# JOHANNES HÜBNER
## GIESSEN

ideas and solutions

增量编码器 FG(HJ) 40, FG 40 Ex, Fg(H) 41, FG(HJ) INOX
用于极端恶劣条件下的速度测量和监测

# Incremental encoders
## FG(HJ) 40, FG 40 Ex, FG(H) 41, FG(HJ) INOX
For speed measurement and monitoring under extreme ambient conditions

可选
**SIL / PL**
认证 /
certified

## Johannes Hübner Giessen

**精确、优势、关注客户**

我们专注于技术— 我们了解我们的客户。我们坚定的站在客户一边为其提供特殊的设想、定制的解决方案。为了支持我们的客户， 我们提供了强大的编码器系统、强大的传动技术和全球化的服务。我们将与我们的客户一起克服在重工业领域或其它极其恶劣条件领域的巨大的挑战，继而不断的增进客户的业务。你有什么挑战?

**Precision. Strength. Customer focused.**

We are fascinated by technology – and we understand our customers. We stand firmly at your side with exceptional ideas and tailor-made solutions; to support our customers we offer robust encoder systems, powerful drive technology and a worldwide service. That is how we overcome together with our customers the huge challenges in heavy industry and other fields subject to harsh conditions to sustainably improve their business. What challenges do you have?

**我们的应用领域：**
- 金属及轧制技术
- 港口和起重机技术
- 矿山工业
- 石油和天然气工业
- 运输
- 海洋工程
- 发电行业
- 其它应用领域

**Our fields of applications:**
- Metal and rolling mill technology
- Port and crane technology
- Mining industry
- Oil and gas industry
- Transport
- Marine engineering
- Power generation
- ... and many other applications

## 目录

## Content

任务和解决方案
Task and Solution

**任务**

重工业对所用部件的可靠性和寿命提出了苛刻的要求。这尤其适用于安装用于测量和监测速度的增量编码器。无论它们是安装在钢厂、轧钢、采矿作业、起重机系统或石油天然气工业的驱动器上，每个应用领域都有自己的特点：从不同的安装方案和扩展选项到不同的脉冲数、辅助信号输出、集成FOC变送器，到不锈钢外壳或特殊认证，如功能安全的SIL/PL认证和潜在爆炸性环境的ATEX/IECEx的认证。我们面临的挑战是为每个任务和每个安装位置提供量身定制的解决方案，并保证每个解决方案的可靠性。

**Task**

Heavy industry places tough demands on the reliability and lifetime of the components utilized. That applies in particular to incremental encoders installed to measure and monitor speeds. No matter if they are installed on drives in steel and rolling mills, in mining operations, in crane systems or in the oil and gas industry, each field of application has its own specifications: from different mounting solutions and extension options to different pulse rates, supplementary signal outputs, integrated FOC transmitters through to stainless steel housings or special certifications such as SIL / PL for functional safety and ATEX / IECEx for potentially explosive atmospheres. The challenge is to provide a tailor-made solution for each task and every mounting situation – and to guarantee the reliability of each and every solution.
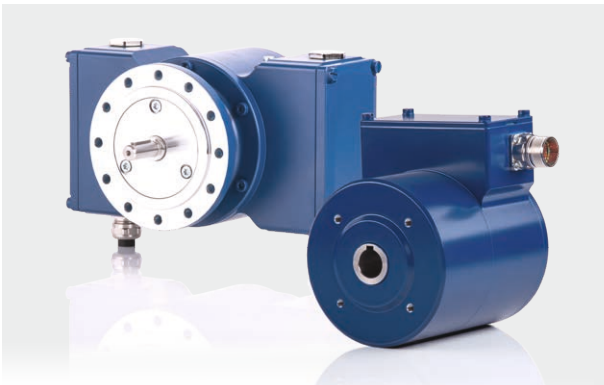
*FG 40 KK 和 FGH 41 T*
*FG 40 KK and FGH 41 T*

*FG 40 Ex 和 FGHJ INOX*
*FG 40 Ex and FGHJ INOX*

**解决方案**

作为定制编码器解决方案专家的Johannes Hübner Fabrik elektrischer Maschinen GmbH 能够满足几乎所有的重工业的要求。40/41 系列的所有装置都设计得非常坚固、寿命长，可靠性高。
它们是专为不同的应用而设计的：

• FG(HJ) 40: 适用于重工业的标准应用；各种版本和附件解决方案
• FG 40 Ex: 适用于潜在爆炸环境；有 ATEX 和 IECEx 认证
• FG (H) 41: 适用于安全应用；具有 SIL 3/PL d 的功能安全认证
• FG (HJ) INOX: 适用于腐蚀性环境；由 V4A (1.4404) 制成的高强度不锈钢外壳

**Solution**

As a specialist for tailor-made encoder solutions Johannes Hübner Fabrik elektrischer Maschinen GmbH is able to meet practically all of the demands of heavy industry. Extremely robust by design all of the devices belonging to the 40/41 series offer a long lifetime as well as high reliability. They are specially designed for different applications:

• FG(HJ) 40: For standard applications in heavy industry; a wide variety of versions and attachment solutions
• FG 40 Ex: For applications in potentially explosive atmospheres; with ATEX and IECEx certification
• FG(H) 41: For safety applications; with functional safety certification up to SIL 3 / PL d
• FG(HJ) INOX: For applications involving corrosive environments; highly resistant stainless steel housing made of V4A (1.4404)

# 产品的优点
## Product benefits

| 可靠的 / reliable | FG(HJ) 40 | FG(H) 41 | FG 40 Ex | FG(HJ) INOX |
|---|---|---|---|---|
| 寿命长，可靠性高<br>Long lifetime, high reliability | x | x | x | x |
| 具有高动载荷额定值的大轴承<br>Large bearings with high dynamic load rating | x | x | x | x |
| 抗冲击、抗振动能力强<br>High shock and vibration resistance | x | x | x | x |
| 轴采用耐腐蚀钢材制成<br>Shaft made of non-corroding steel | x | x | x | x |
| 防盐水，适用于轧钢厂的湿区<br>Saltwater-proof, wet areas in rolling mills | x | x | x | x |
| 耐腐蚀性环境（如：酸和碱）<br>Resistance to corrosive environments<br>(e.g. acids and alkalis) | | | | x |
| 温度范围 -40℃ 至 +85℃<br>Temperature range -40 °C up to +85 °C | x | x | | x |
| 温度范围可达 +100℃<br>Temperature range up to +100 °C | x | | | |

| 安全的 / safe | FG(HJ) 40 | FG(H) 41 | FG 40 Ex | FG(HJ) INOX |
|---|---|---|---|---|
| 最先进的电子技术，坚固的厚壁外壳 / State-of-the-art electronics in a robust, thick-walled housing | x | x | x | x |
| 高达 100 万个脉冲 HTL / TTL<br>Up to 1 million pulses HTL / TTL | x | | | |
| 高达 2500 个正弦周期<br>Up to 2,500 sine periods | x | | x | |
| EMC 电缆添料函<br>EMC cable glands | x | x | x | x |
| 附加旋转方向/停止检测（可选）<br>Additional direction of rotation /<br>standstill detection (optional) | x | | | |
| 带绝缘轴承的空心轴装置<br>Hollow shaft devices with isolated bearings | x | | | x |
| UL/CSA-认证<br>UL/CSA certification | x | | | |
| SIL 3 / PL e 安全认证<br>Safety certified SIL 3 / PL e | | x | | |
| 依照 EN / IEC 60079 的ATEX 和 IECEx 认证<br>ATEX and IECEx certified acc. to EN / IEC 60079 | | | x | |
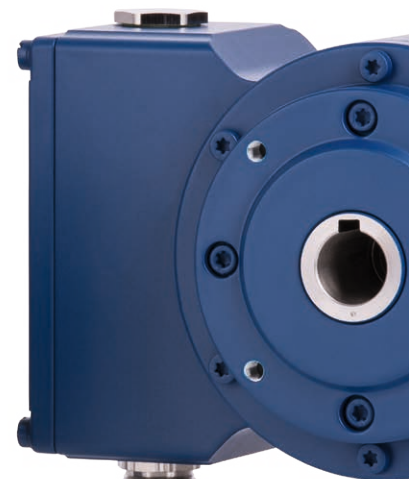
## 产品的优点
## Product benefits

