BEI

Optical Encoder Design & Specifying Guide

BEI INDUSTRIAL ENCODER DIVISION

BEI TECHNOLOGIES, INC.

BEI Technologies Industrial Encoder Division

Dear Customer,

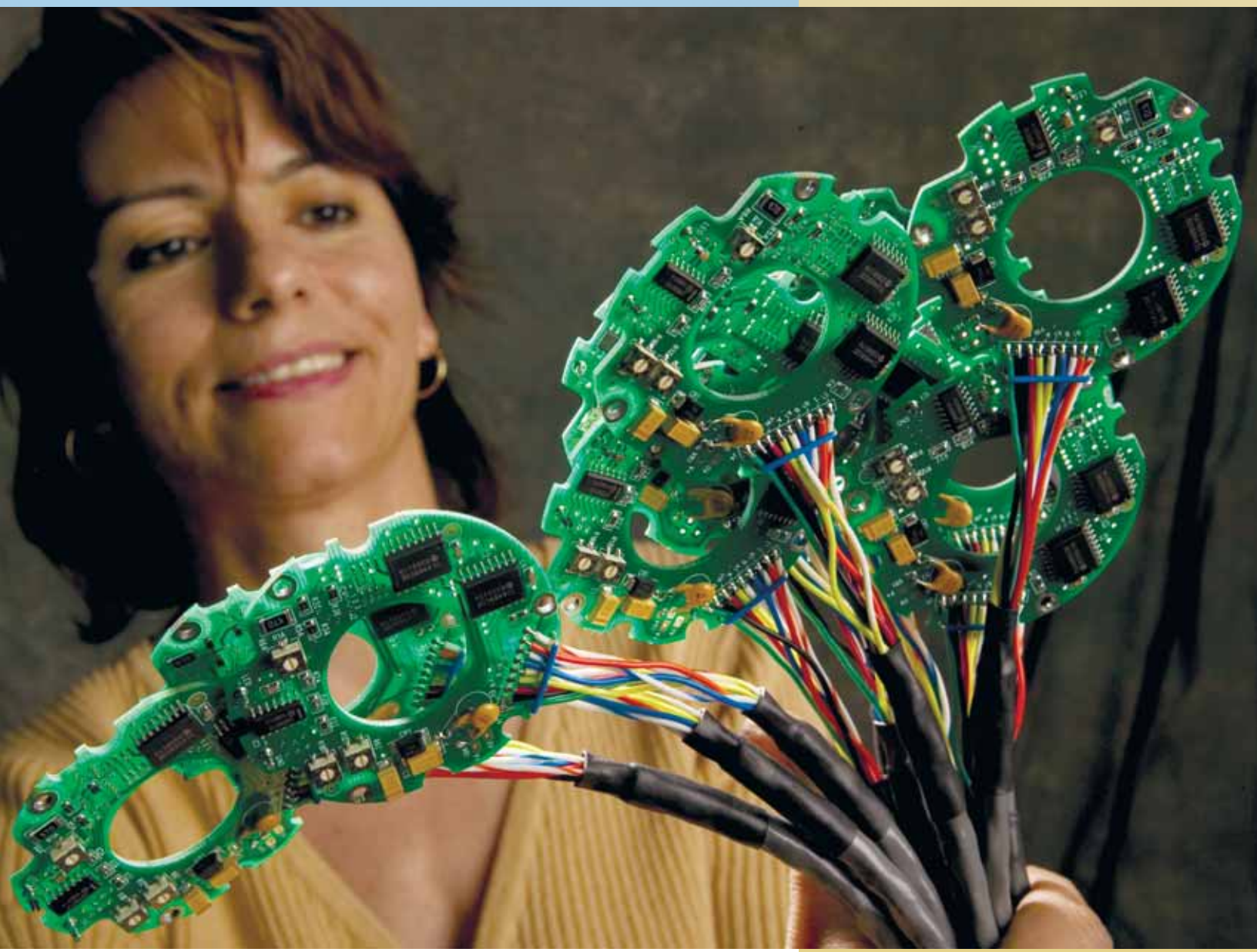
You have in your hand a brochure featuring some of the finest position-sensing devices in the world. As an industrial consumer, you demand the highest quality and reliability in the products you purchase. With over 27 years in the industrial encoder business we understand your needs and have designed products of uncompromising quality and performance. BEI has grown to be the leader in the industrial encoder market by keeping promises and standing by our customers. Chances are you heard about us from one of your colleagues. Word of mouth has always been our best advertising.

Please call the factory on our toll free line with any questions regarding our products or your application. You will find that our professional applications engineers and order specialists are both knowledgeable and easy to talk with. We challenge you to keep us busy helping you find more and better ways to use our products.

Our customers' satisfaction is the key to our growth. So, if you are ever unhappy for any reason with any aspect of our performance and do not receive what you feel is a satisfactory resolution, please contact me directly and I will make every effort to address your concerns. After all, our continued success depends on it.

Sincerely,

Glenn Avolio,
Vice President,
BEI Technologies, Inc
General Manager,
Industrial Encoder Division



The Industrial Encoder Division (IED)

of BEI Technologies, Inc. was founded almost 30 years ago. Our goal was to produce well-made optical encoders specifically for the industrial marketplace. We also wanted to create a new standard for excellence by providing on-time delivery, customer support and reasonable lead times—all at a fair price. Today, as an ISO registered company, we continue to build on that tradition.

Our products have grown to include electronic interfaces, accessory items and specialized products, like those certified for hazardous area use, wash-down environments, and so on. We offer lead times of one to three days on standard Express Encoders®, and two weeks on a wide variety of custom encoders

High manufacturing standards, certified to ISO9001:2000 include inspection of dozens of individual electrical parameters on every encoder produced, as well as confirming each unit's mechanical compliance with its particular specifications. We stand firmly behind all of our products with a full two-year warranty.

CONTINUED ON NEXT PAGE

At IED, Quality Is a Team Effort

(specialty products can take a little longer). We regularly fulfill our delivery commitments with an average on-time delivery record of better than 99%, and have done so since we started.

Our custom-designed factory and office facilities near Santa Barbara, California ensure an efficient flow of production, in which all critical manufacturing processes are tightly controlled. High manufacturing standards, certified to ISO9001:2000 include inspection of dozens of individual electrical parameters on every encoder produced, as well as confirming each unit's mechanical compliance with its particular specifications. We stand firmly behind our products with a two-year warranty.

We have grown since those early days to have three full-time applications specialists to help with your particular technical needs— whether you want to build a model number or need assistance in troubleshooting an interface issue. Our dedicated order entry staff can also help you specify and order a unit that will meet your exact requirements. What's more, we provide this high level of service to an active customer base of thousands of companies…it's what we do.

Presale service. Guaranteed on-time shipment. Top quality product and technical support. Since modest beginnings nearly 30 years ago, we've preserved the founding ideals of our company and remain committed to customer satisfaction as our top priority. BEI is proud to be the leader in the industrial encoder marketplace.

From our manufacturing team (top of page) to our applications engineers and order specialists (shown above) , everyone at IED works together toward a common goal—produce the best products and deliver the best customer service found anywhere.

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Using This Guide

This guide has been designed to provide you with a wide range of information on the products offered by BEI Technologies' Industrial Encoder Division.

The Design Guide on pages 8 to 15 provides assistance for design engineers in specifying the proper encoder for the desired application.

Pages 16 through 39 detail the encoders that comprise our basic product line. Pages 40 through 46 discuss optional features and accessories for basic encoder models.

Pages 47 through 51 contain hazardous area information, regulatory information, and notes and tables that are referred to throughout the preceding pages.

Ordering Optical Encoders from BEI

The ordering information block that accompanies the description of each of our basic products gives detailed instructions for the construction of a model number. This system allows you to take full advantage of the tremendous diversity of product configurations offered by BEI.
If you have questions regarding applications or the construction of a model number, we are always happy to assist you.

Phone: 800-350-ASAP (2727) or 805-968-0782. Fax: 805-968-3154.

BEI Technologies, Inc.
Industrial Encoder Division
7230 Hollister Avenue
Goleta, California 93117

Specifications are subject to change without notice.

Retrofits and Crossovers

As a leader in the manufacture of optical encoders, BEI's Industrial Encoder Division can also offer expertise in crossing over a wide variety of encoders from other manufacturers, both foreign and domestic. We maintain a thorough library of encoder specifications and dimensional information covering a wide range of competitive products. If we cannot quote a replacement unit from one of our three encoder divisions, we may be able to guide you to an appropriate manufacturer or repair facility to help solve your problem. We are aware of the importance of time in a machine-down situation and handle crossover requests in the most expeditious manner possible.

Service and Repair

All encoders produced by the Industrial Encoder Division are backed by our two-year warranty. If anything goes wrong, give us a call. Our trained service personnel can often troubleshoot a problem over the phone and determine if your encoder needs to be sent in for repair. They will perform a thorough evaluation and recommend a course of action. In emergency situations an evaluation and repair can be underway within minutes after the encoder is received at our dock.

Engineering Support

Our on-site sales and engineering staff is available to help support your engineering needs—from deciding what type of encoder to buy, all the way through helping with the interface to your measurement or control system. In addition, a regional sales manager or manufacturer's representative is available locally to help with your system needs.

Product Specifying Assistance

This Specifying Guide covers most of the requirements of the industrial marketplace. If we can explain some of the available options or you have some special requirements, please give us a call. Over the years we have developed more than 17 million variations on the basic encoder, and chances are we can answer your specific need.

Get the Right Encoder… Right Away

EXPRESS ENCODERS® are popular configurations of our standard model encoders that can be built and shipped quickly. With six package styles (four incremental and two absolute) to chose from, over 2000 different configurations —that will meet just about any need— are available as Express Encoders.

Refer to the pages in this catalog for the **Models H25, H20, HS25** and **HS35 Incremental Encoders,** and the **Models H25** and **HS35 12 bit Absolute Encoders.** In the **Ordering Options** block at the bottom of these pages you will see the blue **EXPRESS ENCODERS** highlight bar. By selecting from the highlighted options when constructing your model number, you will specify an Express Encoder for your particular application.

Express Encoders ship in three days or less. We pay the freight for UPS 2nd Day Delivery when shipping to an address in the continental United States. Certain models in the Express line are **kept in stock for same day shipment** (when ordered by 2pm PST).

If you need applications assistance, we are always just a phone call away. Our applications specialists are available to help with your encoder selection. Just call **1-800-ENCODER** (800-362-6337) and ask for technical assistance.

