Encoder Installation Manual

NorthStar™ brand

SERIES EN42

Zone 1 Hazardous Area Rated Encoder

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Ex ia mb eb IIC T4 Gb
EX tb IIIC T119°C Db

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Description

The following instructions are meant to assist in proper installation of the EN42 Sealed Hollowshaft Encoder. The encoder is a speed and position transducer that when mounted to a rotating shaft, produces output pulses that are directly proportional to the shaft speed and direction. The hollowshaft feature eliminates the need for shaft couplings, adapter flanges and machined mounting faces. The encoder is attached to the shaft by a clamping collar. The EN42 can accommodate a variety of shaft diameters by selecting the appropriate "electrically isolated" bore sleeve. An anti-rotation bracket is used to prevent the encoder from rotating while allowing for limited shaft end float and wobble.

The EN42 was designed specifically for "Hazardous Area" rated applications common in Oilfield operations. Proper operation is dependant upon installation by suitably trained personel in accordance with the applicable code of practice.

Care should be taken to inspect the shipping container and product for external damage and/or missing parts. If any is found, contact Dynapar immediately as well as the shipping agent.

Tools Required for Installation

Tool	Purpose
7/64" Hex Key Wrench	Back Cover and Terminal Box Cover
5/32" Hex Key Wrench	Tether Bracket
3/16" Hex Key Wrench	Shaft Clamp Collar
10mm Hex Key Wrench	Stopping Plug
1/8" Flat Blade Screwdriver	Terminal Block Wiring
Open End Adjustable Wrench	Cable Gland and Tether Rod Jam Nuts
Caliper and Dial Indicator Gauges	Shaft Checks

Preparation

The following precautions must be followed when installing the EN42 or EN44 devices.

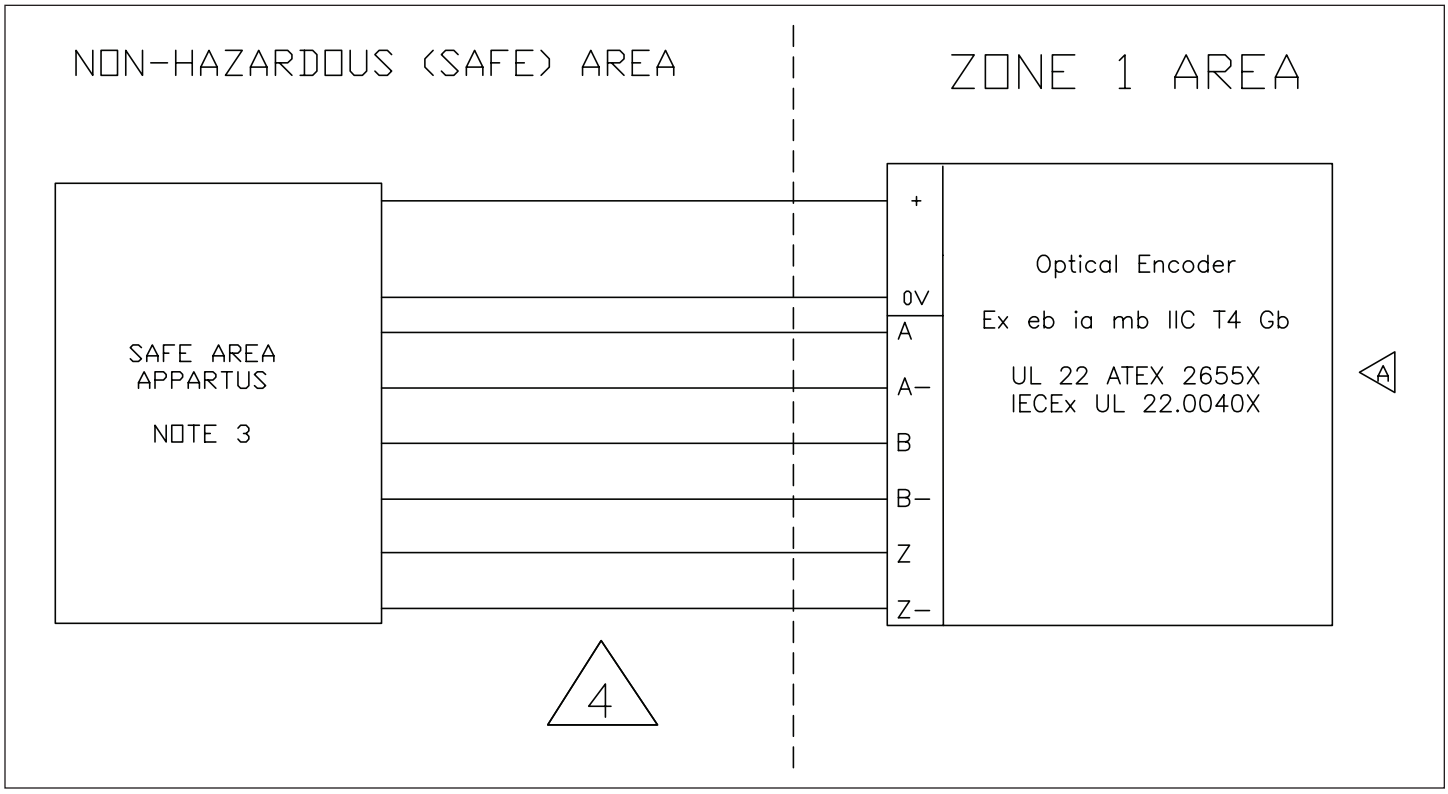
- All cable entry holes shall be fitted with either an Ex certified cable gland or an Ex certified stopping plug that is suitable for the application. The type of cable, glands and stopping plugs shall have temperature ratings of at least 80°C.
- The equipment enclosure has ¾ NPT entries, therefore, when it is being installed, it shall be fitted with external conduit that is compatible with these entries, in addition, the seal between the conduit and the equipment enclosure shall maintain a minimum ingress protection of IP54 when installed in Zone 1 and IP6X when installed in Zone 21.
- The MSB series terminals shall only be fitted with wires that have cross sectional area falling within the following limitations:

  Rigid: 0.08 mm2 to 4 mm2

  Flexible: 0.08 mm2 to 2.5 mm2
- The equipment shall be supplied from a power supply that has an output that is isolated from earth.
- Under certain extreme circumstances, the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore, the equipment shall not be installed in a location where the external conditions are conducive to the buildup of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.
- With regard to the Canadian Approval, installation shall be in accordance with the C22.1, Canadian Electrical Code, Part 1. With regard to the US approval, installation shall be in accordance with the National Electrical Code NFPA 70.
- With regard to the Canadian & US approval, the equipment shall be supplied with Limited Energy Circuit (LEC) as defined in CSA C22.2 No. 61010-1-12, Class 2 as defined in article 725.121 of NFPA70, or Limited Power Source (LPS) as defined in CAN/CSA C22.2 No. 60950-1.

