

HEIDENHAIN



Product Information

EBI 1135

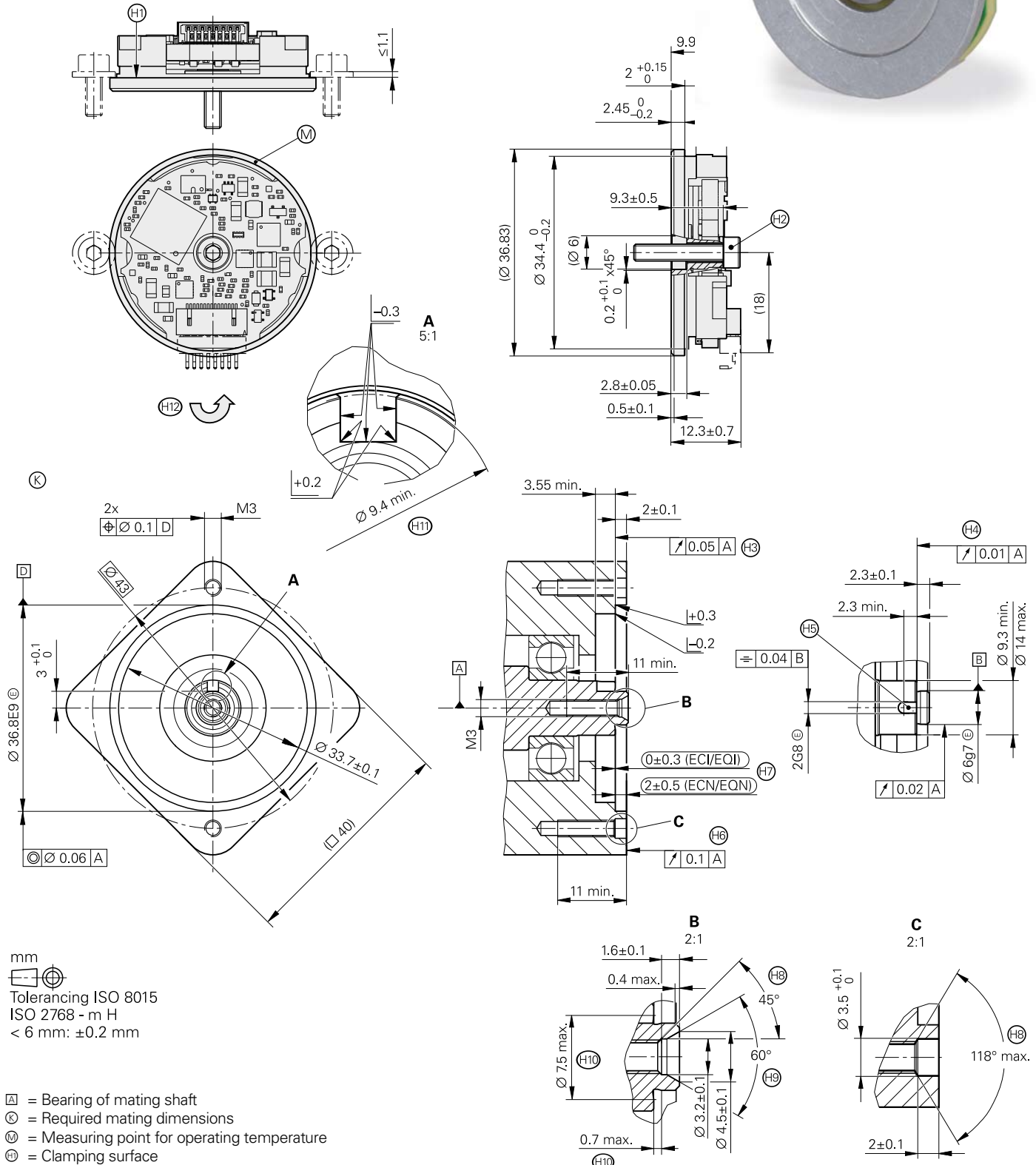
Absolute Rotary Encoder,
Multiturn Feature via
Battery-Buffered Revolution
Counter