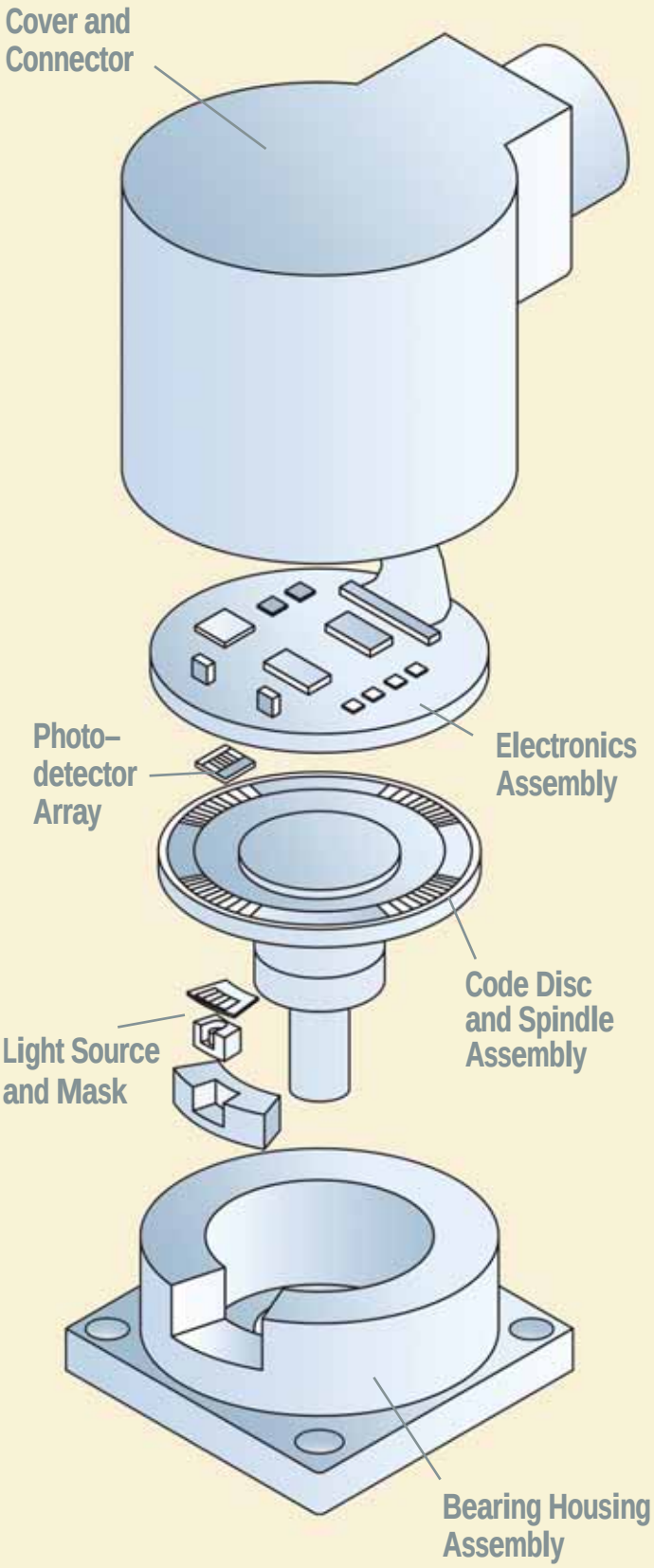
INCREMENTAL ENCODERS

Model Number	Resolution (Max)	Output Format	Sealing (Max)	Output Type	Diameter	Mounts	Hazardous Rating Options
PAGE 31 **L15**	5000	ABZC	IP53	DLD	1.5"	Servo Face	
PAGE 18 **H20**	2048	ABZC	IP66	DLD OC 5V Reg	2.0"	Square Flange Servo Face	CSA
PAGE 16 **H25**	72,000	ABZC	IP66	DLD OC 5V Reg	2.5 "	Square Flange Servo Face	CSA Cenelec UL ATEX
PAGE 30 **L25**	18,000	ABZC	IP43	DLD OC 5V Reg	2.5 "	Servo Face	
PAGE 30 **E25**	18,000	ABZC	IP43	DLD OC 5V Reg	2.5 "	Face	
PAGE 26 **H38**	72,000	ABZC	IP66	DLD OC 5V Reg	3.75"	Square Flange	Explosion Proof I, II
PAGE 28 **H40**	72,000	ABZC	IP66	DLD OC 5V Reg	4.0" Sq.	Square Flange Foot Mount	Explosion Proof I
PAGE 20 **HS25**	2048	ABZC	IP52	DLD OC 5V Reg	2.5"	Shaft Mount with Tether	Cenelec ATEX
PAGE 22 **HS35**	10,000	ABZC	IP65	DLD OC 5V Reg	3.5"	Shaft Mount with Tether	Cenelec ATEX
PAGE 24 **HS45**	8192	ABZC	IP65	DLD OC 5V Reg	4.7"	Shaft Mount with Tether	

ABSOLUTE ENCODERS

Model Number	Resolution (Max)	Output Format	Sealing (Max)	Output Type	Diameter	Mounts	Hazardous Rating Options
PAGE 34 **H25**	13 Bits	GC NB SSI RS422	IP66	LD OC	2.5"	Square Flange Servo Face	
PAGE 35 **H25X**	15 Bits	GC NB	IP65	LD OC	2.5"	Square Flange Servo Face	
PAGE 38 **HMT25**	12 X 12 Bits	GC NB SSI	IP66	LD OC	2.5"	Square Flange Servo Face	
PAGE 36 **HS35**	12 Bits	GC NB SSI	IP65	LD OC	3.5"	Shaft Mount	
PAGE 37 **H38**	13 Bits	GCI NB SSI	IP66	LD OC	3.75"	Square Flange	Explosion Proof I, II
PAGE 37 **H40**	13 Bits	GC NB SSI	IP66	LD OC	4.0" Sq.	Square Flange Foot Mount	Explosion Proof I

KEY: LD = Line Driver, DLD = Differential Line Driver, OC = Open Collectors, GC = Gray Code, NB = Natural Binary, SSI = Serial Synchronous Interface



Incremental Encoders

An incremental encoder produces a series of square waves as it rotates. The number of square wave cycles produced per one turn of the shaft is called the encoder resolution. Incremental encoders work by rotating a code disc in the path of a light source (see figure at left); with the code disc acting like a shutter to alternately shut off or transmit the light to a photodetector. Thus, the resolution of the encoder is the same as the number of lines on the code disc. A resolution of 360 means that the encoder code disc will have 360 lines on it and one turn of the encoder shaft will produce 360 complete square wave cycles, each cycle indicating one degree of shaft rotation.

Since the resolution is "hard coded" on the code disc, optical encoders are inherently very repeatable and, when well constructed, very accurate. They also have no error accumulation as you might experience with analog sensors, and the square wave output is inherently easy for digital signal processing techniques to handle

BEI provides incremental resolutions up to 288,000 counts per turn through a combination of direct read on the code disc and various multiplication techniques (see quadrature detection on next page).

Generally, incremental encoders provide more resolution at a lower cost than their absolute encoder cousins. They also have a simpler interface because they have fewer output lines. Typically, an incremental encoder would have 4 lines: 2 quadrature (A & B) signals, and power and ground lines.

A 12 bit absolute encoder, by contrast, would use 12 output wires plus a power and ground line.

Questions?

Call 1-800-ENCODER and ask for “Applications Assistance”

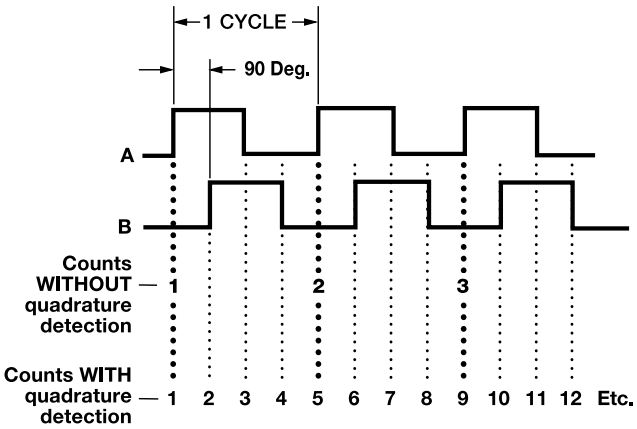
Quadrature Detection (Edge Counting)

Incremental encoders are usually supplied with two channels (A & B) that are offset from one another by 1/4 of a cycle (90 degrees). This type of signal is referred to as quadrature and allows the user to determine not only the speed of rotation but its direction as well. By examining the phase relationship between the A and B channels, one can determine if the encoder is turning clockwise (B leads A) or counterclockwise (A leads B).

Many counter and controller manufacturers include a quadrature detection circuit as part of their electronics. This allows the use of a two-channel quadrature input without further conditioning.

With quadrature detection the controller can derive 1X, 2X or 4X the basic code disc resolution. 10,000 counts per turn can be generated from a 2500 cycle, two-channel encoder by detecting the Up and Down transitions on both the A and B channels. With a quality disc and properly phased encoder, this 4X signal will be accurate to better than 1/2 count (see diagram below).

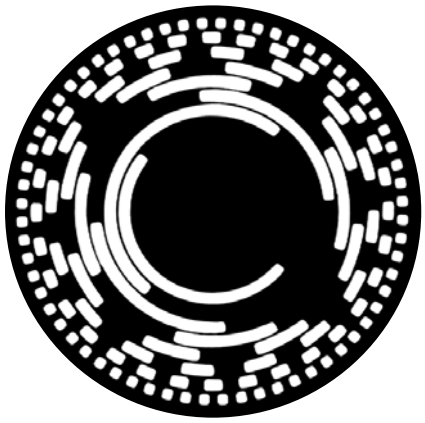
Another means of increasing resolution, interpolation, electronically subdivides the base resolution. Interpolation is achieved through the use of internal electronics acting on the raw encoder signal. This interpolated signal can be further multiplied through the quadrature detection method mentioned above. Interpolative multipliers of 2, 4, 5,10 and 20 are readily available. More detail is available on pages 32 and 33.



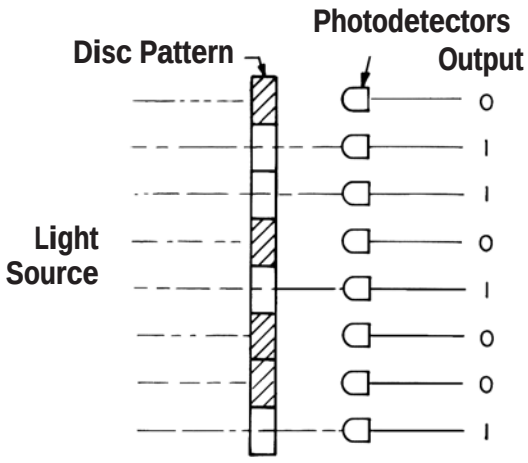
Absolute Encoders

By contrast to incremental encoders, an absolute encoder provides a “whole word” output with a unique code pattern representing each position. This code is derived from independent tracks on the encoder disc (one for each “bit” of resolution) corresponding to individual photodetectors. The output from these detectors is HI or LO depending on the code disc pattern for that particular position.

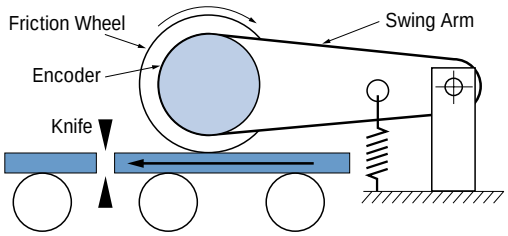
Absolute encoders are used in applications where a device is inactive for long periods of time or moves at a slow rate, such as flood gate control, telescopes, cranes, valves, etc. They are also recommended in systems that must retain position information through a power outage



8 Bit Gray Code Absolute Disc



Measuring Wheel



Purpose

To measure distance travelled for a cut-to-length operation

Parameters

Speed of Travel: 25 feet per minute
Measuring Wheel Circumference: 12 inches
Desired Resolution: 0.005 inches
Uni-directional measurement only
Manufacturing plant environment, very dusty
50 foot electrical cable run to controller
Integrate to programmable controller
12V power supply available
Resolution Required = 12/0.005 = 2400 cycles per turn
Output Frequency = 25 rpm x 2400/60 = 1000Hz

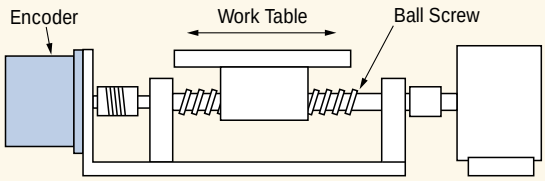
Encoder Specifications

Heavy Duty	H25
Square Flange Mount	D
Shaft Seal	SS
Cycles per Turn	2400
Channels	ABZC
Output IC	7272 (operates from 5-24 Volts)
Termination	SM18 (10 pin, side exit)

BEI Model Number

H25D-SS-2400-ABZC-7272-SM18

Linear Position with N/C Display



Purpose

To encode the position of a work table through a ball screw

Parameters

Rotational Speed: 500 RPM
Pitch: 1/4
Total Travel: 20 inches
Desired Resolution: 0.0005 inches
20 foot cable run to counter
Oil mist environment
Overtravel protection required
5V power supply available
Resolution required = Pitch/resolution = (0.25/0.0005) = 500 cycles per turn
Output Frequency = 500 RPM X 500 / 60 = 4167 Hz

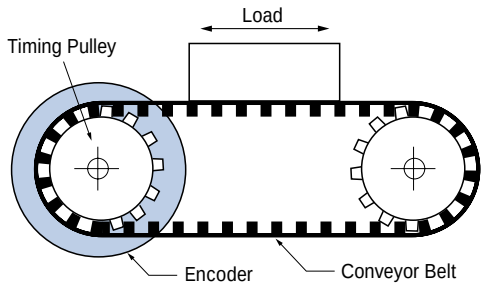
Encoder Specifications

Heavy Duty	H20
Square Flange Mount	D
Pilot (to accept seal)	B
Shaft Diameter	25 (0.25” nominal)
Shaft Seal	SS (protection from oil mist)
Cycles per Turn	500
Channels	ABZC
Note:	Z (generates home pulse with microswitch at end of travel)
Output IC	7272 (operates from 5-24 Volts)
Termination	SM18 (10 pin, side exit)

BEI Model Number

H20DB-25-SS-500-ABZC-7272-SM18-24V

Belt or Conveyor



Purpose

To determine relative position, direction and speed of travel in a bi-directional conveyor belt

Parameters

Conveyor Speed: 100 feet per minute maximum

Desired Resolution: 0.002 inches

Diameter of Conveyor Belt Drum: 4 inches

Manufacturing Plant: Dust and dirt

100 foot cable run to controller

Programmable controller with high speed counter module requiring 12 volt differential line drivers.

