

# BEI H38 Explosion Proof Optical Encoder



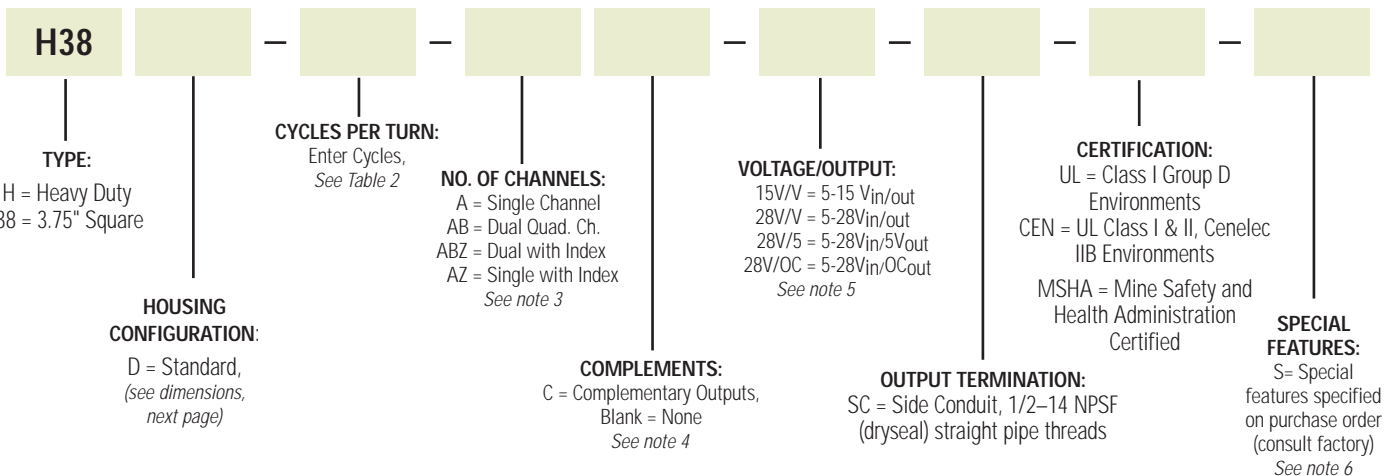
TERMINAL PIN NO.	INCREMENTAL OUTPUT	8 BIT GRAY CODE OUTPUT*
1	CASE GRND.	CASE GRND.
2	0V	0V
3	+V	+V
4	A	G0
5	B	G1
6	Z	G2
7	$\bar{A}$	G3
8	$\bar{B}$	G4
9	$\bar{Z}$	G5
10	SPARE	G6
11	SPARE	G7

\*For higher resolutions, see Absolute Encoder Options on pages 40-41.

The H38 is an explosion proof version of the field-proven H25 encoder series. The H38 is UL certified for NEMA Class 4X and 6 (outdoor non-hazardous locations) and Class 4X and 13 (indoor non-hazardous locations). It is available with Class 1, Group D, Division 1 or Class 2, Division 1 Group E, F, and G rating for use in hazardous locations. It features a standard shaft seal, double bearing seals, and a cast aluminum housing with hard anodized and dichromate sealed finish. The H38 is suitable for use in petroleum service industries, solvent refining operations, spray painting applications, and explosive dust environments.

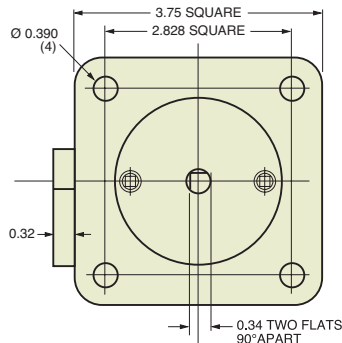
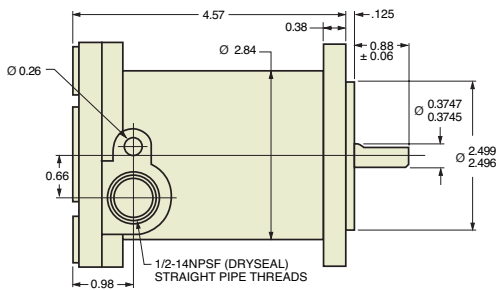
## H38 Explosion Proof Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example:H38D-2000-ABZC-28V/V-SC-CEN). All notes and tables referred to can be found on pages 50-51.