Additional documentation to be provided with each unit:

- UL Certificate
- Installation, NonBarrier #200872-0001



1 The installation shall follow the local elecrical wiring code for the area classification

2 Electrical circuit in hazardous area shall be able to withstand 500VRMS to earth or frame of apparatus for 1 minute without breakdown

3 Non-hazardous supply limited to no more than 250 VRMS or 250 VDC with respect to earth and less than 10kA of short circuit current

4 Cable and installation to comply with IEC/EN 60079-14 and NEC/CEC standards for hazrdous locations

Application Environment

The EN42 is uniquely designed with the primary protection technique as Encapsulation.

The encapsulated electronics and increased safety interface allow for use in Zones 1 and 2 with flammable gases and vapors with apparatus groups IIA, IIB & IIC and with temperature classes T1, T2, T3, and T4. Compliance with the Essential Health and Safety Requirements has been assured by compliance with the following documents:

IEC EN 60079-0 (General)
EN60079-11
EN60079-31
EN 60079-7 (Increased Safety)
EN 60079-18 (Encapsulated)

Before installation or operating in a "Hazardous Area", the installer must be trained and familiar with hazardous area installation and IEC/EN 60079-14 standards.

NOTE: Encapsulation techniques are an improvement over "flameproof" 60079-1 Specifications requiring heavy XP metal enclosures to contain a flame. Encapsulation eliminates the air around the electronics preventing ignition and allowing smaller lightweight enclosures to be used in the design.

Electrical Installation

CAUTION: Before installation, ensure power is off and locked out. Failure to do so may damage encoder and/or cause a spark or explosion.

AVERTISSEMENT : Avant l'installation, assurez-vous que l'alimentation soit éteinte et verrouillée. Ne pas suivre cette instruction pourrait endommager le codeur et/ou provoquer une étincelle ou une explosion.

Electrical Installation must be performed by an individual that is trained and familiar with hazardous area installation. Standards that apply are IEC/EN 60079-14 and other applicable wiring codes that apply to the specific location of the installation. Please follow the guidelines for a type "e" Increased Safety Installation. Other cable considerations include flammability, temperature, chemical, etc as applies to the area and environment of installation. If in doubt see the IEC/EN60079-14 standard as applies to Increased Safety installations and local regulations.

Important Wiring Instructions

Use shielded cable with a defined wire gauge per the following table.

Terminal blocks type 'e' certified for the conductor range:

Connectable Conductor Cross Section	
Rigid/Soild Wire mm^2 (AWG)	0.14 - 2.5 (26-14)
Flexible/Stranded Wire mm^2 (AWG)	0.14 - 1.5 (26-16)

Consider the length of cable and desired drive currents for your application. Consider a 0.5mm2 or 20AWG cable as a minimum starting point. You can increase or decrease the wire diameter based on your specific application.

Shielding

It is good wiring practice for a shield to be connected to signal-ground at the receiving device only. Connecting the shield at both ends can cause grounding (loops) problems that degrade system performance and give a path for stray currents to travel.

Cable protection

Run the encoder cable through a dedicated conduit (not shared with other wiring). Use of conduit will protect the cable from physical damage and provide a degree of electrical isolation. If a conduit is not practical use wire trays to protect cable. If there is not a practical way to protect the cable you may consider using armored cable—See section 9 of the IEC/EN60079-14 standard as applies to Increased Safety installations. Do not run the cable in close proximity to other conductors that carry current to heavy loads such as motors, motor starters, contactors etc. This practice can induce electrical transients in the encoder cable, potentially interfering with reliable data transmission.

CAUTION: Unused encoder signal wires must be individually insulated and under no circumstances be in contact with ground, voltage sources, or other signal lines.

AVERTISSEMENT : Les fils du signal du codeur non utilisés doivent être isolés individuellement et, en aucun cas, être en contact avec le sol, les sources de tension ou d'autres lignes de signal.

Zone 1 Wiring Considerations

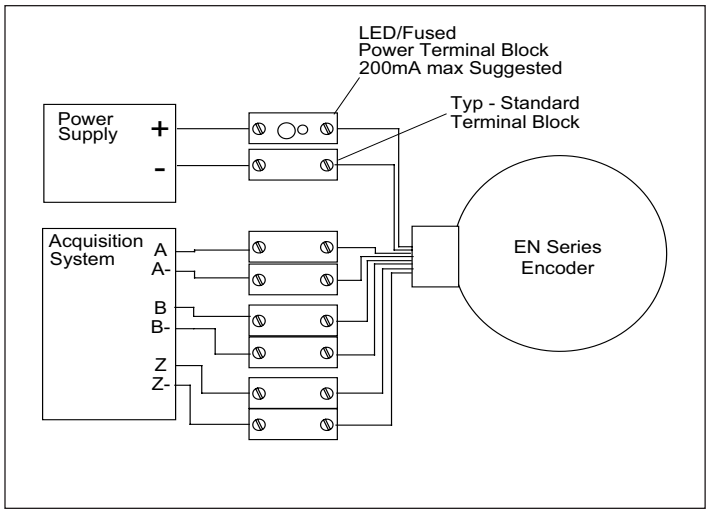
CAUTION: The Encoder wiring configuration for the EN series encoder is different than an Intrinsic Safe wiring configuration. No IS barrier, Zener or Galvanic, is required when using the EN series encoder. Barriers may prevent proper operation and/or frequency performance. Damage to the encoder may occur if the encoder output is connected to an IS barrier.

AVERTISSEMENT : La configuration du câblage du codeur pour le codeur de série EN est différente d'une configuration de câblage de sécurité intrinsèque. Non barrière IS, Zener ou galvanique n'est nécessaire lors de l'utilisation du codeur série EN. Les barrières peuvent empêcher le bon fonctionnement et/ou la performance de la fréquence. Des dommages causés au codeur peuvent se produire si la sortie du codeur est reliée à une barrière IS.

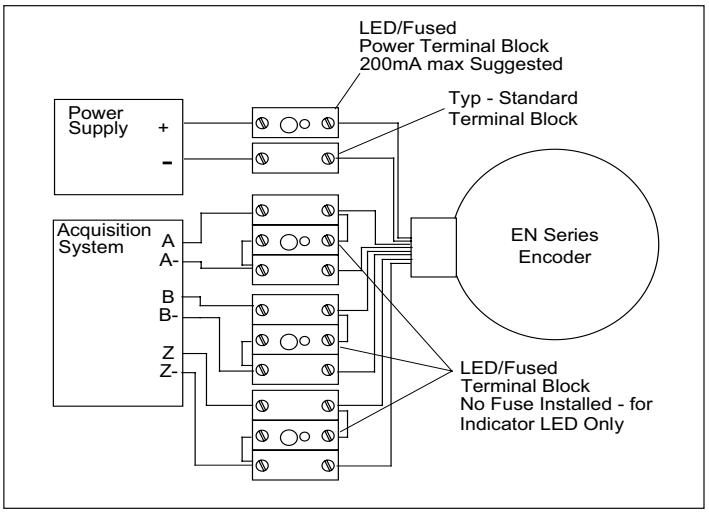
When selecting an encoder, consider the power supply to the encoder and input voltage to your data acquisition, PLC or drive system. Cable length and RPM max will determine which output driver option to select.