12 V power supply available

Drum speed = (12 in/ft) (100feet/min) / (PI X Diam) = (12 X 100) / (PI X 4) = 95.5 RPM

Resolution required = (4 X PI) / (0.002) = 6283 cycles per turn

Use the T5 interpolate feature:
6283/5 = 1256.6 base resolution, use 1257

Output Frequency = 6285 X 95.5 / 60 = 10,004 Hz

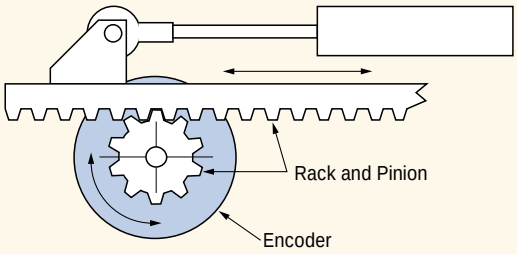
Encoder Specifications

Heavy Duty	H25
Square Flange Mount	D
Shaft Seal	SS
Cycles per Turn	6285-T5
Channels	ABZC
Output IC	7272 (operates from 5-24 Volts)
Termination	SM18 (10 pin, side mount)

BEI Model Number

H25D-SS-6285-T5-ABZC-7272-SM18

Linear Actuator



Purpose

To encode the position and velocity of a rack and pinion

Parameters

Pinion: 40 Tooth 1/20 pitch = 2 inches per turn

Stroke: 20 inch

Maximum Linear Velocity: 10 inches per second

Desired Resolution: 0.0002 inch

Oil spray environment

10 foot cable length

24 V power supply available

Resolution required = 2 inches per turn/0.0002 inches = 10,000 cycles per turn

Use 2500 base cycles per turn with T4 interpolate for 10,000 cycles per turn

Output Frequency = 10,000 cycles per turn X 10 inches/sec X 1 turn/2inches = 50,000 Hz

Encoder Specifications

Heavy Duty	H25
Square Flange Mount	D
Shaft Seal	SS (protection from oil mist)
Cycles per Turn	10,000-T4
Channels	ABZC
Output IC	7272 (operates 5-24 Volts)
Termination	SCS120 (side exit with cable seal, 120 inches long–uses shielded/ jacketed cable)

BEI Model Number

H25D-SS-10,000-T4-ABZC-7272-SCS120

Encoder Quality

Industrial Encoders are available for use over a wide range of environmental conditions. A large variety of designs allows the user to customize an encoder to his requirements. This also allows the specifying engineer to select only the options needed without incurring unnecessary additional costs.

There are a number of factors that must be considered to ensure reliable, consistent encoder operation in industrial applications.

In particular, the encoder must have a high degree of mechanical and electrical stability. In order to achieve this stability the encoder must have a solid foundation. The encoder disc, shaft and bearings must be of the highest quality to assure the ultimate accuracy of the device.

The encoder disc interrupts the light as the encoder shaft is rotated, and it is the code pattern etched on the disc which is primarily responsible for the accuracy of the electrical signal generated by the encoder. Should the disc pattern be inaccurate, the resulting signal will reflect that inaccuracy.

BEI has developed some of the most sophisticated, and accurate divided circle machines in the world. These machines are capable of accuracies in the sub arc second range. Originally intended for the military and aerospace industries, this quality is automatically incorporated into the industrial products.

The shaft and bearings maintain accurate rotation of the disc and help to eliminate such errors as wobble and eccentricity which would be translated into position errors. The encoder disc must be carefully mounted to avoid eccentricity as the pattern is read. Such eccentricity can cause inaccuracies in the encoder output that will not be apparent to the user during electrical testing but will cause false position information.

In order to eliminate eccentricity errors, BEI has developed electronic centering fixtures capable of centering accuracies up to 40 millionths of an inch.

When selecting an optical encoder for the industrial environment, the following areas may be considered:

Encoders intended for use in harsh or hazardous environments can be subjected to many optional tests to ensure they will perform as specified.

Heavy Loads

In applications utilizing gears or drive belts, excessive radial (side) loading on the shaft can shorten bearing life. Encoders should be specified in accordance with the anticipated side loading. Typical maximum loads for industrial encoders are 5, 40, and 100 lbs. Ultra heavy duty encoders are available to withstand heavier loads as well as shocks of up to 200g's.

Corrosive or Washdown

Aluminum encoder housings with a chemical film coating (ex: Iridite or Alodine) finish are sufficient for most applications. However, if the encoder is intended for operation in a corrosive environment, a hard anodize finish with a dichromate seal should be considered. For food or medical grade applications where a washdown may occur, an electroless nickel coating or even stainless steel contruction may be required.

Temperature Extremes

The temperature specification of the selected encoder must be consistent with the application. Zero to 70 degrees Celsius is the standard operating temperature on BEI's industrial encoders. Extended temperature testing from -55 to +105 degrees Celsius is available, depending on the model.

Hazardous Environments

Your application may require a special certification, such as explosion proof. Testing for this certification determines that if certain flammable gases infiltrate the encoder housing and are ignited by the internal electronics, the resulting flame or explosion is not able to escape from the housing and ignite the surrounding atmosphere. Specially designed encoders are available that meet the appropriate specification. For "Intrinsically Safe" and "Explosion Proof" ratings, refer to Hazardous Area Usage on pages 47-49.

Industrial environments can really test the integrity of a mechanical design. The encoders shown here have just undergone a leak test in order to ensure that they are properly sealed against wet environments.

Wet or Dirty Environments

If your application requires operation in a liquid or dusty environment, the encoder must be selected accordingly. Adequate sealing is a "must" to ensure against contamination, particularly through the spindle assembly. Contaminants that infiltrate the shaft bearing can rapidly degrade encoder performance. In the encoder interior they can disrupt the optical components or damage the circuit board. A shaft seal is recommended in general, and must be used in applications where liquids are present. If liquid exposure is anticipated, you can specify a leak test.

Precision alignment of sensor arrays is done under high power. Close attention to critical components means robust operation for the finished product.

Electrically Noisy Environments

The increasing use of factory automation systems means industrial environments are rich in electrical signals that can create Electromagnetic Interference (EMI). Some protection can be afforded by shielded cable, especially in conjunction with the use of twisted pair conductors. When this type of cable is used with an encoder, its complements, and a differential line receiver, a significant improvement in noise immunity can be realized.

SPECIAL NOTES

INSTALLATION: Even with the appropriate package, shaft, bearings, and disc, the user must exercise care to avoid undue shock and abuse. In particular, the bearings or code disc can be damaged if the encoder is dropped or a pulley is hammered on the shaft. The typical shock and vibration specification for an industrial encoder is a 50g shock for 11 msec, as well as a vibration of 20g's from 2 to 2000 Hz.

MECHANICAL PROTECTION: To adequately protect the optical and electronic components from exposure to the environment, encoder case thickness should be consistent with the severity of expected abuse. In applications where the housing may be struck by tools or debris, a cast housing or protective shroud should be used.

Questions?

Call 1-800-ENCODER and ask for "Applications Assistance"

Shafts

Shafts transmit the rotational movement of the device to be monitored into the encoder either directly (hollow-shaft style encoders) or through a flexible coupling (shafted style of encoders)

Inside Tip: Look for corrosion resistant shafts and a low TIR (Total Indicated Runout), generally 0.001" or less.

Shaft Seals

Without a shaft seal, the bearings and optical path would be subject to contamination due to dust, dirt and moisture in the environment.

Inside Tip: A lubricated rotating lip seal provides the best overall environmental protection over the life of the encoder.

Optics & Electronics

The optics assembly, in conjunction with the electronics, generates a variable amplitude analog signal from the rotation of the code disc and translates it into a digital pulse stream for use by a controller or counter.

Inside Tip: Electronically centered discs are accurate to better than ±1/40th of a cycle.

Covers & Connectors

Covers provide mechanical protection for the internal components of the encoder and seal it against dust and moisture intrusion. Connectors carry the signal through the cover of the encoder body while maintaining environmental protection.

Inside Tip: All points of entry, including cover screw holes, should be O-ring sealed for the best environmental protection.

Bearings

Bearings, along with the shaft (or shaft tube in the case of a hollow-shaft style of encoder) combine to provide a stable rotational platform which carries the code disc.

Inside Tip: The most accurate encoders use dual preloaded bearing assemblies.

Environmental & Operational Specifications

The environmental and operational specifications establish the environment under which the manufacturer feels it is prudent to operate the encoder.

Inside Tip: Check bearing and temperature ratings carefully. There is no specification standard in the encoder community for these items. If they are critical to your application, you will want to be sure of what you are getting.

Mechanical Specifications

Shaft Diameter: 3/8" (1/2"as special feature)

Flat On Shaft: 3/8" Shaft: 0.80 long X 0.03" deep; 1/2" Shaft: 0.80 long X 0.04" deep

Shaft Loading: 3/8" shaft: Up to 40 pounds axial and 35 pounds radial; 1/2" shaft: Up to 90 pounds axial and 80 pounds radial

Shaft Runout: 0.0005 T.I.R. at midpoint regardless of shaft diameter

Starting Torque at 25°C: Without shaft seal 1.0 in-oz (max); With shaft seal 2.5 in-oz (max); 1/2" shaft with shaft seal: 3.5 in-oz (max)

Bearings: Class ABEC 7 standard, ABEC 5 for 1/2" shaft

Shaft Material: 416 stainless steel

Bearing Housing: Die cast aluminum with iridite finish

Cover: Die cast aluminum

Bearing Life: 2 X 10^8 revs (1300 hrs at 2500 RPM) at rated load 1 X 10^{10} revs (67,000 hrs at 2500 RPM) at 10% of rated load

Maximum RPM: 12,000 RPM nominal, 8000 RPM with 1/2" shaft (see Frequency Response, below) 30,000 RPM available on units with 3/8" shaft – consult with factory

Moment of Inertia: 4.1 X 10^{-4} oz-in-sec^2; 5.2 X 10^{-4} oz-in-sec^2 with 1/2" shaft

Weight: 13 oz typical, 14.5 oz typical with 1/2" shaft

Electrical Specifications

Code: Incremental

Output Format: 2 channels in quadrature, 1/2 cycle index gated with negative B channel

Cycles Per Shaft Turn: 1 to 72,000 (see table 2) For resolutions above 3,600 see interpolation options on pages 32 and 33

Supply Voltage: 5 to 24 VDC available

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

Output Device: (see note 5)
4469: Line Driver, 5 – 15 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 VDC (special feature)
7273: Open Collector, accepts 5 – 28 VDC

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

Frequency Response: 100 kHz (see note 7)

Output Terminations: See table 1, page 51)

Note: Consult factory for other electrical options

Environmental Specifications

Enclosure Rating: NEMA 4 & 13 (IP 66) when ordered with shaft seal (on units with an MS connector) or a cable gland (on units with cable termination).

Temperature: Operating, 0º to 70º C; extended temperature testing available (see note 8); Storage, -25º to 90º C unless extended temperature option called out.

