

Operating and Assembly Instructions

Incremental Encoder FG 2

**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.

1.2 Scope of delivery

Incremental Encoder FG 2, 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 contacted by 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 device's area of implementation.

2.2 Personnel

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

2.3 Intended use

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

Series FG 2 Incremental Encoders are used for measurement of rotations, for instance of electrical and mechanical drives and shafts.

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.

Option S

The FG 2 with option S has in addition to the incremental output a switching output.

The incremental encoder FG 2 with option S has been designed and constructed exclusively for the intended use described here.

Series FG 2 with option S Incremental Encoders are used for speed monitoring, for instance of electrical and mechanical drives, hoisting gear and conveying machines.

The FG 2 with option S is a device, which generates a switching signal for a superior control system. This is realized with opening of a switch contact.

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

2.4 Improper use

- Do not use the device in potentially explosive areas.
- 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.

2.5 Personal protective equipment

For tasks such as assembly, disassembly or commissioning the use of personal protective equipment such as safety footwear and protective work clothing is required.

The regulations specified by the owner and that are locally specified apply.

2.6 Special dangers

Residual risks that have been determined based on a risk assessment 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.

3 Technical Data

3.1 Type plate

Below are some nameplates for different device models shown.

Without option S or LWL

Siemensstrasse 7 35394 Giessen / Germany www.huebner-giessen.com			JOHANNES HÜBNER GIESSEN		
Incremental encoder FG 2 AKK-1024G-90G-NG					
S/N	123456	ID	12345	Year of manufacture	2019
Max speed			Degree of protection		
7000 rpm			IP65 / Type 1		
System 1			System 2		
Pulse rate			Pulse rate		
1024			1024		
Supply voltage			Supply voltage		
12...30 V DC (Class2)			12...30 V DC (Class2)		
Outputs			Outputs		
HTL			HTL		

Siemensstrasse 7 35394 Giessen / Germany www.huebner-giessen.com			JOHANNES HÜBNER GIESSEN		
Johannes Hübner · Fabrik elektr. Maschinen GmbH Siemensstrasse 7 · 35394 Giessen / Germany					
Incremental encoder FG 2 AK-1024G-90G-NG					
S/N	123456	Degree of protection		IP 66 / Type 1	
ID	12345	Pulse rate		1024	
Y	2019	Max speed		7000 rpm	
Outputs			Supply voltage		
HTL			12...30 V DC (Class2)		
www.huebner-giessen.com					

With option S

Siemensstrasse 7 35394 Giessen / Germany www.huebner-giessen.com			JOHANNES HÜBNER GIESSEN		
Johannes Hübner · Fabrik elektr. Maschinen GmbH Siemensstrasse 7 · 35394 Giessen / Germany					
Incremental encoder with overspeed system C-FG 2 AK-1024G-90G-NG-S					
S/N	123456	Year of manufacture		2019	
ID	12345	Degree of protection		IP66	
Max speed			Release speed		
7000 rpm			4000 rpm		
Outputs			Supply voltage		
HTL			12...30 V DC		
Pulse rate			Release voltage/current		
1024			max. 30 V DC / 500 mA		
www.huebner-giessen.com					

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

Englisch	Deutsch
Manufacturer, address	Hersteller, Anschrift
Type: Incremental Encoder, Year of manufacture	Typ: Inkrementaler Drehgeber, Baujahr
CE mark	CE-Kennzeichnung
Serial number (S/N)	Seriennummer (S/N)
Pulse rate	Impulszahl
Degree of protection	Schutzart
Supply voltage	Versorgungsspannung
Outputs	Ausgänge
Max. speed	Max. Drehzahl
Switching speed	Schalterdrehzahl

3.2 Electrical and mechanical data

Pulse Rates	600, 1024, 2048, others on request		
Connection data			
Supply voltage	12 V...30 VDC Ripple max. 10 % For UL and CSA Class 2 supplied		
No load-current	approx. 50 mA at 24 V		
Connection	screw-type terminal Type Phoenix ZFKDS 1,5-W-5,08 (0,25 mm ² - 1,5 mm ²)		
Connection (Option fiber optic)	St-fiber optic plug		
Outputs	Current limited, short-circuit proof push-pull line driver		
Pulse height (HTL)	approx. as supply voltage output saturation voltage < 0.4 V at I _L 30 mA		
Output current per output	150 mA peak		
Internal resistance	75 Ω at 24 V		
Slew rate	200 V / μs with C _L 100 pF		
Duty cycle	1 : 1 ± 5 %		
Square wave displacement 0°, 90°	90° ± 5 %		
Max. frequency	200 kHz		
Start-up time	< 50 ms		
Encoder temperature range	-25°C ... + 85°C (UL/CSA: max. +70°C)		
Degree of protection acc.DIN EN 60529	Sealing	Rotor moment of inertia	Breakaway torque
IP 66 (UL and CSA Type 1)	with radial shaft seal	approx. 100 gcm ²	approx. 3 Ncm
Vibration resistance	DIN EN 60068-2-6 / IEC 68-2-6 (10 ... 2000 Hz)		20 g (=200 m/s ²)
Shock resistance	DIN EN 60068-2-27 / IEC 68-2-27 (6 ms)		200 g (=2000 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		
Mech. permissible speed	≤ 7000 rpm		
Weight	approx. 2 kg		

Signal outputs

Basic channel 0° (A) and pulse channel 90° (B)
Reference pulse (N) mechanically defined; one square-wave pulse per revolution

Each with inverted signals

0°		Incr. Output 0°
0°		Incr. Output 0° Inverse
90°		Incr. Output 90°
90°		Incr. Output 90° Inverse
N		Reference
N		Reference Inverse

4 Overview additional options

4.1 Option S (overspeed switch)

The incremental encoder **FG 2** with option S has an insulated switching output. The switching function is realized with a semiconductor, the switching speed is set in our factory (switching hysteresis 10%).

If the set switching speed is exceeded, the switch opens.

It is recommended to save the switch circuit against an overcurrent with a fuse (0,5A).

Specification	Value
Deviation from switch:	Accuracy of measurement: 2% Switching time $T_{sw} < 3ms$
Switch data	0...30V DC/max 500mA Max. voltage drop at closed switch: 0,7V

4.2 Option LWL (signal transmission using fiber optics)

The signals 0°, 90° and marker pulse from the incremental encoder will be encoded and transmitted via fiber optics cable. Fiber optic cable types 50/125 µm or 62,5/125 µm are available.

4.3 Option AKK (double pulse output)

Incremental encoder with optic scanning in redundant design. This provides the following combinations of the output signals.

