ... 180 mm
Ø DI	Innendurchmesser / inner diameter	
Ø H	Bohrungen / holes	5,5 ... 13,5 mm
Ø LK	Lochkreis / bolt circle	

MAG 200S Screw mounting - internal centering - bolt circle inside HM 22 M 117672

### 7.3 Screw mounting with external centering and bolt circle outside

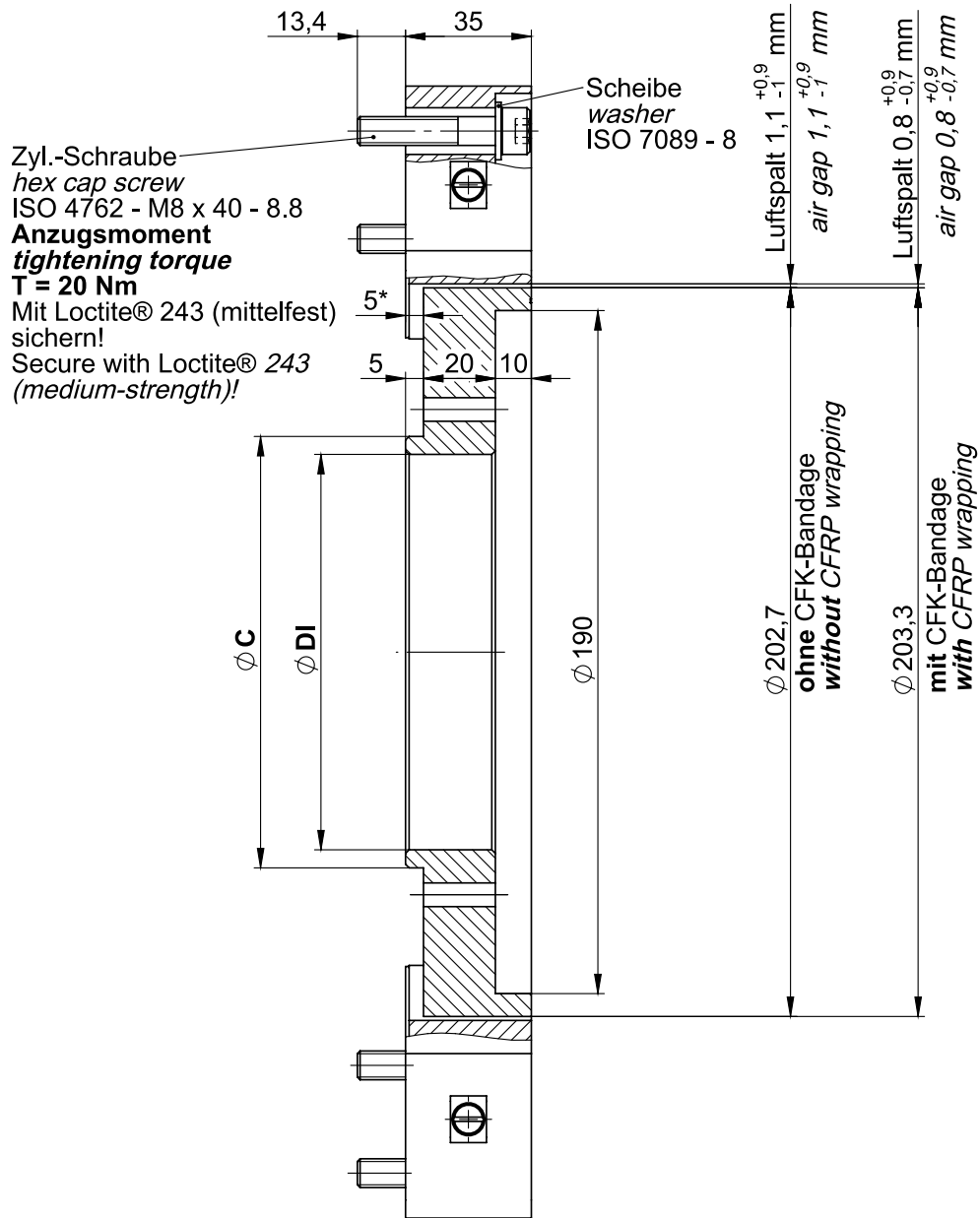
Erdungsklemme gem. EN 60999-1  
*Protective conductor terminal acc. to EN 60999-1*  
Nennquerschnitt / *Nominal cross section* 4,0mm<sup>2</sup>  
Anschließbare Leiter / *Possible conductors:*  
4,0 mm<sup>2</sup> feindrähtig / *stranded* oder / *or*  
6,0mm<sup>2</sup> eindrähtig / *single wire*  
max. Anzugsdrehmoment 2,0 Nm  
*max. tightening torque 2,0 Nm*