Shock: 50 g's for 11 msec duration

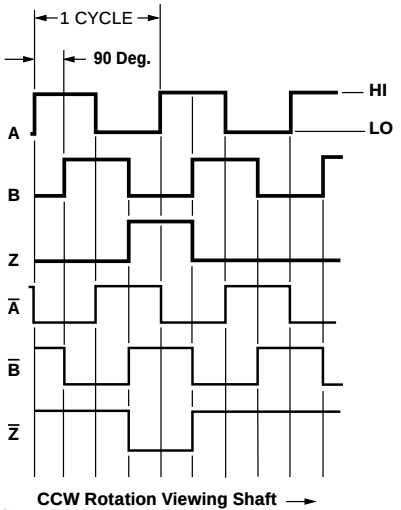
Vibration: 5 to 2000 Hz @ 20 g's

Humidity: 98% RH without condensation

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

The H25 is the flagship of the BEI Industrial Encoder Division product line. It was designed from the ground up for the industrial machine tool marketplace. The H25 offers features such as EMI shielding, 40 lb. ABEC 7 bearings, matched thermal coefficients on critical components, and custom high-efficiency optics. The encoder meets NEMA 4 and 13 requirements when ordered with the shaft seal. Typical applications include machine control, process control, the wood processing industry, oil well logging, industrial weighing, agricultural machinery, textile equipment, web process control, robotics, and food processing.

Figure 1 Output Waveform



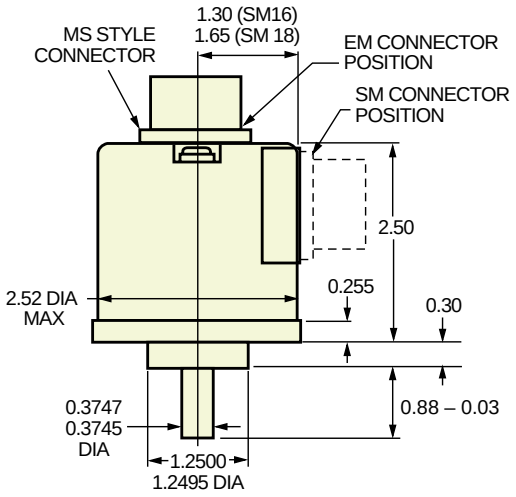
Certifications

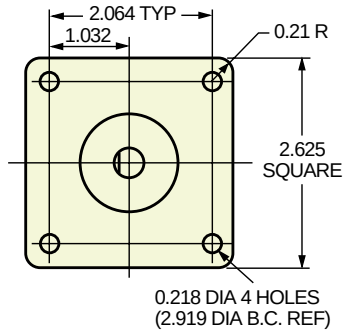
The H25 Incremental Encoder is available with the following certifications:

- EN 55011 and EN 61000-6-2
- CENELEC EEX ia IIB T4 and EEX ia IIC T4
- U.S. Standards Class I, Group A,B,C & D; Class II Group E,F & G
- Canadian Standards Class I, Zone 0, Group IIB & IIC
- CSA Class I, Div 1 Group C&D

See Regulatory Information on pages 47–49 for further certification details.

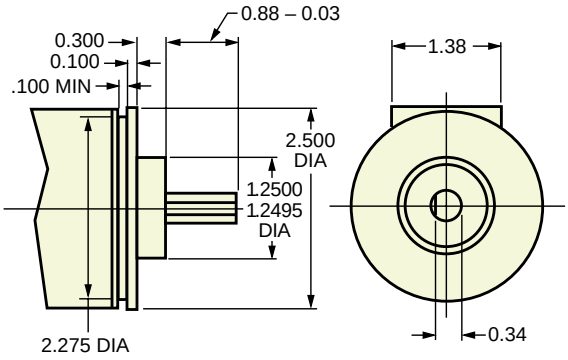
H25D - Square Flange



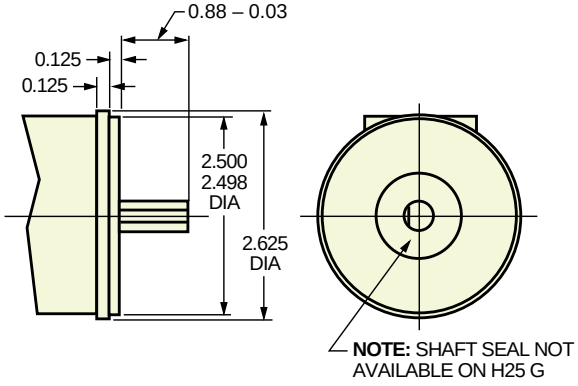


TOLERANCES: .XX = ±0.01, .XXX = ±0.005

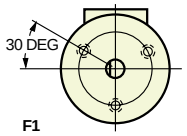
H25E - 2.50 Servo Mount



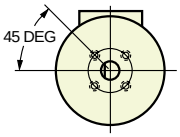
H25G - 2.62 Dia Servo Mount



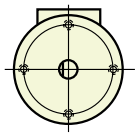
Optional Face Mounts



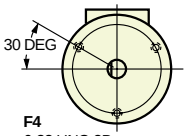
F1
10-32 UNF-2B
0.188 Min. Deep
3 places equally spaced
on a 1.875 Dia. bolt circle.



F2 (H25G Only)
4-40 UNC-2B
0.250 Min. Deep
4 places equally spaced
on a 1.272 Dia. bolt circle.
(0.900 square, Ref.)



F3
4-40 UNC-2B
0.250 Min. Deep
4 places equally spaced
on a 2.00 Dia. bolt circle.



F4
6-32 UNC-2B
0.250 Min. Deep
3 places equally spaced
on a 2.00 Dia. bolt circle.

H25 Incremental Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H25D-SS-2000-ABZC-4469-SM18).
All notes and tables referred to can be found on pages 50-51.

H25 [ ] – [ ] – [ ] – [ ] – [ ] [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
H = Heavy Duty
25 = 2.500" Dia.

OPTIONAL FACE MOUNTS
F1, F2, F3, or F4
Blank = None
See note 1

CYCLES PER TURN:
(Enter Cycles)
See Table 2

COMPLEMENTS
C = Complementary Outputs
Blank = None
See note 4

OUTPUT TERMINATION LOCATION:
E = End
S = Side

OUTPUT TERMINATION:
M16 = MS3102R16S-1P
M18 = MS3102R18-1P
C = Pigtail Cable
CS = Cable with seal
Cable length specified in inches
(i.e. C18 = Pigtail 18" long)
See table 1 & note 9

SPECIAL FEATURES:
S= Special features specified on purchase order (consult factory)
See note 6

HOUSING CONFIG. LETTER:
D=Square Flange
E=2.50 Dia. Servo Mount
G=2.62 Dia. Servo Mount
See dimensions

SHAFT SEAL CONFIGURATION:
SS = Shaft Seal
(Not avail. on H25G)
Blank = Shielded Bearing
See note 2

NO. OF CHANNELS:
A = Single Channel
AB = Dual Quad. Ch.
ABZ = Dual with Index
AZ = Single with Index
See note 3

OUTPUT IC:
4469
7272
7273

EXPRESS ENCODERS® Items highlighted with [ ] are standard Express Encoders and ship in one to three days.
T2 and **T5** options are available as standard H25 Express Encoders. See page 32-33.

The H20 is an all metal, extremely rugged encoder designed to economically fill the resolution range up to 2048 cycles per turn. This compact unit features a shock resistant disc, heavy duty bearings, and EMI shielding. The H20 conforms to NEMA 4 and 13 requirements. The H20 is also available in a hub shaft style with a flexmount (inset) for easy mounting directly to small motors. Typical applications of the H20 include machine control, process control, agricultural machinery, textile equipment, robotics, food processing, and metering.

H20 Incremental Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H20DB-37-SS-500-ABZC-7272-SM18-24V). All notes and tables referred to can be found on pages 50-51.

H20 – – – – – – – – – –

TYPE:
H = Heavy Duty
20 = 2.00" DIA.

HOUSING CONFIG:
D =Square Flange
E=2.00 Dia.
See Dimensions

PILOT CONFIG:
A=1.181 (30mm) Female
(No shaft seal available)
B =1.25

SHAFT DIA:
25= 0.2497 0.2495
37= 0.3747 0.3745
39= 0.3935 0.3932

SHAFT TYPE:
TS=Thru Shaft
HS=Hollow Shaft
HBS=Hub Shaft
Blank = single ended shaft (standard)

FACE MOUNT:
F5, F12, F28
Blank = None
See Dimensions

SHAFT SEAL:
SS = Shaft Seal
(must use pilot B, except HBS units can take SS with pilot A)
See note 2

CYCLES PER TURN:
(Enter Cycles)
See table A on this page

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 Included with 7272 Only
Blank = None
See note 4

OUTPUT IC:
4469
7272
7273

OUTPUT TERMINATION LOCATION:
E = End
S = Side

OUTPUT TERMINATION:
M14 =MS3102R14S-6P
M16 =MS3102R16S-1P
M18 =MS3102R18-1P
C=Pigtail Cable
CS=Cable with Seal (Side Term. only)
Add cable length (i.e., C18=18" cable)
See tabe 1 & note 9

MAX VOLTS
5V to 24V
(Specify)

SPECIAL FEATURES:
S= Non-standard features specified by customer.
(Consult factory)
See note 6

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

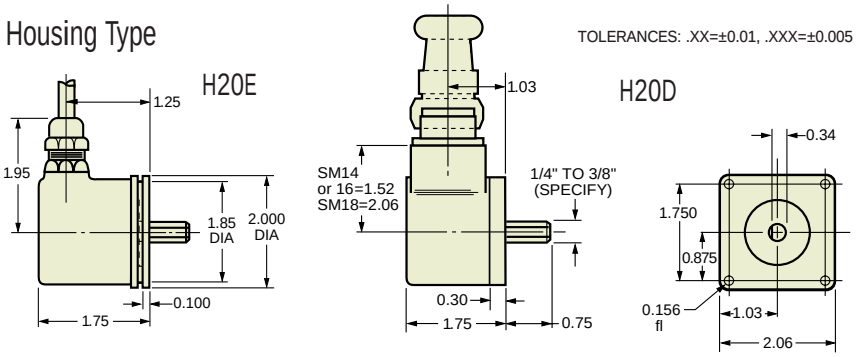
T2 option is available as a standard H20 Express Encoder. See page 32-33.

Table A H20 Disc Resolutions

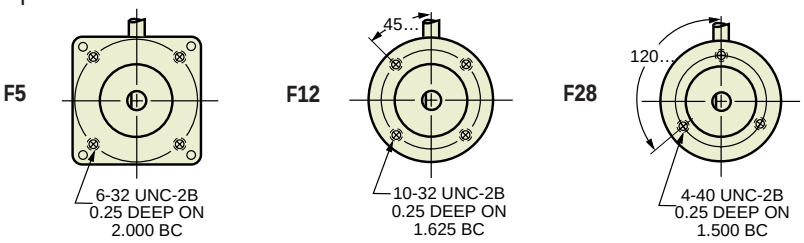
1* 2 3 5 **6** 8 10 11 12 24 25 30 32 40 50 60 64 **70** 75 80 100 105 **112** 115 120 125 150 192 200 240 250 256
300 336 360 400 410 500 510 512 600 720 785 1000 1024 Resolutions Shown in **RED** are not available as Express Encoders

*No index. For interpolation please specify the multiplied output (up to 2,048 for H20) in the model number, i.e. 2,048-T2.