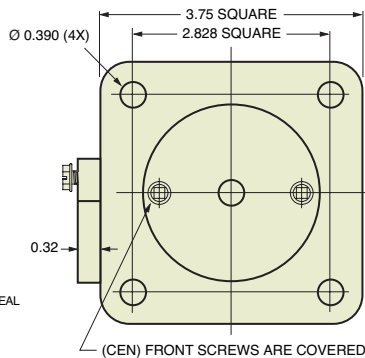
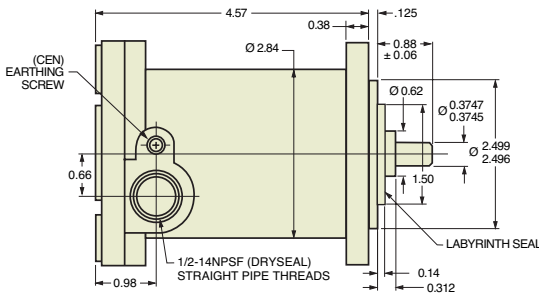


# Incremental Encoders

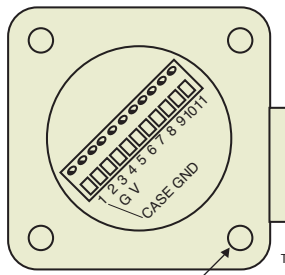
UL



CEN

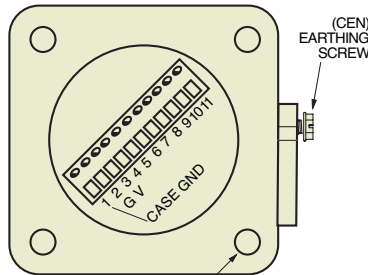


Rear View



UL

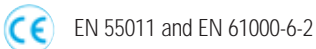
TOLERANCES:  
XX = ± 0.01,  
XXX = ± 0.005



CEN

## Certifications

The H38 Explosion Proof Encoder is available with the following certifications:



The Mine Safety and Health Administration (MSHA) is an organization that operates in the United States and enforces compliance with safety and health standards in the Nation's mines.

## Mechanical Specifications

**Shaft Diameter:** 3/8" nominal

**Flats On Shaft:** Two flats, 0.80" long X 0.30" deep at 90°

**Shaft Loading:** Up to 40 pounds axial and 20 pounds radial applied 1/4" from housing

**Shaft Runout:** 0.0005 T.I.R.

**Starting Torque at 25° C:** 4.0 in-oz (max)

**Bearings:** Class ABEC 7 standard

**Shaft Material:** 303 stainless steel

**Enclosure:** Die cast aluminum, hard anodized with dichromate sealed finish. Shaft seals and sealed bearings are standard to achieve environmental ratings.

**Bearing Life:** 2 X 10<sup>8</sup> revs (1300 hrs at 2500 RPM) at rated load; 1 X 10<sup>10</sup> revs (67,000 hrs at 2500 RPM) at 10% of rated load

**Maximum RPM:** 10,000 RPM (see Frequency Response, below)

**Moment of Inertia:** 4.1 X 10<sup>-4</sup> oz-in-sec<sup>2</sup>

**Weight:** 64 oz typical (approx 4 lbs)

## Electrical Specifications

**Code:** Incremental or Absolute (see Absolute version, pg 37)

**Output Format:** 2 channels in quadrature, 1/2 cycle index gated with negative B channel, or Absolute to 13 bits

**Cycles per Shaft Turn:** 1 to 72,000 (see table 2).

For resolutions above 3,600 see interpolation options on pages 32 and 32); Absolute to 8192 counts per turn

**Supply Voltage:** 5 to 28 VDC available

**Current Requirements:** 100 mA typical +output load, 250 mA (max)

**Voltage/Output:** (see note 5)

15V/V: Line Driver, 5–15 VDC in, V<sub>out</sub> = V<sub>in</sub>

28V/V: Line Driver, 5–28 VDC in, V<sub>out</sub> = V<sub>in</sub>

28V/5: Line Driver, 5–28 VDC in, V<sub>out</sub> = 5 VDC

28V/OC: Open Collector, 5–28 VDC in, OC<sub>out</sub>

**Protection Level:** Reverse, overvoltage and output short circuit (See note 5)

**Frequency Response:** 100 KHz, Up to 1MHz with interpolation option (see note 7)

**Output Terminations:** See Table 1, opposite page

**Termination Type:** Compression type, UL recognized. Accepts AWG 14 to 22, stranded wire, strip 1/4"

**Note:** Consult factory for other electrical options

## Environmental Specifications

**Enclosure Rating:** NEMA 4 X & 6 (IP66), outdoor Non-Hazardous locations, NEMA 4 X & 13 (IP66), indoor Non-Hazardous locations

**Temperature:** Operating, 0° to 70° C; extended temperature testing available (see note 8, pg 50); 80° C max for UL and CEN approved units; storage; -25° to 90° C unless extended temperature option called out.

