

Operating and Assembly Instructions

Incremental Encoder Ex FG 40

with Ex approval

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

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1 General

1.1 Information about the Operating and Assembly Instructions



These Operating and Assembly Instructions provide important instructions for working with the device. They must be carefully read prior to starting all tasks, and the instructions contained herein must be followed.

In addition, applicable local regulations for the prevention of industrial accidents and general safety regulations must be complied with.

These Operating and Assembly Instructions have been drawn up with the utmost care and attention. Nevertheless, we cannot exclude the possibility of errors in form and content. It is strictly forbidden to reproduce this publication or parts of this publication in any form or by any means without the prior written permission of Johannes Hubner Fabrik elektrischer Maschinen GmbH. Subject to errors and changes due to technical improvements.

These Operating and Assembly Instructions have been written to enable the owner to safely and properly transport, assemble, commission and maintain the explosion-protected device. We reserve all rights to make technical changes to the device described in the instructions below. Drawings and images are simplified representations. Due to improvements and modifications it is possible that they differ in some minor details from the device supplied. Technical data and dimensions are not binding. They are provided for information purposes only and are not guaranteed characteristics. The customer will be informed immediately if modifications affect devices already supplied.

Due to the wide variety of application conditions, these Operating and Assembly Instructions can only take into consideration general application conditions to maintain clarity and oversight. In special cases, such as in unusual ambient conditions or when particularly stringent safety regulations apply certain operating characteristics must be agreed with the manufacturer or the distributor.



Caution!

Read and observe the information contained in the assembly, operating and maintenance documentation, connection diagram and Safety Data Sheet before transporting, assembling, commissioning or maintaining the device!

Retain the safety instructions and the Operating and Assembly Instructions for future reference!



Commissioning procedures **MUST ONLY** be carried out by personnel who are able to provide verification of special training to work on Ex certified machinery.

1.2 Scope of delivery

Incremental Encoder Ex FG 40, Operating and Assembly Instructions.

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 use a hammer or similar tool when installing the device due to the risk of damage occurring to the bearings or coupling!



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 complies with the EU directive 2014/34/EU for potentially explosive atmospheres and with the **IECEX-Scheme**.

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 is in accordance with equipment category 2G (use above ground gas) and equipment category 2D (use above ground dust) designed and constructed.

- Equipment category 2G and 2D:
- Ex-labeling: II 2G Ex db IIC T6-T5
II 2D Ex tb IIIC T85°C
 - Conforms to standard: EN 60079-0:2012 + A11: 2013
IEC 60079-0 Ed.6.0
Equipment-General requirements
EN 60079-1:2014
IEC 60079-1 Ed.7.0
Equipment protection by
flameproof closures „d“
EN 60079-31:2014 / IEC 60079-31 Ed.2.0
Equipment dust ignition protection by
enclosure „t“
 - Type of protection: db, tb
 - Temperature class: T6-T5, T85°C
 - Group of equipment: II
 - Explosive gas group: IIC, IIIC
 - Device protection level: Gb, Db

The operation in other explosive atmospheres is not permissible.

EU design test certificate see Chapter 13

The temperature class corresponds to the speed and the ambient temperature. The allowed values are given in the table.

Device category	Temperature class	Degree of protection	max. speed	Ambient temperature
2G	T6	IP66	6000 rpm	-40°C ... 55°C
2G	T5	IP66	6000 rpm	-40°C ... 60°C
2D	T85°C	IP66	6000 rpm	-40°C ... 55°C

The incremental encoder Ex FG 40 can be used in saline environments e.g. on offshore drilling rigs.

It is not permissible to make any alteration to equipment that is used in potentially explosive environments. Repairs may only be carried out by authorized authorities provided by the manufacturer. **Contravention invalidates the EX approval.**

Attend the standard EN 60079-14 / IEC 60079-14 during mount and operation.



The device must be operated in accordance with the stipulations of the Operating and Assembly Instructions. The relevant laws, regulations and standard for the planned application must be observed.

Operation of the device is only permissible when...

- the details on the type label of the device match the on-site conditions for the permissible Ex area in use (group of equipment, equipment category, zone, temperature class or maximum surface temperature),
- the details on the type label of the device match the electrical supply network,
- the maximum permissible input power is not exceeded,
- the permissible ambient temperature is not exceeded,
- the device is undamaged (no damage resulting from transport or storage), and
- it has been checked that there is no explosive atmosphere, oils, acids, gases, vapors, radiation etc. present during installation.
- all openings of the housing are closed (also cable-gland).

2.3 Improper use

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.



WARNING!

Operation in the vicinity of strongly charge-generating processes must be avoided. Charging takes place by friction, contact with charged liquid, spray charging.

Typical processes are:

- running drive belts
- pneumatic conveying of bulk material
- fast multiphase flow of liquids

2.4 Personnel

Installation and commissioning as well as disassembly routines must be carried out by skilled technical staff only.

2.5 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 installation, disassembly or commissioning. Adhere to all applicable statutory regulations as well as the rules and standards determined by the owner.

2.6 Special dangers

Residual risks that have been determined based on a risk analysis are cited below.

2.6.1 Electrical 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.

2.6.2 Rotating shafts / Hot surfaces



WARNING!

Danger of injury due to rotating shafts and hot surfaces!

Touching rotating shafts can cause serious injuries.

Therefore:

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

Close to protect from injury all access openings in flanges with the corresponding plug screw, and provided you exposed rotating components with protective covers.

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

The encoder can become hot during prolonged use.

In case of contact risk of burns is existing.

2.6.3 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.

2.6.4 Danger of explosion



NOTES!

The device can be used in potentially explosive atmospheres of equipment category 2G (Zone 1 and 2) und 2D (Zone 21 and 22). The operation in other explosive atmospheres is not permissible.

3 Technical Data

3.1 Type plates

Below are some nameplates for different device models and signs shown.