The configurations below are examples of protected wiring practices and help to determine the best wiring scheme.

EN Series Encoder Wiring Configuration with Fuse Power



EN Series Encoder Wiring Configuration with Fuse Power and LED Activity Lights



Cable Entry and Gland Selection

This product is supplied with dual 3/4" NPT entry holes for wiring to the terminal block. SPECIAL CONDITIONS FOR SAFE USE (denoted by X in the certificate number) require cable entry to be fitted with an ATEX certified Type "e" cable gland. Any gland certified for use as Type "e" and matching the cable selected and designed to fit a 3/4" NPT can be used.

In addition, the remaining 3/4" NPT hole that is not used for cable entry must be fitted with a Stopping Plug (supplied). Manufacturer's Instructions must be followed for both the Cable Gland and the Stopping Plug. Refer to the list below for the instructions for the Stopping Plug and Cable Glands supplied by Dynapar.

NOTE: For Ingress Protection greater than IP54, the use of a suitable non-setting thread sealant is recommended. Both the Cable Gland and the Stopping Plug must be "wrench tight" in the enclosure.

Dynapar Stopping Plug and Cable Glands
(ref. page 8 "Ordering Information" – Code 5)

Detailed Instructions are available on the Hawke Website: www.ehawke.com.

All Codes:

- **Stopping Plug** – Hawke 475 3/4" NPT Brass Nickel Plated
- **Hawke Datasheet:** 475
- **Hawke Assembly Instructions:** AI404

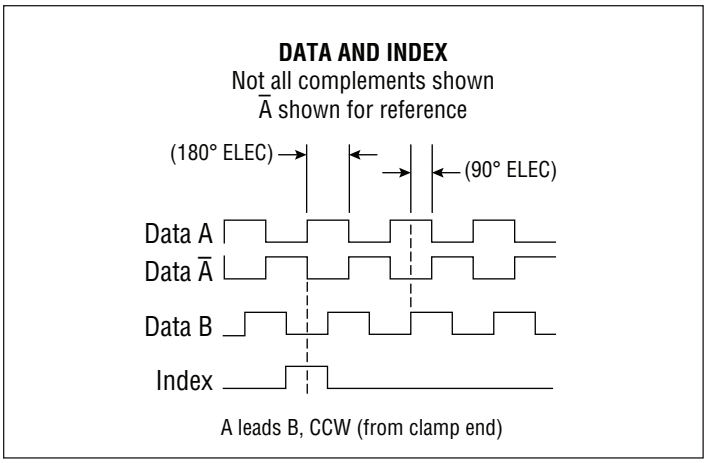
Code 1:

- **Non-Armored Cable Gland:** Hawke 501/421 A 3/4" NPT NP Brass S
- **Hawke Datasheet:** 501/421
- **Hawke Assembly Instructions:** AI307

Code 2:

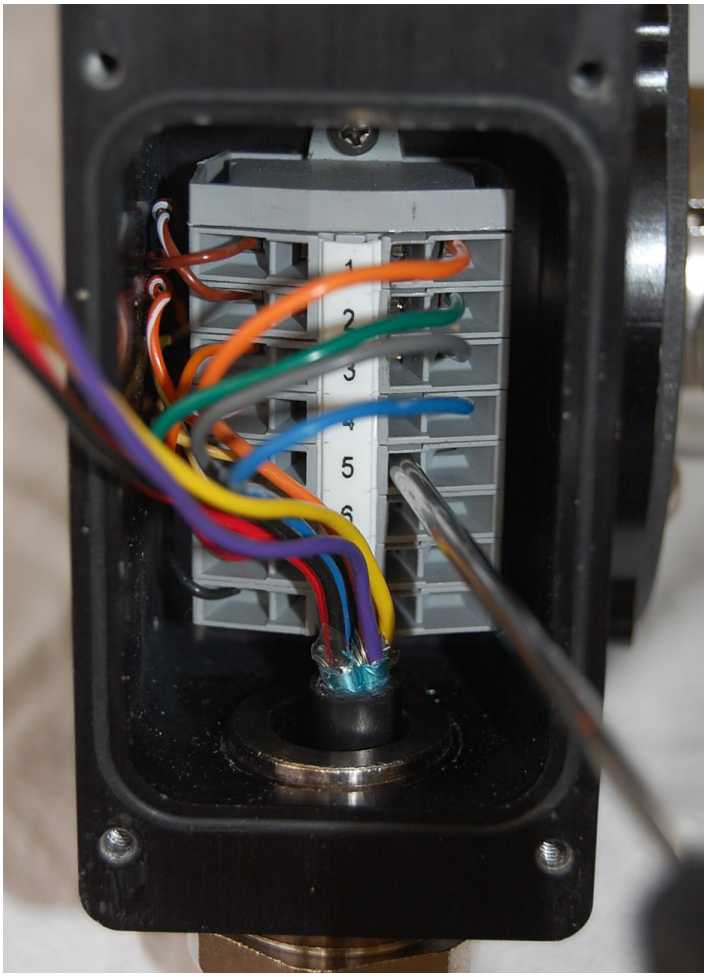
- **Armored Cable Gland:** Hawke 501/453/UNIV A 3/4" NPT NP Brass
- **Hawke Datasheet:** 501/453/UNIV
- **Hawke Assembly Instructions:** AI2000

Signal and Wiring



Electrical Connections

Encoder Function	Terminal Box Connection
Sig. A	1
Sig. Ā	2
Sig. B	3
Sig. B̄	4
Sig. Z	5
Sig. Z̄	6
Power +V	7
COM	8



Wiring Procedure

Step 1: Remove terminal box cover. Assemble cable and gland per manufactures instructions.

Step 2: Strip cable jacket back 3 inches. Strip individual leads back 9mm.

Step 3: Wire to terminal block using pin assignment on this page or on the inside of terminal box cover. Carefully press a 1/8" flat blade screw-driver into the inboard hole to open terminal. Insert wire completely and remove screwdriver.

Step 4: Replace terminal box cover.

Mechanical Installation

Step 1: Check and Clean the Mating Shaft

Ensure that the mating shaft is within proper tolerances Recommended mating shaft diameter tolerances should be nominal +0.0000"/-0.0005" [0.00 to -0.13mm] and shaft Total Indicated Runout (TIR) should be under 0.002", in accordance with NEMA MG1 specifications for shafts up to 1.625".

Clean the shaft of any burrs and check that mating shaft engagement is at least 2.00" inside the encoder hubshaft.