FG(HJ) 2	Output 1 (Basic unit)	Output 2 (double pulse output)
Redundant (number of pulses)	1024	1024
Redundant (number of pulses)	2048	2048
Combined (number of pulses)	1024	2048

4.4 Type code

	FG	2	AK	1024	G	90G	NG	S
Incremental encoder								
Series								
Connections								
AK: Terminal box								
AKK: Double pulse output								
AL: Terminal box with connector for ST-compatible fiber optic plug								
I: 10-pole flange connector ITT Cannon (not combinable with Option S) (Pin compatible with POG 10 DN 1024 I)								
Pulses per rotation								
600, 1024, 2048, others on request								
Basic version								
Basic channel 0° (A)								
Pulse channel 90° (B)								
each with inverted signals (not for LWL see chapter. 4.2)								
NG: Reference pulse with inverted signal								
S: Option S								

JOHANNES HUEBNER FABRIK ELEKTRISCHER MASCHINEN GMBH
is listed by Underwriters Laboratories, see following Link:

<http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html>

UL File Number: E351535

5 Transport, packaging and storage

5.1 Safety instructions for 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.

5.2 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).

5.3 Packaging / disposal

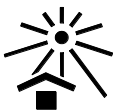
The packaging is not taken back and must be disposed of in accordance with the respective statutory regulations and local guidelines.

5.4 Storage of 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!

6 Installation and commissioning

6.1 Safety instructions

Personnel

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



WARNING!

Observe the safety instructions contained in **Chapter 2** when dismantling the device!

6.2 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 fulfil degree of protection requirements the diameter of the connection cable must correspond to that of the cable gland (please refer to Chapter 12 Dimension drawings)!

Deep groove ball bearings

FG 2 incremental encoders are fitted with maintenance-free, greased "for-life" deep groove 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.

6.3 Required tools

- Spanners: 10 mm, 22 mm
- Allen keys: 2 mm, 3 mm
- Flat-blade screwdrivers:
- Assembly grease
- Loctite® 243 (medium strength threadlocker)

6.4 Mounting preparations

1. Ensure all accessories are available (please refer to Chapter 12 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!

6.5 Mounting the encoder



NOTES!

For a mounting example please refer to dimension drawing HM 11 M 104353 Chapter 12

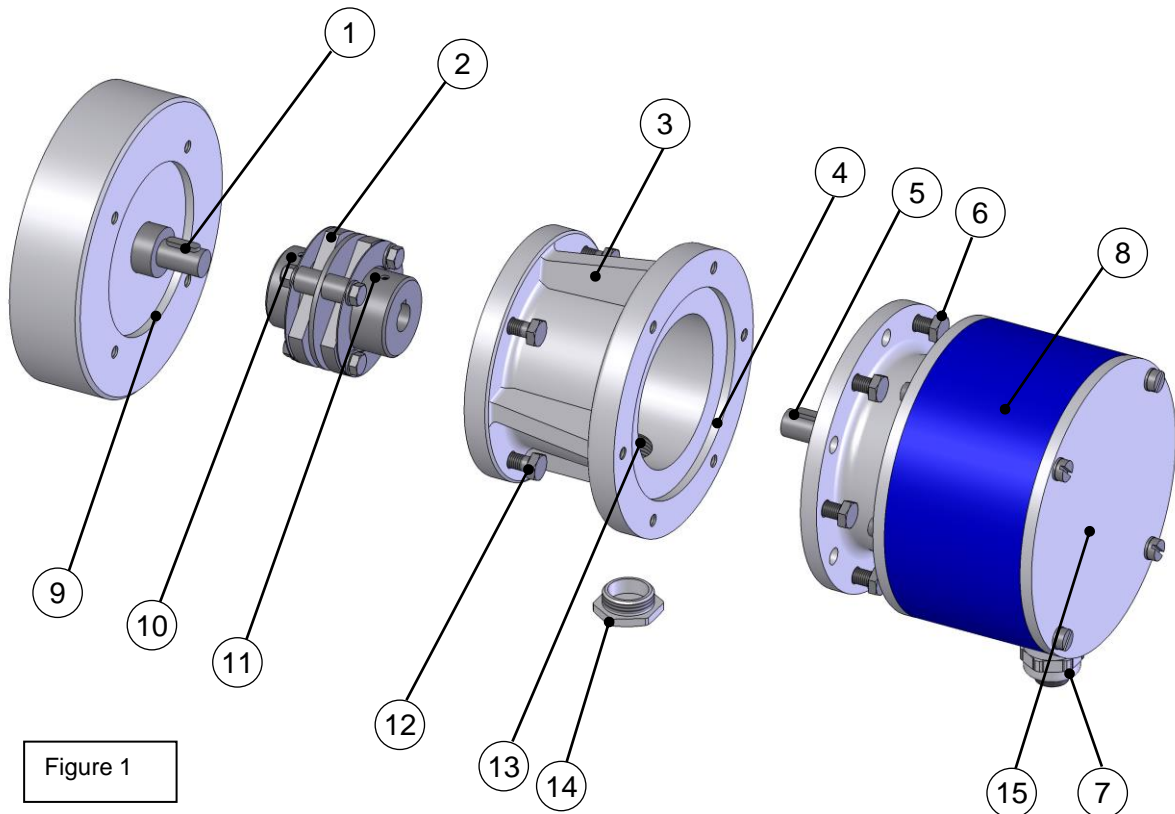


Figure 1

1. Lightly grease the (Motor) Schaft (1) an Centerin (9).
2. Fit coupling (2) onto (motor) shaft.



NOTES!

You must be able to mount the coupling without force. Ream out the bores of used couplings, if necessary!

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. Ream out the bores of used couplings, if necessary!



NOTES!

If possible, fit the device in a manner that ensures the cable gland (7) points downwards.

7. Secure the encoder with 6 screws (6).
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. Replace the sealing plug (14) to seal the access bore to the coupling.

6.6 Mounting tolerances



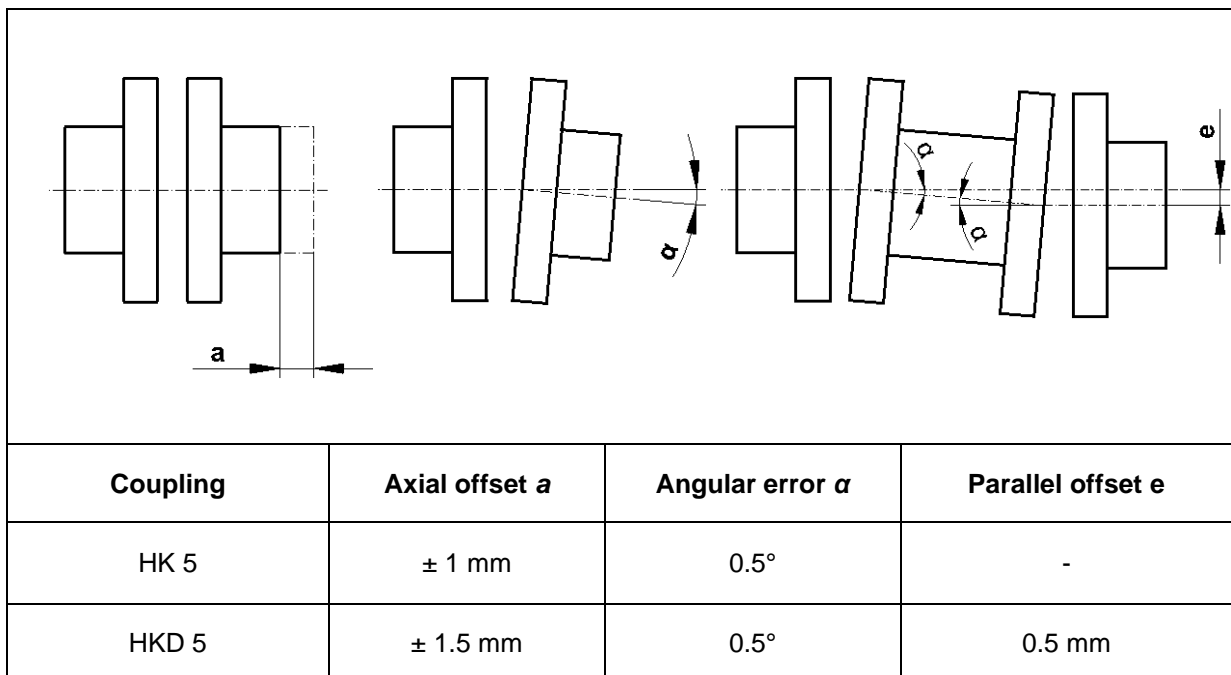
NOTES!

