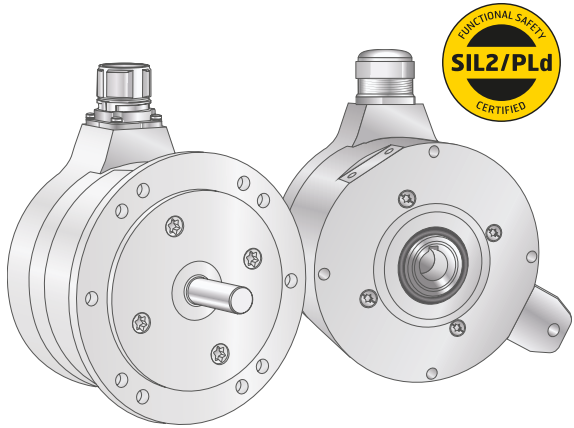
Encoder models

FSI 862
FSI 850



Mounting instructions

LEINE LINDE

1249864, ver 2
1249864-02-A-01

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Leine Linde is a Swedish company dedicated to production of encoders for heavy duty applications. Some of the values offered by Leine Linde are local technical support and possibility of 24 hours express delivery.

On our website **www.leinelinde.com** you can find datasheets and other product information.

Before installation please read this mounting instruction carefully. Failure to follow the instructions and the safety regulations can lead to serious injury, considerable damage or death. The english version is the original instruction.

The following models presented in the code key are fully covered by the mounting instructions.

Code key for hollow shaft encoders

Flange

0 = Standard
1 = Torque bracket 120°
3 = Torque bracket 330°

Shaft

7 = Ø12 mm blind hollow shaft with key way
8 = Ø16 mm blind hollow shaft with key

Connection

1 = Connector M23, 12 pin CW
2 = Connector M23, 12 pin CCW
4 = Cable gland, M20 for Ø8-11 mm cables
5 = Cable gland, M20 for Ø11-14 mm cables
9 = Pre-mounted cable, xx m

Electronics

5 = HCHTL (supply 9-30 Vdc, output 9-30 Vdc)

Number of channels

6 = 6 channels

Resolution

500 - 5000 ppr

Code key for solid shaft encoders

Flange

0 = Euro flange B10

Shaft

9 = Ø11 mm solid shaft
with key nut

Connection

1 = Connector M23, 12 pin CW
2 = Connector M23, 12 pin CCW
4 = Cable gland, M20
for Ø8-11 mm cables
5 = Cable gland, M20
for Ø11-14 mm cables
9 = Pre-mounted cable, xx m

Electronics

5 = HCHTL (supply 9-30 Vdc,
output 9-30 Vdc)

Number of channels

6 = 6 channels

Resolution

500 - 5000 ppr

Contents

1

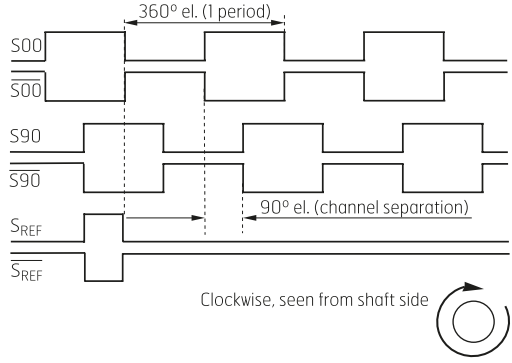
Safety information

The Leine Linde Safe-HCHTL encoder provides a two channel safe incremental output (S00 and S90) to determine speed and direction of axial movement. The reference signal (Sref) is not included in the safe parts but can be used for control of the encoder resolution.

If an internal error occurs due to fault in the optical scanning or in the electronics the encoder sets its outputs to a safe state. The safe state will be asserted via all the three HCHTL outputs channels.

The HCHTL output consists of three differential channels i.e. a total of six signals.

- Incremental signal S00 and $\overline{S00}$ (safe)
- Incremental signal S90 and $\overline{S90}$ (safe)
- Reference signal Sref and $\overline{Sref}$ (non safe)



Providing category 3, redundancy
To achieve category 3 with the signal outputs they have to be connected as separate channels:

S00 and $\overline{S00}$ = One safe channel
S90 and $\overline{S90}$ = One safe channel
Sref and $\overline{Sref}$ = A non-safe channel for reference

1.1 Safety functions

The encoder output signals can be used in the following safety functions according to EN 61800-5-2:2007:

- STO – Safe Torque Off
- SS1 – Safe Stop 1
- SS2 – Safe Stop 2
- SOS – Safe Operating Stop
- SLA – Safely Limited Acceleration
- SAR – Safe Acceleration Range
- SLS – Safely Limited Speed
- SSR – Safe Speed Range
- SLI – Safely Limited Increment
- SDI – Safe Direction
- SBC – Safe Brake Control
- SSM – Safe Speed Monitor

1.2 Safety metric and targets

The encoders according to the code key are certified according to following:

IEC 61508-1:2010
IEC 61508-2:2010
- SIL2
- PFH $3{,}5 \times 10^{-8}$ failures/hour
- Route 1_H and 1_S, Systematic Capability (SC2)

EN ISO 13849-1:2015
- MTTFd 3243 years
- PLd, category 3

Mission time: 20 years.
Channel separation: 90° el ± 25° el.

