HS25 Incremental Optical Encoder

BEI SENSORS



The HS25 combines the rugged, heavy-duty features usually associated with shafted encoders into a hollow-shaft style. Its design includes dual bearings and shaft seals for NEMA 4, 13 and IP65 environmental ratings, a rugged metal housing, and a cable gland.

This low-profile design, just 2" deep, is easily mounted on a through shaft. Securing the encoder to the shaft is simple with a collet-style single screw clamp. The optional anti-rotation tether block maintains housing stability during operation. The HS25 is designed to accommodate shafts up to 3/4" in diameter. With optional insulating inserts, it can be mounted on smaller diameter shafts. Applications include motor feedback and vector control, paper converting and printing industries, robotic control, web process control along with many other applications.

Special Models of the HS25 Incremental Encoder are available with one or more of the following certifications. Consult factory for details.

- EN 55011 and EN 61000-6-2
- U.S. Standards Class I, Group A,B,C & D; Class II Group E,F & G
- UL 12.0035X, UL 13.0071X
- Canadian Standards Class I, Zone 0, Group IIC
- CENELEC II 1 G Ex ia IIB/IIC T4, II 3 G Ex nA IIB T4 Gc
- Class I, Div 2, Group A,B,C & D; Class II, Div 2, Group F & G

Mechanical Specifications

Shaft Bore: 0.375", 0.750", 0.625", 0.500", dia. 0.625" and under are supplied with insulating sleeves.
Allowable Misalignment: 0.005: T.I.R. on mating shaft 0.75" from shaft end
Bore Runout: 0.001" T.I.R.
Starting Torque at 25° C: Through shaft version (SS) = 7 in-oz (max); Blind shaft version (BS) = 4 in-oz (max)
Bearings: 52100 SAE high carbon steel
Shaft Material: 6061-T6 aluminum alloy
Bearing Housing: Die cast aluminum with protective finish
Cover: Die cast aluminum with protective finish
Bearing Life: 7.5 X 10^9 revs (25,000 hrs at 2500 RPM)
Maximum RPM: 6,000 RPM (see Frequency Response, below)
Moment of Inertia: 17 X 10^{-4} oz-in-sec^2
Weight: 9 oz typical

Electrical Specifications

Code: Incremental
Output Format: 2 channels in quadrature, 1/2 cycle index gated with negative B channel
Cycles per Shaft Turn: up to 2048 (see table A, this page)
Supply Voltage: 5 to 28 VDC available (see note 5)
Current Requirements: 100 mA typical + output load, 250 mA (max)
Voltage/Output: (see note 5)
15V/V: Line Driver, 5–15 VDC in, $V_{out} = V_{in}$
28V/V: Line Driver, 5–28 VDC in, $V_{out} = V_{in}$
28V/5: Line Driver, 5–28 VDC in, V_{out} = 5 VDC
28V/OC: Open Collector, 5–28 VDC in, OC_{out}
Protection Level: Reverse, overvoltage and output short circuit
Frequency Response: 100 kHz (see note 7)
Output Terminations: (see table 1, back page)
Note: Consult factory for other electrical options

Environmental Specifications

Enclosure rating: NEMA 4 & 13 (IP65) when ordered with shaft seal and a cable gland.
Temperature: Operating, 0º to 70ºC; extended temperature testing up to 85ºC available (see note 8); Storage, -25º to 90º C unless extended temperature option called out
Shock: 50 g's for 11 msec duration
Vibration: 5 to 2000 Hz @ 20 g's
Humidity: 98% RH non-condensing

NOTES & TABLES: All notes and tables referred to in the text can be found on the back of this page.

HS25 Incremental Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: **HS25F-62-R1-SS-1024-ABZC-28V/V-SCS18**).
All notes and tables referred to can be found on the back of this page.

[ ] **HS25** [ ] – [ ] – [ ] – [ ] – [ ] – [ ] [ ] – [ ] – [ ] – [ ] – [ ]

- [ ] = X = Express Encoder
- **TYPE:** HS = Hollow Shaft; 25 = 2.5" Encoder Diameter
- [ ] **HOUSING CONFIG:** F = Standard
- **SHAFT BORE:** 75 = 0.750"; 62 = 0.625"; 50 = 0.50"; 37 = 0.375"
- **TETHER:** Blank = None; R1 = Tether Block and Pin; R2 = Tether Arm
- **SHAFT SEAL CONFIGURATION:** SS = Through Shaft Rubber Seals; BS = Blind Shaft Rubber Seal; FS = Through Shaft Felt Seals; BFS = Blind Shaft Felt Seal *See note 2*
- **CYCLES PER TURN:** (Enter Cycles) *See table A*
- **NO. OF CHANNELS:** A = Single Channel; AB = Dual Quad. Ch.; ABZ = Dual with Index; AZ = Single with Index *See note 3*
- **COMPLEMENTS:** C = Complementary Outputs *See note 4*
- **VOLTAGE/OUTPUT:** 28V/V = 5–28$V_{in/out}$; 28V/5 = 5–28V_{in}/5V_{out}; 28V/OC = 5–28V_{in}/OC_{out} *See note 5*
- **OUTPUT TERMINATION:** SM12 = MS3112E12-10P; SCS = Shielded, Jacketed Cable with Cable gland seal and cable length in inches, (i.e. SCS18 = 18 inches); SCS18-M18 = SM18 connector on end of cable with length specified in inches (i.e. SCS18-M18); M18 = MS3101F18-1P *See table 1 and note 9*
- **HAZARDOUS AREA RATINGS:** Blank = None; EX = Intrinsically Safe; NI = Non-Incendive Contact factory for voltage options
- **SPECIAL FEATURES:** S = Special features specified on purchase order (consult factory) *See note 6*