Housing Type

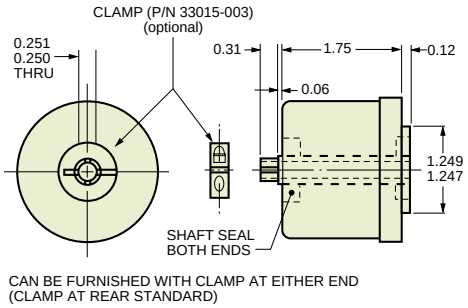


Optional Face Mounts



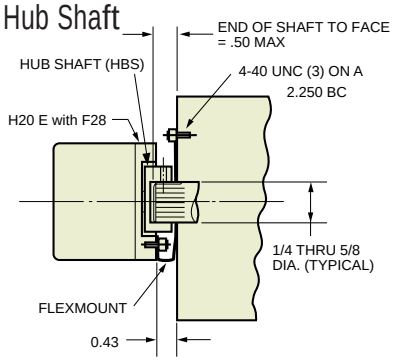
SPECIAL SHAFT OPTIONS

Hollow Shaft

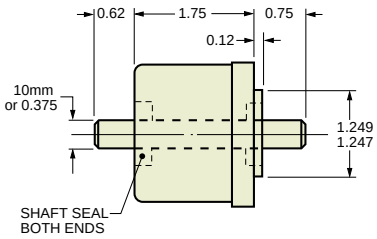


CAN BE FURNISHED WITH CLAMP AT EITHER END
(CLAMP AT REAR STANDARD)

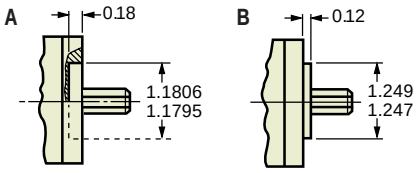
Hub Shaft



Thru-Shaft

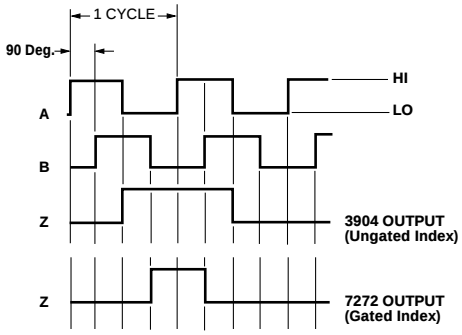


Pilot Options



(H20DA or H20EA) (H20DB or H20EB)

Figure 1 Output Waveform



Certifications

The H20 Incremental Encoder is available with the following certifications:

EN 55011 and EN 61000-6-2

CSA Class I, Div 1 Group A, B, C, & D (3904, 3904R only)

See Regulatory Information on pages 47–49 for further certification details.

Mechanical Specifications

Shaft Diameter: 1/4" thru 3/8" and metric versions. Hollow shaft, hub shaft or thru-shaft versions available.

Flat On Shaft: 0.75 x 0.03 deep

Shaft Loading: up to 40 lbs. axial and 40 lbs. radial

Shaft Runout: .001 T.I.R. maximum

Starting Torque at 25°C: 1.0 in-oz maximum without shaft seal; 2.5 in-oz maximum with shaft seal; 4.0 in-oz thru-shaft

Bearings: 52100 bearing steel

Shaft material: 303 stainless steel

Bearing Housing: Die cast aluminum with iridite finish

Cover: Die cast aluminum with iridite finish (For MS or CS terminations), otherwise drawn aluminum with iridite finish

Bearing Life: 1.5 X 10^9 revs at rated load (10,000 hrs at 2500 RPM)

Maximum RPM: 8,000 (see Frequency Response)

Moment of Inertia: 2.0 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 as standard. Ungated index when 3904 is specified as the output device

Cycles per Shaft Turn: 1 to 2048 (see table A page 18) For resolutions above 1024 see interpolation options on pages 32 and 32)

Supply Voltage: 5 to 24 VDC available

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

Output Device: (see note 5)
4469: Line Driver, 5 – 15 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 VDC (special feature)
7273: Open Collector, accepts 5 – 28 VDC

Protection Level: reverse, overvoltage and output short circuit (see note 5)

Frequency Response: 100 KHz (up to 1024 cpt; 250 KHz with T2 options (see note 7)

Output Terminations: See Table 1, page 51

Note: Consult factory for other electrical options

Environmental Specifications

Enclosure Rating: NEMA 4 & 13 (IP66) when ordered with shaft seal (on units with an MS connector) and a cable gland (on units with cable termination)

Temperature: Operating, 0° to 70°C; extended temperature testing available (see note 8); Storage, -25° to 90°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 without condensation

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

Mechanical Specifications

Shaft Bore: 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 iridite finish

Cover: Die cast aluminum with iridite 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 24 VDC available (see note 5)

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

Output Device: (see note 5)
4469: Line Driver, 5 – 15 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 VDC (special feature)
7273: Open Collector, accepts 5 – 28 VDC

Protection Level: Reverse, overvoltage and output short circuit

Frequency Response: 100 kHz (see note 7)

Output Terminations: (see table 1, page 51)

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 105ºC 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 pages 50 and 51.

Table A HS25 Disc Resolutions

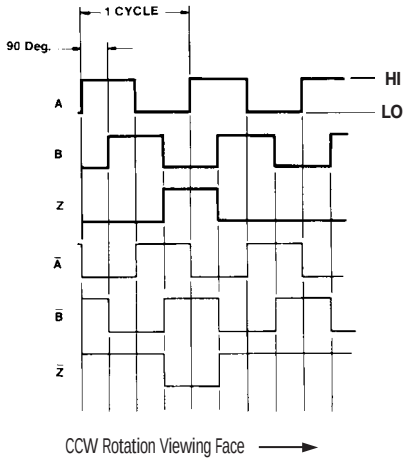
10 88 250 360 500 512 1000 1024 2000 2048

Other resolutions available–consult factory.

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.

Figure 1 Output Waveform



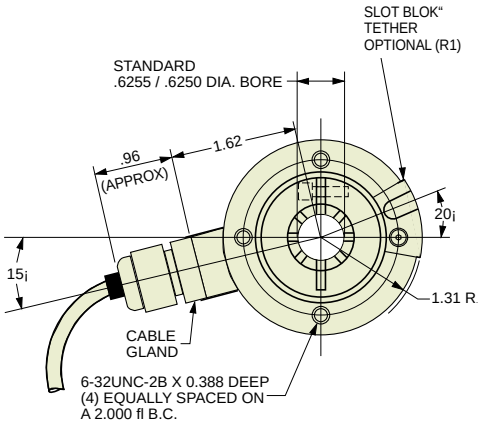
Certifications

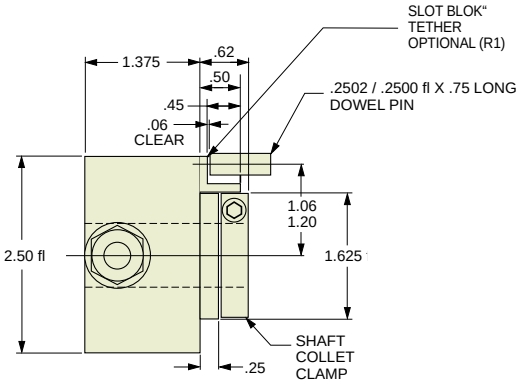
The HS25 Incremental Encoder is available with the following certifications:

- EN 55011 and EN 61000-6-2
- CENELEC EEX ia IIC T4
- U.S. Standards Class I, Group C & D; Class II Group E,F & G
- Canadian Standards Class I, Zone 0, Group IIC

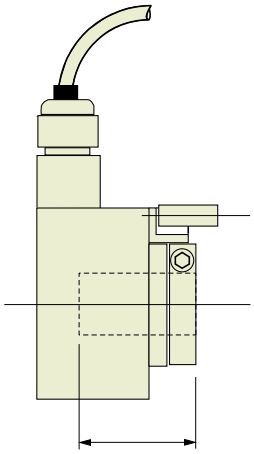
See Regulatory Information on pages 47–49 for further certification details.

Thru Shaft Version



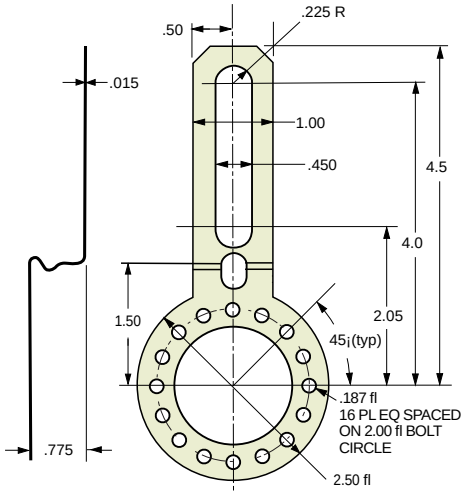


Blind Shaft Version

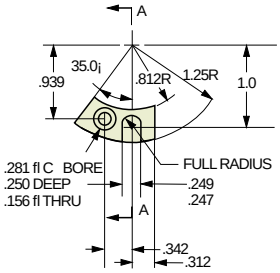


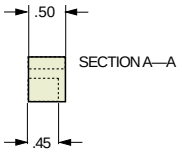
BLIND SHAFT OPTION
1.50 MAX, 0.50 MIN PENETRATION

R2 Tether Arm



R1 Tether Block and Pin





TOLERANCES: .XX = ± 0.01, .XXX = ± 0.005

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-4469-SCS18). All notes and tables referred to can be found on pages 50-51.

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

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 = Dual Shaft Seals
BS = Blind Shaft with single seal and cover
See note 2

CYCLES PER TURN:
(Enter Cycles)

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

OUTPUT IC:
4469
7272
7273

OUTPUT TERMINATION:
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)
See table 1 and note 9

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.

Mechanical Specifications

Shaft Bore: 1.00", 0.875", 0.750", 0.625", 0.500". Diameters under 0.875 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 maximum

Starting Torque at 25°C: Through shaft version (SS) = 7 in-oz (max); Blind shaft version (BS) = 4 in-oz

Bearings: 52100 SAE High carbon steel

Shaft Material: 416 stainless steel

Bearing Housing: Die cast aluminum with iridite finish

Cover: Die cast aluminum with iridite finish

Bearing Life: 7.5 X 10^9 revs (50,000 hrs at 2500 RPM)

Maximum RPM: 6,000 RPM (see Frequency Response below)

Moment of Inertia: 0.019 oz-in-sec^2

Weight: 18 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: 1 to 10,000 (see table A, page 23). For resolutions above 5000 see interpolation options on pages 32 and 33

Supply Voltage: 5 to 24 VDC available (see note 5)

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

Output Device: (see note 5)
4469: Line Driver, 5 – 15 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 VDC (special feature)
7273: Open Collector, accepts 5 – 28 VDC

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

Frequency Response: 150 kHz (up to 5000 cpt resolution; 300 KHz above 5000 cpt, also see Note 7)

Output Terminations: See Table 1 page 51

Note: Consult factory for other electrical options

Environmental Specifications

Enclosure Rating: NEMA 4 & 13 (IP65) when ordered with shaft seal (on units with an MS connector) or a cable gland (on units with cable termination)

Temperature: Operating, 0° to 70° C; extended temperature testing up to 105° C available (see note 8); Storage, -25° to 90° C unless extended temperature option called out

Shock: 50 g's for 11 msec duration

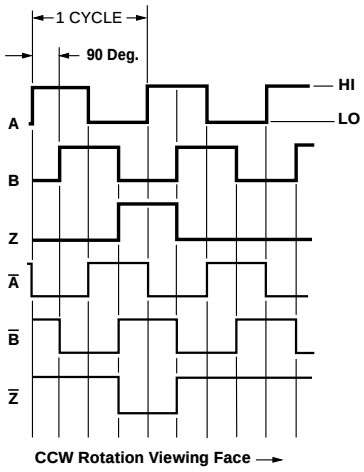
Vibration: 5 to 2000 Hz @ 20 g's

Humidity: 98% RH without condensation

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

The HS35 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 sealed connector or cable gland. The HS35 accommodates shafts up to 1" in diameter. With optional insulating inserts, it can be mounted on smaller diameter shafts. It can be mounted on a through shaft or a blind shaft with a closed cover to maintain its environmental rating. Applications include motor feedback and vector control, printing industries, robotic control, oil service industries, and web process control.

Figure 1 Output Waveform



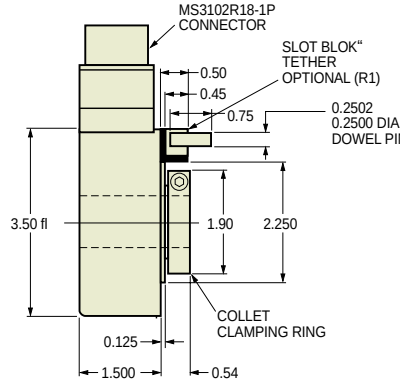
Certifications

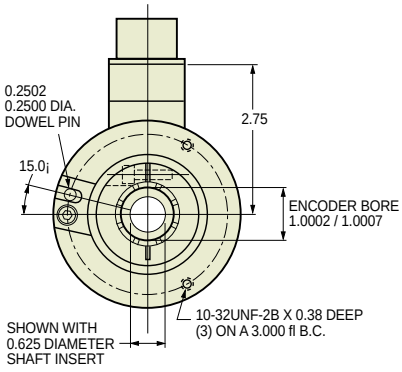
The HS35 Incremental Encoder is available with the following certifications:

- EN 55011 and EN 61000-6-2
- CENELEC EEX ia IIB T4 and EEX ia IIC T4
- U.S. Standards Class I, Group A,B,C & D; Class II Group E,F & G
- Canadian Standards Class I, Zone 0, Group IIB & IIC

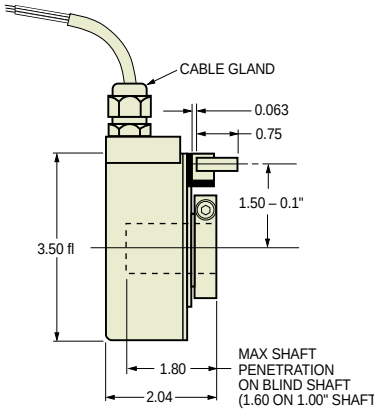
See Regulatory Information on pages 47–49 for further certification details.