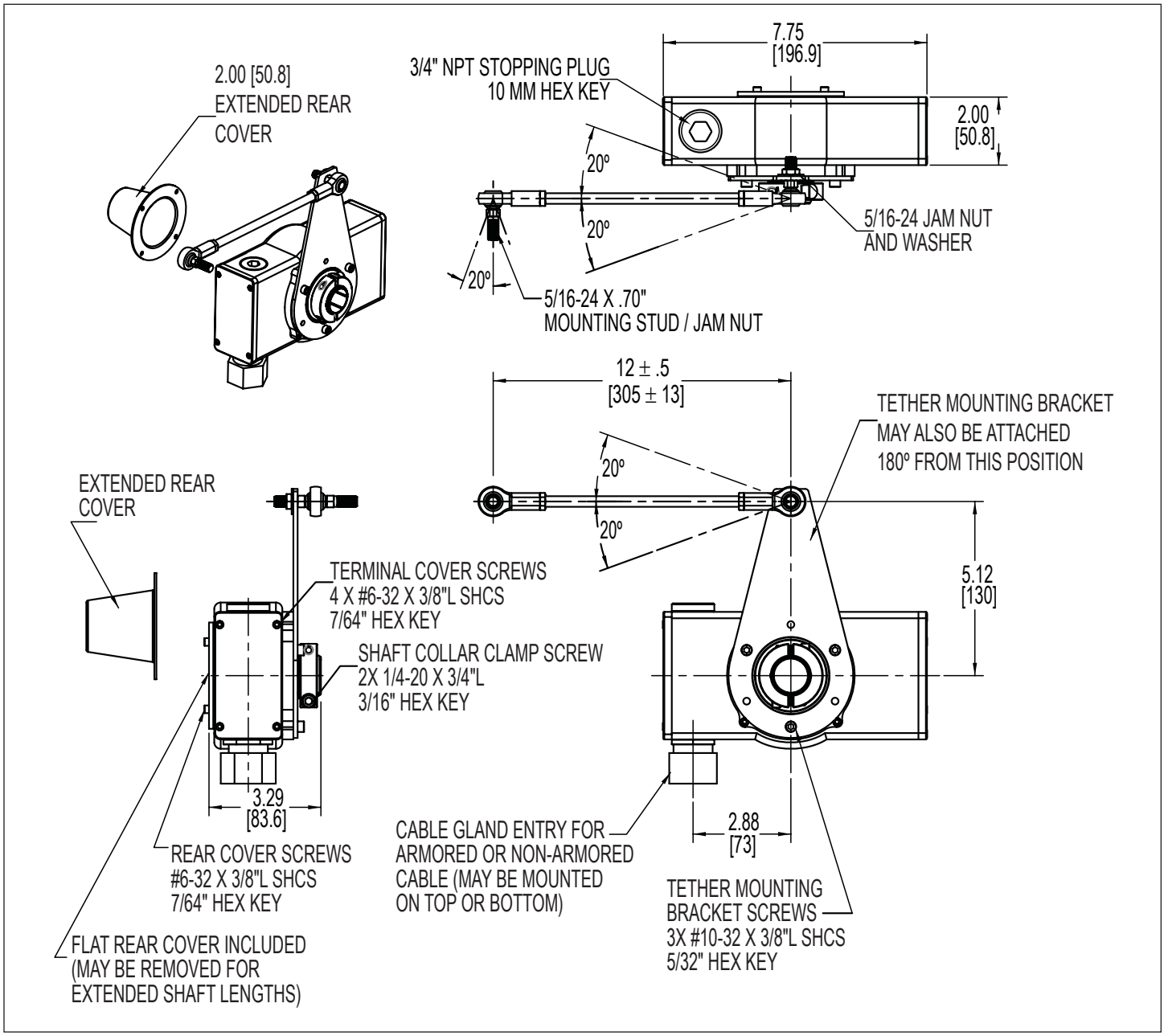
NOTE: The minimum shaft engagement length is 2.00". Recommended is 2.50" [40.6mm] to reduce wobble. The longest shaft length as measured from the mounting face that will allow installation of the endcap is 2.6" [66mm] maximum.

Step 2: Preparing the Encoder

The encoder ships with both a Flat Rear Cover and an Extended Rear Cover. Although installation is optional, it is recommended for additional environmental protection. The Flat Cover can be used with motor shafts up to 2.66" long and the Extended Cover can be used with motor shafts up to 4.66" long.

Install either the Flat or Extended cover by aligning the (4) holes in the cover with the holes in the mating gasket and housing. Place the gasket between the housing and cover and install (4) #6-32 x 3/8" long socket head cap screws. See figure below.

Dimensions: inch (mm). Shown with Heavy Duty Swivel Rod Tether attached



Step 3: Install Tether on Encoder

The EN42 can be ordered with an adjustable rod style tether or a spring steel tether. Both are designed to prevent the encoder from rotating, while giving some degree of flexibility to the encoder. Refer to the drawing on previous page when assembling and attaching tether.

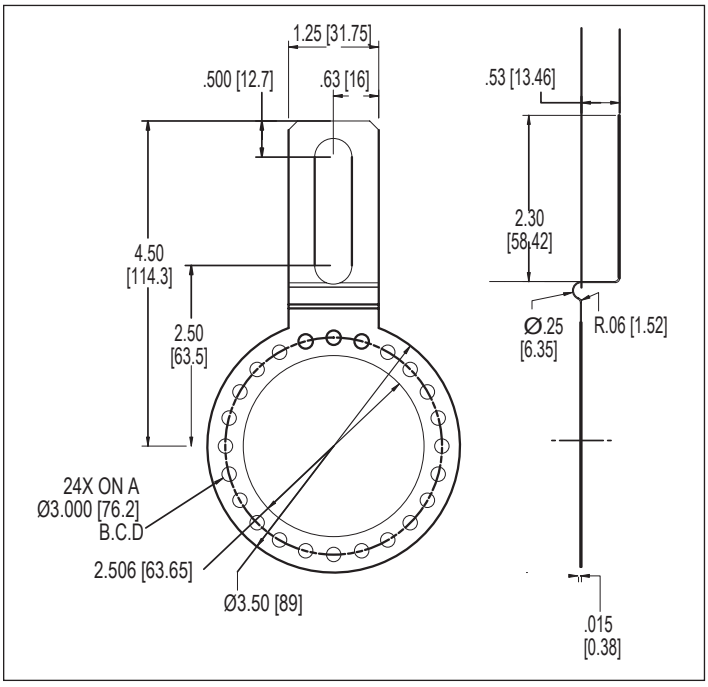
Adjustable Rod Style:

- Attach tether mounting bracket to EN42 housing using the three (3) #10-32 x 3/8" SHCS socket head cap screws provided. Apply removable thread locker (example: LOCTITE® 242).
- Attach encoder side of rod to the tether bracket via the 5/16"- 24 x .7" bolt and torque nut to 20 ft. lbs [27 Nm].
- Loosely adjust anti-rotation arm to desired length. Desired length will be determined in the next step. Apply removable thread locker (example: LOCTITE® 242) on the threaded rod and nuts.
- The other side of the rod will be attached in the next step along with tightening of the rod hardware.

Spring Style Slotted Tether:

- Rotate the tether to the required orientation and tighten the tether arm to the encoder using the three (3) #10-32 x 3/8" SHCS socket head cap screws provided.

NOTE: The drawing on previous page does not illustrate the Slotted Tether which is shown below. Contact Application Engineering for available options.