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).

Mounting tolerances for our zero-backlash, torsion-resistant couplings HK 5 and HKD 5:



6.7 Electrical connection and start up



NOTES!

You must observe applicable EMC guidelines when routing cables!



NOTES for UL and CSA!

Do only use copper cables!

6.7.1 Preparing cables

1. Strip cable insulation. The cable for the signal and supply line is shielded, the cable for the option S and the cable for LWL will not be shielded.
2. Crimp wire-end ferrules.

6.7.2 Electrical connection

1. Open the terminal box cover (15, Fig.1).



CAUTION!

Do not allow moisture to enter the terminal box when the cover is open!

2. Remove the cap of the cable glands (17, Fig.1).
3. Feed the cable into the terminal box trough the cable glands.



NOTES!

The signal cable shielding has to be connected directly to the housing via the EMC cable gland.

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

4. Tighten the cable gland using a spanner.



NOTES!

Prior to delivery cable glands and blanking plugs are tightened finger tight only. To ensure that the terminal box is reliably sealed tighten all cable glands and blanking plugs before starting up for the first time.

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



NOTES!

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

6. Connect the supply voltage, the signal cable and possibly option S (please refer to the connection diagrams, Chapter 13).



CAUTION!

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

7. Close the terminal box cover.



NOTES!

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



CAUTION!

Ensure when closing the terminal box cover that no cable becomes jammed.

For encoders with option S only:

1. Remove the blind plug from inside of the housing
2. Remove the cable gland
3. Close the opening with the blind plug

7 Dismantling

7.1 Safety instructions

Personnel

Dismantling must be carried out by skilled technical staff only.



WARNING!

Observe the safety instructions contained in **Chapter 2** when dismantling the device!



NOTES!

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

7.2 Dismantling the encoder

Disconnect all electrical cable prior to beginning any work.

To dismantling the encoder follow the instructions given in Chapter 6.5 in the reverse order.

8 Faults

8.1 Faults table

Faults	Possible cause	Remedy
Switch does not close (only by option S)	No supply voltage <u>Control</u> : LED in the terminal box does not shine	Check connection cable and supply voltage
	<u>Error LED does not shine</u> : Rotation speed above the switching speed	Adjust the suitable rotation speed
	<u>Error LED is shining</u> : Evaluation of rotation speed is faulty.	Disconnect power supply and switch on again
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!

9 Inspections

9.1 Safety instructions



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!

9.2 Maintenance information

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

9.3 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
Following approx 16 000 – 20 000 hours of operation / higher levels of continuous load	Check deep groove ball bearings are running smoothly and listen for running noises
For FG 2 with option S, no extra inspection is required.	

10 Disposal

10.1 Disposal procedure

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.

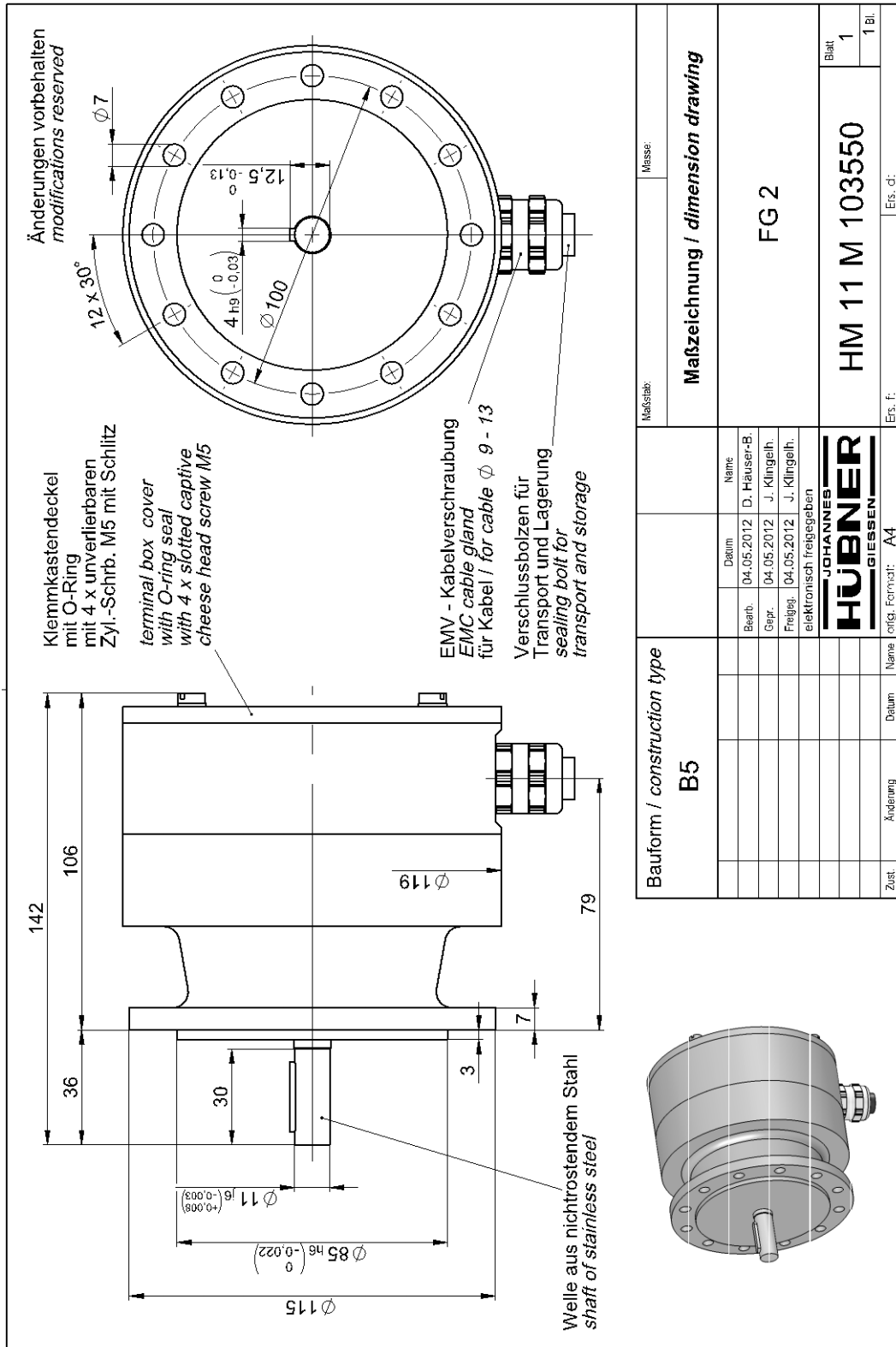
For information on environmentally sound disposal please contact your local authority or a specialist disposal company.