The proof test interval of the encoder is 1 year. Refer to chapter 1.5 on how to perform a proof test.

1

Safety information

1.3 Before installation

To avoid damage to persons and property only qualified personnel is entitled to work with the encoder. The term qualified personnel refers to persons fully familiar with the application and relevant safety measures.

The qualified person must have profound knowledge of the national accident prevention regulations.

After installation and exchange, an acceptance test according to the manufacturer's information of the machine must be performed.

Commissioning is only permitted in strict compliance with the EMC directive. The encoder complies with EN 61326-3-1, EN 61000-6-2 and EN 61000-6-4.

The wiring, connection and functionality in chapter 7 "Electrical mounting" and chapter 8 "Check points for electrical mounting" must be strictly followed.

Ripple currents through the ball bearings of the encoder are not permissible.

The implementation of the product must be coordinated with the demands of the responsible assessor.

All screws must be tightened with a torque wrench.

Do not install or operate damaged products. Report damages immediately to the responsible personnel/manager.

Do not clean the encoder with thinners, alcohol or benzine.

Limitation of use in corrosive environment is recommended. Contact Leine Linde in case of doubt.

Encoders that have contributed to the failure of a safety function in the application must be returned to Leine Linde AB, Strängnäs, together with the fasteners (screws).

1.4 Operating and service

General data	FSI 862	FSI 850
Operating temperature	-40 °C...+80 °C	-20 °C...+80 °C
Storage temperature	-40 °C...+80 °C	-20 °C...+80 °C
Power supply	9-30 Vdc	9-30 Vdc
Current consumption	60 mA at 24 Vdc (Max. 80 mA)	60 mA at 24 Vdc (Max. 80 mA)
Shock	100 g (11 ms), 200 g (6 ms), 400 g (3.5 ms)	100 g (11 ms), 200 g (6 ms), 400 g (3.5 ms)
Vibration	≤ 20 g, ≤ 2000 Hz	≤ 20 g, ≤ 2000 Hz
Ingress protection	IP66 and IP67 with IP66 at shaft inlet	IP66 and IP67 with IP66 at shaft inlet
Humidity	Max. 95% RH non-condensing	Max. 95% RH non-condensing
Altitude	Max. 3000 m	Max. 3000 m
Weight	1500 g	1500 g
Max. operating speed	6000 rpm*	6000 rpm*
Max. angular acc.	1000 rad/s^2	1000 rad/s^2
Max. shaft torque	3.2 Nm	3.2 Nm
Pollution degree	2	2
Shaft load (axial/radial)	100 N/300 N	100 N/100 N
Max. frequency	100 kHz	100 kHz
Max. cable length	350 m at 100 kHz	350 m at 100 kHz

* Consider that the max frequency may limit the max operating speed at resolutions higher than 1000 ppr.

The encoder requires no service during use and is not repairable.
No parts of the encoder are allowed to be replaced.

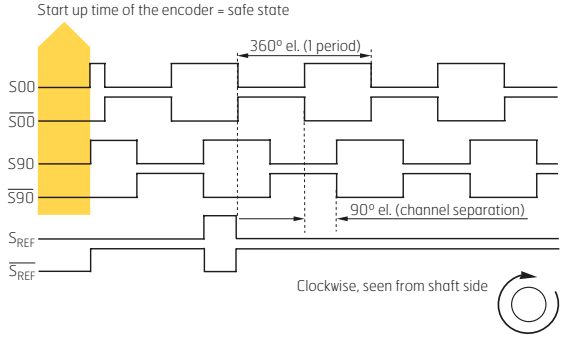
1

Safety information

1.5 Operating state

At start up the unit is in safe state to perform internal hardware and signals check. This sequence takes 5-10 seconds to perform. If fault is detected the unit will not leave safe state. If no fault is detected the unit enters operational state.

This start up sequence should be used to perform a proof test of the unit.



1.6 Safe state

Any fault detected by the unit leads to safe state in less than 1 ms. The encoder output holds safe state for a minimum of 4 ms. If safe state remains after performed power cycle, please contact Leine Linde.

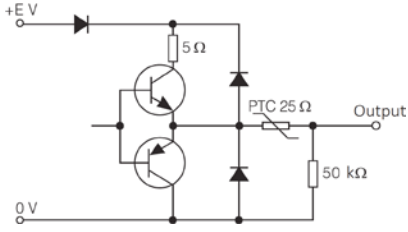
The signal level of any HCHTL output and its complement should stop driving any high level signal and will be pulled low at the encoder safe state:

L ≤ 2.5 V
H ≥ +EV -4.0 V
Valid: Encoder OK
Non valid: Encoder will enter safe state

HCHTL Snn	HCHTL Snn\	Function
Pulled low	Pulled low	Encoder in safe state
L	H	Valid
H	L	Valid
H	H	Non valid
L	L	Non valid

Output at no power
All safe outputs will be in safe state when there is no power to the unit.