| 可定制 / **tailor-made** | FG(HJ) 40 | FG(H) 41 | FG 40 Ex | FG(HJ) INOX |
|---|---|---|---|---|
| 最高转速可达6000 rpm（实心轴）和 4000 rpm（空心轴）/ High speeds up to 6000 rpm (solid shaft) and 4000 rpm (hollow shaft) | x | | x | x |
| 第二信号输出（增量） Second signal output (incremental) | x | | x | |
| 光纤电缆输出（可选） FOC output (optional) | x | | | x |
| 超速开关（可选） Overspeed switch (optional) | x | | | |
| 选择添加更多的装置（实心轴装置） Option to add further devices (solid shaft devices) | x | | | |
| 多种装置和信号选择 Wide variety of further devices and signal options | x | x | x | |
| 实心轴 φ11 / φ14 x 30 mm Solid shaft Ø 11 / Ø 14 x 30 mm | x | x | | x |
| 高强度不锈钢外壳 V4A（1.4404） Highly resistant stainless steel housing V4A (1.4404) | | | | x |

| 舒适的 / **comfortable** | FG(HJ) 40 | FG(H) 41 | FG 40 Ex | FG(HJ) INOX |
|---|---|---|---|---|
| 尺寸宽大的接线盒 Generously dimensioned terminal box | x | x | x | x |
| 带有状态输出的内部诊断 Internal diagnostics with status output | x | | | |
| 多种接头或电缆的连接选择 / Connection options with a variety of connectors or cables | x | x | | |
| 合适的机械附件和安装服务（可选） Suitable mechanical accessories and mounting service (optional) | x | x | x | x |
| 为个别解决方案提供服务和咨询 Service and consultation for individual solutions | x | x | x | x |

## 技术参数 FG 40 / FGH(J) 40 和 FG 41 / FGH 41
## Technical data FG 40 / FGH(J) 40 and FG 41 / FGH 41

| 系列 / **Series** | **FG 40 / FGH(J) 40** | **FG 41 / FGH 41** |
|---|---|---|
| 电源电压 / Supply voltage | 12 – 30 VDC (选项 / optional 5 VDC) | 12 – 30 VDC |
| 最大脉冲率.（信号幅度）<br>Pulse rate max. (signal amplitude) | 1 百万 / Million (HTL, TTL), 2500 (Sin/Cos)   IE INCREMENTAL ENCODER | 4096 (HTL, TTL, Sin/Cos)   IE INCREMENTAL ENCODER |
| 输出信号（+各路反向）<br>Output signals (+ each inverted) | 0°, 90°, N, Status | 0°, 90° (SIL / PL), N (没有 / without SIL / PL) |
| 最大电子系统数量（增量）<br>Number of electronic systems (incremental) max. | 2 | 1 |
| 保护等级（最高）<br>Degree of protection (up to) | IP66 / IP67 | IP66 / IP67 |
| 设备温度范围<br>Device temperature range | -25 … +85 °C, 可选项 / optional -40 … +85 °C, -5 … +100 °C | -40 … +85 °C |
| 抗振动/冲击<br>Vibration / Shock resistance | 20 g / 150 g | 10 g / 100 g |
| 重量（约）/ Weight (approx.) | 3 – 5 kg | 3 kg |
| 特色<br>Special features | 重载+编码器的进一步扩展<br>Heavy duty + further encoder extensions | 重载+安全认证<br>Heavy duty + safety certified |
| 认证<br>Certifications | UL/CSA   c(UL)us LISTED | SIL 3 / PL e   SIL 3 Functional Safety PLe |
| **实心轴设计 /**<br>**Solid shaft design** | | |
| 图像<br>Image | | |
| 结构形式；轴端带滑键<br>Construction type; Shaft end with feather key | B5 / B35; Ø 11 / Ø 14 mm | B5 / B35; Ø 11 / Ø 14 mm |
| 允许机械速度<br>Approved mechanical speed | 最大 / max. 6000 rpm | 最大 / max. 4000 rpm |
| **空心轴设计 /**<br>**Hollow shaft design** | | |
| 图像<br>Image | | |
| 空心轴带键槽（最大）<br>Hollow shaft with keyway (up to) | Ø 20 mm (Ø 25 mm: 夹紧)<br>Ø 20 mm (Ø 25 mm: Clamping) | Ø 20 mm |
| 允许机械速度<br>Approved mechanical speed | 最大 / max. 4000 rpm | 最大 / max. 3000 rpm |
| **选项 / Options** | | |
| 附加超速开关<br>Additional overspeed switch | 选项（2个开关，自由编程）<br>Optional (2 switches, freely programmable)   OS OVERSPEED SWITCH | - |
| 进一步拓展可能性<br>Possibility for further attachments | 第二轴端（仅B5 / B35）<br>Second shaft end (only B5 / B35) | - |

## 技术参数 FG 40 Ex 和 FG INOX / FGHJ INOX
## Technical data FG 40 Ex and FG INOX / FGHJ INOX

| 系列 / **Series** | **FG 40 Ex** | **FG INOX / FGHJ INOX** |
|---|---|---|
| 电源电压 / Supply voltage | 12 – 30 VDC | 12 – 30 VDC |
| 最大脉冲率（信号幅度）<br>Pulse rate max. (signal amplitude) | 250000 (HTL, TTL), 2500 (Sin/Cos) **IE INCREMENTAL ENCODER** | 2048 (HTL, TTL) **IE INCREMENTAL ENCODER** |
| 输出信号（+各路反向）<br>Output signals (+ each inverted) | 0°, 90°, N, Status | 0°, 90°, N |
| 最大电子系统数量（增量）<br>Number of electronic systems (incremental) max. | 2 | 1 |
| 保护等级（最高）<br>Degree of protection (up to) | IP66 | IP66 |
| 设备温度范围<br>Device temperature range | -40 … +60 °C (T6 可达 / up to +55 °C) | -25 … +85 °C |
| 抗振动/冲击<br>Vibration / Shock resistance | 20 g / 100 g | 10 g / 100 g |
| 重量（约）/ Weight (approx.) | 3.9 kg | 3.5 kg |
| 特点<br>Special features | 用于潜在爆炸环境<br>For potentially explosive atmospheres | 抗酸碱腐蚀（不锈钢外壳）<br>Acids and alkalis resistant (stainless steel housing) |
| 认证<br>Certifications | ATEX / IECEx **Ex** | - |
| 实心轴 / **Solid shaft design** | | |
| 图像<br>Image |  |  |
| 结构形式；轴端带滑键<br>Construction type; Shaft end with feather key | B5; Ø 11 / Ø 14 mm | B5 / B35; Ø 11 / Ø 14 mm |
| 允许机械速度<br>Approved mechanical speed | 最大 / max. 6000 rpm | 最大 / max. 6000 rpm |
| 空心轴设计<br>**Hollow shaft design** | | |
| 图像<br>Image | |  |
| 空心轴带键槽（最大）<br>Hollow shaft with keyway (up to) | - | Ø 16 mm: 夹紧 / Clamping<br>Ø 17 mm: 锥形轴 / tapered shaft 1:10 |
| 允许机械速度<br>Approved mechanical speed | - | 最大 / max. 6000 rpm |
| 选项 / **Options** | | |
| 附加超速开关<br>Additional overspeed switch | - | 选项（一个开关，工厂设定）<br>Optional (one switch, set ex works) **OS OVERSPEED SWITCH** |
| 进一步拓展可能性<br>Possibility for further attachments | - | - |