December 2012

EBI 1135

Inductive rotary encoder without integral bearing for integration in motors

- **Installation diameter 36.83 mm**
- **Blind hollow shaft**
- **Multiturn function via battery-buffered revolution counter**



- Ⓐ = Bearing of mating shaft
- Ⓢ = Required mating dimensions
- Ⓜ = Measuring point for operating temperature
- Ⓒ = Clamping surface
- Ⓔ = Screw ISO 4762 – M3x16, tightening torque 1.15±0.05 Nm
- Ⓕ = Flange surface EC/EQI; ensure full-surface contact!
- Ⓖ = Shaft; ensure full-surface contact!
- Ⓗ = Slot required for ECN/EQN
- Ⓖ = Coupling surface
- Ⓢ = Maximum permissible distance between shaft and coupling surface (ECN/EQN) or flange surface (EC/EQI)
Compensation of mounting tolerances and thermal expansion
- Ⓗ = Chamfer is obligatory at start of thread for materially bonding anti-rotation lock
- Ⓔ = Possible centering hole
- Ⓖ = Undercut
- Ⓖ = Contact surface of slot
- Ⓗ = Direction of shaft rotation for output signals as per the interface description

	Absolute EBI 1135	
Absolute position values	EnDat 2.2	
Ordering designation	EnDat 22 ¹⁾	
Position values/revolution	262 144 (18 bits; 19-bit data word length with LSB = 0)	
Revolutions	65 536 (16 bits)	
Elec. permissible speed	$\leq 12\,000 \text{ min}^{-1}$ for continuous position value	
Calculation time t_{cal}	$\leq 6 \mu\text{s}$	
System accuracy	$\pm 120''$	
Power supply	<i>Rotary encoder U_P:</i>	3.6 V to 14 V DC
	<i>Rotary encoder U_{BAT}:</i>	3.6 V to 5.25 V DC
Power consumption (maximum)	<i>Normal operation with 3.6 V:</i> 520 mW <i>Normal operation with 14 V:</i> 600 mW	
Current consumption (typical)	<i>Normal operation with 5 V:</i> 80 mA (without load) <i>Buffer battery²⁾:</i> 22 μA (with rotating shaft) 12 μA (at standstill)	
Electrical connection	Via PCB connector, 15-pin	
Shaft	Blind hollow shaft $\varnothing 6 \text{ mm}$, axial clamping	
Mech. permiss. speed n	$\leq 12\,000 \text{ min}^{-1}$	
Mech. permissible acceleration	$\leq 10^5 \text{ rad/s}^2$	
Moment of inertia of rotor	$0.14 \cdot 10^{-6} \text{ kgm}^2$	
Permissible axial motion of measured shaft	$\pm 0.3 \text{ mm}$	
Vibration 55 Hz to 2000 Hz	$\leq 300 \text{ m/s}^2$ (EN 60068-2-6)	
Shock 6 ms	$\leq 1\,000 \text{ m/s}^2$ (EN 60068-2-27)	
Max. operating temp.	115 °C	
Min. operating temp.	-20 °C	
Protection EN 60529	IP 00 ³⁾	
Weight	Approx. 0.02 kg	


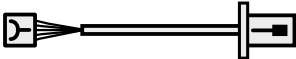
¹⁾ External temperature sensor and online diagnostics are not supported. Compliance with the EnDat specification 297 403 and the EnDat Application Notes 722 024, Chapter 11, "Connecting the EBI 1135 Rotary Encoder with Battery-Buffered Revolution Counter" is required for correct control of the encoder.

²⁾ At $T = 25 \text{ °C}$; $U_{\text{BAT}} = 3.6 \text{ V}$

³⁾ CE compliance of the complete system must be ensured by taking the correct measures during installation.

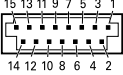






Electrical Connection

Encoder Cable

Encoder cable	TPE single wires with braided sleeving 8xAWG26/19 (unshielded)	
With one 15-pin PCB connector		ID 640055-xx
Complete with PCB connector, 15-pin, and M12 flange socket (male), 8-pin		ID 804201-xx

The CE compliance in the complete system must be ensured for the encoder cable.
The shielding connection must be realized on the motor.