**Max. Drehzahl / max. speed**

ohne CFK-Bandage <i>without CFRP wrapping</i>	2600 1/min (rpm)
mit CFK-Bandage <i>with CFRP wrapping</i>	4000 1/min (rpm)



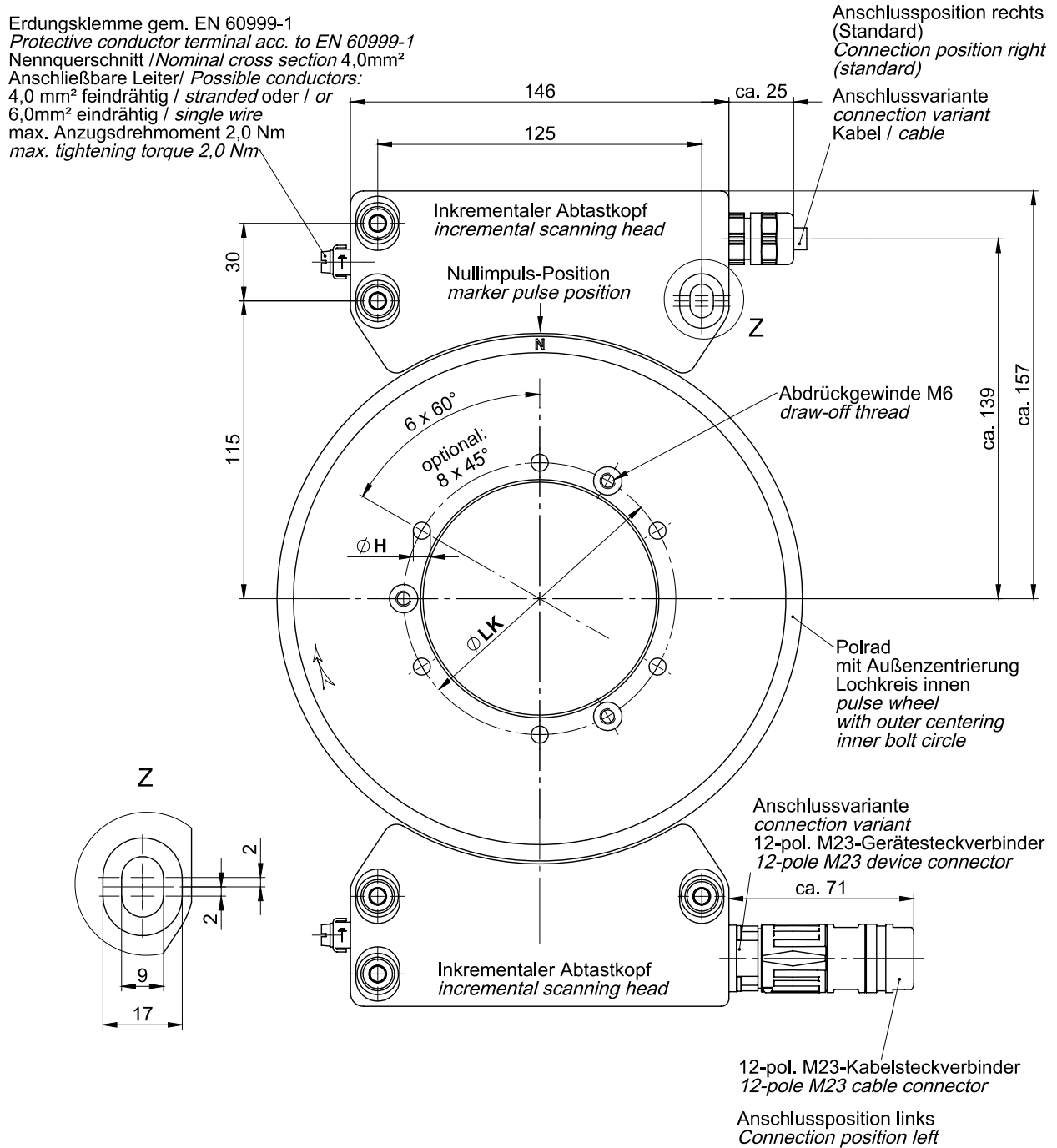


\* Max. axiale Verschiebung des Polrads:  $\pm 3$  mm  
Max. axial tolerance of pulse wheel:  $\pm 3$  mm