信号输出选项 FG 40 / FGH(J) 40
Options Signal outputs FG 40 / FGH(J) 40

## FG 40 / FGH(J) 40

| | | |
|---|---|---|
| **基本版本**<br><br>基本通道 0°(A) 和脉冲信道 90° (B)<br><br>内部系统诊断带状态输出 (Status)<br><br>每路都有反向信号 | **Basic version**<br>Basic channel 0° (A) and<br>pulse channel 90° (B)<br><br>Internal system diagnostics with<br>status output (Status)<br><br>Each with inverted signals | 0°<br>$\overline{0°}$<br><br>90°<br>$\overline{90°}$ |
| **选项 N**<br>标志脉冲 (N) 机械定位；每转一个方波脉冲；带有反向信号 | **Option N**<br>Reference pulse (N) mechanically defined; one square pulse per revolution; with inverted signal | N<br>$\overline{N}$ |
| **选项 2F**<br>通过组合 0° 和 90° 通道得到基本通道两倍的脉冲数 | **Option 2F**<br>Twice as many pulses as basic channel by combining the 0° and 90° channels | 2F<br>$\overline{2F}$ |
| **选项 B**<br>快速检测 0° 和 90° 通道的每个边缘方向 | **Option B**<br>Fast detection of the direction at each edge of the 0° and 90° channels | B    CW CCW<br>$\overline{B}$    CW CCW |
| **选项 B2**<br>快速检测 0° 和 90° 通道的各边方向;附加静止识别 | **Option B2**<br>Fast detection of the direction at each edge of the 0° and 90° channels; additional standstill recognition | B2    CW CCW ...<br>$\overline{B2}$    CW CCW ...<br>STOP |
| **选项 B3**<br>旋转相关输出信号。这个选项支持具有独立的上/下脉冲输入的计数器卡。顺时针旋转时，在选项输出 1，逆时针旋转时在选项输出 2 发出基本通道信号 | **Option B3**<br>Rotation-dependent output signals. This option supports counter cards with separate UP/DOWN pulse inputs. Basic channel signals are issued at option output 1 when rotation is clockwise and at option output 2 when rotation is counterclockwise. | O1   CW ... CCW<br>O2   CW ... CCW |
| **选项 S**<br>电子超速开关带有两个独立可编程的切断点 | **Option S**<br>Electronic overspeed switch with two independently programmable switching points | |
| **选项 FOC**<br>作为通过铜电缆传输信号的替代方案，编码器信号也可以通过光纤传输 | **Option FOC**<br>As an alternative to conventional signal transmissions via copper cable encoder signals can also be transmitted via fiber optic cable. | |

提供更多信号选项和输出配置。/ Further signal options and output configurations available.

## 选项 S:
## 电子超速开关

电子超速开关带有两个独立可编程切断点识别限制速度。

### 更多优势
- 可编程切断点在整个开关速度范围内
- 超速或欠速监测
- 可调切断延迟
- 切断速度从0.63到7000rpm
- 切断触点被电子监控
- 诊断输出

## 编程软件

### 可调整参数
- 超速
- 欠速
- 旋转方向相关开关
- 切断延迟
- 旋转角度（用于静止监测）
- 切断滞后
- …附加功能

图形用户界面（监控）
- 速度/时间图和开关输出状态显示

将数据导入和导出到 PC
- 保存参数数据、设备数据、监控数据

## Option S:
## Electronic overspeed switch

Electronic overspeed switch with two independently programmable switching points for recognition of limit speeds.

### Further advantages
- Programmable switching points over the whole switching speed range
- Monitoring of overspeed or underspeed
- Adjustable switching delay
- Switching speed from 0.63 to 7000 rpm
- Switching contacts are electronically monitored
- Diagnostics output

## Programming software

Adjustable parameters
- Overspeed
- Underspeed
- Rotation direction dependent switching
- Switching delay
- Rotational angle (for standstill monitoring)
- Switching hysteresis
- … additional functions

Graphic user interface (monitoring)
- Speed / time graph and switching outputs status display

Importing and exporting data to a PC
- Save parameter data, device data, monitoring data



速度传感器　Speed sensor　逻辑模块　Logic module　开关　Switch
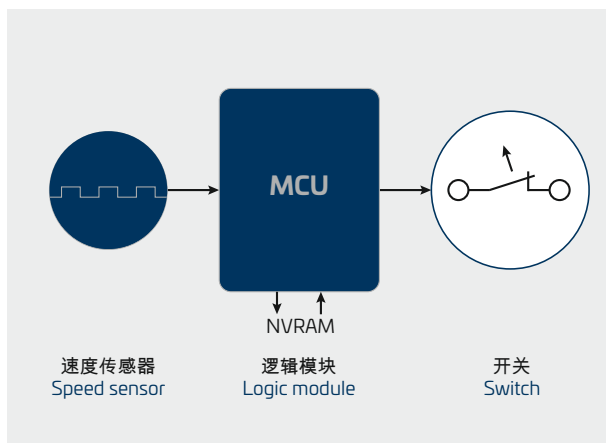
集成速度传感器由带有光学扫描仪的脉冲盘组成，产生与速度成比例的频率。

这是由逻辑模块（MCU）处理的。当前速度与存储在非易失性存储器（NVRAM）中的编程极限速度进行连续比较。
当达到极限速度时，逻辑单元触发相应的开关 （开关打开）。

The integrated speed sensor consists of a pulse disk with optical scanner and generates a frequency proportional to the speed.

This is processed by the logic module (MCU). The current speed is continuously compared with the programmed limit speeds stored in the nonvolatile memory (NVRAM).
The logic unit triggers the corresponding switch when a limit speed is reached (switch opens).

## 选项 FOC (光缆) FG 40 / FGH(J) 40
## Option FOC (fiber optic cable) FG 40 / FGH(J) 40

### 选项 FOC:
### 通过光缆传输信号

- 无干扰信号传输
- 传输距离可达到 1000 米
- 一个单芯的光缆传输所有通道的信号
- 带 2 组输出的解码器
- 光缆中断监测

### 操作模式

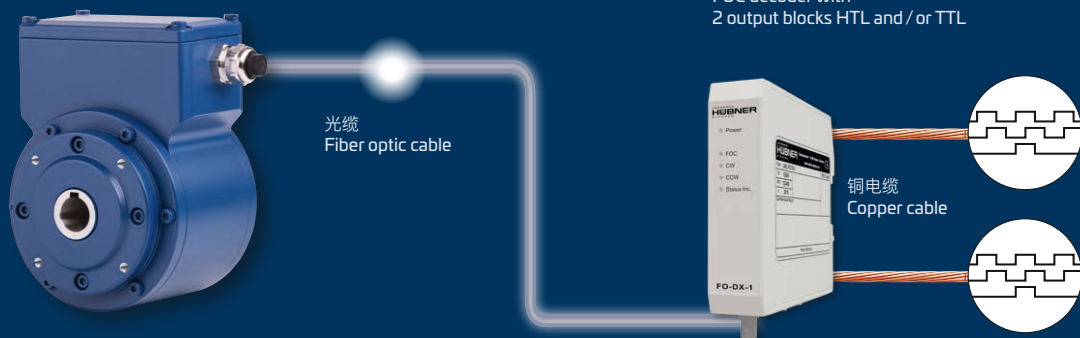编码器信号 0°、90° 和标志脉冲在通过光缆传输之前被编码。它们在控制柜中被解码，并发出反向信号。

