LP series
Explosion-proof and Flameproof Incremental Encoder

- Low profile package saves space
- Designed for use in hazardous areas
- Excellent resistance to shock and vibration
- 30mm standard through shaft, PEEK reduction hub available
- Hard anodized housing and high protection level of IP66
- High performance in temperatures from -40°C to +85°C
- Ruggedized HTL 11-30V push-pull
- Wiring fault tolerant output and overvoltage protection up to 60Vdc
- Long cables drive capability
- Resolutions from 1 to 10000 PPR

**Certifications:**
The LP Incremental Encoder is available with the following certifications

- CEN/ELEC II 2 G Ex d IIB T4 Gb
- IECEx Ex d IIB T4 Gb
- UL – ATEX – IECEx certified

**Mechanical Characteristics:**

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td>Hard anodized aluminum</td>
</tr>
<tr>
<td>Body</td>
<td>Hard anodized aluminum</td>
</tr>
<tr>
<td>Shaft</td>
<td>AISI 303 stainless steel</td>
</tr>
<tr>
<td>Ball bearings</td>
<td>6807 - Sealed</td>
</tr>
<tr>
<td>Maximum loads</td>
<td>Axial: 40 N</td>
</tr>
<tr>
<td></td>
<td>Radial: 80 N</td>
</tr>
<tr>
<td>Shock (EN60068-2-27)</td>
<td>≤ 3000m.s² (during 5 ms)</td>
</tr>
</tbody>
</table>

Vibrations (EN60068-2-6) ≤ 200m.s² (55 ... 2000 Hz)
Shaft inertia < 130 000 g.mm²
Static/Dynamic torque 30 / 300 mN.m
Continuous max. speed* 6000 min⁻¹
Theoretical mechanical lifetime L₁₀h** > 18.10⁹ turns / 100000 hours
Encoder weight (approx.) 1.6 kg

* The temperature given on the following chart has to be added to the ambient temperature. The total must never exceed the maximum T°C given by the datasheet.
** Continuous max. Speed – ½ max. load – ISO 281, L₁₀

**Available mechanics - shaft options:**

- HHAX: Shaft with Integrated coupling
- HHUX: Through Hollow Shaft
- HHIX: Blind Hollow Shaft
- HHMX: Solid Shaft

**Output Waveform:**
Index calibration gated A & B (code 9)

- Z: 90°
- A
- B

Index calibration gated B (code V/US)

- Z: 180°
- A
- B

Waveform AA/ BB/ 00/ Channel B before A
Clockwise

**Specifications:**
- Certification:
  - CEN/ELEC II 2 G Ex d IIB T4 Gb
  - IECEx Ex d IIB T4 Gb
- UL – ATEX – IECEx certified
- DEMKO 16 ATEX 1691X rev.0
- IECEx UL 16.0064X Issue 0

**Wiring Fault Tolerance:**
- Overvoltage protection up to 60Vdc
- Wiring fault tolerant output

**Temperture Ranges:**
- High performance in temperatures from -40°C to +85°C

**Protection Level:**
- High protection level of IP66

**Applications:**
- Suitable for use in hazardous areas
- Excellent resistance to shock and vibration
- Robust design for demanding environments

**Technical Specifications:**
- Shaft options: HHAX, HHUX, HHIX, HHMX
- Material: Hard anodized aluminum, AISI 303 stainless steel
- Ball bearings: 6807 - Sealed
- Maximum loads: Axial: 40 N, Radial: 80 N
- Shock resistance: ≤ 3000m.s²
- Vibrations: ≤ 200m.s²
- Shaft inertia: < 130 000 g.mm²
- Dynamic torque: 30 / 300 mN.m
- Continuous max. speed: 6000 min⁻¹
- Theoretical mechanical lifetime: > 18.10⁹ turns / 100000 hours
- Encoder weight: 1.6 kg

**Certifications:**
- CEN/ELEC II 2 G Ex d IIB T4 Gb
- IECEx Ex d IIB T4 Gb
- UL – ATEX – IECEx certified
**Floating Mountings**

**Dimensions**

**HHUX – Through hollow shaft**

- HHUX-52.5
  - Through hollow shaft
  - Dimensions: 52.5 (with insulating sleeve)