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AK-1024-AH	
S/N 123456	ID 123456 Y 2017 IP66
CPR 1024	Power supply 12-30 V DC
No-load current approx. 50 mA at 24 V	
max. load approx. 250 mA at 24 V	
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb II 2D Ex tb IIIC T85°C Db IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb Ex tb IIIC T85°C Db IECEX IBE 17.0040 X	

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AK-1024-SH	
S/N 123456	ID 123456 Y 2017 IP66
√1 V pp 1024	Power supply 12-30 V DC
No-load current approx. 50 mA at 24 V	
max. load approx. 250 mA at 24 V	
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb II 2D Ex tb IIIC T85°C Db IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb Ex tb IIIC T85°C Db IECEX IBE 17.0040 X	

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AKK-1024-AH-8192-AH	
S/N 123456	ID 123456 Y 2017 IP66
CPR/Syst. 1 1024	CPR/Syst. 2 8192
Power supply/Syst. 1 12-30 V DC	Power supply/Syst. 2 12-30 V DC
No-load current/Syst. 1 approx. 50 mA at 24 V	No-load current/Syst. 2 approx. 50 mA at 24 V
max. load/Syst. 1 approx. 250 mA at 24 V	max. load/Syst. 2 approx. 250 mA at 24 V
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb II 2D Ex tb IIIC T85°C Db IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb Ex tb IIIC T85°C Db IECEX IBE 17.0040 X	

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AKK-1024-SH-1024-SH	
S/N 123456	ID 123456 Y 2017 IP66
√1 Vpp/Syst.1024	Power supply/Syst.12-30 V DC
No-load current/Syst approx. 50 mA at 24 V	
max. load/Syst. approx. 250 mA at 24 V	
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb II 2D Ex tb IIIC T85°C Db IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb Ex tb IIIC T85°C Db IECEX IBE 17.0040 X	

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AK-1024-AH	
S/N 123456	ID 123456 Y 2017 IP66
CPR 1024	Power supply 12-30 V DC
No-load current approx. 50 mA at 24 V	
max. load approx. 250 mA at 24 V	
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb IECEX IBE 17.0040 X	

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AK-1024-SH	
S/N 123456	ID 123456 Y 2017 IP66
√1 V pp 1024	Power supply 12-30 V DC
No-load current approx. 50 mA at 24 V	
max. load approx. 250 mA at 24 V	
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb IECEX IBE 17.0040 X	

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AKK-1024-AH-8192-AH	
S/N 123456	ID 123456 Y 2017 IP66
CPR/Syst. 1 1024	CPR/Syst. 2 8192
Power supply/Syst. 1 12-30 V DC	Power supply/Syst. 2 12-30 V DC
No-load current/Syst. 1 approx. 50 mA at 24 V	No-load current/Syst. 2 approx. 50 mA at 24 V
max. load/Syst. 1 approx. 250 mA at 24 V	max. load/Syst. 2 approx. 250 mA at 24 V
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb IECEX IBE 17.0040 X	

JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AKK-1024-SH-1024-SH	
S/N 123456	ID 123456 Y 2017 IP66
√1 Vpp/Syst.1024	Power supply/Syst.12-30 V DC
No-load current/Syst approx. 50 mA at 24 V	
max. load/Syst. approx. 250 mA at 24 V	
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb IECEX IBE 17.0040 X	









JOHANNES HUBNER GIESSEN	
Siemensstrasse 7 · 35394 Giessen / Germany www.huebner-giessen.com	
Incremental encoder Ex FG40 AKK-1024-SH-8192-AH	
S/N 123456	ID 123456 Y 2017 IP66
√1 Vpp 1024	CPR/Syst. 2 8192
Power supply/Syst. 1 12-30 V DC	Power supply/Syst. 2 12-30 V DC
No-load current/Syst. 1 approx. 50 mA at 24 V	No-load current/Syst. 2 approx. 50 mA at 24 V
max. load/Syst. 1 approx. 250 mA at 24 V	max. load/Syst. 2 approx. 250 mA at 24 V
-40°C ≤ Tamb	
ATEX II 2G Ex db IIC T6-T5 Gb II 2D Ex tb IIIC T85°C Db IBExU16ATEX1159 X IECEX Ex db IIC T6-T5 Gb Ex tb IIIC T85°C Db IECEX IBE 17.0040 X	

The type plate is located on the side of the housing and contains the following information:

- Manufacturer, address
- Type, year of construction
- CE and Ex mark, type of protection
- Serial number (S/N)
- ID number
- CPR = Number of pulses ($\sqrt{1}$ Vpp = Sinus periodes)
- Degree of protection
- Max. speed
- Power supply
- No-load current
- Max-Load
- Explosion group

3.2 Electrical and mechanical data

Pulse rates (square wave signals)	Value
Standard pulse rates	500, 600, 1000, 1024, 1200, 1300, 2500
Resolution enhancement by signal interpolation	Interpolation factors: 1, 2, 4, 8, 10, 20, 25 (Example. : Basic-pulse rate 1024 x Interpolation factor 8 = Resolution 8192)
Connection data	
Supply voltage	12...30 VDC, ripple max. 10%
No load-current	approx. 50 mA at 24 V
Maximum current consumption	approx. 250 mA at 24 V
Outputs	Current limited, short-circuit proof push-pull line driver with integrated impedance adaptation for 30 to 140 Ω lines.
Pulse high (HTL)	approx. as supply voltage, output saturation voltage < 0.4 V at I _L 30 mA
Internal resistance	75 Ω at 24 V
alternative pulse high (TTL)	5V, RS422-compatible (TIA/EIA-Standard)
Slew rate	200 V / μs with C _L 100 pF
Duty cycle	1 : 1 ± 3 % for standard pulse rates 1 : 1 ± 5 % for pulse rates by signal interpolation
Square wave displacement 0°, 90°	90° ± 3 % for standard pulse rates 90° ± 5 % pulse rates by signal interpolation
Max. frequency	200 kHz, higher max. frequency on request