### Option FOC:
### Signal transmission via fiber optic cable

- Interference-free signal transmission
- For long transmission distances up to 1000 m
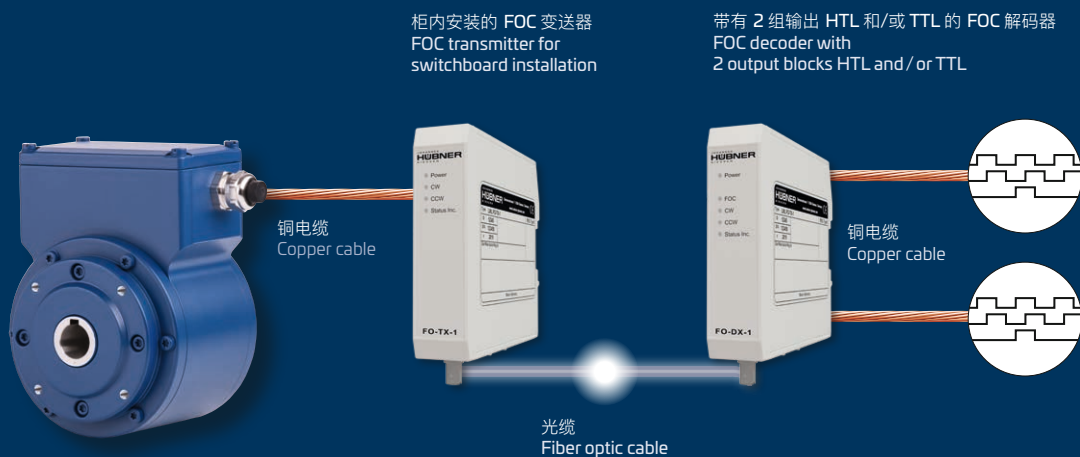- A single fiber optic cable for all channels
- Decoder with 2 output blocks
- FOC cable break monitoring

### Mode of operation

The encoder signals 0°, 90° and reference pulse are coded before being transmitted via a fiber optic cable. They are decoded in the switchboard and issued with inverted signals.

### 集成 FOC 变送器的编码器
### Encoder with integrated FOC transmitter

带有 2 组输出 HTL 和/或 TTL 的 FOC 解码器
FOC decoder with
2 output blocks HTL and / or TTL

光缆
Fiber optic cable

铜电缆
Copper cable

FO-DX-1

### 带有独立 FOC 变送器的编码器
### Encoder with separate FOC transmitter

柜内安装的 FOC 变送器
FOC transmitter for
switchboard installation

带有 2 组输出 HTL 和/或 TTL 的 FOC 解码器
FOC decoder with
2 output blocks HTL and / or TTL

铜电缆
Copper cable

铜电缆
Copper cable

FO-TX-1

FO-DX-1

光缆
Fiber optic cable

# 组合选项 FG 40
# Combination options FG 40

FG 40 系列为需要多个相同信号或不同输出信号的应用提供了定制的系统组合选项。

The series FG 40 offers tailor-made system combination options for applications that require multiples of the same signals or different output signals.



例如1个, *2 个, 4 个和 6 个端子箱 / Examples for one, two, four and six terminal boxes*

## 可能的输出信号
**每个端子箱可容纳下列功能之:**

**IE** INCREMENTAL ENCODER
- HTL或TTL高达一百万ppr
- 正弦/余弦高达2500个正弦周期

**OS** OVERSPEED SWITCH
- 两个速度开关（可编程）
- 一个诊断开关

安装绝对值编码器将提供以下功能:

**AE** ABSOLUTE ENCODER
- SSI
- SSI 带有增量输出
- EtherCAT
- Parallel
- PROFIBUS-DP
- DeviceNet

## Possible output signals
Each terminal box can house one of the following functions:

**IE** INCREMENTAL ENCODER
- HTL or TTL up to one million ppr
- Sin/Cos up to 2500 sine periods

**OS** OVERSPEED SWITCH
- Two speed switches (programmable)
- One diagnostics switch

The addition of an absolute encoder will offer the following functions:

**AE** ABSOLUTE ENCODER
- SSI
- SSI with incremental
- EtherCAT
- Parallel
- PROFIBUS-DP
- DeviceNet



用于多个输出信号的应用，推荐使用 U-ONE 系统。
Alternatively we recommend for applications that require multiple output signals our proven U-ONE-System.

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# 接线技术
# Connection technology

| 可提供接线工艺<br>**Possible connection technology** | **FG(HJ) 40** | **FG(H) 41** | **FG 40 Ex** | **FG(HJ) INOX** |
|---|---|---|---|---|
| 端子箱内端子排<br>Terminal strip in a terminal box | x | x | x | x |
| 直出电缆<br>Fixed cable | x | x | | x |
| 端子箱内 FOC 接头<br>FOC connector in a terminal box | x | | | x |
| 12 针 Burndy 圆接头<br>12-pole round connector Burndy | x | | | |
| 12 针 M23 圆接头<br>12-pole round connector M23 | | x | | |
| 15 针工业接头<br>15-pole industrial connector | x | | | |

其它接线工艺可指定 / *Other connection technologies on request.*



端子箱内端子排 / *Terminal strip in a terminal box*



直出电缆 / *Fixed cable*



端子箱内 FOC 接头 / *FOC connector in a terminal box*



*Burndy 接头 / Burndy connector*



*M23 接头 / M23 connector*



工业接头 / *Industrial connector*

我们很高兴为您推荐我们为极端环境条件定制的电缆保护系统。
*We are pleased to advice you about our custom-made cable protection systems for extreme environmental conditions.*