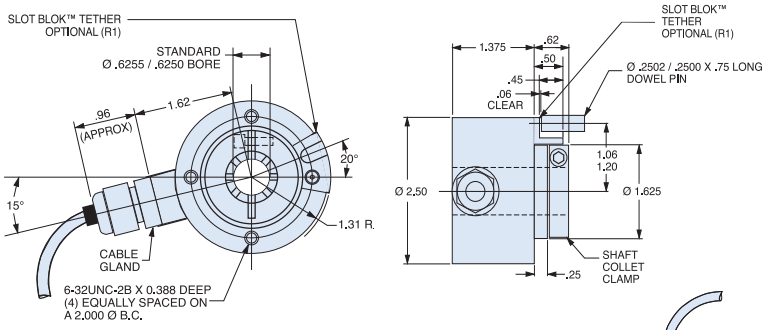
EXPRESS ENCODERS Items highlighted with [ ] are standard Express Encoders and ship in one to three days.

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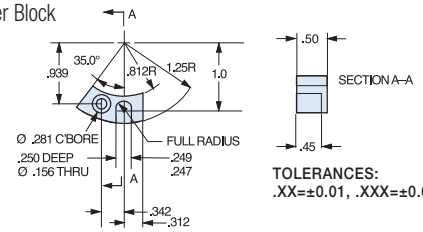
These commodities, technology or software if exported from the United States must be in accordance with the Bureau of Industry, and Security, Export Administration regulations. Diversion contrary to U.S law is prohibited.

Dimensions

Thru Shaft Version

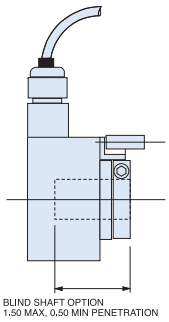


R1 Tether Block and Pin

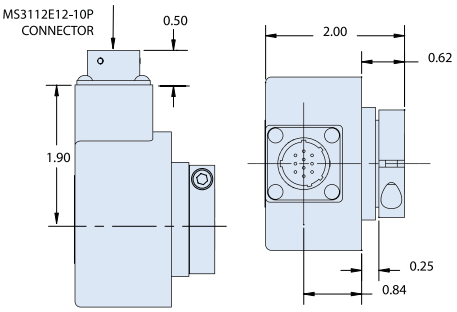


TOLERANCES:
.XX=±0.01, .XXX=±0.005

Blind Shaft Version



M12



R2 Tether Arm

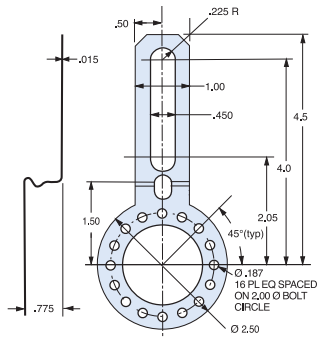


Table A

HS25 Disc Resolutions

10 12 60 88 100 122 250 360 500 512 1000 1024 2000 2048

Other resolutions available—consult factory.

Figure 1

Output Waveform

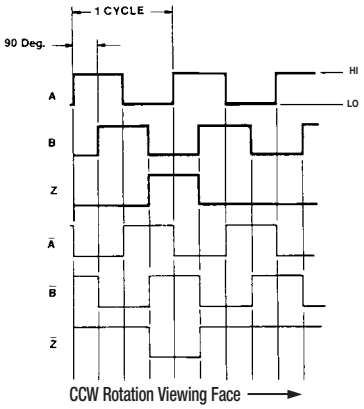


Table 1

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.

M18 CONNECTOR		M12 CONNECTOR	
PIN	CHANNEL	PIN	CHANNEL
A	A	A	A
B	B	B	B
C	Z	C	Z
D	+V	D	+V
E	—	E	—
F	0V	F	0V
G	CG	G	CG
H	A	H	$\overline{A}$
I	B	J	$\overline{B}$
J	Z	K	$\overline{Z}$

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)	

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)		

Notes

1. The typical hollow shaft product is supported by, and clamped to, the driving shaft. A flexible tether is used to keep the housing from rotating.

2. The rubber 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. For these exceptions, a felt shaft seal is recommended. Felt seals require very low starting torque and can virtually eliminate frictional heat. Encoders ordered with felt shaft seals will have an enclosure rating of IP50 and will have less than 1/10th the Starting Torque specified under Mechanical Configurations.

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/0V, which 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).

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. 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. Some models can operate down to -55°C. 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

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