Step 4: Install the Encoder

- Carefully slide the encoder on the shaft. Position the encoder so that the clamp collar faces the motor or machine. The encoder should slide on easily, if not, check shaft again. Position the encoder as close as possible until the tether bolt threads into the desired motor or machine tapped hole.
- Secure 5/16"- 24 x .7" tether bolt to motor or machine. Torque nut to 20 ft. lbs [27 Nm]. Check to make sure the tether is properly aligned, and then tighten adjustable rod hardware. Check that the tether and encoder are "unstressed." If not, loosen, adjust and retighten.
- Tighten the shaft clamp collar to 50 to 55 in-lbs. This secures the encoder to the shaft

NOTE: The EN42 comes equipped with a split collar, requiring both screws to be tightened securely.

Hand tighten each screw to ensure an even gap in both splits, then tighten.

Step 5: Installation Check Point

Follow the 3 step installation check to ensure a good installation thus far.

1. **Check clearances from mounting face.** Ensure you have a minimum clearance of 1/16" between the encoder shaft and any non-rotating surface closest to the encoder shaft
2. **Check tether installation.** Make sure that the tether is in proper alignment. There should be no visible bending or deflection on any surface of the tether. Visible tether deflections should be corrected immediately. If the tether is bent or distorted, DO NOT USE, and call the factory for a replacement tether. Tether installation is critical to the long life of the bearings and improper tether installation will lead to excessive bearing loads and encoder failure.
3. **Check wobble of encoder housing.** Turn the shaft by hand and make sure that the shaft turns freely and does not produce excessive runout/wobble of the encoder. Most encoder installations will have wobble arising from shaft tolerances. Measure the wobble on the visible back face of the encoder. A wobble of 0.005" TIR (or less) will not have any adverse effect on encoder performance. In general, the lower the TIR of runout, the better.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental

Resolution: to 5000 PPR (pulses/ revolution) See Ordering Information

Format: Two channel quadrature (AB) with optional Index (Z, ungated), and complementary outputs

Index: 180 degrees ±25 degrees (electrical), ungated

Phase Sense: A leads B for CCW shaft rotation viewing the shaft clamp end of the encoder

Quadrature Phasing: 90° ± 30° electrical

Symmetry: 180° ± 30° electrical

Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Voltage: 7-15VDC, 7-26VDC, 10-30VDC

Input Current: 100mA max., not including output loads

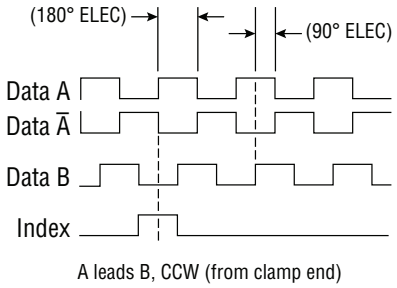
Outputs:

Input/Output Type	Line Driver Type
7-15V/7-15V DC	4428
7-26V/5V DC	4428
10-30V/10-30V DC	2707

DATA AND INDEX

Not all complements shown

$\overline{A}$ shown for reference



A leads B, CCW (from clamp end)

Output Current: (Refer to Ordering Information Table, Code 4: Output Format)

Code 4 Option	Current per Channel (max)
0 or 2	125mA @ 80°C
1 or 3	15mA @ 80°C
4	60mA @ 80°C

Frequency Response: 125 kHz (data and index)

Termination: Terminal block - Ex screwless w/spring cage-clamp

Interface: HAWKE type "E" increased safety rated gland for armored and non-armored cables.

HAWKE Part Numbers:

Non-Armored Gland	HAWKE 501/421 A 3/4" NPT S (accepts 8.5 - 13mm cable, OD)
Amored Gland	HAWKE 501/453 UNIV A 3/4" NPT (accepts 12.5 - 20.5mm cable, OD)

MECHANICAL

Shaft Material: Stainless steel or anodized aluminum (See ordering information)

Bore Diameter: 1.00", 0.875", 0.750", 0.625", 16mm, 15mm. Insulated inserts provided for bores under 1 inch

Mating Shaft Length: 2.00", Minimum; 2.50", Recommended

Shaft Speed: 3600RPM Maximum continuous; 6000RPM Peak (Derate max operating temp by 10°F for every 1000 RPM over 3000)

Starting torque: 8.0 in-oz. maximum (at 25°C)

Running Torque: 5.0 in-oz. maximum (at ambient)

Bearings: 61806-ZZ

Bearing Life: 5 x 10^8 revs at rated shaft Loading, 5 x 10^{11} revs at 10% of rated shaft loading. (manufacturer's specs)

Housing and Cover: Hard Anodized Aluminum.

Disc Material: Aluminum

Accessory Fastners, Provided with:

Tether Bracket	(3) #10-32 x 3/8" SHCS Socket Head Cap Screws
Threaded Rod	(2) 5/16-24 x .70" Mounting Bolts
Rear Cover	(4) #6-32 x 3/8" SHCS Socket Head Cap Screws
Terminal Box	(4) #6-32 x 3/8" SHCS Socket Head Cap Screws

Weight: 6.5 lb, typical

ENVIRONMENTAL

Operating Temperature: Refer to Temperature Range Table (on page 8)

Storage temperature: -50 to 100°C. Armored Gland high-temperature specification limited to +80°C.

Shock: 50G's for 11msec duration

Vibration: 5 to 2000Hz @ 20 G's

Humidity: 100%

Enclosure Rating: IP67

CERTIFICATIONS

Ex eb ia mb IIC T4 Gb
Ex tb IIIC T119°C Db
Class I, Zone 1, AEx eb ia mb IIC T4 Gb
Zone 21, AEx tb IIIC T119°C Db

Temperature Range

Code 4 Option	Output Current	Group II Ambient Temperature Range	Group III Ambient Temperature Range
0 or 2	125mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
1 or 3	10mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
1 or 3	15mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
4	90mA max per channel	Ta = -50°C to +60°C	Ta = -25°C to +60°C
4	60mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C

ORDERING INFORMATION

To order, complete the model number with code numbers from the table below:

Code 1: Model	Code 2: PPR	Code 3: Bore Size	Code 4: Output Format	Code 5: Termination	Code 6: Tether	Code 7: Cover
EN42	☐☐☐☐	☐	☐	☐		
EN42 Triple Certified ATEX Zone 1 Hollowshaft Encoder	**0015** **0032** **0100** **0200** **0240** **0250** **0500** **0512** **0600** **1000** **1024** **1200** **2000** **2048** **2500** **4000** **5000**	Stainless Steel Hub **8** 5/8" **9** 15 mm **A** 16mm **D** 3/4" **F** 7/8" **H** 1" Non-Isolated Anodized Aluminum Hub **R** 1" Isolated	**0** Differential AB, 7-15V in, 7-15V out* **1** Differential AB, 7-26V in, 5V out* **2** Differential ABZ, 7-15V in, 7-15V out* **3** Differential ABZ, 7-26V in, 5V out* **4** Differential ABZ, 10-30V in, 10-30V out*	**0** No Gland **1** Ex Gland for non-armored cables (8.5 - 13.5mm OD) **2** Ex Gland for armored cables (12.5 - 20.5mm OD)	**0** Slotted Tether **1** Heavy Duty Swivel Rod Tether	**0** Covers, Standard Flat and Extended