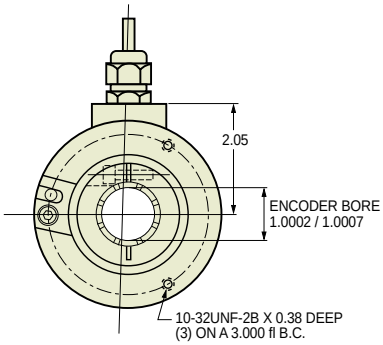
MS Connector Termination





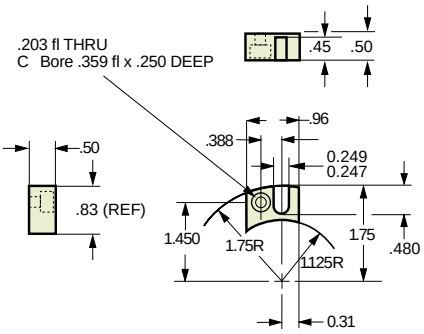
Cable Termination





TOLERANCES: .XX = ±0.01, .XXX = ±0.005

R1 Tether Block and Pin



R2 Tether Arm

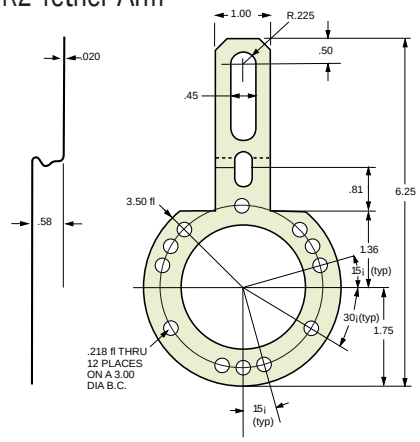


Table A HS35 Disc Resolutions

32 100 250 360 500 512 600 1000 1024 1200 1650 1800 2000 2100 2048 2500 2881 2884 3600 4096 5000

For interpolation please specify the multiplied output (up to 10,000 for the HS35) in the model number, i.e. 10,000-T2. Other resolutions available—consult factory.

HS35 Incremental Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: HS35F-100- R1-SS-2048-ABZC-7272-SM18). All notes and tables referred to can be found on pages 50-51.

HS35 [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
HS = Hollow Shaft
35 = 3.5" Encoder Diameter

HOUSING CONFIG:
F = Standard

SHAFT BORE:
100 = 1.00"
87 = 0.875"
75 = 0.75"
62 = 0.625"
50 = 0.50"etc.
Metric bores available

TETHER:
R1 = Tether Block and Pin
R2 = Tether Arm
Blank = None

SHAFT SEAL CONFIGURATION:
SS = Dual Shaft Seals
BS = Blind Shaft with single seal and cover
See note 2

CYCLES PER TURN:
(Enter Cycles)
See table A on this page

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

OUTPUT IC:
4469
7272
7273

OUTPUT TERMINATION:
SM18 = 10 Pin MS3102F18S-1P
SCS = Shielded/Jacketed Cable with length specified in inches (i.e. C18 = 18" of cable)
TB = Terminal Block
See table 1 & note 9

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.

T2 option is available as a standard HS35 Express Encoder. See page 32-33.

Mechanical Specifications

Shaft Bore: 1.750" max

Allowable Misalignment: 0.005 TIR, Radial; ±0.030 (with R2), ±0.050 (with R1) axial

Bore Runout: 0.002" T.I.R.

Running Torque at 25° C: Dual seals (SS) = 30 in-oz (max); Single seal (BS) = 18 in-oz (max)

Bearings: 52100 dual preloaded bearings

Shaft Material: Stainless Steel

Bearing Housing: Die cast aluminum with iridite finish

Cover: Die cast aluminum with iridite finish

Bearing Life: 5 X 10^{12} revs at reated load

Maximum RPM: 5,000 RPM (see Frequency Response, below)

Moment of Inertia: 0.063 oz-in-sec^2 max

Weight: Approximately 2.3 lbs single output, 2.6 lbs dual output

Electrical Specifications

Code: Incremental

Output Format: Incremental output format, 2 channels with complements, in quadrature, 1/2 cycle index gated with negative B channel

Cycles per Shaft Turn: 1024, 8192

Supply Voltage: 5-28 VDC (±5%)

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

Output Device: 7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$

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

Frequency Response: 150kHz

Output Terminations: (see table 1, this page)

Environmental Specifications

Enclosure Rating: IP65 (NEMA 4 & 13)

Temperature: Operating 0º to 70ºC standard, -40º to 85º C optional, storage -40 to 90° C

Shock: 50 g's for 11 msec

Vibration: 20 g's 10 - 2000 Hz

Humidity: 98% non-condensing

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

Certifications

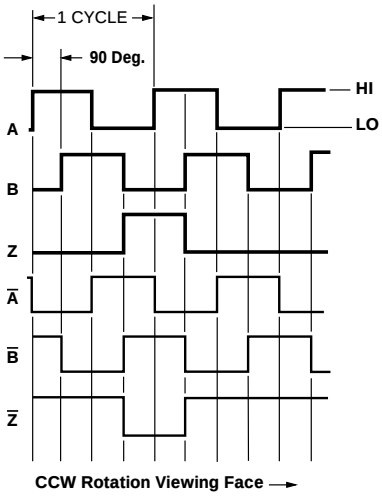
The HS45 Incremental Encoder is available with the following certifications:

CE EN 55011 and EN 61000-6-2

See Regulatory Information on pages 47–49 for further certification details.

The HS45 is a large bore, heavy duty, rugged encoder designed to operate in very demanding environments. It is available in both single and dual output versions as shown above. These encoders use a preloaded bearing set for mechanical stability and a long service life. The dual output version has redundant electronics internal to the encoder simplifying signal distribution to multiple controllers.

Figure 1 Output Waveform

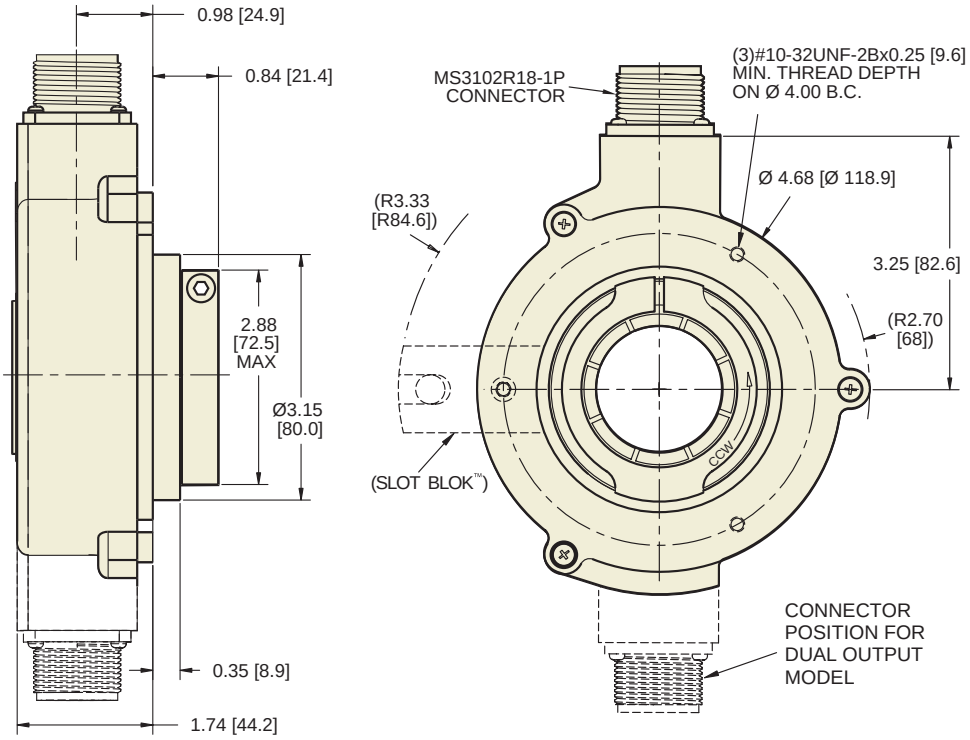


NOTE: Index location is displaced 180° (mechanical) on 2nd output with dual output option

Table 1- Output Functions

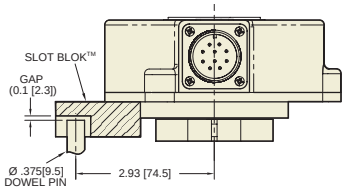
PIN NO.	FUNCTION
A	A
B	B
C	Z
D	+V (SUPPLY)
E	NC
F	0V (CIRCUIT GROUND)
G	CASE GROUND
H	A/
I	B/
J	Z/

MS Connector Termination

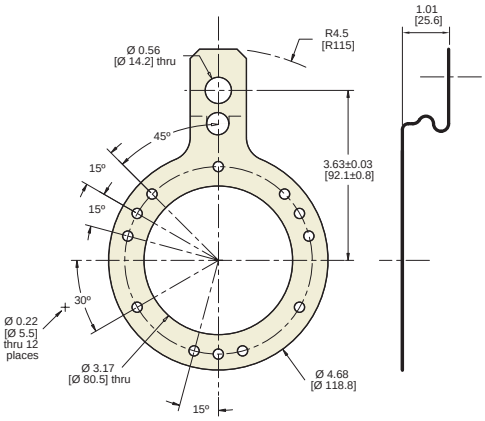


TOLERANCES: .XX = ±0.01, .XXX = ±0.005

R1 Tether Block and Pin



R2 Tether Arm (Fits Ø 7.25 [184] B.C.)



HS45 Incremental Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: HS45F-175-R2-SS-8192-ABZC-7272-SM18).

HS45 – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
Hollow Shaft
2.0" Diameter

HOUSING CONFIG:
F = Standard

BORE SIZE:
175 = 1.750"
162 = 1.625"
150 = 1.50"
Bores <175 are insulated

TETHER:
Blank = None
R1 = Tether Block and Pin
R2 = Tether Arm

SHAFT SEAL CONFIGURATION:
SS = Through, standard
BS = Blind, option

CYCLES PER TURN:
1000, 1024, 8192

CHANNELS:
ABZC

OUTPUT DEVICE:
7272 = 28 VDC max
$V_{out} = V_{in}$, Line Driver

TERMINATION:
S = Side termination
DS = Dual side termination

CONNECTOR:
M18 = 10 PIN connector

H38 Explosion Proof Optical Encoder

Table 1- Output Functions		
TERMINAL PIN NO.	**INCREMENTAL OUTPUT**	**8 BIT GRAY CODE OUTPUT***
1	CASE GRND.	CASE GRND.
2	GROUND	GROUND
3	+V	+V
4	A	G0
5	B	G1
6	Z	G2
7	$\overline{A}$	G3
8	$\overline{B}$	G4
9	$\overline{Z}$	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 also carries a Class 1, Group D, Division 1; and 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-4469-SC-UL2).
All notes and tables referred to can be found on pages 50-51.