**Shock:** 50 g's at 11 msec

**Vibration:** 5 to 2000 Hz @ 20 g's

**Humidity:** 100% RH

**Hazardous Area Rating:** Underwriters Laboratories listed for use in hazardous locations; NEMA Enclosure 7, Class 1, Group C & D, Division 1, NEC Class 2 circuits only, or Class 2, Groups E, F, and G

**NOTES & TABLES:** All notes and tables referred to in the text can be found on pages 50 and 51.

# Notes and Tables

1. Mounting is usually done either using the D-style square flange mount, E- or G-style servo mounts, or one of the standard face mounts, F1 for example. Consult factory for additional face mount options.
2. The shaft seal is recommended in virtually all installations. The most common exceptions are applications requiring a very low starting torque or those requiring operation at both high temperature and high speed.
3. Non-standard index widths and multiple indices are available by special order. Consult factory.
4. Complementary outputs are recommended for use with line driver type (source/sink) outputs. When used with differential receivers, this combination provides a high degree of noise immunity.

## 5. Output IC's

Output IC's are available as either Line Driver (LD) or NPN Open Collector (OC) types. Open Collectors require pull-up resistors, resulting in higher output source impedance (sink impedance is similar to that of line drivers). In general, use of a Line Driver style output is recommended. Line Drivers source or sink current and their lower impedance mean better noise immunity and faster switching times. **Warning:** Do not connect any line driver outputs directly to circuit common/OV. Those may damage the driver. Unused outputs should be isolated and left floating. Our applications specialists would be pleased to discuss your system requirements and the compatibility of your receiving electronics with Line Driver type outputs.

### 28V/V

Multi-voltage Line Driver (7272\*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard (Note:  $V_{out} = V_{in}$ ). This driver is TTL compatible when used with 5 volt supply. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 120 mA typical (plus load current). This is the recommended replacement for 3904R and 7406R open collector outputs with internal pullup resistors. It is also a direct replacement for any 4469, 88C30, 8830 or 26LS31 line driver

### 28V/5

Multi-voltage Line Driver (7272\*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard, internally regulated with 5V (TTL compatible) logic out. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 90 mA typical (plus load current).

\* Products manufactured prior to April 2007 used the line driver IC number instead of voltage output in model number.

## 15V/V

Multi-voltage Line Driver (4469\*): 100 mA source/sink. Input voltage 5 to 15 VDC +/- 5% standard (Note:  $V_{out} = V_{in}$ ). TTL compatible when used with 5 volt. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 90 mA typical (plus load current). This is a direct replacement for the 4469 Line Driver.

## 28V/OC

NPN Open Collector (3904\*, 7273\*). Current sink of 80 mA max. Current sourced by external pull-up resistor. Output can be pulled up to voltage other than supply voltage (30 V max). Input voltage 5 to 28 VDC +/- 5% standard. Supply current is 120 mA typical. This replaces prior IC's with designations of 3904, 7406, 3302, 681 and 689.

## 5V/OCR, 15V/OCR, 24V/OCR

Open Collector (3904R\*, 7406R\*, 7273R\*): Current sink of 70 mA max. Includes internal pull-ups sized at approximately 100 ohms/volt. Max current source is 10 mA. Supply current is 100 mA typical, 120 mA with internal pull-ups. The 5V/OCR, 15V/OCR and 24V/OCR are often replaced by the 28V/V in system upgrades.

## 3904, 3904R, 4469, 5V/V, 5V/OC, 5V/OCR, 9V/OC

Intrinsically safe line driver and open collector outputs. These drivers are specific to intrinsically safe encoders, and are installed per the appropriate control drawings listed in Table 2.1 on page 48.

6. Special -S at the end of the model number is used to define a variety of non-standard features such as special shaft lengths, voltage options, or special testing. Please consult the factory to discuss your special requirements.
7. Higher frequency response may be available. Please consult with the factory.
8. Extended temperature ratings are available in the following ranges: -40 to 70°C, -40 to 85°C, -20 to 105°C and -40 to 105°C depending on the particular model. Extended temperature ranges can affect other performance factors. Consult with factory for more specific information.
9. Mating straight plug receptacles may be ordered from the factory:
  - For M12 use MS3116F12-10S
  - For M14 use MS3106F14S-6S
  - For M14/19 use MS3116J14-19S
  - For M16 use MS3106F16S-1S
  - For M18 use MS3106F18-1S
  - For M20 use MS3106F20-29S

For additional Accessories refer to page 46.