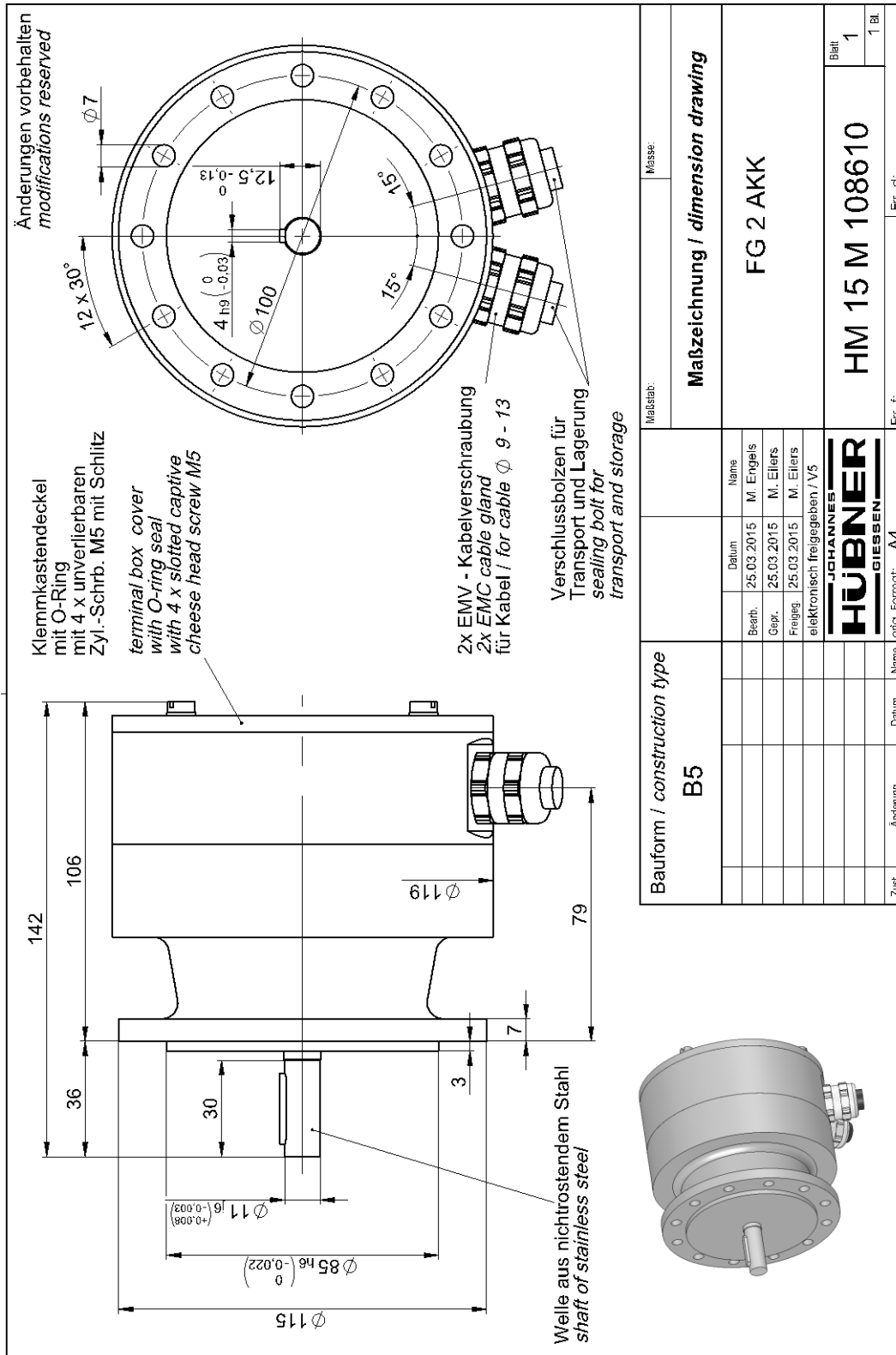
11 Replacement parts

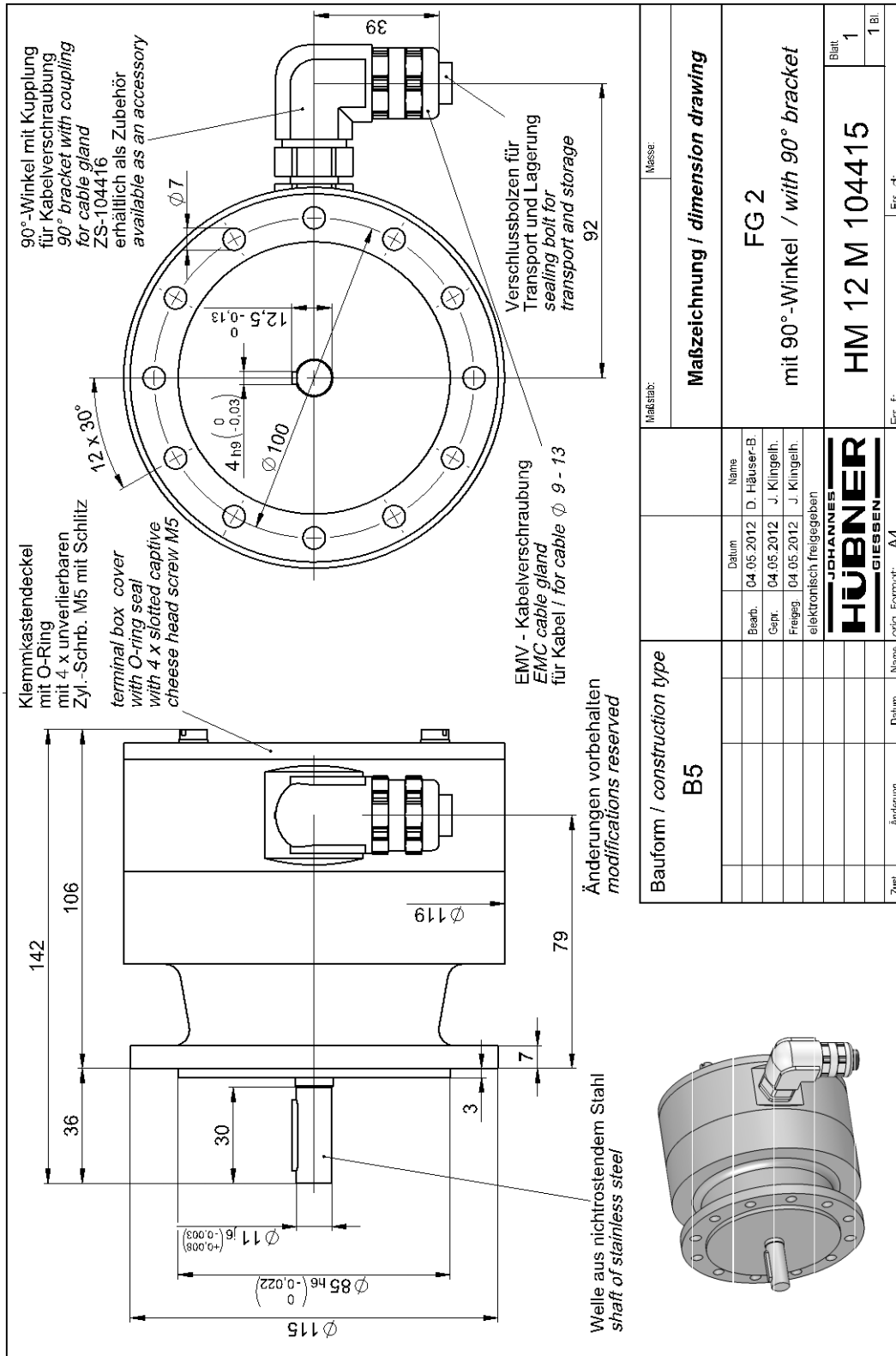
The replacement parts listed below can be obtained via the service address on page 2.