Signal outputs		
<p>Basic channel 0° (A) and pulse channel 90° (B). Internal system diagnostics with error output (ERROR). Each with inverted signal. Reference pulse (N) mechanically defined; one square-wave pulse per revolution; with inverted signal.</p>	0°	 <i>Incr. Output 0°</i>
	0°	 <i>Incr. Output 0° Inverse</i>
	90°	 <i>Incr. Output 90°</i>
	90°	 <i>Incr. Output 90° Inverse</i>
	N	 <i>Reference</i>
	N	 <i>Reference Inverse</i>
	ERR	 <i>Error Output (Low active)</i>
	ERR	 <i>Error Output (High active)</i>

Output signals Sinus / Cosinus	Value
Pulse rates	500, 600, 1000, 1024, 1200, 1300, 2500
Connection data	
Supply voltage	12...30 VDC, ripple max. 10%
No load-current consumption	approx. 50 mA at 24 V
Maximum current consumption	approx. 200 mA at 24 V
Signalamplitudes	1 V pp / $R_L = 120 \Omega$
Duty cycle	1 : 1 \pm 3 %
Phase shift 0°, 90°	90° \pm 3 %
Max. frequency	200 kHz, higher max. frequency on request

Signal outputs				
<p>Basic channel 0° (A) and pulse channel 90° (B). Reference pulse (N) mechanically defined; one square-wave pulse per revolution. Each with inverted signal.</p> <p>Internal system diagnostics with error output (ERROR).</p>	A+		Ausgang A+	Output A+
	A-		Ausgang A-Invers	Output A-Inverse
	B+		Ausgang B+	Output B+
	B-		Ausgang B-Invers	Output B-Inverse
	N+		Ausgang Nullimpuls	Output Reference
	N-		Ausgang Nullimpuls Invers	Output Reference Inverse
	ERR		Fehlerausgang (Low aktiv)	Error Output (Low aktiv)
	$\overline{\text{ERR}}$		Fehlerausgang (High aktiv)	Error Output (High aktiv)

Encoder temperature range

See table page 8

Supply voltage	12...30 VDC
----------------	-------------

Protection class acc. to DIN EN 60529	Sealing	Permissible speed mechanically	Rotor moment of inertia	Breakaway torque
IP66	With radial shaft seal	acc. table	approx. 773 gcm ²	approx. 3,5 Ncm

Vibration resistance	DIN EN 60068-2-6 / IEC 68-2-6 (10 ... 500 Hz)	20 g (=200 m/s ²)
Shock resistance	DIN EN 60068-2-27 / IEC 68-2-27 (6 ms)	100 g (=1000 m/s ²)
Max. encoder shaft load	F _{a, max.} (axial) = 100 N F _{r, max.} (radial) = 120 N	
Shaft dimensions	11j6 x 30 mm (standard) 14j6 x 30 mm (optional)	
Weight	Type AK Type AKK	approx. 3,9 kg approx. 4,0 kg

3.3 Type key

3.3.1 For pulse rates (square wave pulses)

	Ex FG	40	AK	1024	AH	1024	AH
Incremental encoder with Ex certification							
Series							
Connections, axial design AK: One system with terminal strip AKK: Two systems with terminal strip							
System 1: Standard pulse rates respectively resolution enhancement by signal interpolation See page 12							
Output signals Each with inverted signals Supply voltage each 12 ... 30V AH: HTL-signals 0°, 90°, N, Err AT: TTL-signals 0°, 90°, N, Err							
System 2: Standard pulse rates respectively resolution enhancement by signal interpolation (same standard pulse rates as system1, interpolation can be selected freely). See page 12							
Output signals Each with inverted signals Supply voltage each 12 ... 30V AH: HTL-signals 0°, 90°, N, Err AT: TTL-signals 0°, 90°, N, Err							

3.3.2 For output signals Sinus / Cosinus

	Ex FG	40	AK	1024	SH	1024	SH
Incremental encoder with Ex certification							
Series							
Connections, axial design AK: One system with terminal strip AKK: Two systems with terminal strip							
System 1: Number of pulses See page 13							
Output signals Each with inverted signals Supply voltage each 12 ... 30V SH: Sin, Cos, marker pulse 1 V pp-signals; Error-Signal HTL ST: Sin, Cos, marker pulse 1 V pp-signals; Error-Signal TTL							
System 2: Number of pulses same as system 1 See page 13							
Output signals Each with inverted signals Supply voltage each 12 ... 30V SH: Sin, Cos, marker pulse 1 V pp-signals; Error-Signal HTL ST: Sin, Cos, marker pulse 1 V pp-signals; Error-Signal TTL							

3.3.3 For output signals Sinus / Cosinus – pulse rates (square wave pulses)

	Ex FG	40	AKK	1024	SH	1024	AH
Incremental encoder with Ex certification							
Series							
Connections, axial design AKK: Two systems with terminal strip							
System 1: Number of pulses See page 13							
Output signals Each with inverted signals Supply voltage each 12 ... 30V SH: Sin, Cos, marker pulse 1 V pp-signals; Error-Signal HTL ST: Sin, Cos, marker pulse 1 V pp-signals; Error-Signal TTL							
System 2: Standard pulse rates respectively resolution enhancement by signal interpolation (same standard pulse rates as system1, interpolation can be selected freely). See page 12							
Output signals Each with inverted signals Supply voltage each 12 ... 30V AH: HTL-signals 0°, 90°, N, Err AT: TTL-signals 0°, 90°, N, Err							

4 Transport, packaging and storage

4.1 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.

4.2 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).

4.3 Packaging (disposal)

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

4.4 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).



NOTES!

Turn the shaft of the device every 6 month to prevent the bearing grease solidifying!

5 Mounting and commissioning

5.1 Safety instructions

**NOTES!**

Observe the safety instructions contained in **Chapter 2** when installing or working on the device!

**NOTES!**

Dirt penetrating inside the encoder can cause short circuits and damage the optical sensing system. Absolute cleanliness must be maintained when carrying out any work on the open housing cover.

**NOTES!**

Adhesive fluids can damage the optical sensing system and the bearings. Dismounting an encoder, secured to a shaft by adhesive may lead to the destruction of the unit.