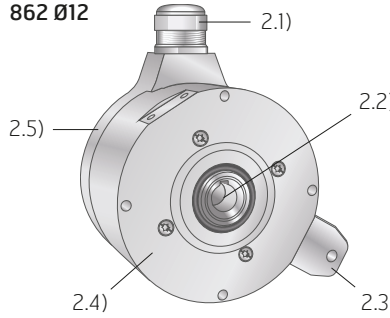
Output circuit for the HCHTL signals



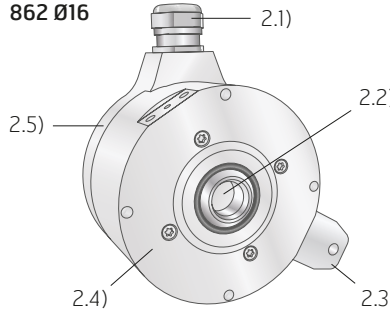
2

Parts of the products

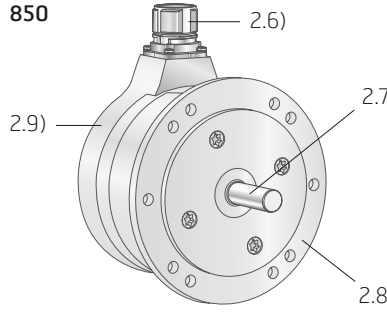
862 Ø12



862 Ø16



850



Model 862 Ø12 mm
2.1 Cable gland
2.2 Hollow shaft with keyway
2.3 Torque bracket (120° or 330°)
2.4 Flange
2.5 Terminal cover

Model 862 Ø16 mm
2.1 Cable gland
2.2 Hollow shaft with key
2.3 Torque bracket (120° or 330°)
2.4 Flange
2.5 Terminal cover

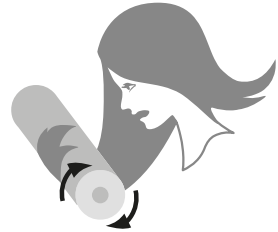
Model 850
2.6 Connector
2.7 Solid shaft with key
2.8 Euro flange (B10)
2.9 Terminal cover

3

Risk of bodily injury

3.1)

3.2)



Important before mounting begins:

3.1 Switch off the power.

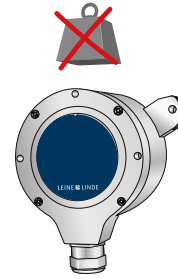
3.2 Make sure the machine is at a standstill. The product is to be mounted on a rotating part that can cause bodily injury when in motion.

4

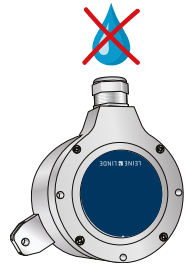
Risk of damage to the product

4.1)

4.2)

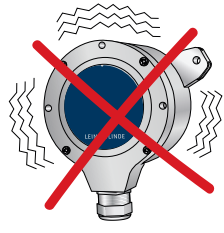


4.3)



4.4)

4.5)



4.6)

4.7)

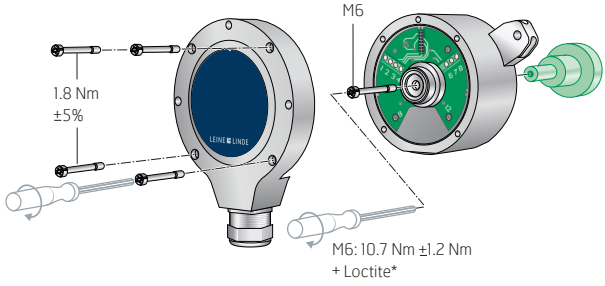
The product is a precision measuring instrument. It should be handled with care, by experienced personnel. The warnings below apply in the event of effects outside the limit values stated in chapter 1.4.

The product may be damaged
4.1 by ESD discharges if the electronics are touched
4.2 if the shaft is exposed to high mechanical forces
4.3 by moisture or chemical fluids (do not install cable pointing upwards)
4.4 if it is exposed to extreme temperatures
4.5 if it is exposed to powerful vibrations or shock
4.6 by short-circuits or an excessively high supply voltage
4.7 by impacts or knocks or other physical damage.

Note!
Do not use a damaged encoder, it is not considered safe.