* See Electrical Specifications for Details

[1]

EU-TYPE EXAMINATION CERTIFICATE

[2] **Equipment or Protective System intended for use in Potentially Explosive Atmospheres Directive 2014/34/EU**

[3] EU-Type Examination Certificate Number: **UL 22 ATEX 2655X Rev. 1**

[4] Product: **Optical Encoder**

[5] Manufacturer: **Dynapar Corporation**

[6] Address: **2100 West Broad Street, Elizabethtown NC 28337 USA**

[7] This product and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

[8] UL International Demko A/S, notified body number 0539 in accordance with Article 17 of the Council Directive 2014/34/EU of 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report no. **US/UL/ExTR22.0045/01.**

[9] Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN IEC 60079-0:2018 **EN IEC 60079-7:2015/A1:2018** **EN 60079-11:2012**
EN 60079-18:2015/A1:2017 **EN 60079-31:2014** **IEC 60079-31, 3rd Edition (2022-01)**

[10] If the sign "**X**" is placed after the certificate number, it indicates that the product is subject to special conditions for safe use specified in the schedule to this certificate.

[11] This EU-Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by the certificate.

[12] The marking of the product shall include the following:

II 2 G Ex eb ia mb IIC T4 Gb

II 2 D Ex tb IIIC T119°C Db

Certification Manager
Thomas Wilson

This is to certify that the sample(s) of the Product described herein ("Certified Product") has been investigated and found in compliance with the Standard(s) indicated on this Certificate, in accordance with the ATEX Product Certification Program Requirements. This certificate and test results obtained apply only to the product sample(s) submitted by the Manufacturer. UL did not select the sample(s) or determine whether the sample(s) provided were representative of other manufactured product. UL has not established Follow-Up Service or other surveillance of the product. The Manufacturer is solely and fully responsible for conformity of all product to all applicable Standards, specifications, requirements or Directives. The test results may not be used, in whole or in part, in any other document without UL's prior written approval.

Date of issue: 2022-11-14
Re-issued: 2023-03-31

Notified Body UL International Demko A/S, Borupvang 5A, 2750 Ballerup, Denmark
Tel. +45 44 85 65 65, info.dk@ul.com, www.ul.com

Accredited by DANAK under registration number 7011 to certification of products.

[13] [14]

Schedule
EU-TYPE EXAMINATION CERTIFICATE No.
UL 22 ATEX 2655X Rev. 1

[15] Description of Product

The equipment is an optical encoder that is intended to be attached to the rotating shaft of a machine. It uses an anodized aluminum enclosure that has three internal compartments. A compartment at one end of the equipment contains certified 'Ex e' terminals that are used for external connections; external cables enter this compartment via certified 'Ex e' cable glands and any unused entries are blanked by certified 'Ex e' plugs. This 'Ex e' compartment is fitted with a lid that allows access to the terminals. The compartment at the other end of the encoder contains 'Ex m' devices that include an encapsulated printed circuit board assembly. The central compartment houses an optically encoded disc, this is fitted to a shaft that emerges from the wall of the compartment. The disc is fitted with an optical reading device that is protected by intrinsic safety, 'Ex ia', however, there are no intrinsically safe inputs or outputs.
An alternative version of the equipment is fitted with a permanently connected cable. This version of the equipment has no Ex 'e' terminal compartment. Entry of the cable is again via an 'Ex e' cable gland.

Nomenclature:

Optical encoders, models EN42aaaabcdef and EN44aaaabcd rated Um = 250 V and as depicted in model code

Where: a = 0000-9999 representing Pulse Per Revolution.
b = single alphamerical digit representing Bore Size.
c = Output
0 – Differential AB, 7-15 V in, 500 mA max input, 7-15 V out*
1 – Differential AB, 7-26 V in, 500 mA max input, 5 V out*
2 – Differential ABZ, 7-15 V in, 500 mA max input, 7-15 V out*
3 – Differential ABZ, 7-26 V in, 500 mA max input, 5 V out*
4 – Differential ABZ, 10-30 V in, 400 mA max input, 10-30 V out*

Option	Output current	Group II Ambient Temperature Range	Group III Ambient Temperature Range
0 or 2	125mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
1 or 3	10mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
1 or 3	15mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
4	90mA max per channel	Ta = -50°C to +60°C	Ta = -25°C to +60°C
4	60mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C

d = Single numerical digit representing termination options.
e = single numerical digit representing Tether options.
f = single numerical digit representing cover options.

Routine tests

The routine visual inspection requirements of Clause 9.1 of EN 60079-18:2015 are to be covered by a Condition of Manufacture on the certificate. See Section 1.12.

All complete manufactured units shall be subjected to a routine 500V r.m.s. a.c. between all terminals and the equipment enclosure, in accordance with Clause 10.3 of EN 60079-11:2012.

All manufactured units shall be subjected to a visual inspection on the encapsulation. No damage shall be evident such as cracks in the compound, exposure of the encapsulated parts, flaking, inadmissible shrinkage, swelling, decomposition, failure of adhesion or softening.

[16] Descriptive Documents

The scheduled drawings are listed in the report no. provided under item no. [8] on page 1 of this EU-Type Examination Certificate.

Accredited by DANAK under registration number 7011 to certification of products.

[13] [14]

Schedule
EU-TYPE EXAMINATION CERTIFICATE No.
UL 22 ATEX 2655X Rev. 1

[17] Specific conditions of use:

- All cable entry holes shall be fitted with either an ATEX certified cable gland or an ATEX certified stopping plug that is suitable for the application. The type of cable, glands and stopping plugs shall have temperature ratings of at least 100°C.
- The MSB series terminals shall only be fitted with wires that have cross sectional area falling within the following limitations:
  Rigid: 0.08 mm^2 to 4 mm^2
  Flexible: 0.08 mm^2 to 2.5 mm^2
- The equipment shall be supplied from a power supply that has an output that is isolated from earth.
- Under certain extreme circumstances, the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

[18] Essential Health and Safety Requirements

The Essential Health and Safety Requirements (EHSRs) covered by the standards listed at item 9.

Additional information

The trademark DYNAPAR will be used as the company identifier on the marking label.

The manufacturer shall inform the notified body concerning all modifications to the technical documentation as described in Annex III to Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014.

Accredited by DANAK under registration number 7011 to certification of products.

CERTIFICATE OF COMPLIANCE

Certificate Number	E116133
Report Reference	E116133-20221130
Date	2022-December-07
Issued to:	DYNAPAR CORP 1675 N DELANY RD GURNEE IL, 60031-1237 US
This is to certify that representative samples of	TELEMETERING EQUIPMENT FOR USE IN HAZARDOUS LOCATIONS See Addendum Page for Product Designation(s).
	Have been evaluated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	See Addendum Page for Standards of Safety
Additional Information:	See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information

This Certificate of Compliance indicates that representative samples of the product described in the certification report have met the requirements for UL certification. It does not provide authorization to apply the UL Mark. Only the Authorization Page that references the Follow-Up Services Procedure for ongoing surveillance provides authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.