**WARNING!**

Couplings must be approved for explosive environments when using the encoder in potentially explosive environments. The use of standard couplings is not permissible.

Personnel

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

5.2 Technical information

**NOTES!**

Do not use a hammer or similar tool when installing the device due to the risk of damage occurring to the bearings or coupling!

Ambient temperature

The max. permissible ambient temperature depends on the speed and degree of protection of the device, the signal frequency, the length of the signal cable and the place of installation (please refer to Chapter 3.2).

Degree of protection

To fulfill degree of protection requirements the diameter of the connection cable must correspond to that of the cable gland.

Deep groove ball bearings

The Incremental Encoder Ex FG 40 is fitted with maintenance-free, greased "for-life" deep groove ball bearings. Bearings must be changed by the manufacturer only. Opening the encoder renders the guarantee null and void.

Screw retention

We recommend using Loctite® 243 threadlocker (medium strength) on all fastening screws to prevent loosening.

5.3 Mounting preparations

1. Ensure all accessories are available (please refer to Chapter 14 dimension drawings).



NOTES!

Fastening screws and earth cable are not included in the range of supply.

2. Preparing the place of attachment: Clean the (motor) shaft, centering, bolting surfaces and fastening threads; check for damage. Repair any damage!

5.4 Mounting B5 type (flange)



NOTES!

Mounting example

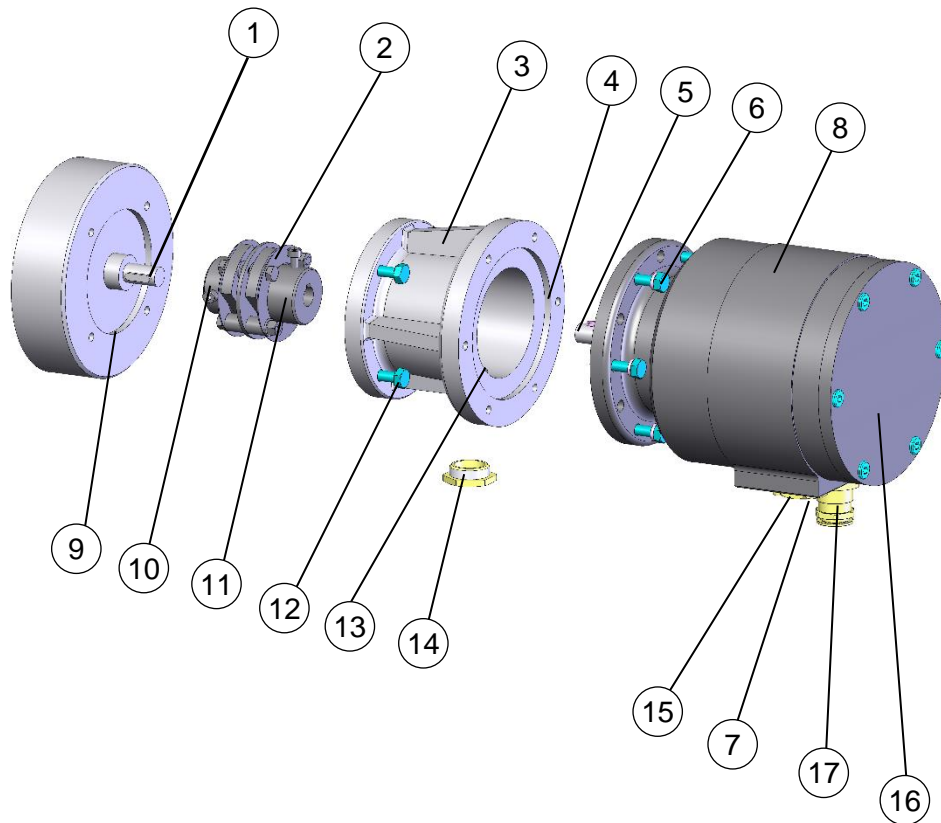


Fig. 1: Ex FG 40 construction type

The installation described below is only an example and can vary depending on the type of coupling. The special instructions of the coupling manufacturer must be observed.

1. Lightly grease the (motor) shaft (1) and centring (9)
2. Fit coupling (2) onto (motor) shaft.

**NOTES!**

Use only couplings which are approved for hazardous areas. Carefully observe all instruction of the coupling manufacturer

**NOTES!**

You must be able to mount the coupling without force. Ream out the bores of used couplings, if permitted and necessary! Please refer to the instructions of the coupling manufacturer.

3. Secure the coupling hub on the (motor) shaft with a grub screw or cheese head screw (10) (depending on the coupling type).
4. Fasten the intermediate flange (3) to the motor using the fastening screws (12).

**NOTES!**

If possible, fit the intermediate flange in a manner that ensures the screwed sealing plug (14) points downwards!

5. Lightly grease the encoder shaft (5) and centering (4).
6. Fit the encoder (8) into both the centering (4) and coupling hub at the same time.

**NOTES!**

You must be able to mount the coupling without force.

**NOTES!**

If possible, fit the device in a manner that ensures the cable gland points downwards

7. Secure the encoder with 4 - 6 screws (6) evenly distributed around the circumference of the flange.
8. Remove the sealing plug (14) from the access bore (13) to the coupling.
9. Secure the coupling hub on the encoder shaft with a grub screw or cheese head screw (11) (depending on the coupling type).

**NOTES!**

To carry out this task, it may be necessary to turn the (motor) shaft to the correct position.

10. Close the access bore to the coupling with a plug screw (14).

5.5 Mounting tolerances for Construction Type B5



NOTES!

Angle misalignment and parallel displacement between the (motor) shaft and the encoder shaft are mounting errors and should be kept as small as possible.

Mounting errors

- Cause radial forces to act on the encoder shaft.
- Reduce the service life of the bearings and the coupling.
- Degrade the quality of the signals (harmonic content).

5.6 Electrical connection and start up



WARNING!