# 尺寸图 FG 40
## Dimension drawings FG 40
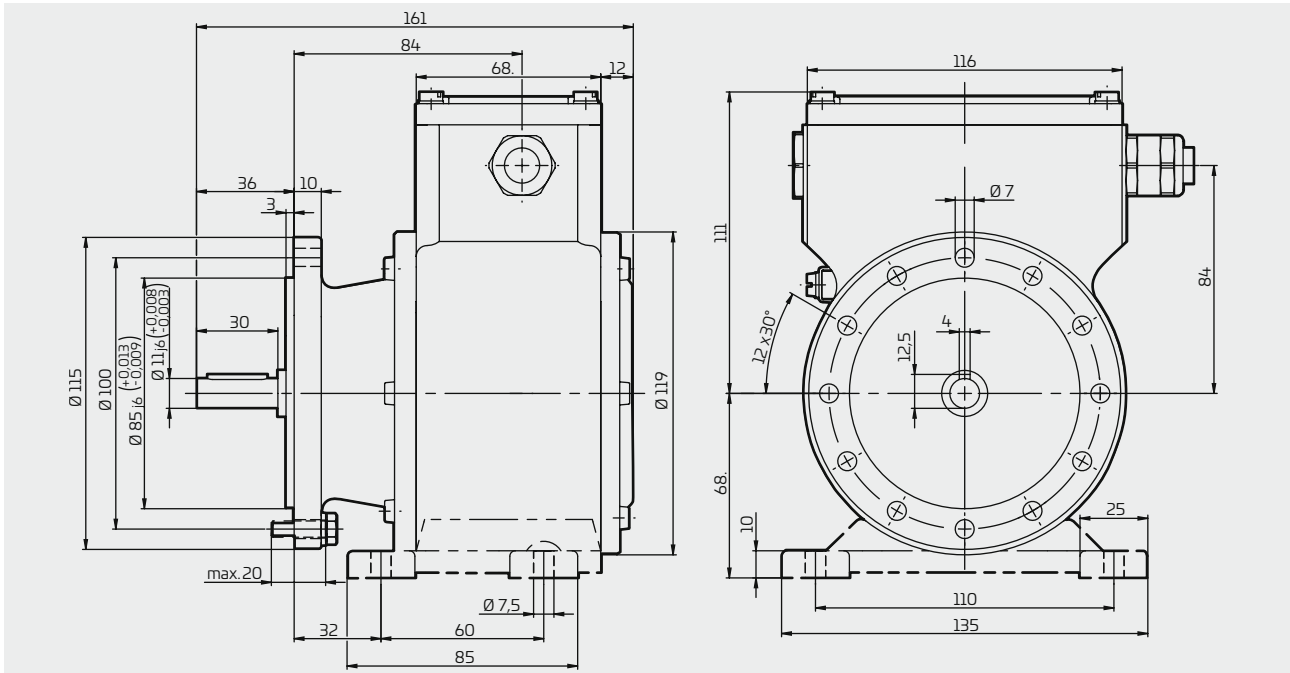


**FG 40 K** 结构形式 B35 / B5，底座用虚线表示
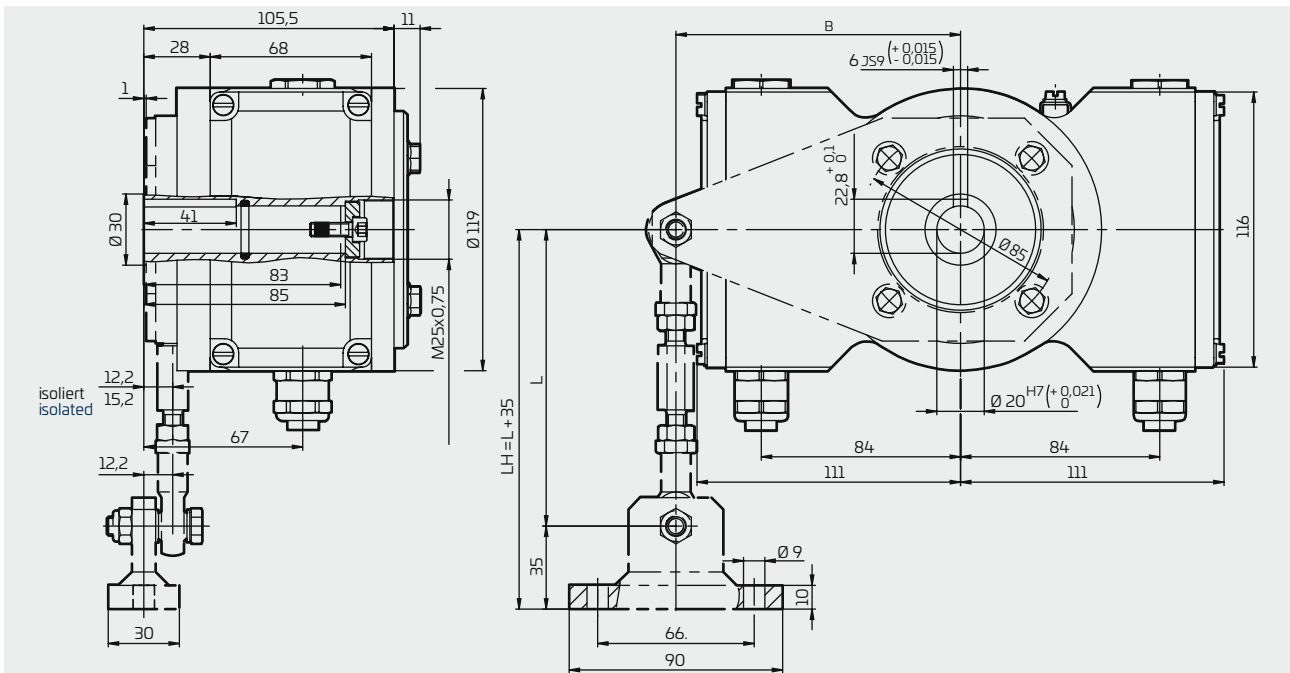Construction type B35 / B5 foot indicated by dashed line
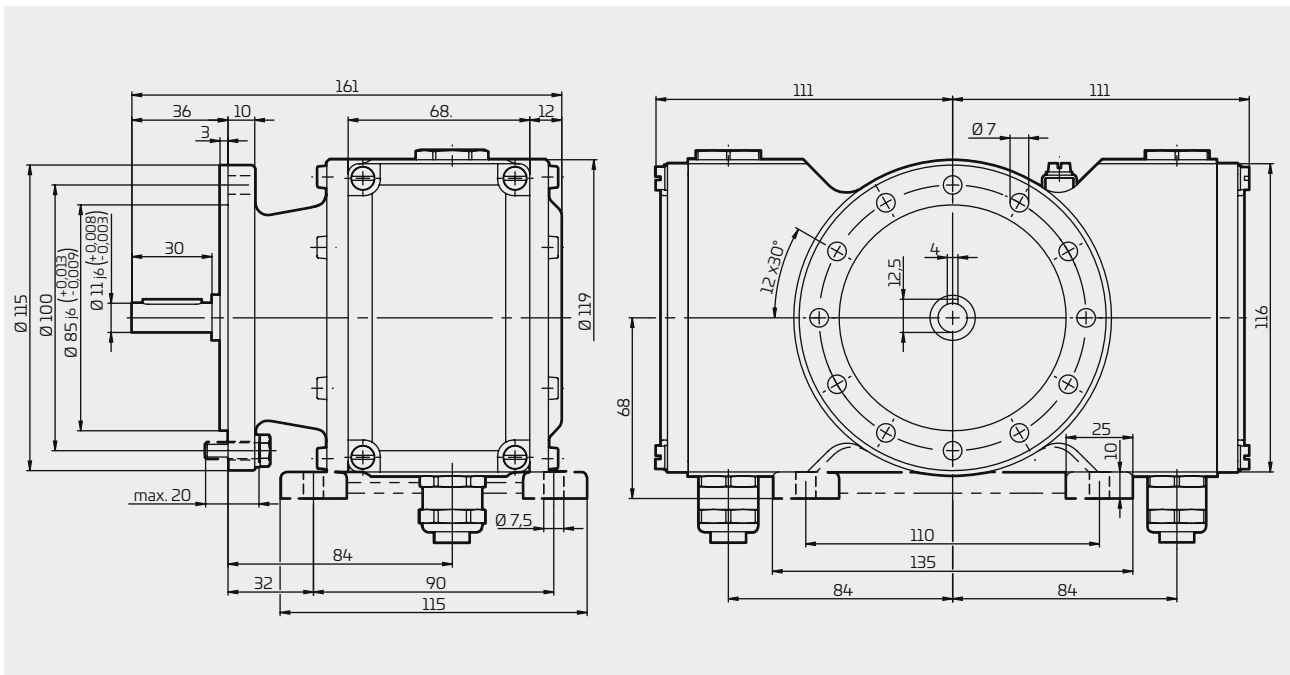