Pin Layout

15-pin PCB connector  					8-pin flange socket M12  			
	Power supply				Absolute position values			
	13	11	14	12	7	8	9	10
	8	2	5	1	3	4	7	6
	U_P	U_{BAT}	0V	Battery 0V	DATA	DATA	CLOCK	CLOCK
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

U_P = power supply **U_{BAT}** = external buffer battery
Vacant pins or wires must not be used!

Connection of the external buffer battery

The multiturn function of the EBI 1135 is realized through a revolution counter. To prevent loss of the absolute position information during power failure, the EBI must be driven with an external buffer battery.

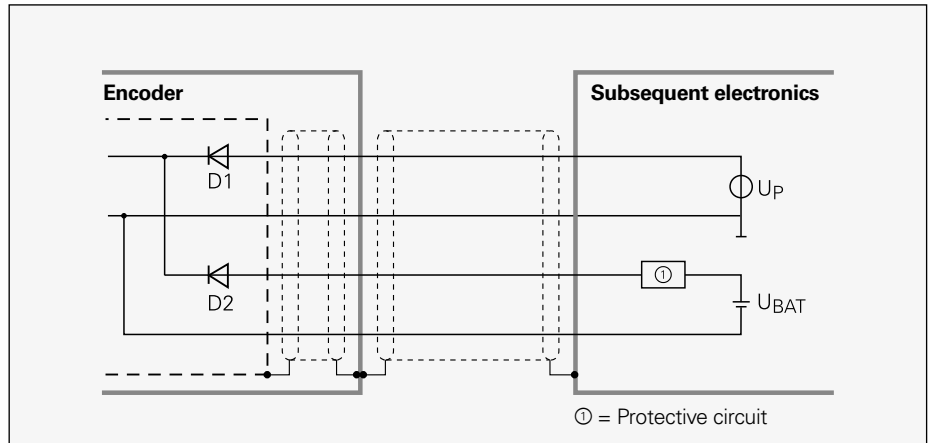
A lithium thionyl chloride battery with 3.6 V and 1 500 mAh is recommended as buffer battery. A service life of over 10 years in appropriate conditions (one EBI per battery; ambient temperature 25 °C; shaft at standstill, self-discharge < 1 % per year) can be expected. To achieve this, the main power supply (U_P) must be connected to the encoder while connecting the buffer battery, or directly thereafter, in order for the encoder to become fully initialized after having been completely powerless. Otherwise the encoder will consume a significantly higher amount of battery current until main power is supplied the first time.

If the application requires compliance with DIN EN 60086-4 or UL 1642, an appropriate protective circuit is required for protection from wiring errors.

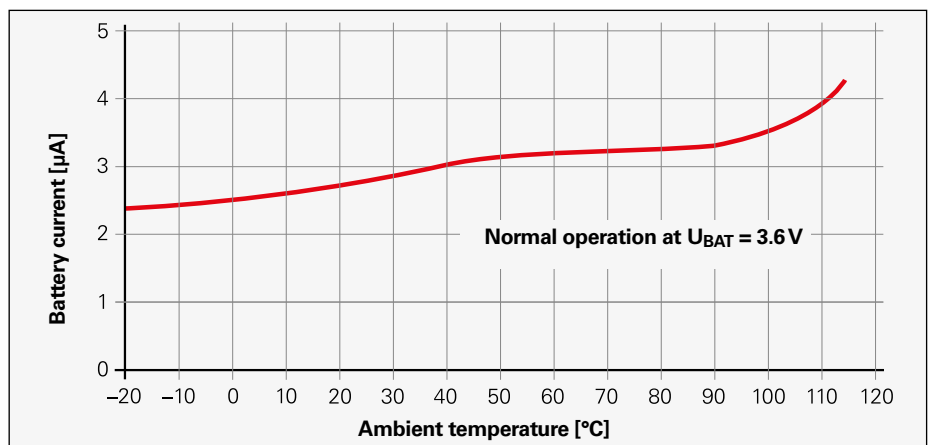
If the battery voltage falls below certain limits, the EBI issues warnings or error messages over the EnDat interface:

- **"M Battery" warning**
2.8 to 3.2 V (typically 2.9 V)
- **"M All Power Down" error message**
2.0 to 2.4 V (typically 2.2 V): the encoder has to find a new reference.