Parameter / parameters		Bereich / range
Ø C	Zentrierung / centering	60 ... 160 mm
Ø DI	Innendurchmesser / Inner diameter	
Ø H	Bohrungen / holes	5,5 ... 13,5 mm
Ø LK	Lochkreis / bolt circle	

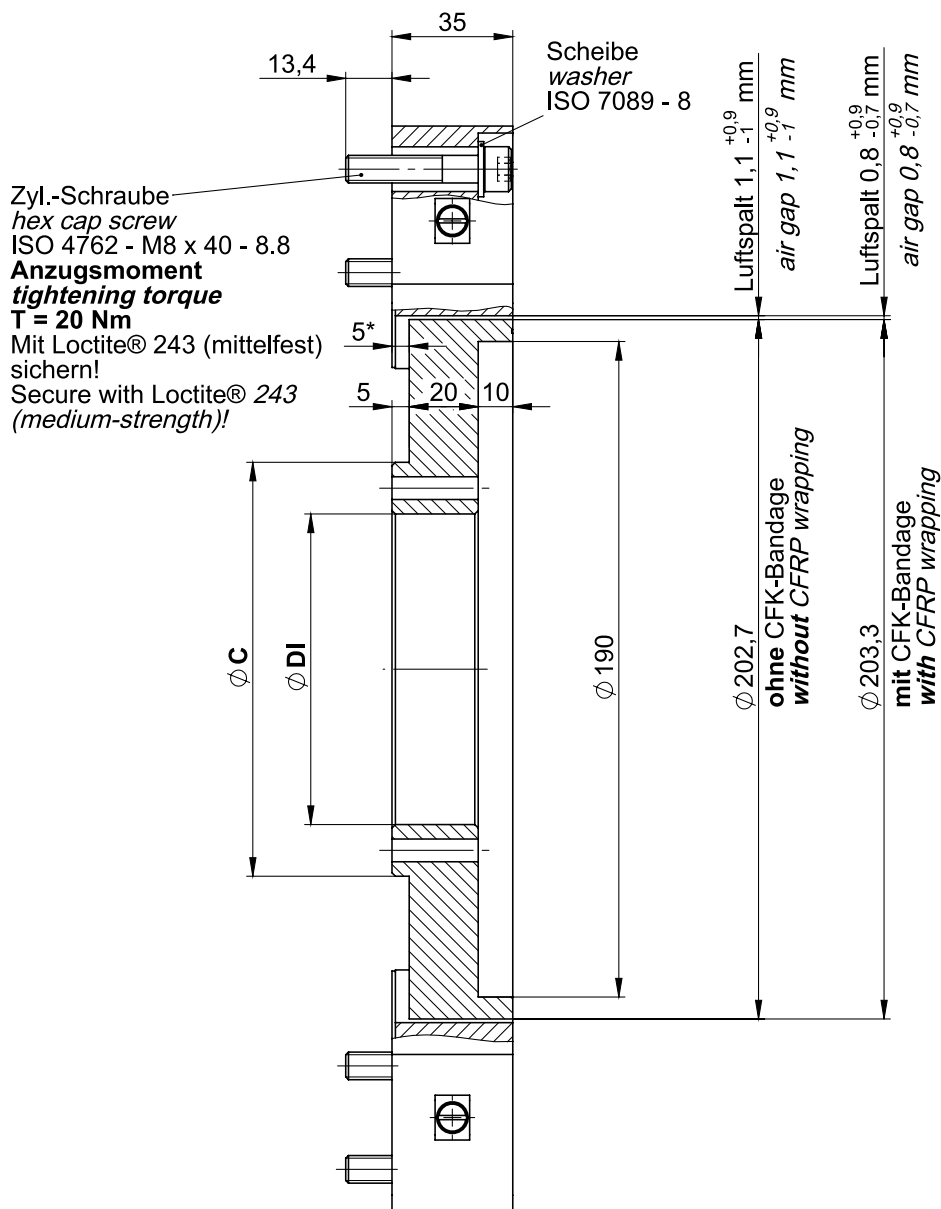
MAG 200S Screw mounting - external centering - bolt circle outside HM 22 M 117673