**FG 40 KK** 结构形式 B35/B5，带两个端子箱，底座用虚线表示
Connector type B35 / B5 with two terminal boxes with foot indicated by dashed line
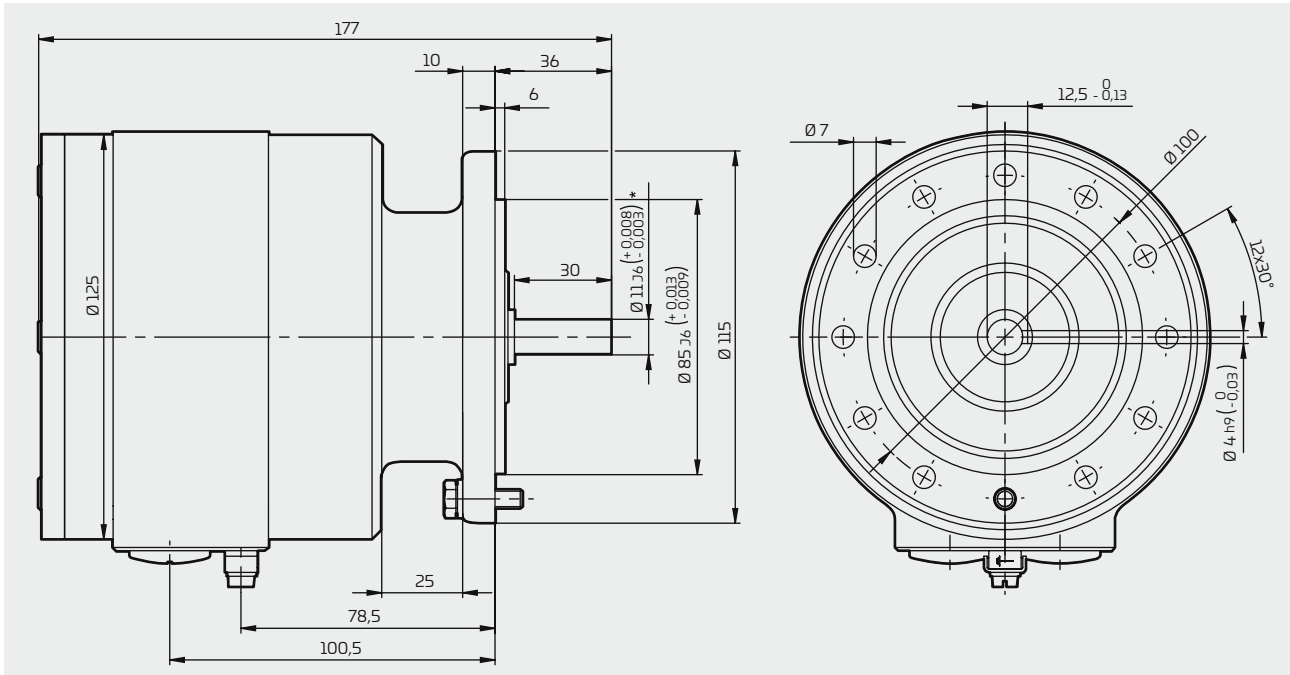
# 尺寸图 FGH(J) 40
# Dimension drawings FGH(J) 40
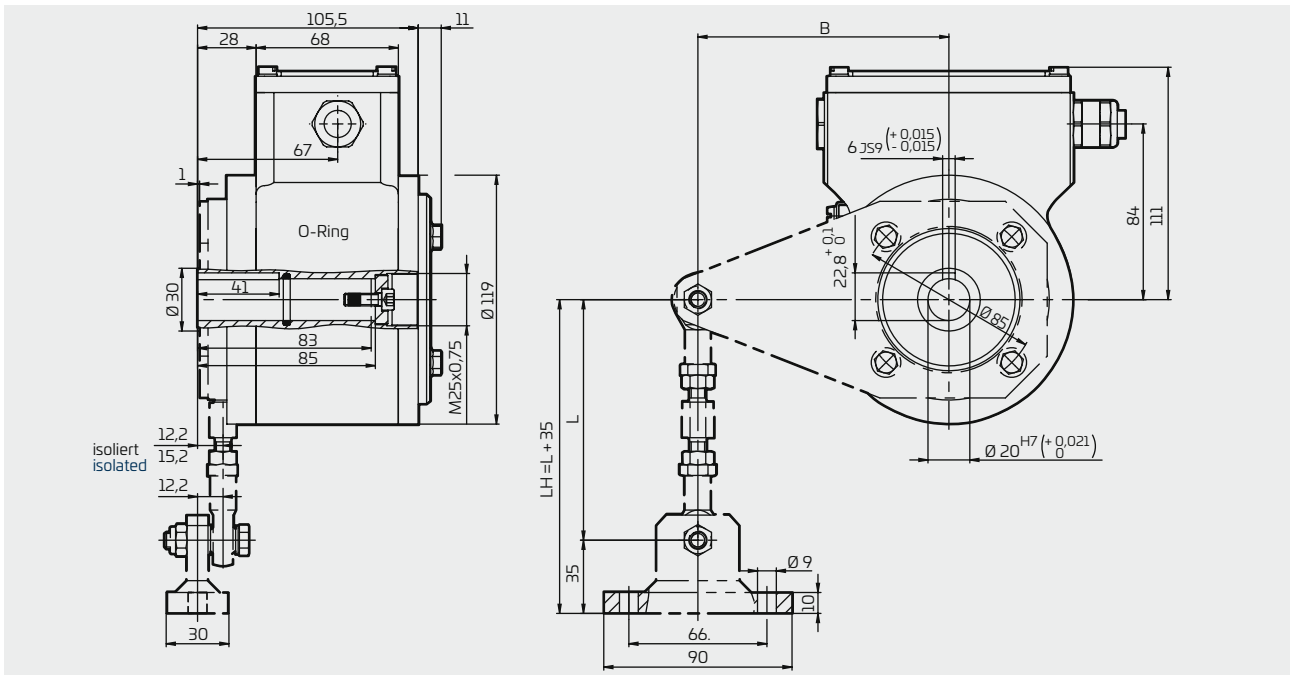


**FGH 40 K**　空心轴设计，虚线表示扭矩支架
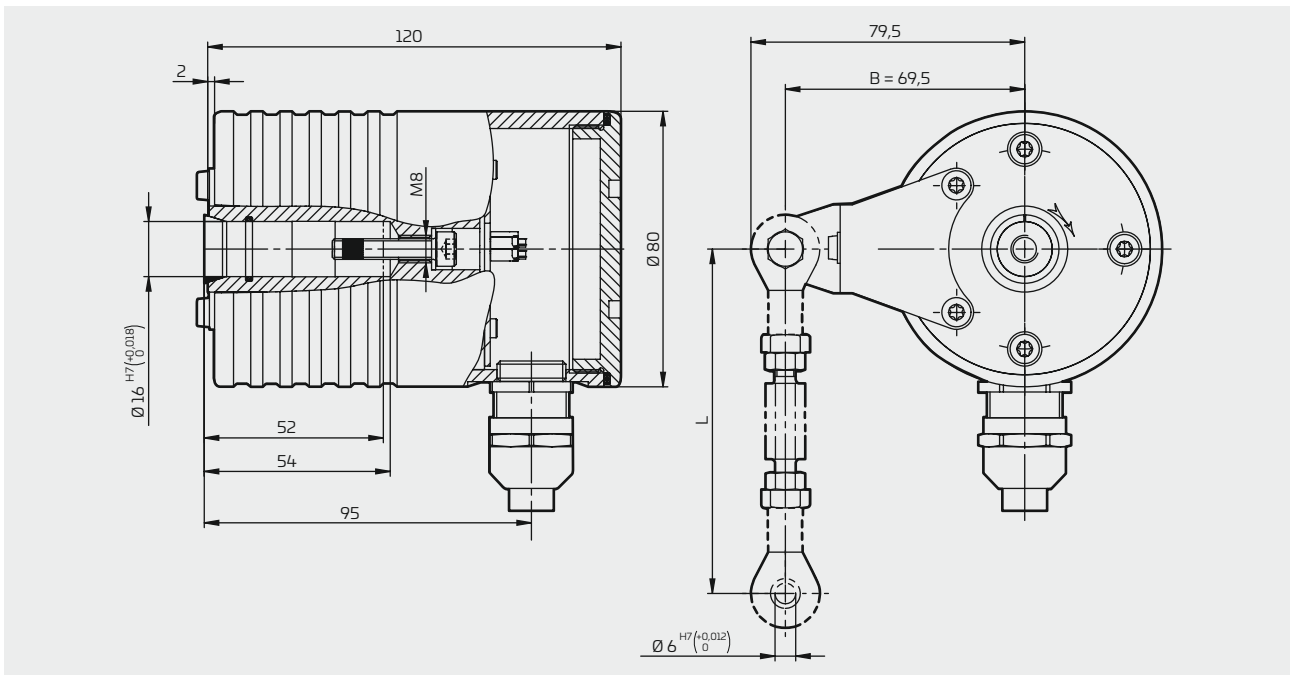Hollow shaft design with torque bracket indicated by dashed line