Only cables are permitted that comply with the manufacturer requirement of the cable entry as well as the IEC 60079-14



NOTES!

You must observe applicable EMC guidelines when routing cables!

5.6.1 Preparing cables

1. Screw cable gland with flat gasket into the thread of the encoder.



WARNING!

The special instructions from the manufacturer of the cable entry apply for the mounting. When using the encoder in potentially explosive environments use only cable glands that are permitted in the respective potentially explosive environments.

The plastic closures must be replaced before operation against certified cable glands or certified threaded plugs.

2. Strip cable insulation and crimp wire-end ferrules.

5.6.2 Electrical connection

1. Open the housing cover (16 Fig. 1).



WARNING!

The cylindrical surface of the housing cover represents a part of flameproof gap. If the surface is damaged, the encoder must not longer be used in the potentially explosive environments. If in doubt, contact the manufacturer.



CAUTION!

Do not allow moisture to enter the terminal box when the housing cover (16) is open!

2. If present, remove the cap of the cable gland.
3. Feed the cable into the terminal box trough the cable gland.



NOTES!

The signal cable shielding can be connected directly to the housing via the EMC cable gland. A coil spring integrated in the cable gland ensures all-round contact is made with the bare cable shielding to ensure a good shield connection. This type of shield connection should be preferred.

Alternatively, if equipotential boning currents are anticipated it is possible to connect the cable shielding to a shield terminal in the terminal box. A capacitor between the shield terminal and the encoder housing prevents the flow of equalizing current.

To achieve an effective shielding the cable shield must also be connected in the electrical cabinet.



NOTES!

Fastening screws and earth cable are not included in the range of supply.

4. Tighten the cable gland and blanking plugs using a spanner.



NOTES!

Cable glands and blanking plugs are not included in the range of supply. Tighten all cable glands and blanking plugs as prescribed by the manufacturer, before commissioning

5. Use a spanner to tighten the cable gland until the cable is securely clamped and properly sealed.



NOTES!

Prevent lateral pulling forces acting on the cable and plugs so as not to impair the degree of protection of the cable gland.

6. Connect the supply voltage and signal cable (please refer to the connection diagrams, Chapter 05).



CAUTION!

Do not apply supply voltage to the signal outputs, as this will destroy the device!



NOTES!

Use only for the hazardous area approved cable glands that conform to the specifications on the nameplate. Carefully observe all instructions of the manufacturer.

7. Close the housing cover (16).

The screws of the housing cover must be tightened with 6 Nm. Only cylinder head screws M6x20 according to DIN 7984 of strength class **A2-70** with thread tolerance 6g may be used.



NOTES!

Before closing the housing cover check and if necessary clean both seal surfaces and the gasket.



CAUTION!

Ensure when closing the housing cover that no cable becomes jammed.

8. Secure earth cable to earth terminal (7, Fig.1 see dimension drawing HM 15 M 108631b).

6 Dismantling

6.1 Safety instructions

Personnel

Dismantling must be carried out by skilled technical staff only.



WARNING!

Observe the safety instructions contained in **Chapter 2** when inspecting or working on the device!



NOTES!

Do not use a hammer or similar tool when installing the device due to the risk of damage occurring to the bearings or coupling!

6.2 Dismantling the encoder

Remove all electrical cables from the device before dismantling. To dismantling the encoder follow the instructions given in Chapters 5.4 or 5.6 in the reverse order.

7 Faults

7.1 Faults table

Faults	Possible cause	Remedy
Moisture in the terminal box	Soiled terminal box gasket or seal surfaces	Clean terminal box gasket and seal surfaces
	Damaged terminal box gasket	Replace terminal box gasket
	Cable gland/blanking plug not tightened	Tighten cable gland/blanking plug
	Unsuitable cable for cable gland	Use suitable cable and cable glands
No output signals	Supply voltage not connected	Connect supply voltage
	Connection cable reversed	Wire correctly
Output signals subject to interference	Unsuitable cable	Use data cable with conductors arranged as twisted pairs and common shield
	Cable shield not connected	Connect cable shield at both ends
	Cable routing not EMC compliant	Observe applicable EMC guidelines when routing cables
Signal interruptions	Signal end stage overloaded	Check pin assignment; observe connection diagram
		Do not assign unused outputs
	Outputs short-circuited	Do not connect outputs with supply voltage or GND
Contact Hubner-Service (page 2) if none of the remedies listed above provides a solution!		

8 Inspections

8.1 Safety instructions personnel



WARNING!

Skilled technical staff only are permitted to inspect the device and its installation. Observe the safety instructions contained in **Chapter 2** when inspecting or working on the device!

8.2 Maintenance information

The device is maintenance-free. However, to guarantee optimum fault-free operations we recommend that you carry out the following inspections.

8.3 Inspection schedule

Interval	Inspections
Yearly	Inspect the coupling for damage and ensure it is free of play
	Ensure the fastening screws are properly tightened
	Ensure cable connections and connection terminals are securely seated
	The radial shaft seal must be checked for wear. On suspicion of wearing the device should be returned to the manufacturer for maintenance
Following approx 16 000 ... 20 000 hours of operation / higher levels of continuous load, annually thereafter	Check deep groove ball bearings are running smoothly and listen for running noises



Bearings life time!

The expected operating life of the device depends on the ball bearings, which are equipped with a permanent lubrication. A inspection of ball bearings at the specified intervals is nevertheless essential.

9 Disposal

The manufacturer is not obliged to take back the device.

The device is classed as electronic equipment and subject to the WEEE Directive; observe local, country-specific laws when disposing of the device.

For information on environmentally sound disposal please contact your local authority or a specialist disposal company.

10 Repair


Repair work must be carried out only by the manufacturer. Alterations of the device are not permitted.
Contraventions invalidates the EX approval.

11 Replacement parts

The replacement parts listed below can be obtained via the service address on page 2.