Deborah Jennings-Conner

Deborah Jennings-Conner, VP Regulatory Services

UL LLC

CERTIFICATE OF COMPLIANCE

Certificate Number	E116133
Report Reference	E116133-20221130
Date	2022-December-07

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements

Optical encoders, models EN42; Followed by four numerical digits; followed by single alphamerical digit; followed by 0,1,2,3 or 4; followed by 0,1 or 2; followed by 0 or 1; followed by 0.

Optical encoders, models EN44; Followed by four numerical digits; followed by single alphamerical digit; followed by 0,1,2,3 or 4; followed by 0, 1 or 2.

Standard(s) for Safety:
Standard No. UL 60079-0, 7th Ed., Rev. 2020-04-15, Explosive atmospheres – Part 0: Equipment – General requirements
UL 60079-7, Explosive atmospheres - Part 7: Equipment protection by increased safety "e", Edition 5, Revision Date 06/03/2021
Standard No. UL 60079-11, 6th Ed., Rev. 2018-09-14, Explosive Atmospheres – Part 11: Equipment Protection by Intrinsic Safety “i”
UL 60079-18, STANDARD FOR EXPLOSIVE ATMOSPHERES - PART 18: EQUIPMENT PROTECTION BY ENCAPSULATION 'M', Edition 4, Revision Date 02/07/2019
UL 60079-31, Explosive Atmospheres - Part 31: Equipment Dust Ignition Protection by Enclosure "t", Edition 2, Revision Date 08/13/2020
Standard No. CSA C22.2 No. 60079-0:19, 4th Ed., Issued 2019-02, Explosive atmospheres – Part 0: Equipment – General requirements
CSA C22.2 No. 60079-7, Explosive Atmospheres - Part 7: Equipment Protection by Increased Safety "e", Edition 2, Issue Date 10/2016
Standard No. CAN/CSA-C22.2 No. 60079-11:14, 2nd Ed., Issued 2014-02, Explosive atmospheres — Part 11: Equipment protection by intrinsic safety “i”
CSA C22.2 No. 60079-18, Explosive Atmospheres - Part 18: Equipment Protection by Encapsulation "m", Edition 2, Issue Date 08/2016
CSA C22.2 No. 60079-31, Explosive Atmospheres - Part 31: Equipment Dust Ignition Protection by Enclosure "t", Edition 2, Issue Date 10/2015
UL 61010-1 SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - PART 1: GENERAL REQUIREMENTS- Edition 3 - Revision Date 2019-07-19
CSA C22.2 NO. 61010-1-12 SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - PART 1: GENERAL REQUIREMENTS- Edition 3 - Revision Date 2018-11

Deborah Jennings-Conner

Deborah Jennings-Conner, VP Regulatory Services

UL LLC

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification System for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	**IECEx UL 22.0040X**	Page 1 of 4	Certificate history:
Status:	**Current**	Issue No: 1	Issue 0 (2022-11-14)
Date of Issue:	2023-03-31		
Applicant:	**Dynapar Corporation** 2100 West Broad Street Elizabethtown, NC 28337 **United States of America**		
Equipment:	**Optical Encoder, Models EN42********* and EN44******* **		
Optional accessory:			
Type of Protection:	**Increased Safety "eb", Intrinsic Safety "ia", Encapsulation "mb", Dust Ignition Protection by Enclosure "tb"**		
Marking:	Ex eb ia mb IIC T4 Gb Ex tb IIIC T119°C Db See Annex for Temperature Ratings		

Approved for issue on behalf of the IECEx Certification Body:	**Katy A. Holdredge**
Position:	**Senior Staff Engineer**
Signature: (for printed version)	Katy A. Holdredge
Date: (for printed version)	2023-03-31

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting www.iecex.com or use of this QR Code.

Certificate issued by:

UL LLC
333 Pfingsten Road
Northbrook IL 60062-2096
United States of America

IECEx Certificate of Conformity

Certificate No.:	**IECEx UL 22.0040X**	Page 2 of 4
Date of issue:	2023-03-31	Issue No: 1

Manufacturer: **Dynapar Corporation**
2100 West Broad Street
Elizabethtown, NC 28337
United States of America

Manufacturing locations: **Dynapar Corporation**
2100 West Broad Street
Elizabethtown, NC 28337
United States of America

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements.This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended

STANDARDS :
The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards

IEC 60079-0:2017 Edition:7.0	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-11:2011 Edition:6.0	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
IEC 60079-18:2017 Edition:4.1	Explosive atmospheres - Part 18: Protection by encapsulation "m"
IEC 60079-31:2022-01 Edition:3.0	Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure "t"
IEC 60079-7:2017 Edition:5.1	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"

This Certificate **does not** indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:

Test Reports:

US/UL/ExTR22.0045/00 US/UL/ExTR22.0045/01

Quality Assessment Report:

US/UL/QAR22.0016/00

IECEx Certificate of Conformity

EQUIPMENT:
Equipment and systems covered by this Certificate are as follows:

The equipment is an optical encoder that is intended to be attached to the rotating shaft of a machine. It uses an anodized and/or powder coated aluminum enclosure that has three internal compartments. A compartment at one end of the equipment contains certified 'Ex e' terminals that are used for external connections; external cables enter this compartment via certified 'Ex e' cable glands and any unused entries are blanked by certified 'Ex e' plugs. This 'Ex e' compartment is fitted with a lid that allows access to the terminals. The compartment at the other end of the encoder contains 'Ex m' devices that include an encapsulated printed circuit board assembly. The central compartment houses an optically encoded disc, this is fitted to a shaft that emerges from the wall of the compartment. The disc is fitted with an optical reading device that is protected by intrinsic safety, 'Ex ia', however, there are no intrinsically safe inputs or outputs.

An alternative version of the equipment is fitted with a permanently connected cable. This version of the equipment has no Ex 'e' terminal compartment. Entry of the cable is again via an 'Ex e' cable gland.

Please see Annex for additional information.

SPECIFIC CONDITIONS OF USE: YES as shown below:

- All cable entry holes shall be fitted with either an IECEx certified cable gland or an IECEx certified stopping plug that is suitable for the application. The type of cable, glands and stopping plugs shall have temperature ratings of at least 100°C.
- The MSB series terminals shall only be fitted with wires that have cross sectional area falling within the following limitations:
  - Rigid: 0.08 mm^2 to 4 mm^2
  - Flexible: 0.08 mm^2 to 2.5 mm^2
- The equipment shall be supplied from a power supply that has an output that is isolated from earth.
- Under certain extreme circumstances, the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

IECEx Certificate of Conformity

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above)
Issue 1: Update to temperature range and diameter for bearing. Update IEC 60079-31 to 3rd edition.