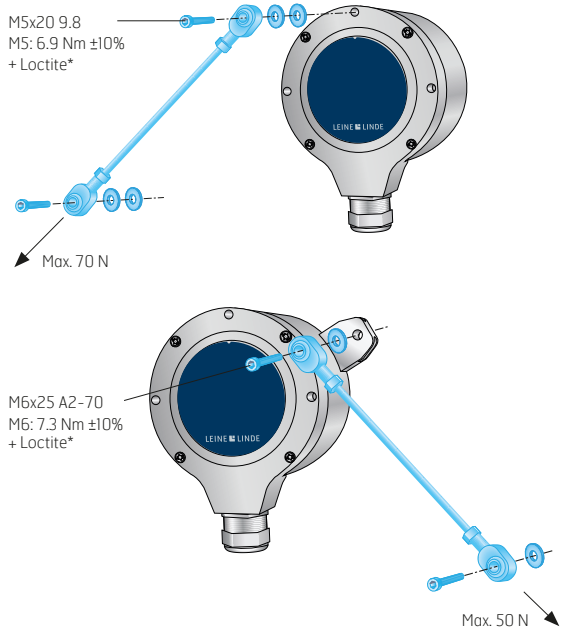
5.1

Mounting of hollow shaft



5.2

Mounting of torque arm



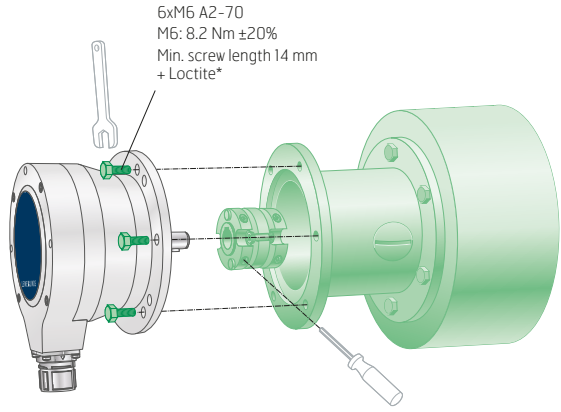
*The screw must be secured with thread lock adhesive Loctite 2400 or equivalent.

See chapter 9 for correct mounting.

- Part from customer
- Accessories from Leine Linde (to be ordered separately, see page 40)
- Tools for mounting

5.3

Mounting of solid shaft/flange



*The screw must be secured with thread lock adhesive Loctite 2400 or equivalent.

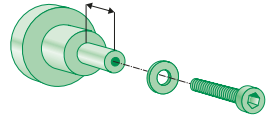
The coupling must be dimensioned for a minimum of 13.5 Nm. See chapter 9 for mating requirements.

Part from customer
Tools for mounting

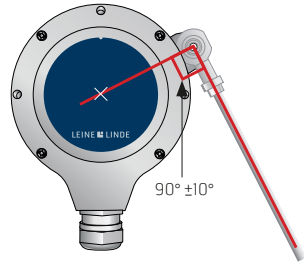
6

Check points for mechanical mounting

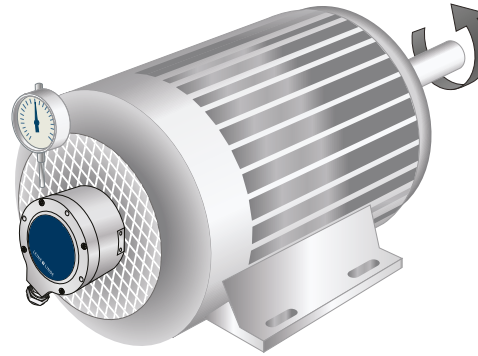
6.1)



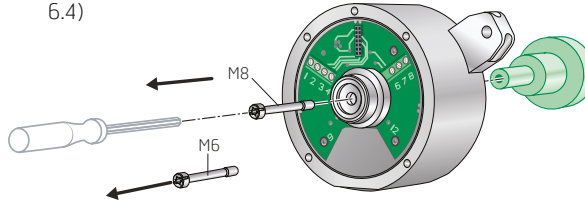
6.2)



6.3)



6.4)

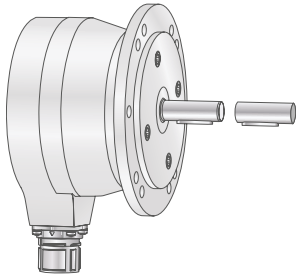


6.1 Check that the dimensions of the mating shaft match the specifications in chapter 9. Fix the encoder with a M6 screw (ISO 4762).
6.2 Refer to chapter 9 for mating requirements.
6.3 Check the encoder's radial runout with slow rotation of complete assembly. The runout should not exceed 0.1 mm, as this may shorten the encoders service life or influence the system accuracy.
6.4 Dismounting; Use M8 screw, if necessary, to detach the encoder.

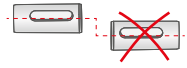
6

Check points for mechanical mounting

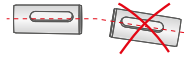
6.5)



a)



b)



c)

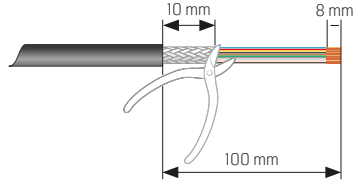
6.5 Minimise the displacement between the two mating shafts.

Always try to avoid
a) radial displacement
b) angle displacement
c) axial movement.