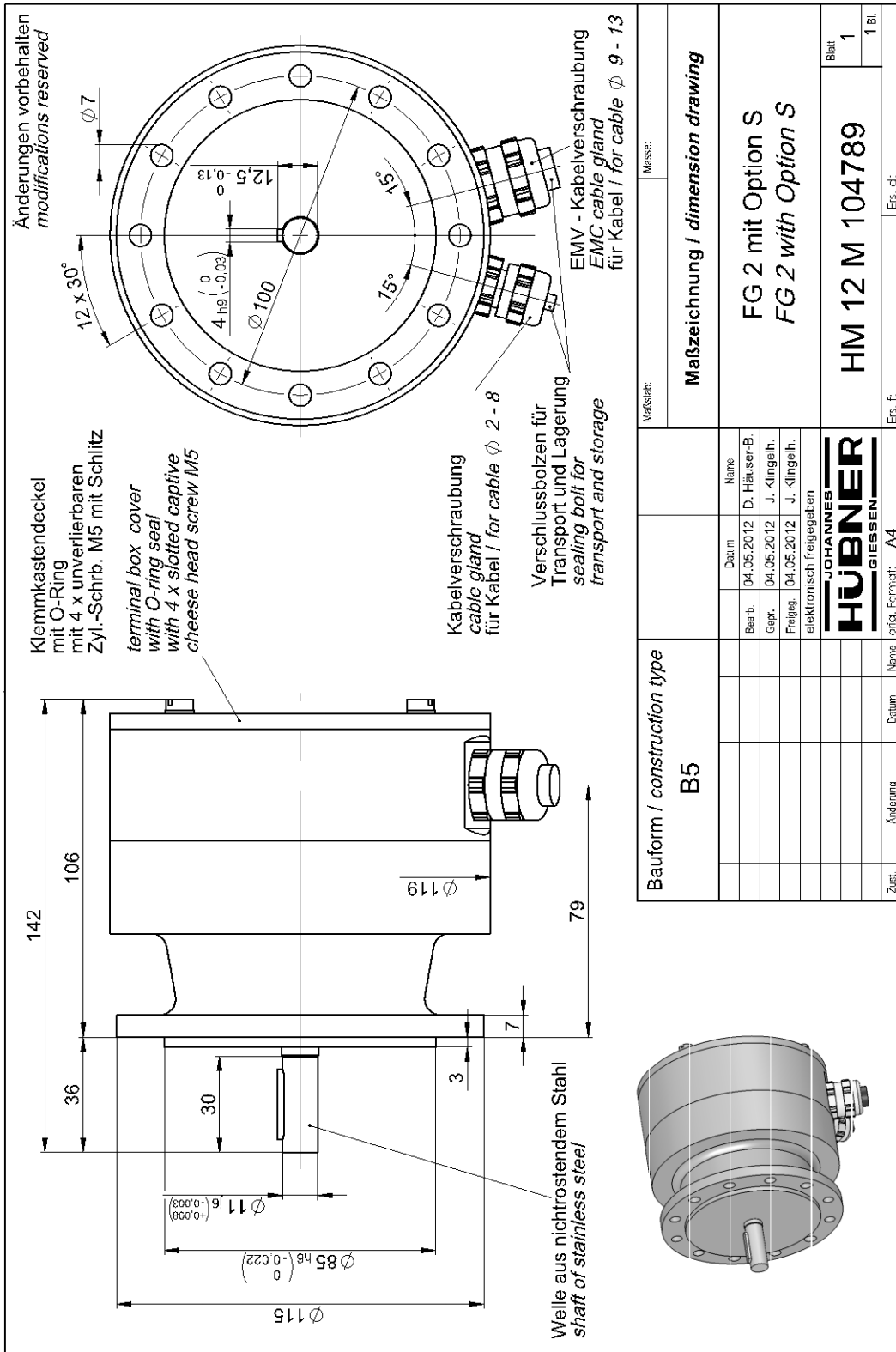
Replacement parts	Comment
EMC cable gland	M 20 x 1.5, cable Ø 9...13 mm
Terminal box cover	Including O-Ring and screws
Screw plug	For closing the access to the coupling
10-pole angle connector, complete	