Replacement parts	Comment
<ul style="list-style-type: none">• Cable glands and locking screws• Couplings	

12 EU-Declaration of Conformity

	<p style="text-align: center;">EU-Konformitätserklärung (EU-Richtlinie 2014/34/EG + 2006/42/EG + 2014/30/EU+2011/65/EU)</p> <p style="text-align: center;">EU-Declaration of Conformity (EU-Directive 2014/34/EC + 2006/42/EC + 2014/30/EU+2011/65/EU)</p>
<p>Hersteller / Manufacturer: Johannes Hübner Fabrik elektrischer Maschinen GmbH</p> <p>Anschrift / Address: 35394 Giessen, Siemensstrasse 7</p> <p>Produktbezeichnung / Product designation:</p> <p>Drehgeber Ex FG 40 Encoder Ex FG 40</p>	
<p>Die oben bezeichneten Produkte stimmen in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischer Richtlinien überein:</p>	
<p>The products described above in the form as placed on the market are in conformity with the provisions of the following European Directives:</p>	
<p>2014/34/EU Richtlinie des Europäischen Parlaments und des Rates vom 26. Februar 2014 zur Harmonisierung der Rechtsvorschriften der Mitgliedsstaaten für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen (Neufassung) Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres (recast)</p>	
<p>2006/42/EG Richtlinie des Europäischen Parlaments und des Rates vom 17. Mai 2006 über Maschinen und zur Änderung der Richtlinie 95/16/EG (Neufassung) – ABL C 348 der 28.11.2013 Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast) - OJ C 348 of 28/11/2013</p>	
<p>2014/30/EU Richtlinie des Europäischen Parlaments und des Rates vom 26. Februar 2014 zur Harmonisierung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility</p>	
<p>2011/65/EU (Ausgabe 2011-06-08) Richtlinie des Europäischen Parlaments und des Rates vom 8. Juni 2011 zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten Directive 2011/65/EU of the European Parliament and of the Council of 08 June 2011 of the restriction of the use of certain hazardous substances in electrical and electronic equipment</p>	
<p>2014/34/EU: Folgende harmonisierte Normen wurden angewandt:</p>	
<p>2014/34/EU: Following harmonized standards have been applied:</p>	
<p>DIN EN 60079-0 (Ausgabe 2014-06) Explosionsgefährdete Bereiche Teil 0: Betriebsmittel – Allgemeine Anforderungen EN 60079-0:2012 + A11:2013 Explosive atmospheres – Part 0: Equipment – General requirements</p>	

DIN EN 60079-1 (Ausgabe 2015-04) Explosionsgefährdete Bereiche Teil 1: Geräteschutz durch druckfeste Kapselung „d“

EN 60079-1: 2014 Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures “d”

DIN EN 60079-31 (Ausgabe 2014-12) Explosionsgefährdete Bereiche Teil 31: Geräteschutz durch Gehäuse „t“

EN 60079-31: 2014 Explosive atmospheres – Part 31: Equipment dust protection by enclosure “t”

2006/42/EG: Folgende harmonisierte Normen wurden angewandt:

2006/42/EC: Following harmonized standards have been applied:

DIN EN ISO 12100 (Ausgabe 2011-03) + **Berichtigung 1** (2013-08)
Sicherheit von Maschinen. Allgemeine Gestaltungsleitsätze. Risikobewertung

EN 12100: 2010 Safety of machinery. General principles of design. Risk assessment and risk reduction

2014/30/EU: Folgende harmonisierte Normen wurden angewandt:

2014/30/EU: Following harmonized standards have been applied:

DIN EN 55011 (Ausgabe 2011-04) Industrielle, wissenschaftliche und medizinische Geräte - Funkstörungen - Grenzwerte und Messverfahren

EN 55011 + A1: 2010 Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

DIN EN 61326-1 (Ausgabe 2013-07)
Elektrische Mess-, Steuer-, Regel- und Laborgeräte. EMV-Anforderungen. Allgemeine Anforderungen

EN 61326-1: 2013 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements

2011/65/EU: Folgende harmonisierte Normen wurden angewandt:

2011/65/EU: Following harmonized standards have been applied:

DIN EN 50581 (Ausgabe 2013-02)
Technische Dokumentation zur Beurteilung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe

EN 50581: 2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Für die Zusammenstellung der technischen Unterlagen ist bevollmächtigt:

Authorized to compile the technical file:

Johannes Hübner Fabrik elektrischer Maschinen GmbH, Siemensstr. 7, 35394 Giessen, Germany

Dieses Gerät ist zertifiziert nach der Richtlinie 2014/34/EU.

This device is certified according to the directive 2014/34/EU

Zertifikatsnummer / certification number: IBExU16ATEX1159 X

Benannte Stelle / notified body:

IBExU Institut für Sicherheitstechnik GmbH

Fuchsmühlenweg 7

09599 Freiberg, GERMANY

Unterschrift/
signature:



Frank Tscherney
(Geschäftsführer / General manager)

Gießen, 03.01.2018

13 EU-type examination certificate

IBExU Institut für Sicherheitstechnik GmbH
An-Institut der TU Bergakademie Freiberg

[1] **EU-TYPE EXAMINATION CERTIFICATE - Translation**

[2] Equipment or protective systems intended for use in potentially explosive atmospheres, Directive 2014/34/EU

[3] EU-type examination certificate number **IBExU16ATEX1159 X** | Issue 0

[4] Product: **Encoder**
Type: Ex FG 40

[5] Manufacturer: **JOHANNES HÜBNER Fabrik elektrischer Maschinen GmbH**

[6] Address: **Siemensstraße 7
35394 Giessen
GERMANY**

[7] This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] IBExU Institut für Sicherheitstechnik GmbH, Notified Body number 0637 in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the essential health and safety requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.


The examination and test results are recorded in the confidential test report IB-16-3-142.

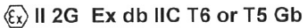
[9] Compliance with the essential health and safety requirements has been assured by compliance with:
EN 60079-0:2012+A11:2013 EN 60079-1:2014 EN 60079-31:2014
except in respect of those requirements listed at item [18] of the schedule.