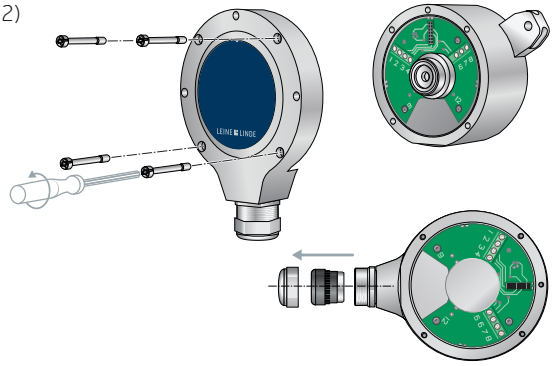
7

Electrical mounting

1)



2)



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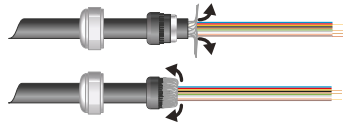
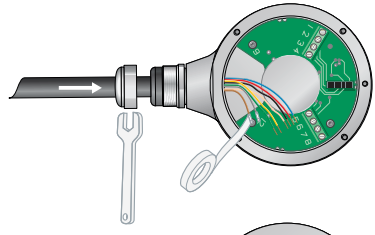
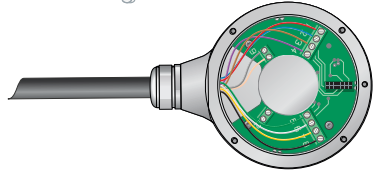


4)



5)



Fit cable*, using the following steps:

Step 1. Strip the cable according to the dimensions in the illustration.

Step 2. Open the terminal cover and unscrew the cable bushing.

Step 3. Fold the cable shield backwards over the shell ring.

Step 4. Connect the wires according to the product label. Insulate any wire that is not being used. Tighten all terminal screws (including any unused ones).

Step 5. Position the wires as in the illustration to avoid the rotating shaft.

Step 6. Mount the terminal cover. See chapter 5.1.

* Does not apply to models with pre-installed cable or connector.

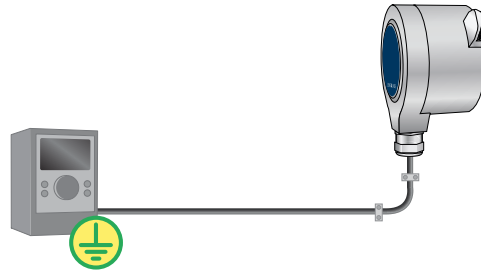
Note!
The channel 0 (Sref and $\overline{\text{Sref}}$) is not a part of the safety function!

It can be used for signal evaluation.

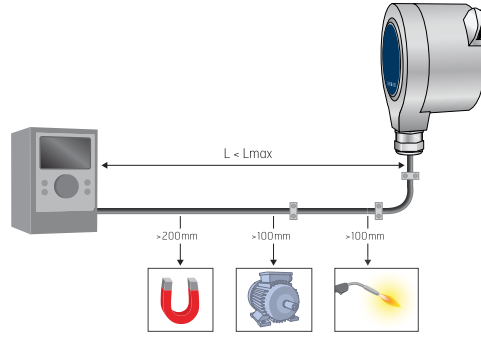
8

Check points for electrical mounting

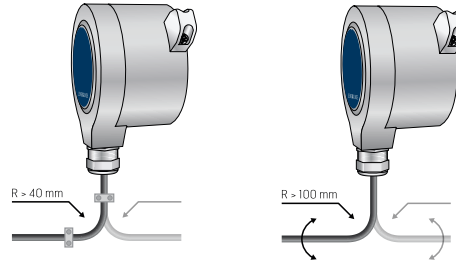
8.1)



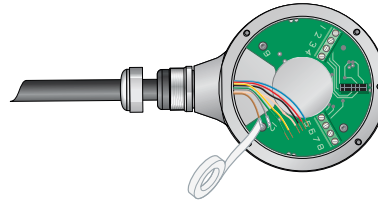
8.2)



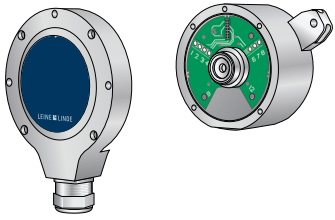
8.3)



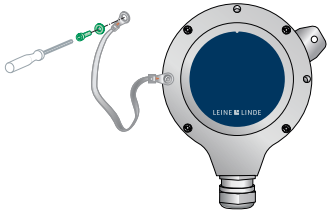
8.4)



8.5)



8.6)



8.1 Use a shielded twisted-pair cable.The shielding must be connected to the chassis at both ends and be earthed at one point. The encoder has an internal fuse rated at 0.8 A. It should be powered by a SELV/PELV-system.

8.2 Keep potential sources of disturbance at the recommended distance from the cable. Make sure that the length of the cable does not exceed the value specified in chapter 1.4.

8.3 Ensure that the cable's bending radius exceeds the permitted minimum value.

8.4 Treat all wires as live. Any wires not in use must be insulated.

8.5 Do not combine old encoder parts with new ones, when replacing a worn out encoder.

8.6 If the product comes with an earthing strap, this must be connected to the chassis of the machine.

9

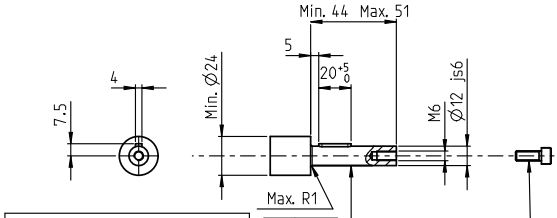
Drawings

Mating shaft

For mounting of the FSI 862 encoder with hollow shaft, the mating shaft is required to have dimensions as given.