For standard pinouts, refer to the facing page.

## Table 1: Incremental Output Terminations

The connector style will determine pinouts. For example, an encoder with ABC channels and an M18 connector uses the table to the right.

M14 CONNECTOR	M16 CONNECTOR	CHANNELS DESIGNATED IN MODEL NO.	
PIN	PIN	ABZ	ABC
E	A	A	A
D	B	B	B
C	C	Z	$\overline{A}$
B	D	+V (SUPPLY VOLTAGE)	
F	E	—	$\overline{B}$
A	F	0 V (CIRCUIT COMMON)	
	G	CASE GROUND (CG) (except H20)	

M18 CONNECTOR	
PIN	CHANNEL
A	A
B	B
C	Z
D	+V
E	—
F	0V
G	CG
H	$\overline{A}$
I	$\overline{B}$
J	$\overline{Z}$

WIRE COLOR (22AWG)	DA 15P CONNECTOR	CHANNELS DESIGNATED IN MODEL NO.		
		ABZ	ABC	ABZC
YEL	13	A	A	A
BLUE	14	B	B	B
ORN	15	Z	—	Z
W-Yel	10	—	$\overline{A}$	$\overline{A}$
W-Blu	11	—	$\overline{B}$	$\overline{B}$
W-Orn	12	—	—	$\overline{Z}$
RED	6	+V (SUPPLY VOLTAGE)		
BLK	1	0 V (CIRCUIT COMMON)		
GRN	9	CASE GROUND (CG) (except H20)		
WHITE		SHIELD DRAIN (Shielded Cable Only)		

M12 CONNECTOR	
PIN	CHANNEL
A	A
B	B
C	Z
D	+V
E	—
F	0V
G	CG
H	$\overline{A}$
J	$\overline{B}$
K	$\overline{Z}$

## Table 2: Disc Resolutions for Incremental Encoder Models H25, H38, H40, L 25, E25

Resolutions highlighted with    are available as standard **Model H25 EXPRESS ENCODERS**® that ship in one to three days.

1, 2, 3, 5, 6, 7, 8, 10, 13, 16, 20, 24, 25, 26, 30, 32, 33, 34, 36, 37, 40, 45, 48, 50, 51, 56\*, 60, 64, 66, 72, 75, 80, 86, 88, 90, 100, 102, 120, 122, 125, 127, 128, 132, 144, 148, 150, 158, 160, 175, 176, 180, 187, 192, 200, 202, 204\*, 217, 220, 240, 250, 254, 255, 256, 264\*, 274, 280, 283, 288, 292, 300, 312, 320, 321, 325, 360, 366, 372, 375, 377, 380, 381, 384, 385, 393, 400, 430, 432, 450, 462, 480, 490, 500, 502, 508, 512, 522, 530, 550, 560\*, 576, 598, 600, 604, 625, 628, 635, 638, 640, 660, 672, 676, 680, 687, 690, 700, 720, 725, 735, 740, 744, 748, 750, 762, 768, 780, 785, 800, 812, 825, 850, 864, 878, 888, 900, 912, 914, 938, 942, 955, 960, 1000, 1016, 1024, 1030, 1035, 1036, 1040, 1054, 1056, 1074, 1076, 1080, 1088, 1100, 1101, 1125, 1136, 1200, 1237, 1250, 1257, 1270, 1280, 1300, 1314, 1332, 1333, 1390, 1400, 1414, 1427, 1440, 1484, 1500, 1562, 1570, 1596, 1600, 1650, 1666, 1718, 1745, 1774, 1800, 1840\*, 1850, 1855, 1875, 1894, 1920, 1952, 1968, 1979, 1995, 2000, 2048, 2080, 2094, 2100, 2160, 2164, 2199, 2200, 2250, 2356, 2400, 2485, 2500, 2514, 2519, 2540, 3000, 3125, 3600, 4000, 4096, 5000

\*AB or ABC output only. NOTE: Resolutions up to 72,000 are available.

For Model H20 Resolutions See Table A on Page 18.

For Model HS35 Resolutions See Table A on Page 23.

For Model HS25 Resolutions See Table A on Page 20.

For Model L15 Resolutions See Table A on Page 31.

For Model HS45 Resolutions See "Cycles per Turn" in Ordering Information.