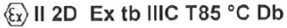
[10] If the sign "X" is placed after the certificate number, it indicates that the product is subject to the specific conditions of use specified in the schedule to this certificate.

[11] This EU-type examination certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

[12] The marking of the product shall include the following:









IBExU Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7
09599 Freiberg, GERMANY

By order


Dipl.-Ing. Willamowski



Tel: + 49 (0) 37 31 / 38 05 0
Fax: + 49 (0) 37 31 / 38 05 10

Certificates without signature and seal are not valid. Certificates may only be duplicated completely and unchanged. In case of dispute, the German text shall prevail.

Freiberg, 2016-07-29

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An-Institut der TU Bergakademie Freiberg

[13] **Schedule**

[14] **Certificate number IBExU16ATEX1159 X | Issue 0**

[15] **Description of product**

The Encoder of the type Ex FG 40 is a cylindrical unit with internal electronics for the angle and speed measurement and the transmission in electrical signals. The enclosure is designed in type of protection flameproof enclosure and protection by enclosure.

The type key Ex FG 40 **.*.***.**.*.***.** describes different variants and configurations of the encoder. In the area of the mechanics there are no differences with influence on the design of the flameproof gaps. The enclosure is produced from aluminium. The cable glands are not part of the examination. In addition, the type key describes the number of pulses, measured signals and interfaces of the encoder.

The permissible maximum ambient temperature of the various designs depends on the intended use of the encoder and is specified in the following table:

Category	Temperature Class	Max. ambient temperature
2G	T6	55 °C
2G	T5	60 °C
2D	T85°C	55 °C

The permissible lower ambient temperature limit of -40 °C applies to all encoder designs.

Technical parameters:

- Supply voltage electronics: 12 up to 30 V DC
- Rated power: ≤ 3,62 W
- Max. rotation speed: 6000 min⁻¹
- Ambient temperature range: -40 °C up to +55 °C or +60 °C
- Degree of protection of enclosure acc. to EN 60529: IP 6X
- Property class screw plug: A2-70

[16] **Test report**

The test results are recorded in the confidential test report IB-16-3-142 of 29 July 2016. The test documents are part of the test report and they are listed there.

Summary of the test results

The Encoder of the type Ex FG 40 fulfils the requirements of the explosion protection for equipment of group II, category 2G in the type of protection flameproof enclosure "db" as well as category 2D in type of protection dust explosion protection by enclosure "tb".

[17] **Specific conditions of use**

1. The surface temperature or temperature class of the equipment depends on the ambient temperature. The corresponding assignment for each design is specified in this EU-type examination or in the operating manual.
2. The shaft and shaft sealing ring were not tested for resistance against environmental influences (UV radiation, mechanical influences) because, at a proper installation of the equipment for the intended use, no environmental influences are expected. If the equipment occasionally should not be installed as required, then the shaft and shaft sealing ring have to be protected against environmental influences (light sources, mechanical influences).

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3. The type of protection depends on a proper selection and installation of the cable glands. All openings have to be provided with suitable cable glands. These cable glands must have been certified with EC-type examination certificates or EU-type examination certificates in accordance with the standards EN 60079-0 and EN 60079-1 (explosive gas atmospheres) and, if required, EN 60079-31 (explosive dust atmospheres). In addition, they have to be selected in accordance with EN 60079-14.
4. The product contains gaps which deviate from the minimum requirements of EN 60079-1. Therefore, repair work is not allowed.

[18] **Essential health and safety requirements**

In addition to the essential health and safety requirements (EHSRs) covered by the standards listed at item [9], the following are considered relevant to this product, and conformity is demonstrated in the test report:

Not applicable

[19] **Drawings and Documents**

The documents are listed in the test report.

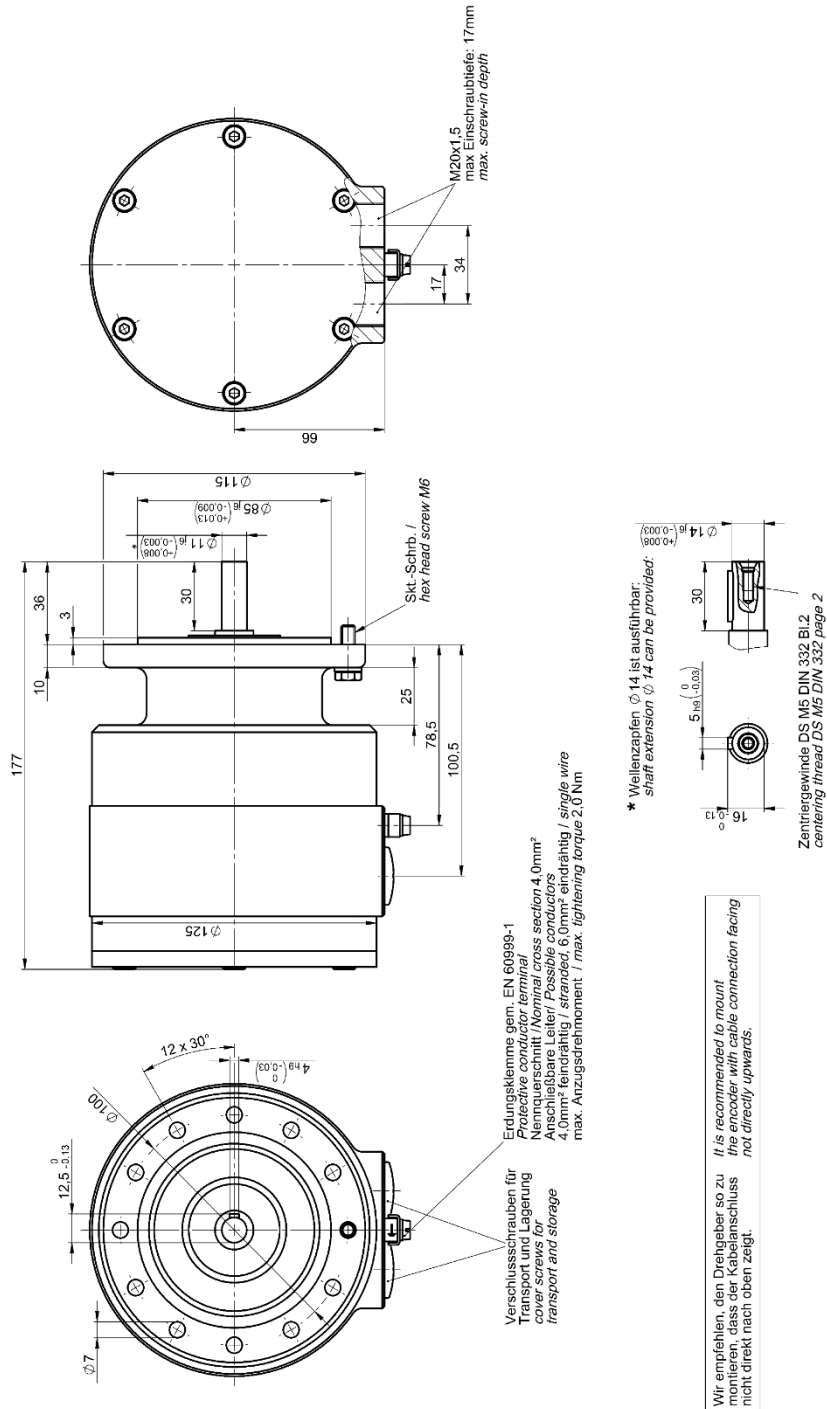
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09599 Freiberg, GERMANY