**HHKX – Blind hollow shaft**

- HHKX
  - Blind hollow shaft
  - Dimensions

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**Note:**

- **CHc**: Hexagonal socket head cap screws (recommended torque clamp screw CHc M4=3,5N.m, and Terminal Box CHc M6=6,5N.m)
- **HC**: Hexagonal socket set screws (recommended torque HC M6: 2,5N.m)

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**Optional Ball end tether arm:**

- P/N : M9230-03/xxx
  - Length in mm

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**Specifications:**

- **HHX**
  - P/N 2000/008 Rev. A

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**Technical Details:**

- UL – ATEX – IECEx certified

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**Table of Dimensions:**

<table>
<thead>
<tr>
<th>Part</th>
<th>mm</th>
<th>Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>97</td>
<td>3.819</td>
</tr>
<tr>
<td>B</td>
<td>82</td>
<td>3.228</td>
</tr>
<tr>
<td>C</td>
<td>37.5</td>
<td>1.477</td>
</tr>
<tr>
<td>D</td>
<td>18.25</td>
<td>0.719</td>
</tr>
<tr>
<td>E</td>
<td>27</td>
<td>1.063</td>
</tr>
<tr>
<td>Ø6 (Center drill)</td>
<td>31</td>
<td>1.220</td>
</tr>
<tr>
<td>Cable Ø</td>
<td>9 to 15</td>
<td>3/8 to 5/8</td>
</tr>
</tbody>
</table>
**Dimensions**

**HHAX - Shaft with integrated coupling**

**Flange Mountings**

**Dimensions**

**HHMX - Solid shaft**

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### Specification sheet HH_X - P/N 2000/008 Rev. A
**Electrical Characteristics:**

<table>
<thead>
<tr>
<th>Version</th>
<th>Output signals</th>
<th>Resolution</th>
<th>Operating Voltage Vcl</th>
<th>Supply current (no loads)</th>
<th>Current per channel pair</th>
<th>Output Levels (Is=20mA)</th>
<th>Frequency capability</th>
<th>Short circuits proof</th>
<th>Reverse polarity tolerant</th>
<th>Wiring fault tolerant &amp; Overvoltage protection</th>
<th>Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>5GE</td>
<td>HTL</td>
<td>11-30V</td>
<td>100mA</td>
<td>60mA</td>
<td>Low max: 1.5V High min: Vcl – 3.5V</td>
<td>Up to 300kHz</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Up to 60Vdc</td>
<td>-40°C - 85°C</td>
</tr>
<tr>
<td>PG5</td>
<td></td>
<td>5-30V</td>
<td>100mA</td>
<td>60mA</td>
<td>Low max: 0.5V High min: Vcl – 2.5V</td>
<td>Up to 1MHz</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2G2</td>
<td>RS422</td>
<td>5V±5%</td>
<td>75mA</td>
<td>40mA</td>
<td>Low max: 0.5V High min: 0V</td>
<td>Up to 1MHz</td>
<td>Yes</td>
<td>No</td>
<td>(except to Vcl)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RG2</td>
<td>4.75-30V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Terminal Box Connection:**

- [ ] + A B Z A/ B/ Z/ Ground
- [ ] 1 2 3 4 5 6 7 8 9

Available Terminal Box versions:
- E0R: M16 without cable-gland
- E4R: 1/2’’ NPT without cable-gland
- E6R: 3/4’’ NPT without cable-gland

**Available resolutions:**

Standard: 32 64 100 128 250 256 360 512 600 700 800 1000 1200 1250 1400 1500 2000 2048 2500 2880 3600 4096 5000 7200 8192 10000

For non-standard and resolutions above 10000 ppr, please contact factory

**LP Incremental Ordering Options**

Use this diagram, working from left to right to construct your model number (Example: HHAX_E6/5GE/US/01024/E6R/UB6)

- HH_ X = hollow shaft
- HHX = solid shaft
- E0R = M16 radial terminal box (without cable-gland)
- E4R = 1/2’’ NPT radial terminal box (without cable-gland)
- E6R = 3/4’’ NPT radial terminal box (without cable-gland)
- 30 = 30mm
- 2G2 = 5V voltage and RS422 output
- 2G5 = 11-30V voltage and reinforced Push-Pull output
- 5GE = 11-30V voltage and reinforced Push-Pull output
- PG5 = 5-30V voltage and Push-Pull output
- RG2 = 4.75-30V voltage and RS422 output
- 9 = AA/BB/ZZI before A Zigated A&B
- V/US = AA/BB/ZZI before A Zigated on B
- G3R = M16 cable-gland with vinyl cable
- GPR = M16 cable-gland with PUR cable
- U3 = With insulated Sleeve (1” max)
- U6 = Through sleeve

(1) Atex IECEx certified only

Stainless steel option available.