**FGH 40 KK**　空心轴设计，带两个端子箱，虚线表示扭矩支架
Hollow shaft design with two terminal boxes with torque bracket indicated by dashed line
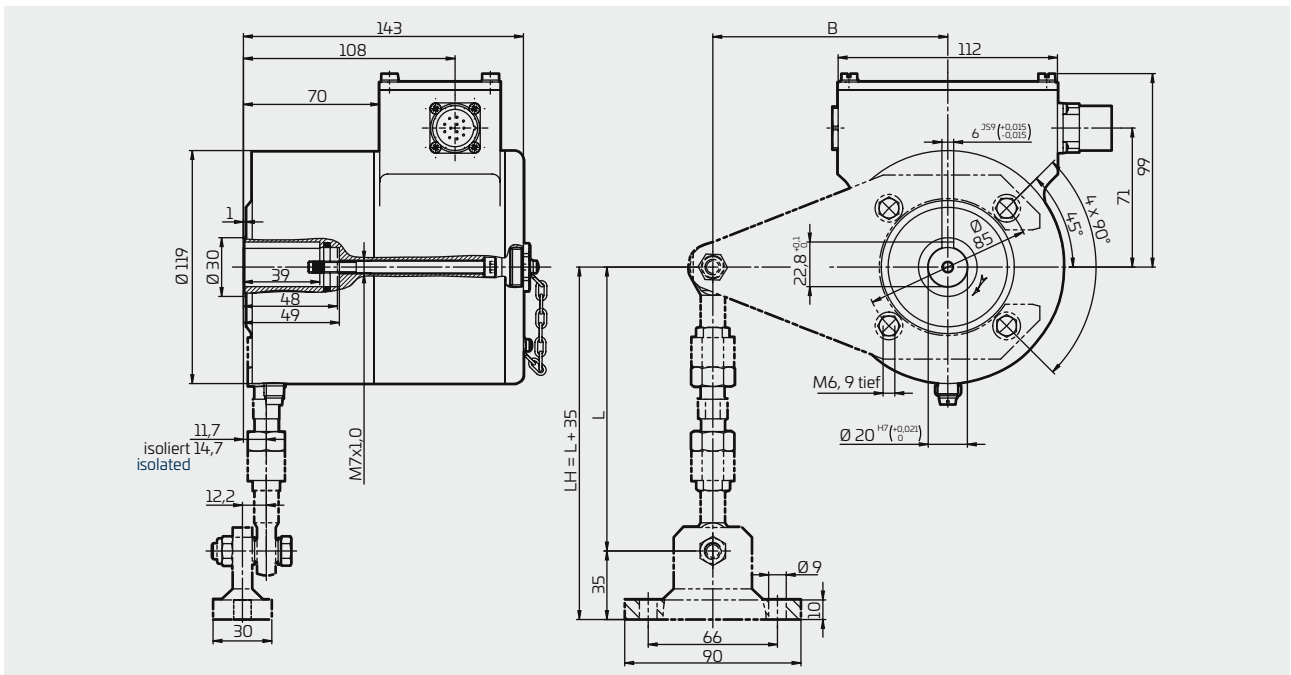
**FG 40 Ex**  结构形式 B5
Construction type B5

**FGHJ INOX**  空心轴设计，虚线表示扭矩支架
Hollow shaft design with torque bracket indicated by dashed line

## 尺寸图 FG(H) 41
## Dimension drawings FG(H) 41
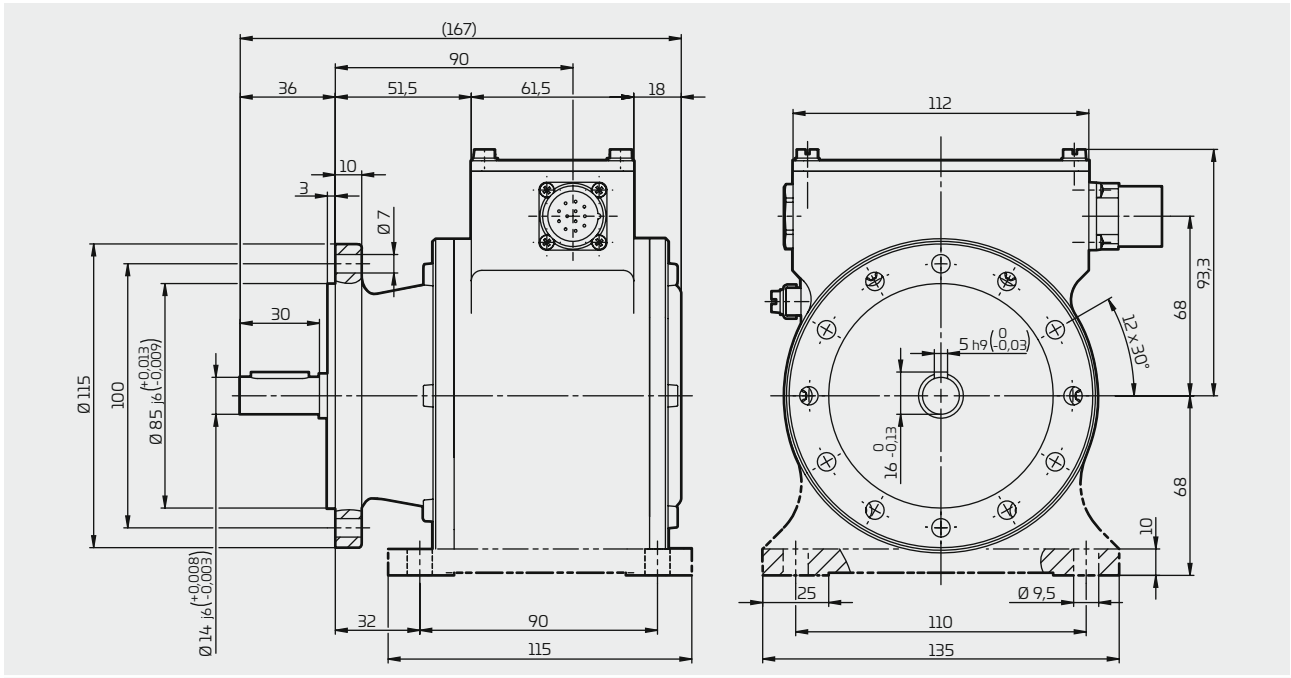


**FG 41 T**　结构形式 B35/B5，底座用虚线表示
Construction type B35 / B5 foot indicated by dashed line



**FGH 41 T**　空心轴设计，虚线表示扭矩支架
Hollow shaft design with torque bracket indicated by dashed line

| FG(HJ) 40 | | FG | | 40 | | - | | - | G-90G | - | - | - | | / | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