By order


Dipl.-Ing. Willamowski

Freiberg, 2016-07-29

14 Dimension drawings



Ex FG 40 AK/AKK

without cable gland

HM 15 M 108631b

15 Connection Diagrams

1	2	3	4
System 1	System 2*	Klemmkasten Terminal box	Anschlussplan Connection diagram
1	11	0V	GND
2	12	12...30V	Versorgungsspannung Power Supply
3	13	0°	Inkr. Ausgang 0° Incr. Output 0°
4	14	0°	Inkr. Ausgang 0° Invers Incr. Output 0° Inverse
5	15	90°	Inkr. Ausgang 90° Incr. Output 90°
6	16	90°	Inkr. Ausgang 90° Invers Incr. Output 90° Inverse
7	17	N	Nullimpuls Reference
8	18	N	Nullimpuls Invers Reference Inverse
9	19	ERR	Fehlerausgang (Low aktiv) Error Output (Low active)
10	20	ERR	Fehlerausgang (High aktiv) Error Output (High active)

2x10 pol. Print-Zugfederklemme Typ Phoenix ZFKDS
2x10 pole printed circuit spring terminal block type Phoenix ZFKDS

Anschlussdaten:
Aderquerschnitt
0,25-1,5 [mm²]

Schirmung:
Der Schirm der Signalleitung muss über die Kabelverschraubung direkt mit dem Gehäuse verbunden werden.

Shielding:
The shield of the signal cable has to be connected directly to the housing of the encoder by the cable gland.

Connection data:
wire section
0.25-1.5 [mm²]

* optional je nach Ausführung
depending on options

Proj.Nr. PN187	Benennung / Description Terminal box connection diagram	Leitpl.Nr. / PCB No. 400a
Datum / Date 10.02.2015	Bearbeitet / Processed F. Diriam	Geprüft / Checked: J. Komkowski
		Abt. / Dept. EE
Siemensstr. 7 35394 Giessen		Maßstab SCALE: 1:02
a Namen geändert Datum 06.10.15 Änderungs-Modifikation Index		Blatt / Sheet 1 / 1 And.Nr. Mez. No.
1	2	3

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1	2	3	4
Klemmkasten Anschlussplan PN187-420 Terminal box Connection diagram PN187-420			
System 1			
1	0V	GND	GND
2	12...30V	Versorgungsspannung	Power Supply
3	A+	Ausgang A+	Output A+
4	A-	Ausgang A- Inverse	Output A- Inverse
5	B+	Ausgang B+	Output B+
6	B-	Ausgang B- Inverse	Output B- Inverse
7	N+	Ausgang Nullimpuls	Output Reference
8	N-	Ausgang Nullimpuls Inverse	Output Reference Inverse
9	ERR	Fehlerausgang (Low aktiv)	Error Output (Low active)
10	ERR	Fehlerausgang (High aktiv)	Error Output (High active)
System 2			
11	0V	GND	GND
12	12...30V	Versorgungsspannung	Power Supply
13	0°	Inkr. Ausgang 0°	Incr. Output 0°
14	0°	Inkr. Ausgang 0° Inverse	Incr. Output 0° Inverse
15	90°	Inkr. Ausgang 90°	Incr. Output 90°
16	90°	Inkr. Ausgang 90° Inverse	Incr. Output 90° Inverse
17	N	Ausgang Nullimpuls	Output Reference
18	N	Ausgang Nullimpuls Inverse	Output Reference Inverse
19	ERR	Fehlerausgang (Low aktiv)	Error Output (Low active)
20	ERR	Fehlerausgang (High aktiv)	Error Output (High active)
<p>Ansulssdaten: Aderquerschnitt 0.25-1.5 [mm²]</p> <p>Connection data: wire section 0.25-1.5 [mm²]</p> <p>Schirmung: Der Schirm der Signalleitung muss über die Kabelverschraubung direkt mit dem Gehäuse verbunden werden.</p> <p>Shielding: The shield of the signal cable has to be connected directly to the housing of the encoder by the cable gland.</p>			
Proj.Nr. PN187 Proj.No. PN187 Benennung Description Terminal box connection diagram Letterpl. Nr. PCB No. 420			
Datum Date 14.07.2016 Bearbeitet Processed F. Dittam Geprüft Checked J. Komkowski Abt. Dept. EE			
Siemensstr. 7 35394 Giessen SCALE: 1:02 Blatt Sheet 1 / 1 And.Nr Mod. No.			
1	2	3	4

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