The EBI uses low battery current even during normal operation. The amount of current depends on the ambient temperature.



Connection of the buffer battery



Typical discharge current in normal operation

Adjusting and Testing Software

PWM 20

The PWM 20 phase angle measuring unit serves together with the provided ATS adjusting and testing software for diagnosis and adjustment of HEIDENHAIN encoders.



	PWM 20
Encoder input	<ul style="list-style-type: none"> • EnDat 2.1 or EnDat 2.2 (absolute value with/without incremental signals) • DRIVE-CLiQ • Fanuc Serial Interface • Mitsubishi High Speed Serial Interface • SSI
Interface	USB 2.0
Power supply	100 to 240 V AC or 24 V DC
Dimensions	258 mm 154 mm 55 mm

	ATS
Languages	Choice between English or German
Functions	<ul style="list-style-type: none"> • Position display • Connection dialog • Diagnostics • Mounting wizard for EBI/ECI/EQI, LIP 200, LIC 4000 • Additional functions (if supported by the encoder) • Memory contents
System requirements	PC (Dual-Core processor; > 2 GHz) Main memory > 1 GB Windows XP, Vista, 7 (32-bit) 100 MB free space on hard disk

Cables for PWM 20

Test of battery buffer possible

Encoder cable

Wire with 15-pin PCB connector for EBI and M23 coupling (male), 17-pin
Length 1.00 m
ID 573552-01

Adapter cable

With 15-pin D-sub connector for IK 215, PWM 20 and 17-pin M23 connector (female)
ID 324544-xx

Adapter

For providing an external buffer voltage (to test the buffer function)
With 17-pin M23 connector and coupling
ID 652780-01

Mounting accessories

Aid for connecting or disconnecting the PCB connector
ID 592818-01

Without test of battery buffer

Encoder cable

For IK 215, PWM 20, incl. three 12-pin adapter connectors and three 15-pin adapter connectors
ID 621742-01

15-pin adapter connector

Three connectors for replacement
ID 528694-02

Mounting accessories

Aid for connecting or disconnecting the PCB connector
ID 592818-01

Mounting Information

The EBI 1135 is an encoder without integral bearing. This means that mounting and operating conditions influence the functional reserves of the encoder. It is essential to ensure that the specified mating dimensions and tolerances are maintained in all operating conditions.

The following in particular must be kept in mind:

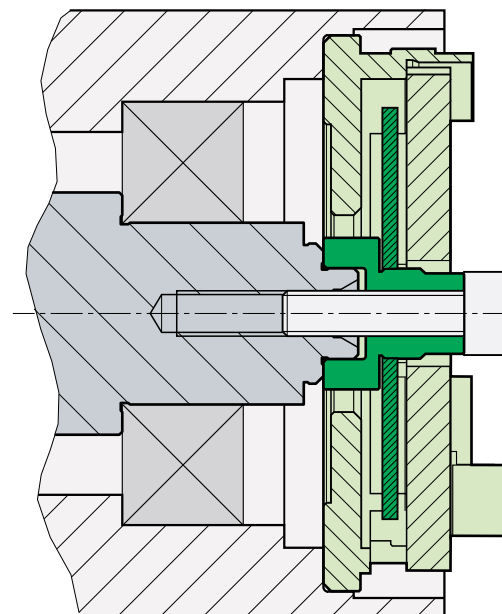
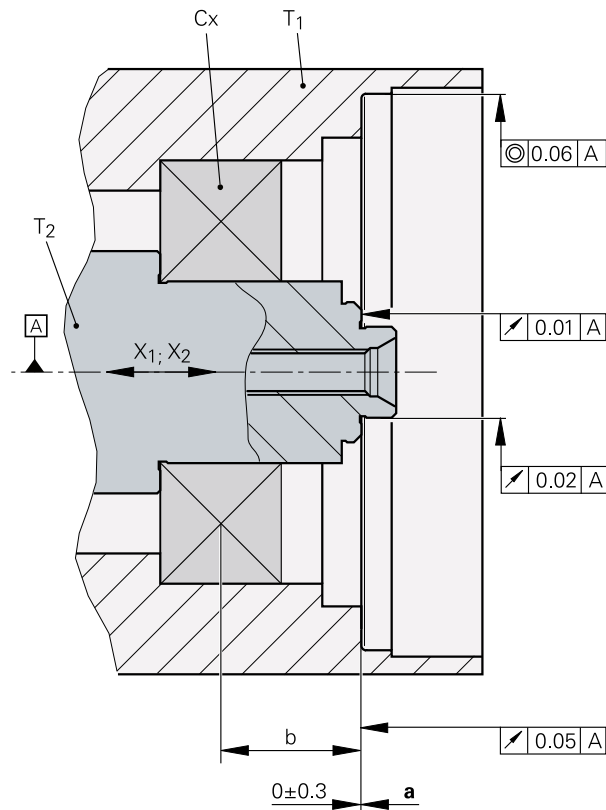
- Axial runout of flange mounting surface
- Radial runout of the motor shaft
- Maintaining the scanning gap (a), while taking into account the superimposition of motions, such as:
 - The length relation of the motor shaft and housing under temperature influence (T_1 ; T_2 ; α_1 ; α_2) depending on the position of the fixed bearing (b)
 - The bearing play (Cx)
 - Nondynamic shaft offsets due to load (X_1)
 - The effect of engaging motor brakes (X_2)

The application analysis must result in values within specification under all operating conditions (particularly under max. load and at minimum and maximum operating temperature) for the measured

- max. radial runout of the motor shaft
- max. axial runout of the motor shaft with respect to the mounting surface
- max. scanning gap (a)
- minimum scanning gap (a)

and under consideration of the signal amplitude (by inspecting the scanning gap at room temperature) using the ATS software.

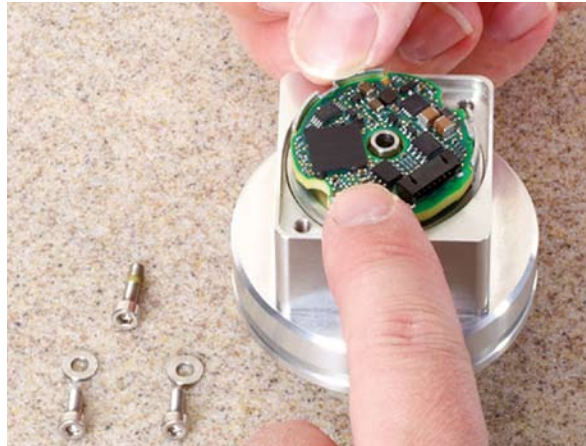
Furthermore, the general mechanical and electrical information in the current *Position Encoders for Servo Drives* brochure must be kept in mind!



Mounting/Removing the Rotary Encoder

Slide on the encoder

Without applying too much force, slide the encoder onto the mating shaft; do not jam it.



Clamp the encoder shaft

Secure the encoder shaft with the central screw.

- Self-locking screw as per DIN EN ISO 4762-A2 SW 2.5 (e.g. M3 x 16 mm)
- Tightening torque (e.g. 1.15 ± 0.05 Nm) to be set in accordance with the selected screw (use a torque wrench)

Appropriate tools are available from HEIDENHAIN.



Clamp the encoder flange

Fasten the encoder housing to the clamping surface with at least two sets of screws and washers by evenly tightening them crosswise with increasing tightening torque.

- Self-locking screws as per DIN EN ISO 4762 (e.g. 2 x M3 x 20 mm SW 2.5)
- Washers as per ISO 7092
- Tightening torque (e.g. 1.15 ± 0.05 Nm) to be set in accordance with the selected screw (use a torque wrench)

Appropriate tools are available from HEIDENHAIN.