H38 – [ ] – [ ] – [ ] [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
H = Heavy Duty
38 = 3.75" Square

HOUSING CONFIGURATION:
D = Standard, (see dimensions, next page)

CYCLES PER TURN:
Enter Cycles, *See Table 2*

NO. OF CHANNELS:
A = Single Channel
AB = Dual Quad. Ch.
ABZ = Dual with Index
AZ = Single with Index
See note 3

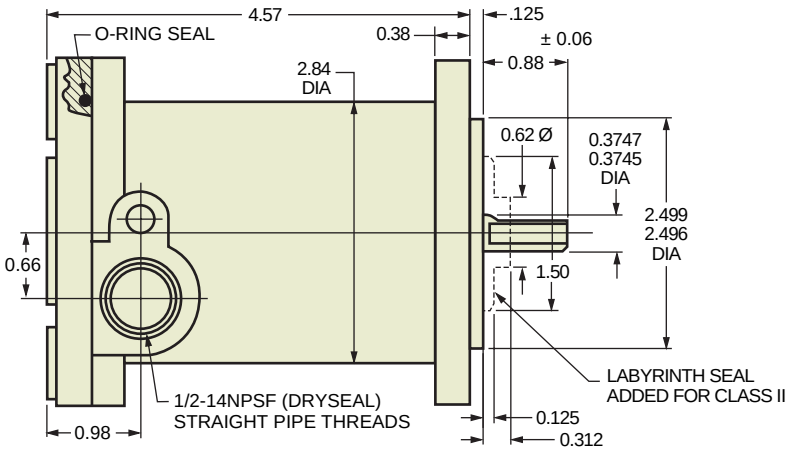
COMPLEMENTS:
C = Complementary Outputs,
Blank = None
See note 4

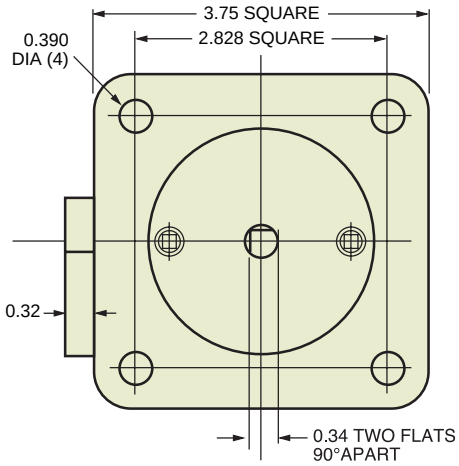
OUTPUT IC:
4469, 7272, or 7273
See note 5

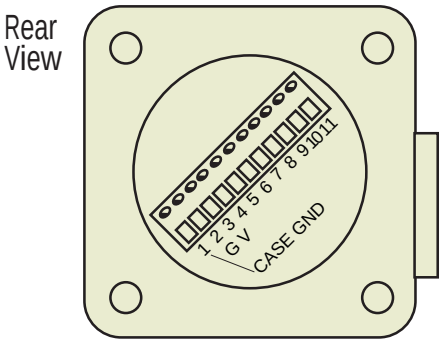
OUTPUT TERMINATION:
SC = Side Conduit, 1/2–14 NPSF (dryseal) straight pipe threads

UL:
UL = Class I Environments
UL2 = Class I & II Environments

SPECIAL FEATURES:
S= Special features specified on purchase order (consult factory)
See note 6







TOLERANCES:
.XX = ±0.01,
.XXX = ±0.005

Certifications

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

- EN 55011 and EN 61000-6-2
- CENELEC EEX ia IIB T5*
- U.S. Standards Class I, Group D, Division 1; Class II, Group E,F & G–requires labyrinth seal
- Canadian Standards Class I, Division 1, Group D; Class II, Class II, Group E, F & G–requires labyrinth seal
- CSA Class I, Div 1 Group C&D

*Available after Q3, 2004. See Regulatory Information on pages 47–49 for further certification details.

Mechanical Specifications

Shaft Diameter: 3/8" nominal

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

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 10^8 revs (1300 hrs at 2500 RPM) at rated load; 1 X 10^{10} 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^{-4} oz-in-sec^2

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 24 VDC available

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

Output Device: (see note 5)
4469: Line Driver, 5 – 15 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 VDC (special feature)
7273: Open Collector, accepts 5 – 28 VDC

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

Frequency Response: 100 KHz (see note 7)

Output Terminations: See Table A, this 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, 0º to 70º C; extended temperature testing available (see note 8, pg 50); storage; -25º to 90º 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 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.

The H40 is an ultra heavy duty encoder whose internal structure is totally isolated from severe shock and shaft loading conditions. The optics and electronics are supported in shock absorbing material within the heavy cast outer housing. The encoder shaft is flexibly coupled to the high load capacity bearings and shaft assembly, which is carried in the outer housing. The entire bearing assembly is field-removable to permit proper shaft support while pressing pulleys, gears, etc. onto the shaft. An Underwriters Laboratories listed version of this model is available.

H40 Shock Proof Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H40A-2000-ABZC-4469-SC-UL).
All notes and tables referred to can be found on pages 50-51.

H40 [ ] – [ ] – [ ] [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
H = Heavy Duty;
40 = 4.00" Square

HOUSING CONFIGURATION:
A = Base Mounted Feet
B = No Mounting Feet

CYCLES PER TURN:
Enter Cycles
See table 2

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,
Blank = None
See note 4

OUTPUT IC:
4469
7272
7273
See note 5

OUTPUT TERMINATION:
SC = Side Conduit
EC = End Conduit; Conduit uses 1/2-14 NPSF (dryseal) straight pipe threads;
EM16 = MS3102R16S-1P
EM18 = MS3102R18-1P,
See table A on next page

UL:
UL = UL Explosion Proof rating, only available with SC termination

SPECIAL FEATURES:
S= Special features specified on purchase order (consult factory)
See note 6

Certifications

The H40 Shock Proof Encoder is available with the following certifications:

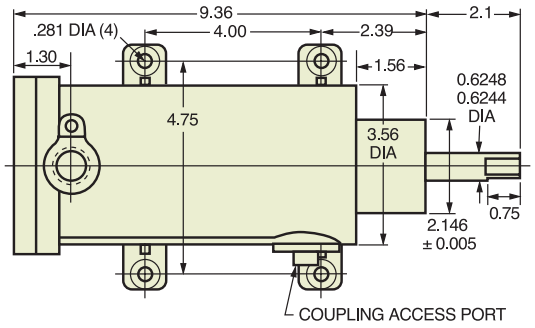
EN 55011 and EN 61000-6-2

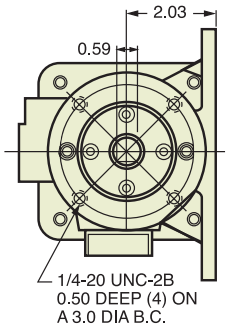
U.S. Standards Class I, Group D, Division 1

Canadian Standards Class I, Group D, Division 1

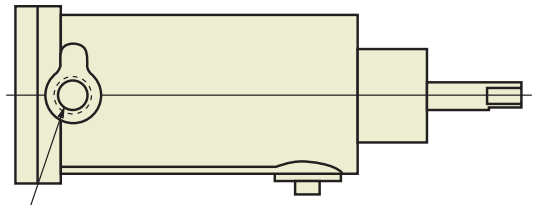
See Regulatory Information on pages 47–49 for further certification details.

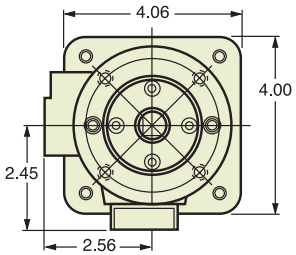
H40A





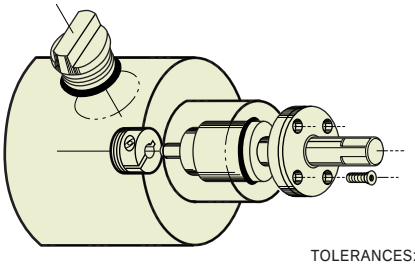
H40B





1/2 - NPSF (DRYSEAL) STRAIGHT PIPE THREADS
NOTE: THIS WIRING PORT WILL BE SEALED WITH A PIPE PLUG IF THE EM OR EC OPTION IS SPECIFIED

Field Replaceable Coupling and Bearing Assembly



TOLERANCES:
.XX = ± 0.01,
.XXX = ± 0.005

Rear View

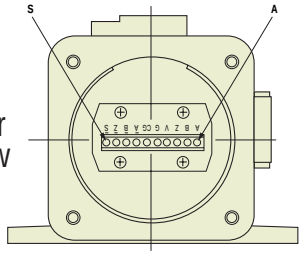


Table A Output Functions

INCREMENTAL	
TERMINAL	FUNCTION
A	CHANNEL A
B	B
Z	Z
V	+VDC
G	GROUND (0V)
CG	CASE GROUND
$\overline{A}$	$\overline{A}$
$\overline{B}$	$\overline{B}$
$\overline{Z}$	$\overline{Z}$
S	SPARE*

*or SELECT on Dual Count encoders

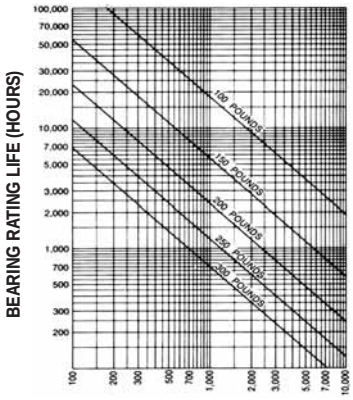
8-BIT ABSOLUTE*		
GRAY CODE	NATURAL BINARY	TERMINAL NUMBER
G0	2^0	1
G1	2^1	2
G2	2^2	3
G3	2^3	4
G4	2^4	5
G5	2^5	6
G6	2^6	7
G7	2^7	8
SPARE		9
SPARE		10
LATCH		11
INTERROGATE		12
SPARE		13
+VDC		14
0V (COMMON)		15
CASE GROUND		16

Latch and Interrogate are optional

*For higher resolutions, see Absolute Options pages 40-41

Figure 1

Bearing Life vs. Speed at Various Radial Loads



Mechanical Specifications

Shaft Diameter: 5/8" nominal

Flats On Shaft: Two flats, 0.75" long X 0.30" deep at 90º

Shaft Loading/Bearing Life: Refer to Figure 1

Shaft Runout: 0.001" T.I.R. at mid-point of shaft

Starting Torque at 25° C: 10.0 in-oz (max)

Bearings: Class 52100 SAE high carbon steel

Shaft Material: 1070 carbon steel, 303 stainless steel optional

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

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

Coupling Windup: The H40 uses an internal coupling. Windup error (degrees) = α X 7.5 X 10^{-4} rad/sec^2
where α = angular acceleration in rad/sec^2

Weight: Approx 9 lbs

Electrical Specifications

Code: Incremental or Absolute (see Absolute options, pgs 40-41)

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 33); Absolute to 8192 counts per turn

Supply Voltage: 5 to 24 VDC available

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

Output Device: (see note 5)
4469: Line Driver, 5 – 15 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 VDC (special feature)
7273: Open Collector, accepts 5 – 28 VDC

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

Frequency Response: 100 KHz (see note 7)

Output Terminations: See Table A, this 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

Hazardous Area Rating: The optional Underwriters Laboratories listed version is for use in hazardous locations; NEMA Enclosure 7. Class 1, Group D, Division 1, NEC Class 2 circuits only

Temperature: Operating, 0º to 70º C; extended temperature testing available (see note 8, pg 50); storage; -25º to 90º C unless extended temperature option called out

Shock: 200 g's at 11msec

Vibration: 5 to 2000 Hz @ 20 g's

Humidity: 100% RH

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

E25 Incremental Optical Encoder

The E25 has been designed as a light duty encoder for applications such as robotics, precision computer peripherals and OEM motors and controls. It is designed with an integrated mounting ring and shaft coupling. In most intances, the E25 encoder can be replaced with an equivalent H25 model. For example,

E25BA-4R-SB-1024-ABZC-7272-SM18 would become: **H25E-F45-SB-1024-ABZC-7272-SM18-S** where -S=.050 shaft protusion, plus 31170-001 adapter kit and 39074-12-8 coupling

Please call our Applications Assistance Hotline at **1-800-ENCODER** for help in crossing your E25 over to an H25 equivalent.