**增量编码器**
**Incremental encoder**

**结构形式 / Construction type**
- **-** = 实心轴 B5 (法兰)或 B35 (法兰+底脚)
  Solid shaft B5 (flange) or B35 (flange + foot)
- **H** = 空心轴 / Hollow shaft
- **HJ** = 空心轴（绝缘）
  Hollow shaft (isolated)

**系列 / Series**

**电气接线 / Electrical connection**
- **K** = 端子箱内端子排 / Terminal strip in a terminal box
- **R** = 12 针 Burndy 圆接头 / 12-pole round connector Burndy
- **C** = 直出电缆 / Fixed cable
- **L** = 端子箱内 FOC 接头 / FOC connector in a terminal box
- **KK** = 第二端子箱（可指定输出信号）
  Second terminal box (available output signals on request)

**每转脉冲数 / Pulses per rotation**
方波脉冲 / Square pulses:
500, 600, 1000, 1024, 1200, 1300, 2000, 2048, 2400, 2500, ..., 1 百万 / million
正弦信号 / Sinus signals:
500, 600, 1000, 1024, 1200, 1300, 2500
其它脉冲率可指定 / other pulse rates on request

**信号输出 / Signal output**
基本版本 0°, 90°, 每路带反向信号
Basic version 0°, 90°; each with inverted signals

- **-** = 没有标志脉冲 / without reference pulse
- **NG** = 标志脉冲及其反向信号 / Reference pulse with inverted signal

**其它信号输出选项（见 11 页）/ Additional options signal outputs (see p. 11)**
- **2F** = 选项 / Option 2F
- **B** = 选项 / Option B
- **B2** = 选项 / Option B2
- **B3** = 选项 / Option B3

**超速开关（见 11 页）/ Overspeed switch (see p. 11 f.)**
- **-** = 没有选项 S / without option S
- **S** = 选项 S

**轴 / Shaft**
带滑键/键槽 / with feather key / keyway
- **-** = 实心轴 / Solid shaft: Ø 11 j6 mm (可选项 14 j6)
- **16P** = 空心轴 / Hollow shaft: Ø 16 H7 mm
- **19P** = 空心轴 / Hollow shaft: Ø 19 H7 mm
- **20P** = 空心轴 / Hollow shaft: Ø 20 H7 mm

带夹紧 / with clamping
- **16K** = 空心轴 / Hollow shaft: Ø 16 H7 mm
- **25K** = 空心轴 / Hollow shaft: Ø 25 H7 mm

## 选型表 FG 40 Ex
## Type code FG 40 Ex

| FG 40 Ex | | | FG | 40 | Ex | | - | | - | | - | | - | | - | / | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**增量编码器**
**Incremental encoder**

**系列 / Series**

**带 Ex 认证 / With Ex certification**

**电气接线 / Electrical connection**
AK  = 单系统带端子排 / One system with terminal strip
AKK = 双系统带端子排 / Two systems with terminal strip

**系统 1 (AK) / System 1 (AK)**

**每转脉冲数* / Pulses per rotation***
方波脉冲 / Square signals:
500 - 250000 (具体脉冲率可指定 / exact pulse rate on request)
正弦信号 / Sinus signals:
500, 600, 1000, 1024, 1200, 1300, 2500
其它脉冲率可指定 / other pulse rates on request

**信号幅度* / Signal amplitude***
AH = HTL
AT = TTL
SH = Sin/Cos + Status (HTL)
ST = Sin/Cos + Status (TTL)

**系统 2 (AKK) / System 2 (AkK)**

**每转脉冲数* / Pulses per rotation***
方波信号 / Square signals:
500 - 250000 (具体脉冲率可指定 / exact pulse rate on request):
Sinusssignale / Sinus signals:
500, 600, 1000, 1024, 1200, 1300, 2500
其它脉冲率可指定 / other pulse rates on request

**信号幅度* / Signal amplitude***
AH = HTL
AT = TTL
SH = Sin/Cos + Status (HTL)
ST = Sin/Cos + Status (TTL)

**轴 / Shaft**
带滑键 / with feather key
11P = 实心轴 / Solid shaft: Ø 11 j6 mm
14P = 实心轴 / Solid shaft: Ø 14 j6 mm

*) 信号输出 0°, 90°, N, Status; 相应的反向信号 / Signal outputs 0°, 90°, N, Status; each with inverted signals

| FG(H) 41 | | | FG | | 41 | | | | G-90G-NG | / | |

**增量编码器**
**Incremental encoder**

**结构形式 / Construction type**
- = 实心轴 B5（法兰）或者 B35（法兰+底脚）
　　Solid shaft B5 (flange) or B35 (flange + foot)
H = 空心轴 / Hollow shaft

**系列 / Series**

**电气接线 / Electrical connection**
T = 12 针 M23 圆接头 / 12-pole round connector M23
K = 端子箱内端子排 / Terminal strip in terminal box

**每圈脉冲数 / Pulses per revolution**
1024, 2048, 4096

**信号幅度 / Signal amplitude**
H = HTL
T = TTL
S = Sin/Cos

**信号输出 / Signal output**
基本版本 0°, 90°, N; 及其对应的反向信号
Basic version 0°, 90°, N; each with inverted signals

**轴 / Shaft**
带滑键/键槽 / with feather key / feather keyway
-　　= 实心轴 / Solid shaft: Ø 14 j6 mm（可选项 Ø 11 j6 mm）
20P = 空心轴 / Hollow shaft: Ø 20 H7 mm

# 选型表 FG INOX / FGHJ INOX
# Type code FG INOX / FGHJ INOX

| FG(HJ) INOX | FG | | INOX | - | | G-90 G-NG | - | / | |

**不锈钢增量编码器**
**Incremental encoder stainless steel**

**结构形式 / Construction type**
- = 实心轴 B5 （法兰）或者 B35 （法兰+底脚）
  Solid shaft B5 (flange) or B35 (flange + foot)
HJ = 空心轴（绝缘）/ Hollow shaft (isolated)

**系列 / Series**

**电气接线 / Electrical connection**
K = 端子箱内端子排 / Terminal strip in a terminal box
L = 端子箱内 FOC 接头 / FOC connector in a terminal box

**每转脉冲数 / Pulses per revolution**
1-2048

**信号幅度 / Signal amplitude**
H = HTL
T = TTL

**信号输出 / Signal output**
基本版本 0°, 90°, N; 及其对应的反向信号
Basic version 0°, 90°; N; each with inverted signals

**超速开关 / Overspeed switch**
- = 没有开关 / without switch
S = 带开关 （工厂设定）/ with switch (set ex works)

**轴 / Shaft**
带键 / 键槽 / with feather key / feather keyway
-   = 实心轴 / Solid shaft: Ø 14 j6 mm (可选项 Ø 11 j6 mm)
16K = 空心轴 / Hollow shaft: Ø 16 H7 mm 带夹紧 / with clamping
17C = 空心轴 / Hollow shaft: Ø 17 JS8 mm 锥度 1:10 / tapered 1:10

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