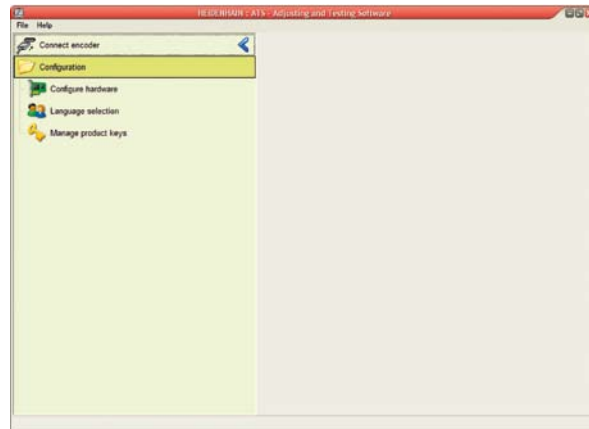
Removing the rotary encoder

The encoder is removed in the opposite sequence. Remount only if the encoder and mounting parts are in faultless condition.

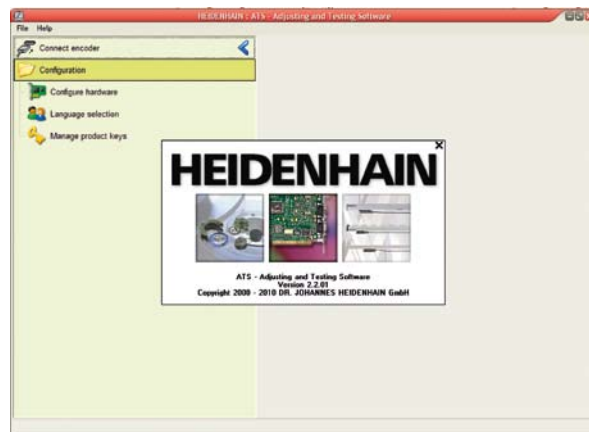
Checking the Mounting

Examination with the ATS software

(At room temperature, $U_P = 3.6$ to 14 V)
Start the ATS software.



Rotary encoder inspection is supported as of ATS version 2.2.00. The software version can be called over "Help" in the menu bar.



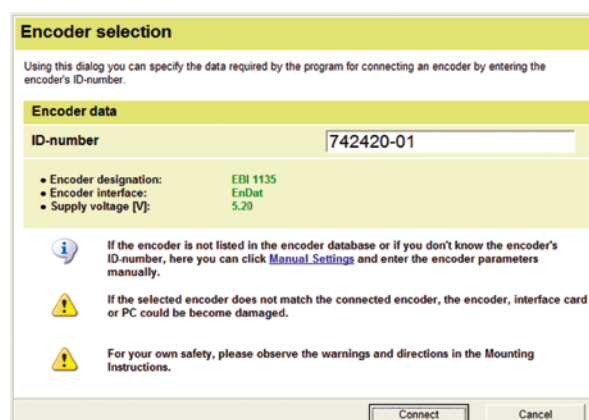
Connect the testing cable

(15-pin PCB connector; ensure proper polarization).
Check the mounting quality by means of the ATS software.



Connection setup

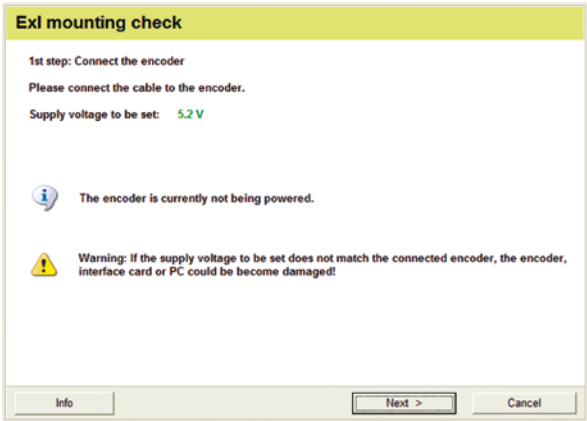
Select "Connect encoder" and enter the ID number.
Then select "Connect."