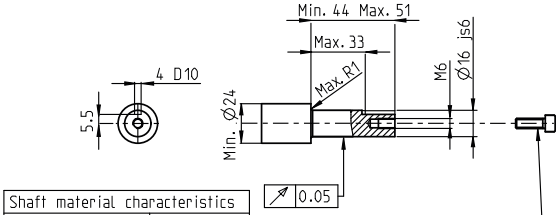
For hollow shaft with keyway

Key according to DIN 6885.



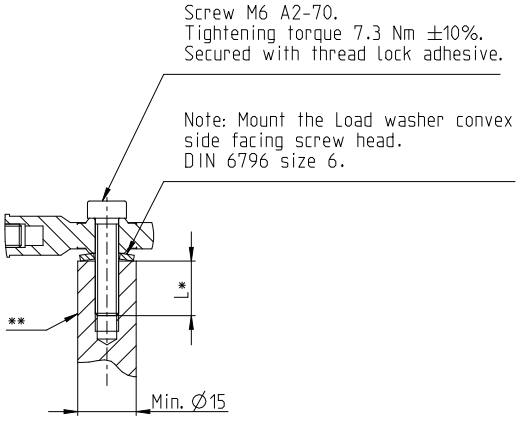
Shaft material characteristics	
Rm min	500 MPa
Rp 0.2 / Rel	300 MPa
Coefficient of thermal expansion	10-12*10e-6

For hollow shaft with key



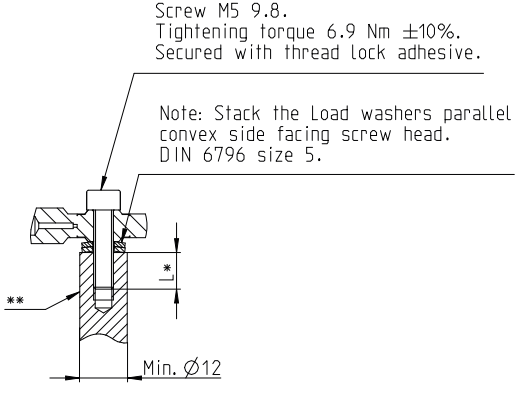
Shaft material characteristics	
Rm min	500 MPa
Rp 0.2 / Rel	300 MPa
Coefficient of thermal expansion	10-12*10e-6

Torque rod M6



*Min thread engagement length, L=8 mm.
**Material: Tensile strength, min. 260 MPa.
If bolt-nut assembly, property class of nut min. 8 alternatively A2-70.

Torque rod M5



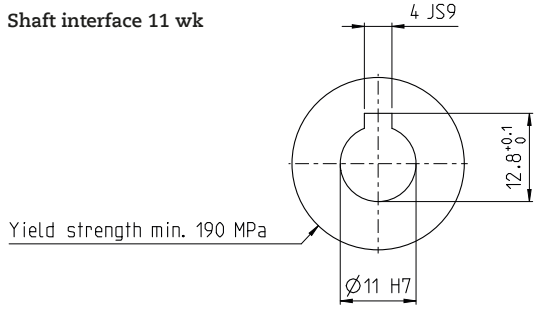
*Min thread engagement length, L=8 mm.
**Material: Tensile strength, min. 290 MPa.
If bolt-nut assembly, property class of nut min. 9.

9

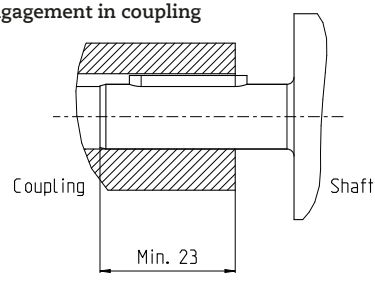
Drawings

For mounting of the FSI 850, please refer to the dimensions as given.