Anti-rotation accessory: M9230-03/xxx Ball end tether arm (xxx = length in mm) to be ordered separately.
**SPECIAL CONDITIONS FOR SAFE USE:**

None required.

The gaps of the different flame paths are less than the values specified in the tables of the IEC 60079-1 standard.

The width of the different flameproof joints are superior to these specified in tables of IEC 60079-1 standard.

See Document 08329-001 for construction details.

**ASSEMBLY CAUTION/WARNING:**

Keep terminal cover closed and cable gland secured while in presence of hazardous atmosphere.

Open all circuits to this product prior to removal of terminal block cover.

Electrical installation shall use standard EN/IEC 60079-14 and/or NEC Class 2 circuit specifications. UL certified installations require the use of a sealing fitting certified to 60079-0 Ex d IIB within 18 in. (46 cm) of the encoder. Terminal block covers are marked near the threaded hole with the basic thread size to aid with selection of fittings or glands. Conductor insulation must be rated for at least 105°C ambient temperature. External case ground connection is provided by means of a screw and ring type terminal which accepts up to 10 AWG (5.26 mm²) size conductor.

The customer shall use our products according to our specifications and to the manners of the profession. BEI Sensors will not be responsible for any defect resulting from improper installation or from operating outside of the specification limits of the product. Malfunctions caused by excessive shocks, bad electric supply, under or over voltage, the environmental conditions outside of the design specifications, are not covered by warranty. The encoder doesn’t require any maintenance. There are no user serviceable parts inside. Any defective encoder shall be returned to the nearest BEI Sensors facility for evaluation and repair/replacement. A high integrity case ground connection must be made at or near the encoder installation location.

See LP series User Manual for installation details and Specification Documents (no. 2000/008 or 2000/009) for product details not otherwise indicated on this document.

**EU Declaration of Conformity**

1. We, BEI Sensors, certify that Models HH_X and AH_X all resolutions, channel and output type options are explosion proof and flame proof as noted on the UL, IECEx and DEMKO certificates cited below.

2. With the following marking: II 2 G Ex d IIB T4 Gb

3. Designed and manufactured to comply with these directives:
   - ATEX 2014/34/EC
   - CEM 2014/30/EC

4. Complies with these standards:
   - IECEx: IEC60079-0:2011+IS1 2013, IEC60079-1:2014

5. As detailed in EC type examination certificates:
   - DEMKO 16 ATEX 1691X rev.0
   - IECEx UL 16.0064X Issue 0

6. EMC: The following standards were also investigated for this certification: NFC 23-520, NFC 23-539, EN 50081-1, EN 55014, EN 61000-6-2, CEI 61000-4-2, CEI 61000-4-3, CEI61000-4-4, CEI 61000-4-5, CEI 61000-4-6, CEI61000-4-11

7. The notified organization responsible for the follow-up of the ATEX directive is (Assessed by): LCIE, B.P.8, F92260 Fontenay-aux-Roses - Identification number: 0081

8. The company in charge of certification CEM is LCIE BUREAU VERITAS, Aire de la Thur 68840 Pulversheim

**UL Declaration of Conformity**

Part number Model HH_X and AH_X model for use in Class I, Group C & D

UL 2303 Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations

UL Certificate No. E78446

The notified organization responsible for the follow-up inspections for this UL listing is (Assessed by):

UL International (France) SA
Espace Technologique de Saint-Aubin, Immeuble Explorer
Route de l’Orme des Ménriers – F-91190 SAINTAUBIN
Identification number: 675
Unscrew the 3 CHc M6 screws to remove the connection box

Slide right to unlock Connector Wiring

Align Bumps and Notches to take Connector out

Prepare the wires

Tighten Pressure screw

Crimp the wires and screw it on connector

Align Bumps and Notches and push-in

Slide left to lock connector in place

Put Connection box in place and screw 3 CHc screws on recommended torque