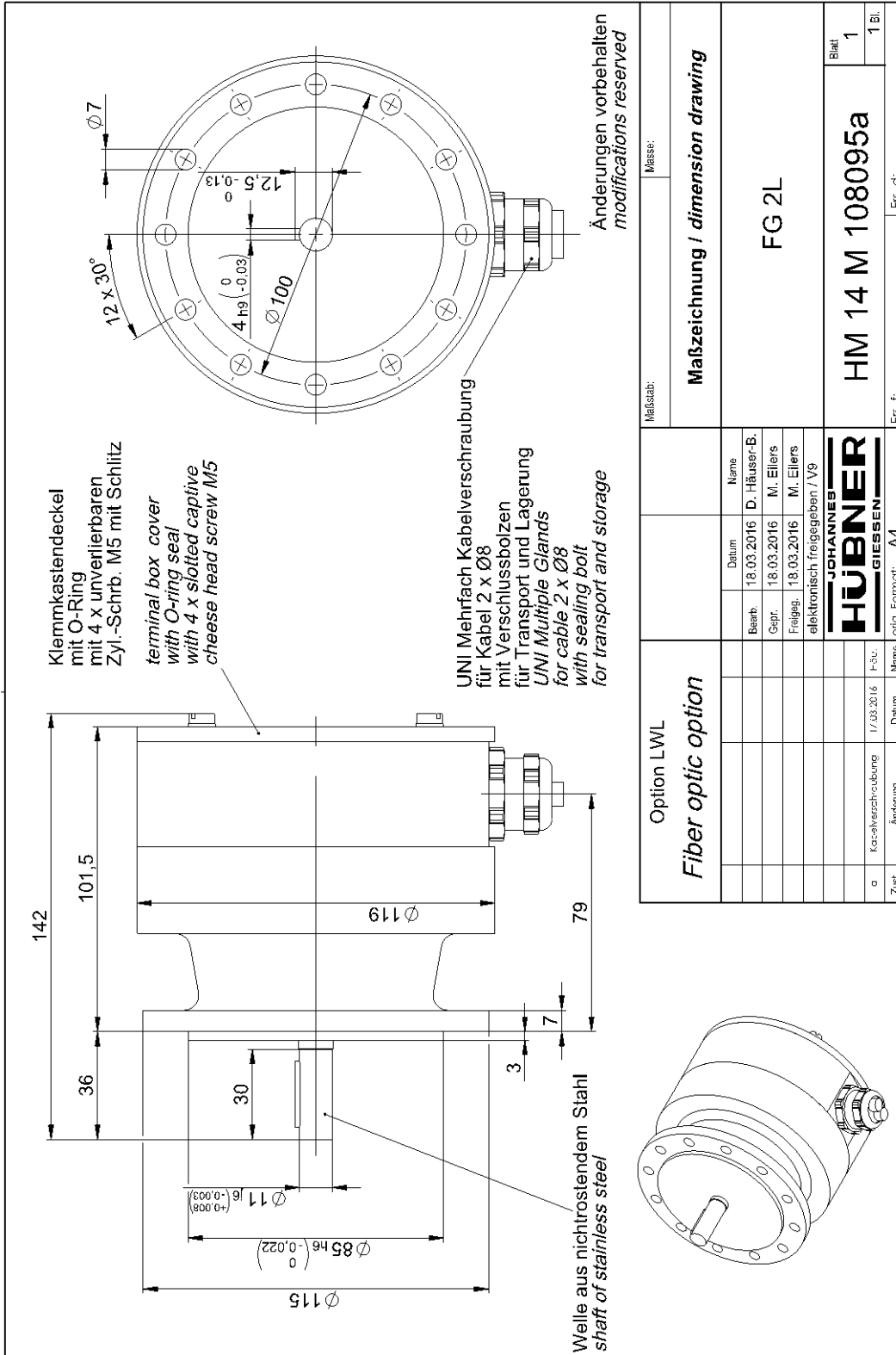
12 Dimension drawings



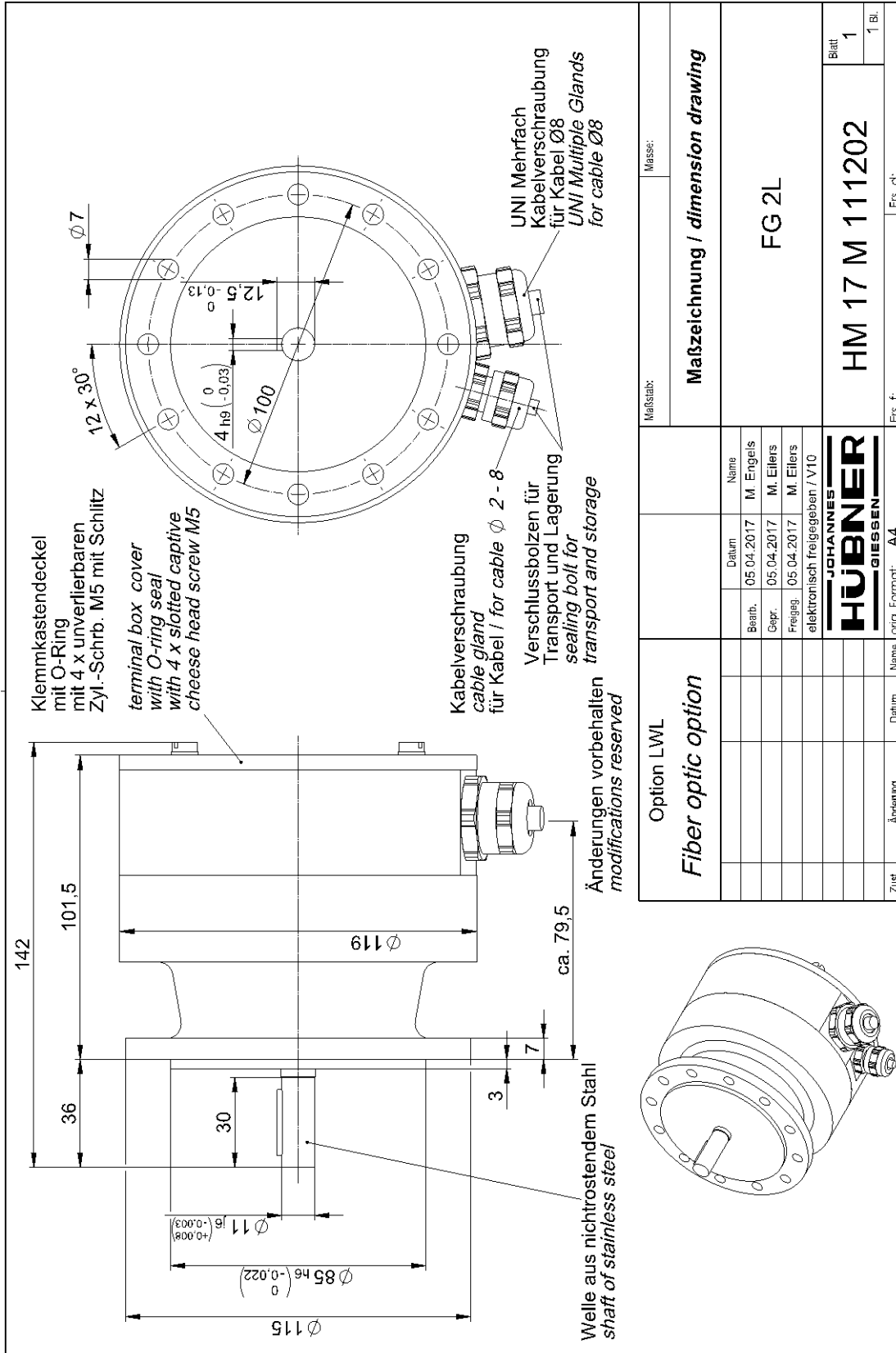


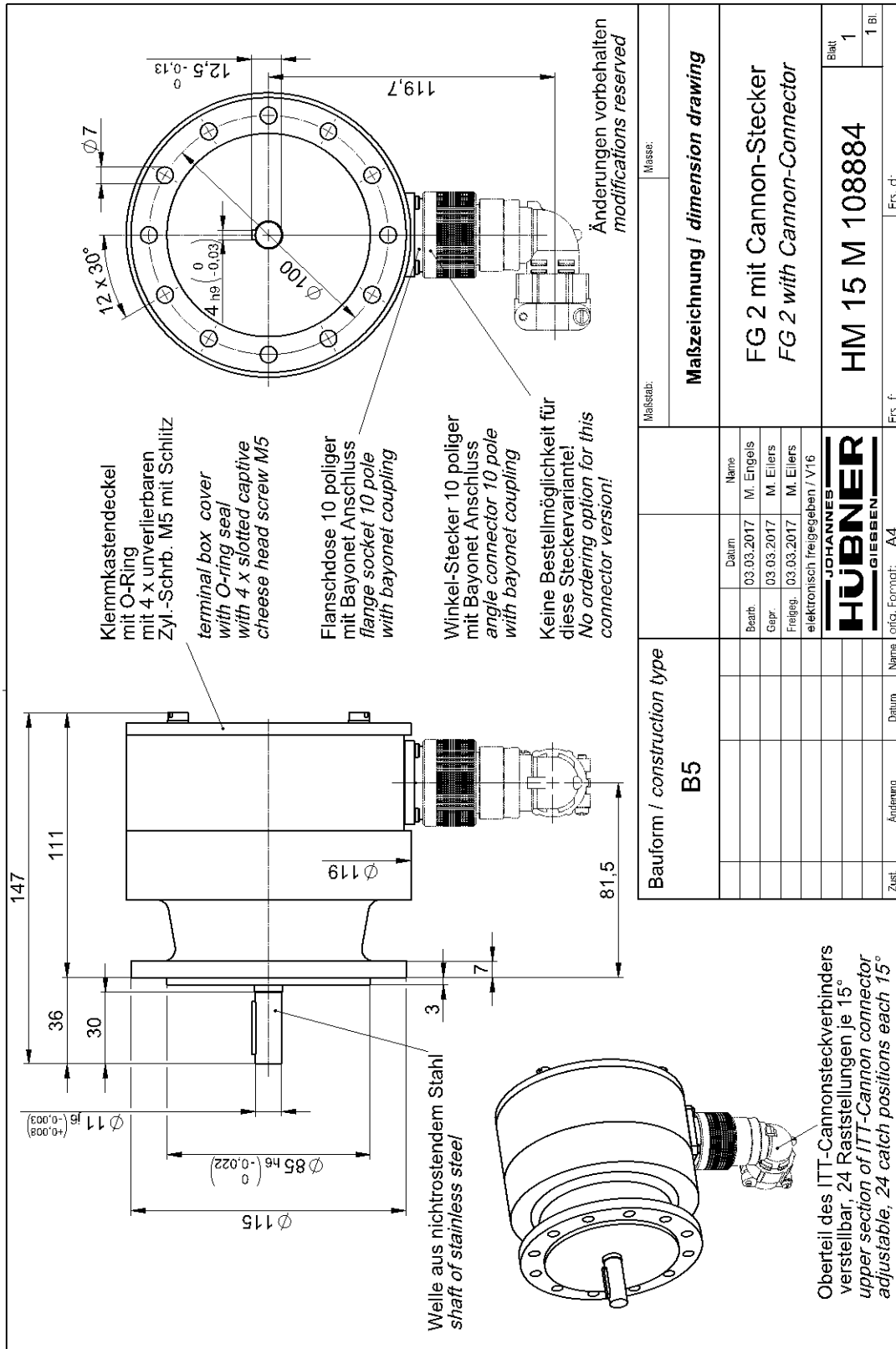


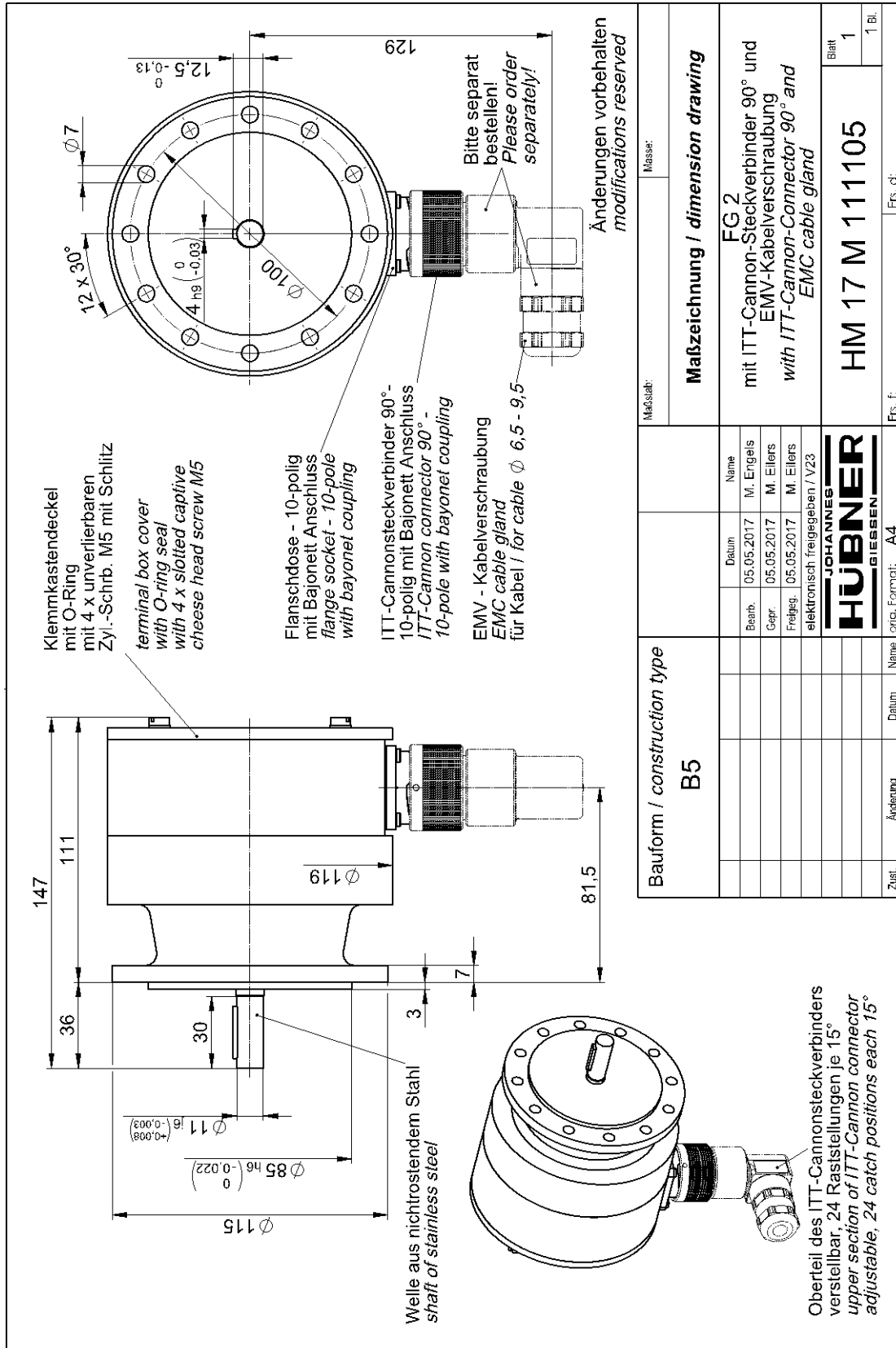




Incremental Encoder FG 2







Maßstab:		Maßstab:	
Bauform / construction type		Maßzeichnung / dimension drawing	
B5		FG 2	
Bearb.	Datum	Name	mit ITT-Cannon-Steckverbinder 90° und EMV-Kabelverschraubung
05.05.2017	05.05.2017	M. Engels	with ITT-Cannon-Connector 90° and EMC cable gland
Gepr.	Freigab.	M. Eilers	
05.05.2017	05.05.2017	M. Eilers	
elektronisch freigegeben / V23			
HUBNER			
JOHANNES GIESSEN			
Zust.	Ävelung	Name	HM 17 M 111105
		orig. Format:	A4
		Datum	
		Name	
		Ers. f.	
		Ers. d.	
		Blatt	1
		1 Bl.	1