Annex:

Annex to IECEx UL 22.0040X Issue 1.pdf

IECEx Certificate of Conformity

Certificate No.: IECEx UL 22.0040X

Issue No.: 1

TYPE DESIGNATION AND PARAMETERS RELATING TO THE SAFETY

Optical encoders, models EN42aaaabcdef and EN44aaaabcd rated Um = 250 V and as depicted in model code

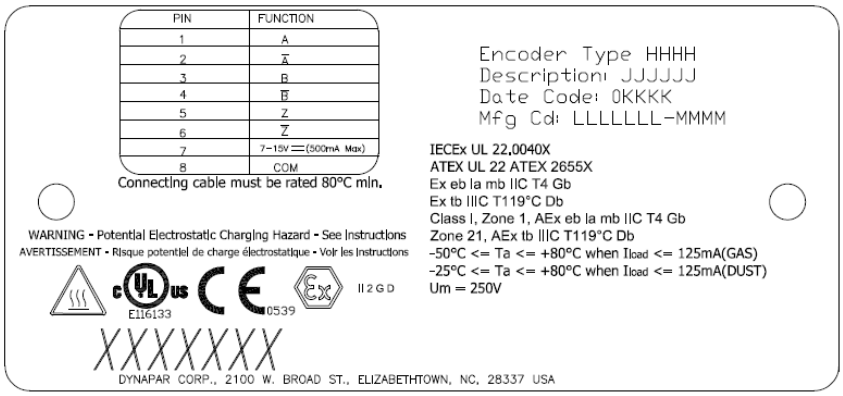
Where: a = 0000-9999 representing Pulse Per Revolution.
b = single alphamerical digit representing Bore Size.
c = Output
0 – Differential AB, 7-15 V in, 500 mA max input, 7-15 V out*
1 – Differential AB, 7-26 V in, 500 mA max input, 5 V out*
2 – Differential ABZ, 7-15 V in, 500 mA max input, 7-15 V out*
3 – Differential ABZ, 7-26 V in, 500 mA max input, 5 V out*
4 – Differential ABZ, 10-30 V in, 400 mA max input, 10-30 V out*

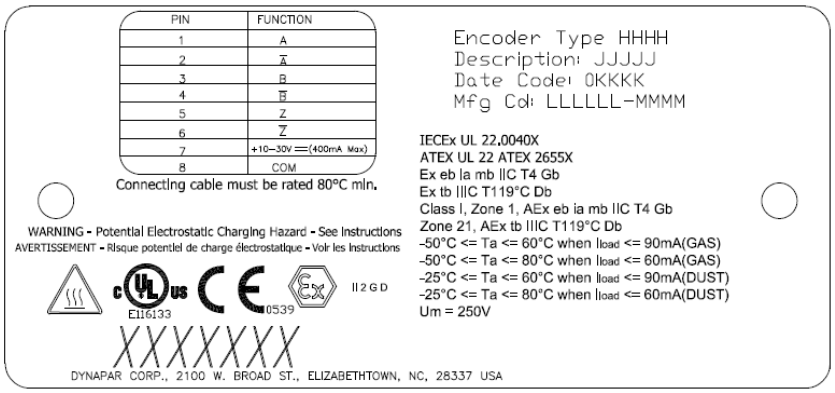
Option	Output current	Group II Ambient Temperature Range	Group III Ambient Temperature Range
0 or 2	125mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
1 or 3	10mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
1 or 3	15mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C
4	90mA max per channel	Ta = -50°C to +60°C	Ta = -25°C to +60°C
4	60mA max per channel	Ta = -50°C to +80°C	Ta = -25°C to +80°C

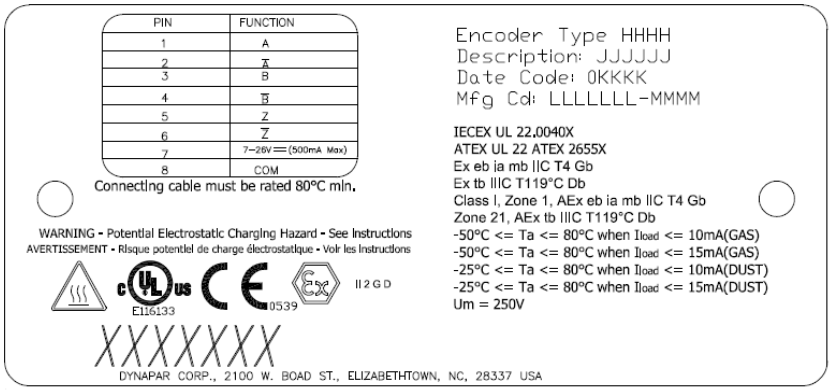
d = Single numerical digit representing termination options.
e = single numerical digit representing Tether options.
f = single numerical digit representing cover options.

MARKING

Marking has to be readable and indelible; it has to include the following indications:







IECEx Certificate of Conformity

Certificate No.: IECEx UL 22.0040X

Issue No.: 1

ROUTINE EXAMINATIONS AND TESTS

Each piece of equipment defined above has to have successfully passed before delivery:

1. All complete manufactured units shall be subjected to a routine 500V r.m.s. a.c. between all terminals and the equipment enclosure, in accordance with Clause 10.3 of IEC 60079-11 Sixth Edition.
2. All manufactured units shall be subjected to a visual inspection on the encapsulation. No damage shall be evident such as cracks in the compound, exposure of the encapsulated parts, flaking, inadmissible shrinkage, swelling, decomposition, failure of adhesion or softening.

LIST OF CERTIFIED COMPONENTS

Product	Certificate Number	Standards
Terminal Block, Part No. MSB 2,5***, MSDB 2,5***, manufactured by PHOENIX CONTACT GmbH & Co.KG	IECEx PTB 08.0048U	IEC 60079-0: 2017/ Ed.7.0 IEC 60079-7: 2017/Ed.5.1

Declaration of EU-Conformity

Manufacturers Name: **Dynapar**
Manufacturers Address: 2100 W. Broad St.
Elizabethtown, NC 28337

Representative in the EU:
Hengstler GmbH
Uhlandstr. 49
78554 Aldingen

Notified Body:
UL International Demko A/S
Borupvang 5A
2750 Ballerup, Denmark

Product Type: Optical Encoder
Model Names: EN42 & EN44

We declare to the best of our knowledge that the products listed above comply with the essential requirements of the directives and standards listed below.

Directives:

EMV/EMC	2014/30/EU	
RoHS	2011/65/EU	
ATEX	2014/34/EU	II 2G D Ex ia mb eb IIC T4 Gb Ex tb IIIC T119°C Db

Standards:

EN 61326-1:2013*
EN 55011:2016+A1:2017
EN IEC 63000:2018
EN60079-31:2014
Immunity: Industrial environment
Emission: Group 1 Class B

EN IEC 60079-0:2018
EN 60079-11:2012
EN 60079-7:2015/A1:2018
EN 60079-18:2015+A1:2017

ATEX Certificates:
EC Type Examination Certificate UL 22 ATEX 2655X

* The connection cable must be shielded, less than 30 meters in length and not connected to a DC supply network.

Cornell Turrentine
Quality Manager - Dynapar
Date of issue: October 25, 2022

Brad Stecker
ATEX Representative - Dynapar

This declaration certifies the accordance with the above-mentioned directives. It does not, however, constitute a guarantee of features. Please observe the Safety Notes of the product documentation attached.

702825-0001 Rev. K