**7.4 Screw mounting with external centering and bolt circle inside**



Max. Drehzahl / <i>max. speed</i>	
ohne CFK-Bandage <i>without CFRP wrapping</i>	2600 1/min ( <i>rpm</i> )
mit CFK-Bandage <i>with CFRP wrapping</i>	4000 1/min ( <i>rpm</i> )

**MAG 200S Screw mounting - external centering - bolt circle inside HM 22 M 117674**



\* Max. axiale Verschiebung des Polrads:  $\pm 3$  mm  
Max. axial tolerance of pulse wheel:  $\pm 3$  mm

Parameter / parameters		Bereich / range
Ø C	Zentrierung / centering	80 ... 180 mm
Ø DI	Innendurchmesser / Inner diameter	
Ø H	Bohrungen / holes	5,5 ... 13,5 mm
Ø LK	Lochkreis / bolt circle	

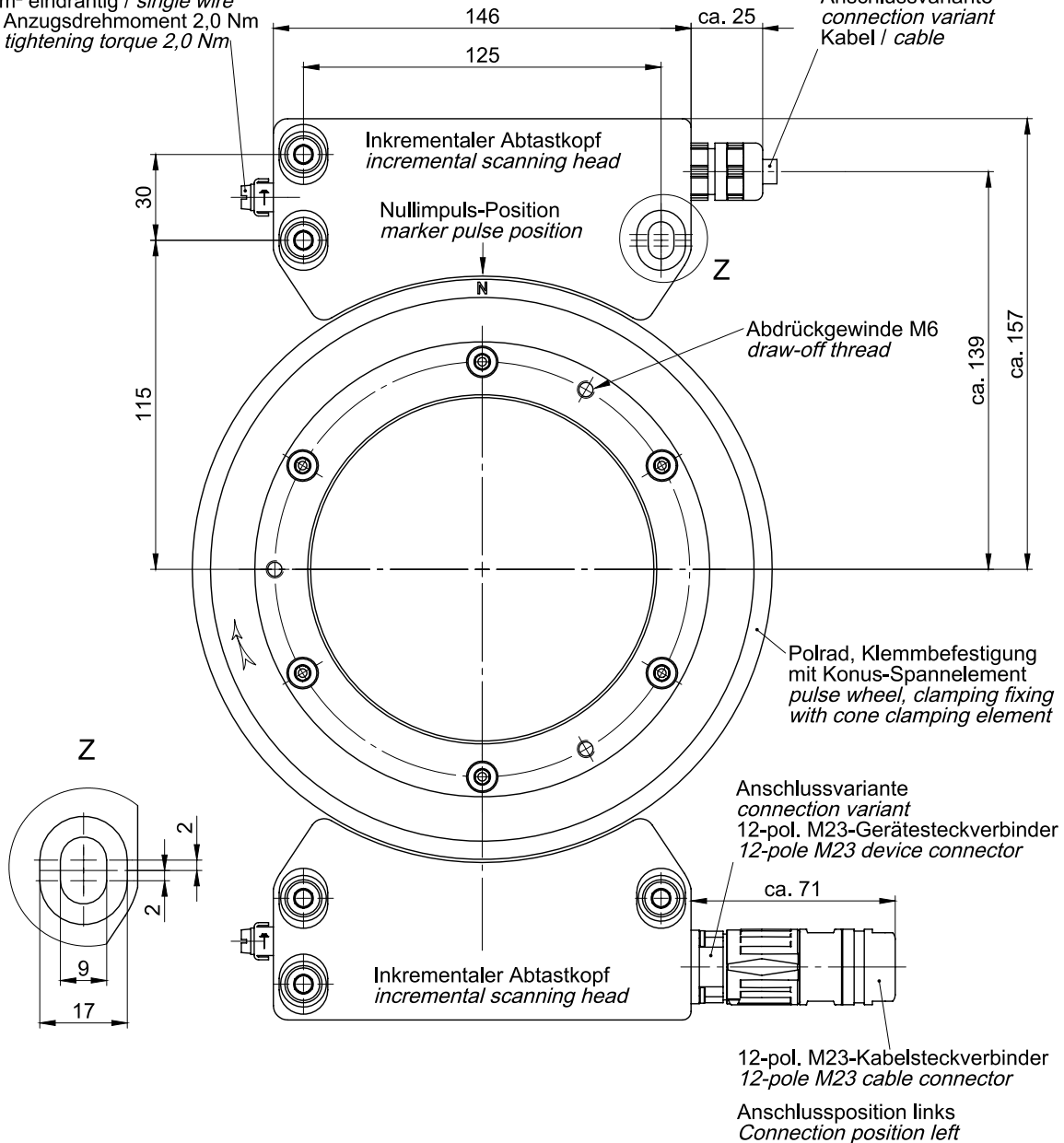
MAG 200S Screw mounting - external centering - bolt circle inside HM 22 M 117674

**7.5 Pulse wheel for clamping with cone clamping element**

Erdungsklemme gem. EN 60999-1  
*Protective conductor terminal acc. to EN 60999-1*  
Nennquerschnitt / *Nominal cross section* 4,0mm<sup>2</sup>  
Anschließbare Leiter / *Possible conductors:*  
4,0 mm<sup>2</sup> feindrähtig / *stranded* oder / *or*  
6,0mm<sup>2</sup> eindrähtig / *single wire*  
max. Anzugsdrehmoment 2,0 Nm  
*max. tightening torque 2,0 Nm*

Anschlussposition rechts  
*(Standard)*  
*Connection position right*  
*(standard)*

Anschlussvariante  
*connection variant*  
Kabel / *cable*



Anschlussvariante  
*connection variant*  
12-pol. M23-Gerätesteckverbinder  
*12-pole M23 device connector*