Select "ExI check" under "Mounting."



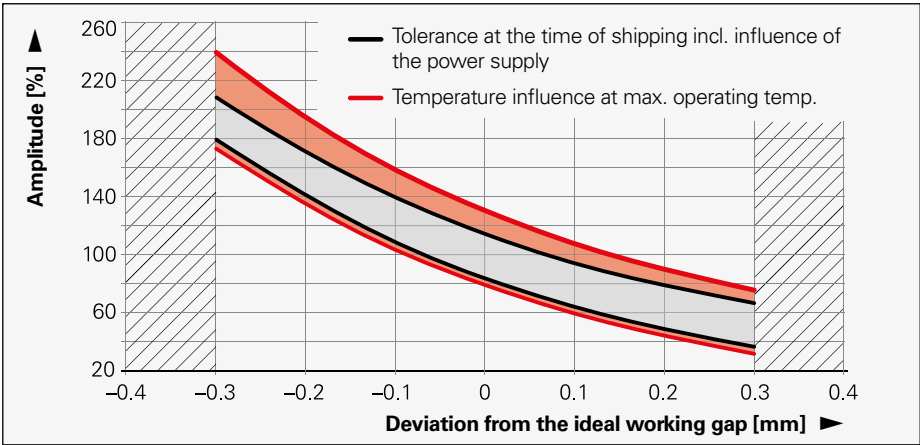
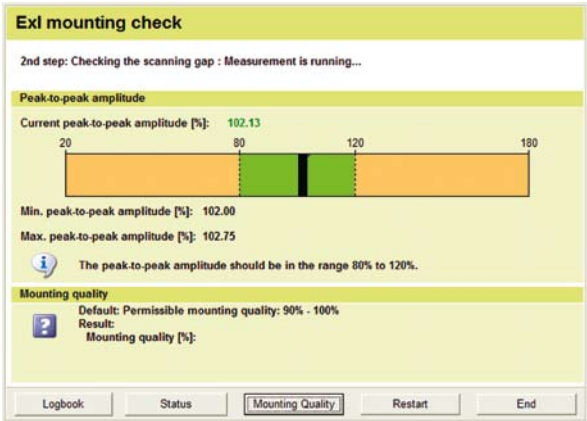
Confirm with "Next."



Checking the scanning gap

Important note

Signal amplitude deviating from 100 % limits permissible axial motion for operation (see diagram).



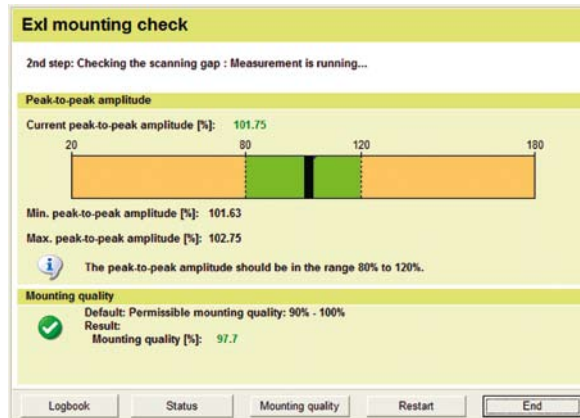
Checking the mounting quality

Select "Mounting quality:"

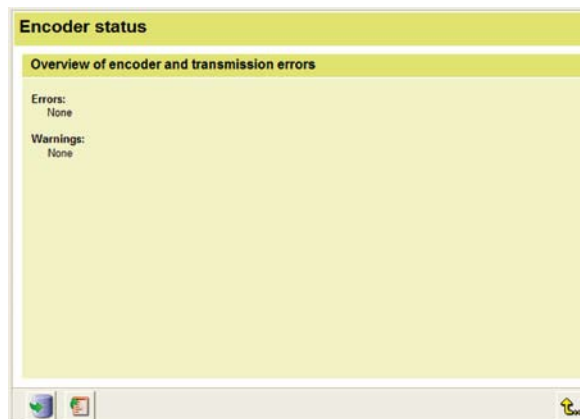
Then rotate the encoder shaft slowly until the value for mounting quality is shown.