Oberteil des ITT-Cannonsteckverbinders verstellbar, 24 Raststellungen je 15°
upper section of ITT-Cannon connector adjustable, 24 catch positions each 15°

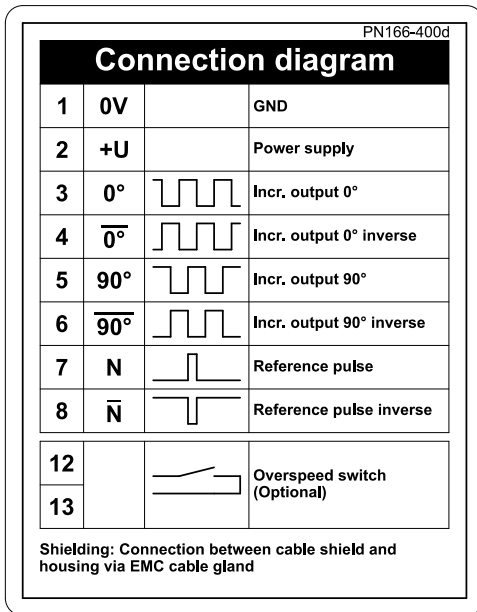
13 Connection diagrams

13.1 Terminal box

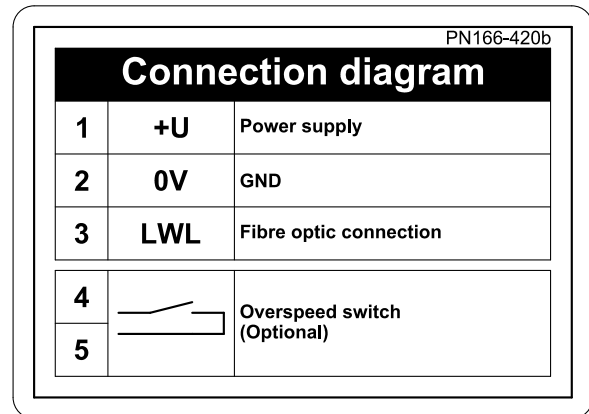


NOTES!

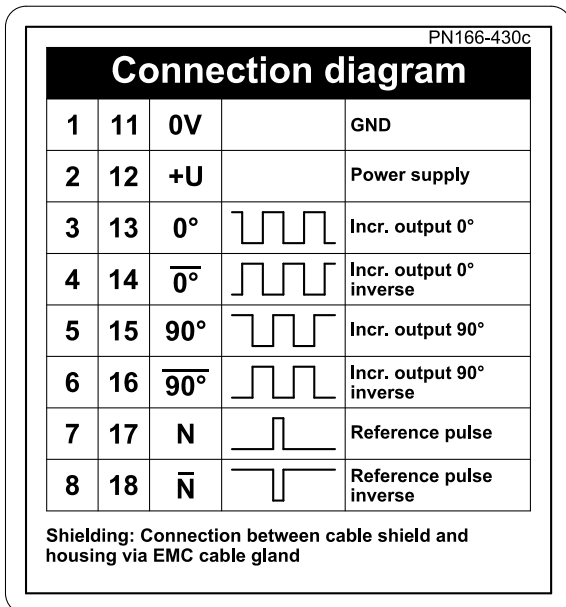
The connection diagrams are displayed in each terminal box cover!



Connection technology AK



Connection technology AL



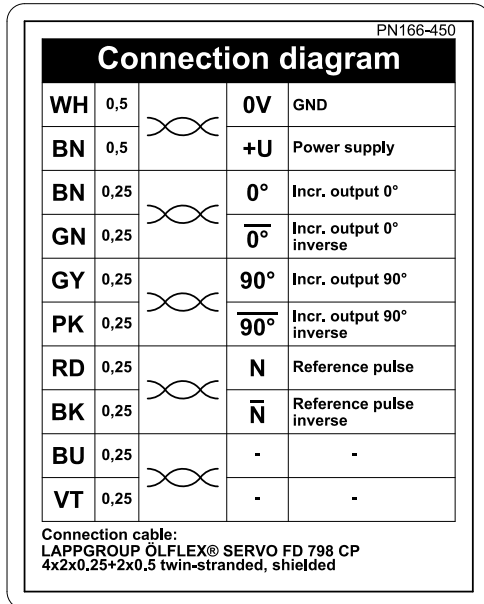
Connection technology AKK

13.2 Connection cable

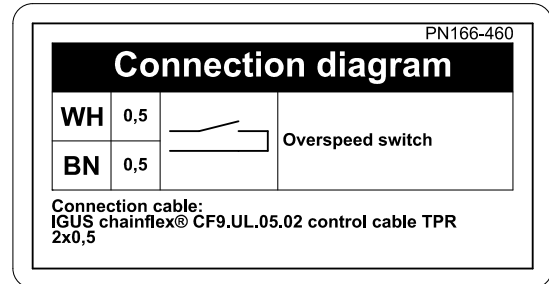


NOTES!

The connection diagrams are attached to each cable!

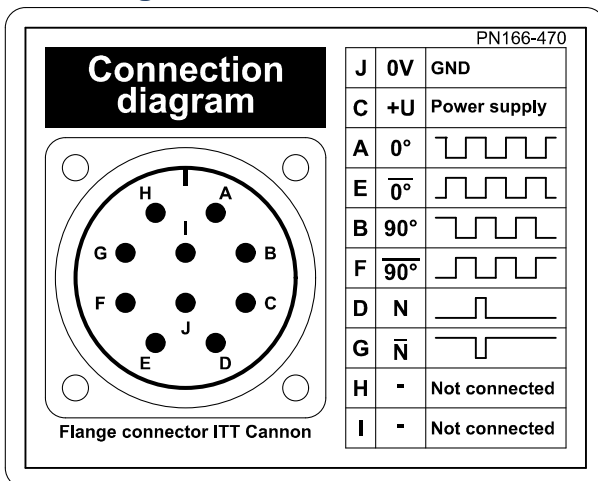


Connection cable



Connection cable (option S)

13.3 Flange connector ITT-Cannon



10-pole-flange connector ITT Cannon