12-pol. M23-Kabelsteckverbinder  
*12-pole M23 cable connector*

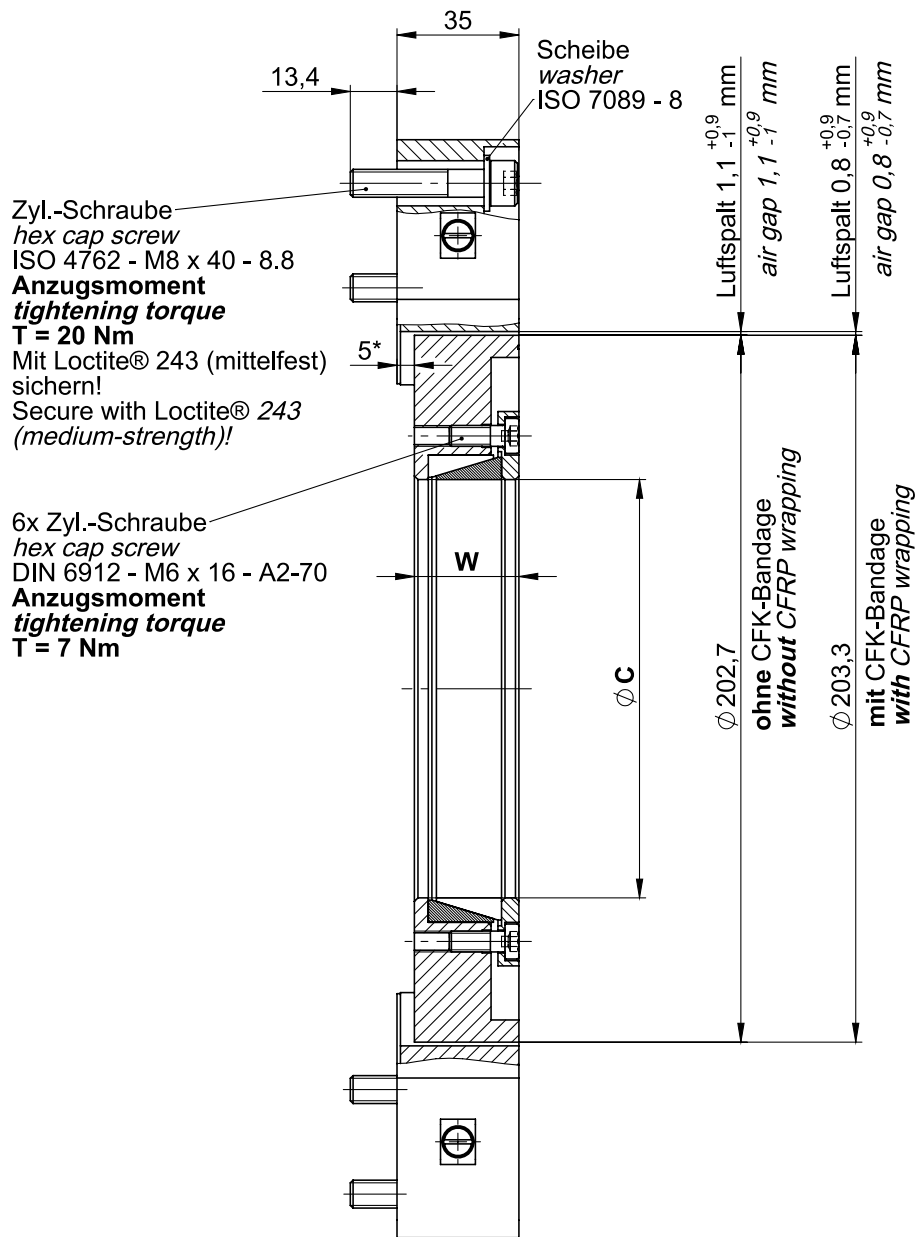
Anschlussposition links  
*Connection position left*

Max. Drehzahl / <i>max. speed</i>	
ohne CFK-Bandage <i>without CFRP wrapping</i>	2600 1/min ( <i>rpm</i> )
mit CFK-Bandage <i>with CFRP wrapping</i>	4000 1/min ( <i>rpm</i> )

**MAG 200S**

**Clamping with cone clamping element**

**HM 22 M 117675**



\* Max. axiale Verschiebung des Polrads:  $\pm 3$  mm  
Max. axial tolerance of pulse wheel:  $\pm 3$  mm

Parameter / parameters		Bereich / range	
Ø C	Zentrierung / centering	70 ... 150 mm	
W	Breite / width	max. 30 mm	ØC < 130 mm
		max. 40 mm	ØC ≥ 130 mm