Important note

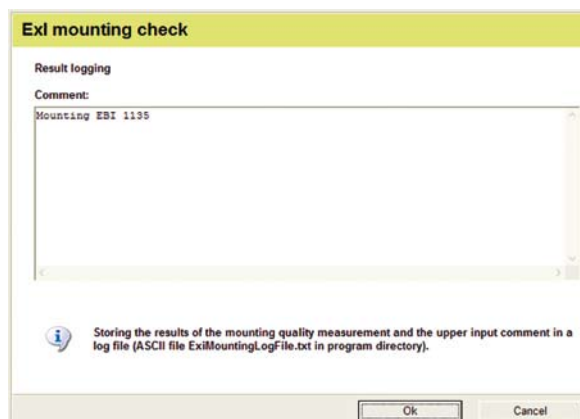
The mounting quality should lie within 90 % to 100 %. A mounting quality of < 90 % indicates an inadequate mounting situation. If necessary, check the mating dimensions and repeat the mounting procedure.



Active warnings and alarms can be displayed through "Status."

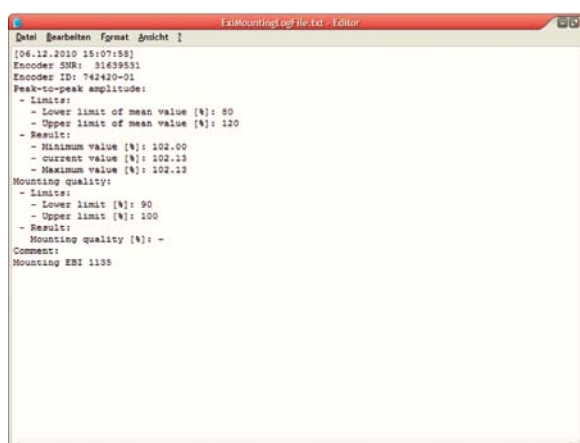


The detailed results of all measurements are saved in the log file through the Logbook. Comments can be entered.



Note

The measurement results (amplitude, mounting quality, etc.) can be called, printed and archived with "Log file." The log file is in the ATS program folder and has to be opened using Windows Explorer.



Inspection complete. Select **End** or **Restart**.

Note

For synchronous motors, an optional EnDat datum shift can be conducted (select **Datum shift**) to align the zero position to the motor commutation.

Exl mounting assistant

4th step: Adjusting the encoder position: Measurement is running...

Encoder position

Position [degrees]: 60.06

Mechanical alignment of the encoder position

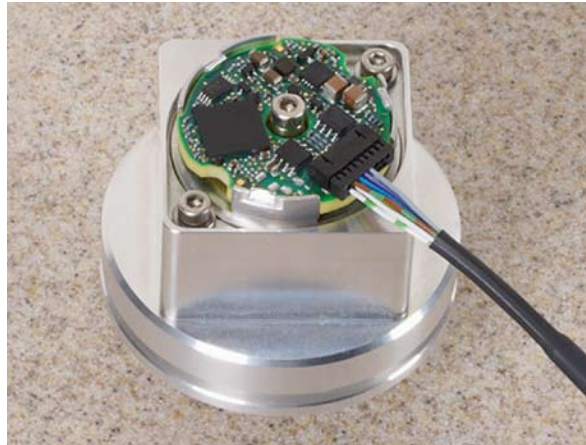
Mechanically align the encoder according to the motor commutation.

Alignment of the encoder position via datum shift

Click the "Datum shift" button at the desired position for this.

< Back Next > Cancel

Remove testing cable, mount encoder cable.



HEIDENHAIN

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This Product Information supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the Product Information valid when the contract is made.

More Information

- Catalog: *Position Encoders for Servo Drives*
- *EnDat Specification* 297403
- *EnDat Application Notes* 722024