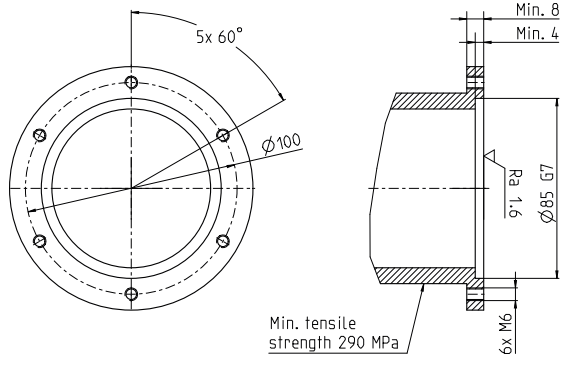
Shaft interface 11 wk



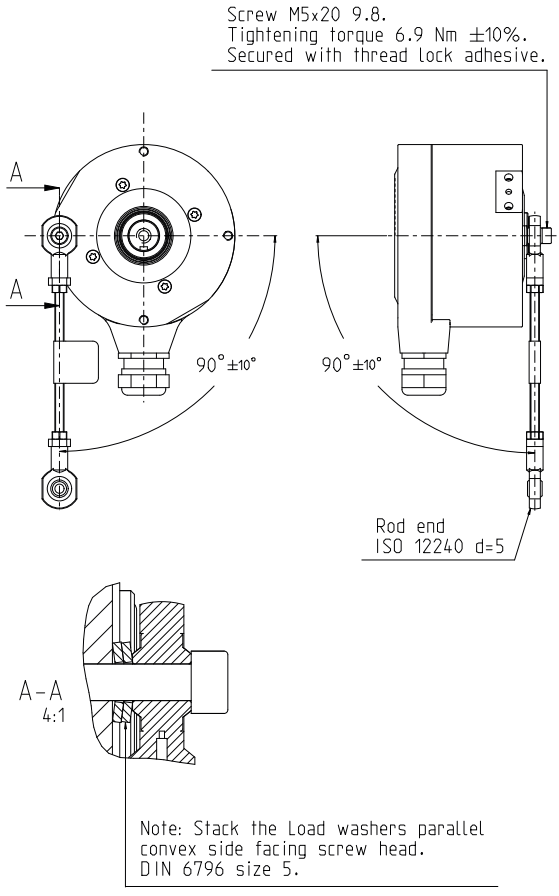
Shaft engagement in coupling



Mating for euro flange



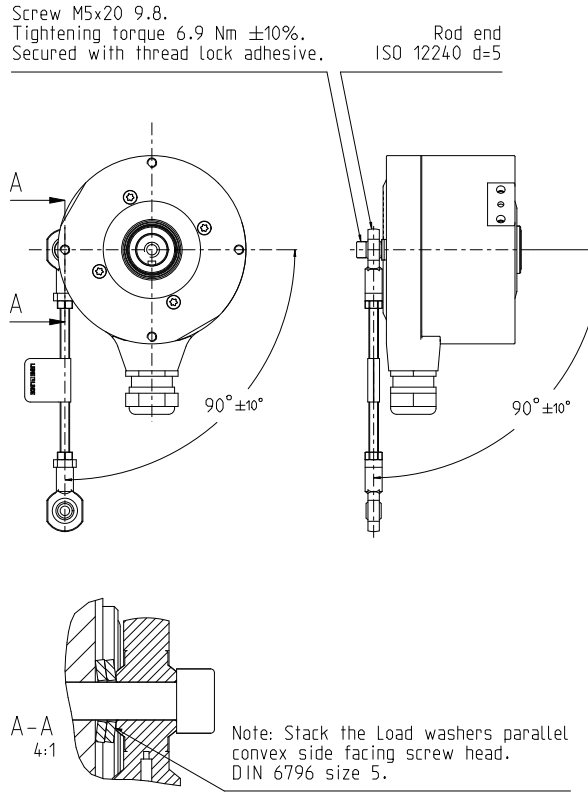
Torque support - Alternative 1



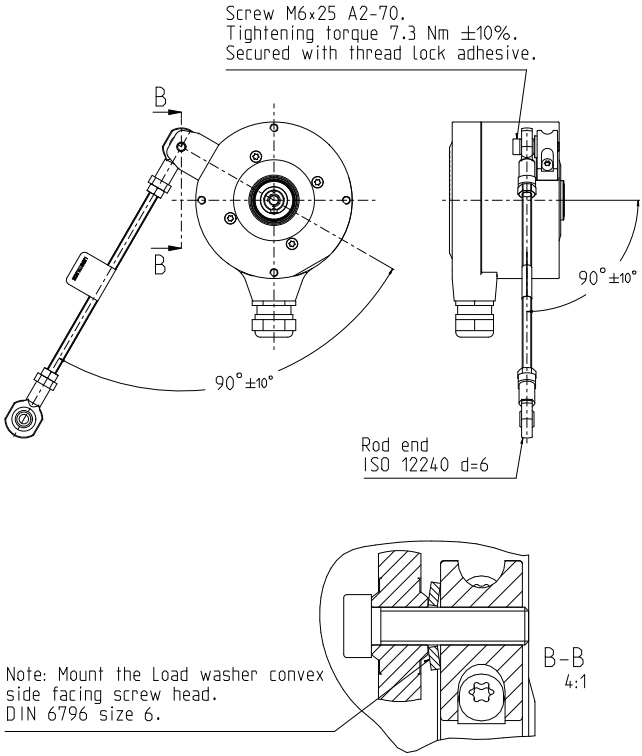
9

Drawings

Torque support - Alternative 2



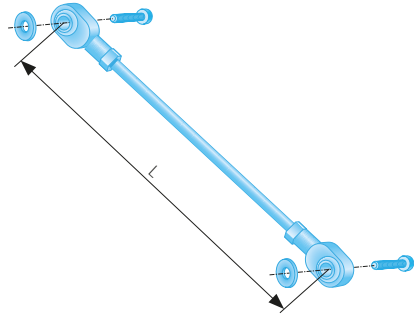
Torque support - Alternative 3



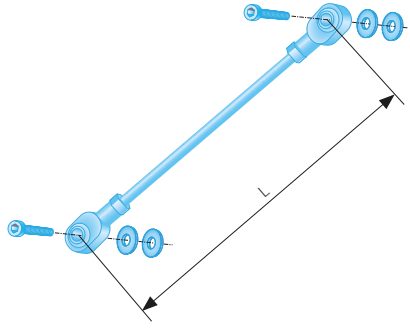
10

Accessories

10.1)



10.2)



10.1 Torque arm **M6**
Part number 1212481, specify length (min 70 mm, max 500 mm) when ordering.

10.2 Torque arm **M5**
Part number 1189552, specify length (min 70 mm, max 325 mm) when ordering.

11

Certificates and approvals

11.1)

11.2)

11.3)

Leine Linde products conform to several standards and approvals. Certificates and documentation may be provided upon request to your local Leine Linde representative.

11.1 **UL/CSA standards, type approval**
Most Leine Linde products have been type tested in accordance with IEC 61010. The product box label states if the product conforms to the standard. When the product is to be operated in accordance with IEC 61010-1, the power must be supplied from an isolated secondary circuit with current or energy or power limitation as per IEC 61010-1, IEC 60950-1, or by a class 2 secondary circuit as specified in UL 1310.

11.2 **CE marking and Declaration of conformity**
The CE marking on the product states conformity according to “The electromagnetic compatibility (EMC) Directive 2014/30/EU”, “The Machinery Directive 2006/42/EC” and “The RoHS 2 directive (2011/65/EU)”. Further details provided in the included DoC.

11.3 **SIL2/PLd information**
IEC 61508-1:2010 (SIL2)
IEC 61508-2:2010 (SIL2)
EN ISO 13849-1:2015 (Cat 3, Pl d)
EN 61800-5-2:2017
IEC 62061:2021

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

CE

TÜV SÜD Product Service

EC-Attestation

No. D1 038896 0020 Rev. 00

Holder of Certificate: **Leine & Linde AB**
Olivehällsvägen 8
645 42 Strängnäs
SWEDEN

Product: **Safety components**
Rotary Encoder

Model(s): **FSI 8xx-Series**

Parameters: HCHTL Encoders with safe incremental output (SOC and S90) to determine speed and direction of axial movement. Safety assessment of mechanics included. The certified components are listed in report LS88994C in the current valid revision.

Directives / Standards:
2006/42/EC
IEC 61508-1:2010 (SIL 2)
IEC 61508-2:2010 (SIL 2)
EN ISO 13849-1:2015 (Cat 3, PI d)
EN 61800-5-2:2017
IEC 62061:2021

This EC-Attestation is issued according to the listed directives. It confirms that the equipment complies with the essential requirements and objectives of those directives and refers only to the sample provided for testing and certification. It expires in the event of changes relating to products of the listed directives. The certificate holder is responsible for the consistent manufacturing of the product in compliance with the test sample submitted to us. For details see: www.tuvsud.com/ps-cert

Test report no.: LS88994T

Date, 2021-06-09

(Peter Weiß)

Page 1 of 1
After preparation of the necessary technical documentation as well as the EC conformity declaration the required CE marking can be affixed on the product. Other relevant directives have to be observed.

TÜV SÜD Product Service GmbH • Certification Body • Ridlerstraße 65 • 80339 Munich • Germany

TÜV®

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Declaration of Conformity

LEINE LINDE

Declaration of Conformity

Leine & Linde AB
Box 8
SE-645 21 Strängnäs
SWEDEN
T +46-(0)152-265 00

FSI 8XX series encoders

We herewith declare that the above mentioned products are in conformity with the provision of the following directives of the European Commission:
EMC Directive 2014/30/EU
Machinery Directive 2006/42/EC
RoHS 2 Directive 2011/65/EU

The equipment complies with the directives by meeting the following harmonized standards:

EN 61000-6-2:2005 Generic immunity standard: Industrial environment

EN 61000-6-4:2007/A1:2011 Generic emission standard: Industrial environment

EN ISO 13849-1:2015 (Cat 3, PI d) Safety of Machinery – Safety-related parts of control systems, Part 1: General principles for design

IEC 61508-1:2010 (SIL 2) Functional safety of electrical/electronic/programmable electronic safety-related systems, Part 1: General requirements

IEC 61508-2:2010 (SIL 2) Functional safety of electrical/electronic/programmable electronic safety-related systems, Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems

EN 61800-5-2:2017 Adjustable speed and electrical power drive systems – Part 5-2: Safety requirements – Functional

IEC 62061:2021 Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems

EC-Attestation No. 01 038896 0020 Rev. 00

EN IEC 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Per Andréason
CEO

These certificate documents can be downloaded from **www.leinelinde.com**.

Products from Leine Linde are usually components in larger systems. These applications require the system as a whole to be tested, and do not depend on the component specifications only.

Instructions in these mounting instructions apply to products from Leine Linde, not for the system as a whole.
If products are used in a way for which they are not intended, this is at the user's own risk.

This product is to be disposed of separately.

Montageanleitungen auf weiteren Sprachen sind auf Anfrage erhältlich.
Bitte kontaktieren Sie **info@leinelinde.com**

根据要求可提供其他语言版本的安装说明。
请联系 **info@leinelinde.com**

Monteringsanvisningar på ytterligare språk finns tillgängliga på förfrågan.
Var vänlig kontakta **info@leinelinde.com**

Hay instrucciones de montaje en otros idiomas disponibles a petición del cliente.
Póngase en contacto **info@leinelinde.com**

Инструкции по установке на других языках предоставляются по запросу.
Электронная почта для отправки запроса **info@leinelinde.com**