Coupling Bore: 1/4" and 3/8" nominal, standard

Starting Torque at 25° C: 0.07 in-oz typical

Bearings: Class ABEC 5

Coupling Material: Aluminum with iridite finish

Bearing Housing: Die cast aluminum with iridite finish

Cover: Drawn aluminum, 0.060" wall, iridite finish standard. Die cast aluminum with iridite finish for EM, SM, ECS and SCS terminations

Bearing Life: 1 X 10^9 revs (6,700 hrs at 2500 RPM) at rated load

Maximum RPM: 10,000

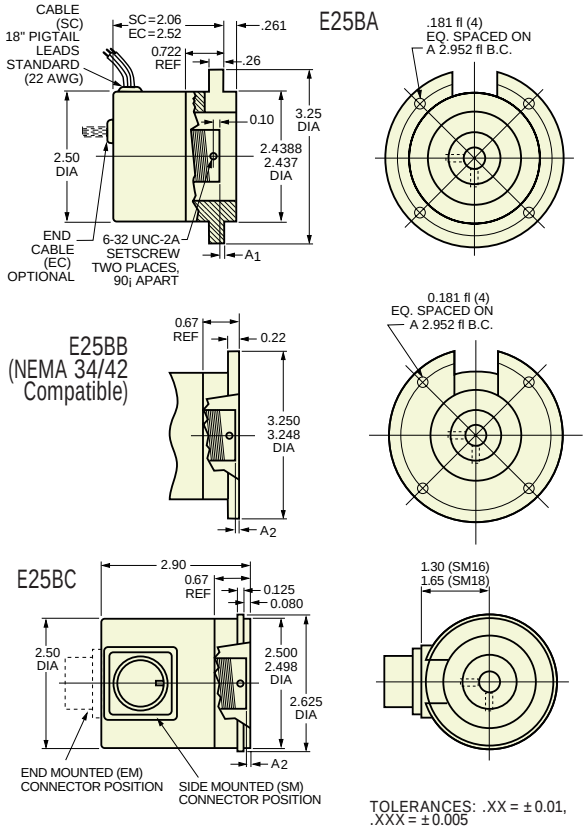
Weight: 13 oz., typical

Enclosure Rating: NEMA 2 (IP43)

Temperature, Shock, Vibration, Humidity and Electrical Specifications: Refer to H25 Incremental, pages 16-17

COUPLING DATA	STANDARD COUPLING	HIGH -PERFORMANCE COUPLING	
	TYPE 4H	TYPE 4R	TYPE 6R
Coupling Bore	.250/.251	.2500/.2505	.3750/.3755
Dimension A1(E25BA only)	.16	.08	.08
Dimension A2 (E25BB &BC)	.10	.02	.02
Axial Motion (Inches Max.)	±.010	±.020	±.030
Parallel Offset(Inches Max.)	.010	.010	.010
Angular Misalignment (Degrees Max.)	2	2	2
Torsional Spring Rate (TS)	52	15	21

Installation Note: To prevent damage, the coupling must be operated without excessive axial compression or extension. For proper installation, rotate the coupling on the mating shaft prior to tightening the set screws.



L25 Incremental Optical Encoder

The L25 is a lighter duty version of the H25. With low starting torque, a 1/4" diameter stainless steel shaft and a drawn aluminum cover.

In most intances, the L25 encoder can be replaced with an equivalent H25 model. For example,

L25G-SB-1024-ABZC-7272-SM18-S would become: **H25G-SB-1024-ABZC-7272-SM18-S-S=1/4" dia. shaft**

Please Call our Applications Assistance hotline at **1-800-ENCODER** for help in crossing your L25 over to an H25 equivalent.

Shaft Diameter: 1/4" nominal

Flat On Shaft: 0.80 long x 0.03 deep

Shaft Loading: up to 5 lbs. axial and 8 lbs. radial

Shaft Runout: .0005 T.I.R. maximum

Starting Torque at 25°C: 0.07 in-oz typical, 0.12 in-oz maximum without sealed bearings; 0.50 in-oz typical, 1.0 in-oz maximum with sealed bearings

Bearings: Class ABEC 5

Shaft material: 416 stainless steel

Bearing Housing: Die cast aluminum with iridite finish

Cover: Drawn aluminum, 0.060" wall, iridite finish standard. Die cast aluminum with iridite finish for EM, SM, ECS and SCS terminations

Bearing Life: 1 X 10^9 revs (6,700 hrs at 2500 RPM) at rated load

Maximum RPM: 10,000

Moment of Inertia: 4.1 x 10^{-4} oz-in-sec^2

Weight: 13 oz. typical

Electrical Specifications: Refer to H25 Incremental, pages 16-17 for typical electrical specifications

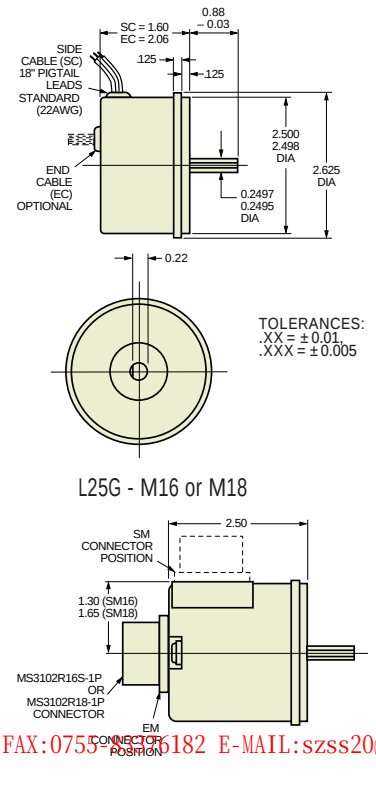
Enclosure Rating: NEMA 2 (IP43)

Temperature: Operating, 0º to 70º C; extended temperature testing 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 without condensation

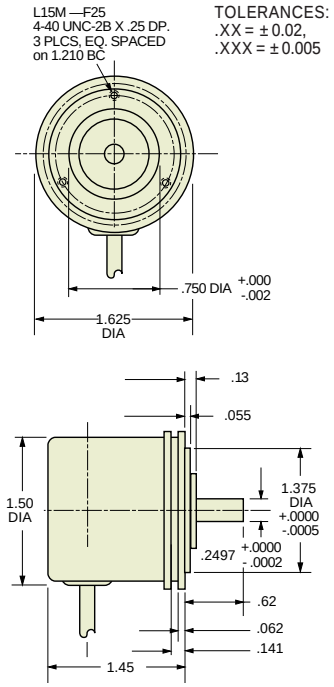


L15 Incremental Optical Encoder

The L15 encoder provides the industrial marketplace with a rugged optical encoder in a size 15 servo package. Ideal for space-limited applications, these compact encoders discount size without compromising performance. Each L15 encoder package has field-proven ASIC electronics, sealed bearings and BEI's accurate code disk in an all metal housing to ensure ruggedness and reliability.

The L15 offers resolution to 2540 cycles per turn, quadrature output with index, a 1/4-inch diameter stainless steel shaft with 5 pounds radial or axial load capability and an electronic operating speed of 100khz, minimum.

Other features include voltage selection of +5, +12 or +24 VDC, differential line driver option with complementary ouputs, and an extendend temperature range for operation from -40˚C to +85˚C. The T2 interpolation option can be used to double the base resolution (i.e. 4096-T2).



Mechanical Specifications

Shaft Diameter: 1/4 inch nominal

Shaft Loading: Up to 5 pounds axial and 5 pounds radial

Shaft Runout: 0.00 T.I.R. at midpoint of shaft

Starting Torque at 25°C: 0.20 in-oz (max)

Bearings: Sealed, instrument grade

Shaft Material: 416 stainless steel

Bearing Housing: Aluminum with iridite finish

Cover: Drawn aluminum

Bearing Life: 1 X 10^9 revs (10,000 hrs at 1500 RPM)

Maximum RPM: 5,000 RPM nominal (see Frequency Response, below)

Moment of Inertia: 1.0 X 10^{-4} oz-in-sec^2

Weight: 6 oz (max)

Electrical Specifications

Code: Incremental Output Format, 2 channels in quadrature, 1 cycle (nominal) ungated index (other index options and commutation channels available—consult factory).

Cycles Per Shaft Turn: 50 to 5,000 (see Table 2, on this page)

Supply Voltage: 5, 12-15, 24 VDC

Current Requirements: 125 mA typical, 175 mA max

Output Device:
Line Driver 5 – 28 VDC, $V_{out} = V_{in}$

Protection Level: Reverse, output short circuit

Frequency Response: 100kHz

Output Termination Pinouts: See Table 1, on this page

Environmental Specifications

Enclosure Rating: NEMA 3. (IP53)

Temperature: Operating, 0º to 70º C; extended temperature testing available, -40º to 85º ; storage, -40º to 90º C

Shock: 30 G's for 11 msec duration

Vibration: 5 to 2000 Hz @ 10 G's

Humidity: 98% RH non-condensing

Table 1–Output Functions

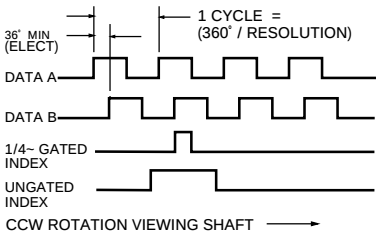
COLOR	FUNCTION
RED	+V (SUPPLY)
BLK	0 V (GROUND)
YEL	A
WHT/YEL	$\overline{A}$
BLU	B
WHT/BLU	$\overline{B}$
ORN	Z
WHT/ORN	$\overline{Z}$
BARE	SHIELD DRAIN

Table 2 L15 Disc Resolutions

50 60 100 200 250 256 300 360 500 512 625 1000
1024 1200 1440 1600 1800 2000 2048 2500 2540

Other resolutions available–consult factory.

Figure 1 Output Waveforms



L15 Incremental Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: L15M-F25-256-ABZC-5V/V-SC18).
All notes and tables referred to can be found on pages 50-51.

L15 **M** – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
L = Light duty
15 = 1.5 inch Diameter

HOUSING :
M = Standard

FACE MOUNT:
F25 = Standard

RESOLUTION NUMBER OF CYCLES:
1 to 2540
See Table 2, above

INTERPOLATION:
T2

CHANNELS:
ABZ
ABZC
See Figure 1, above

VOLTAGE:
5V/V = 5V IN/OUT TTL
15V/V = 12-15V IN/OUT
24V/V = 24-28V IN/OUT

OUTPUT TERMINATION SHIELDED CABLE:
SC18 = 18.0"
See Table 1, above

SPECIAL FEATURES:
Blank = None
S = Special

Electronically Multiplied Squarewave Output

Interpolate encoders provide a higher degree of angular resolution. These encoders are ideal for position readouts and position servo applications. The major specifications of interest for this type of encoder are transition accuracy and frequency response. In position readout situations the system usually doesn't know where it is within a particular count, so tight transition accuracy specs tend to be wasted. What is desired in these applications is the ability to subdivide a "count" into smaller divisions to improve system resolution. Interpolation provides this ability without any sacrifice in mechanical integrity or internal electrical signal strength.

Ordering Interpolation Options

The factory will be pleased to assist you in construction of the model number.
Call toll free: 800-350-(2727

When constructing the model number for any one of BEI's standard encoders, insert the desired number of Cycles Per Turn, after multiplication and the correct interpolation designator, in the model number between Shaft Seal Configuration and Number of Channels.

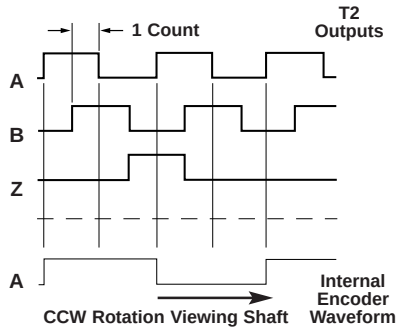
Example:
H25D-SS-7200-T2-ABZC-4469-SM18
(one possible encoder configuration with Interpolation Option T2.)

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

Interpolation Option T-2

Available on all models, except HS25, HS45

Waveform Pattern



Electrical Specifications

Multiplication Factor: X 2 (T2)

Cycles per Turn: (all Models, except H20, HS35 and HS25): Up to 7200 (3600 X 2)

Cycles per Turn (H20 Model Only): Up to 2048 (1024 X 2)

Cycles per Turn (HS35 Model Only): Up to 10,000 (5000 X 2)

Supply Voltages Available: 5-24 VDC ± 5%; (see note 5)

Output Options: (see note 5 for details): Model H20, Line Driver: 7272, Model HS35, Line Drivers: 4469, 7272, 7272 regulated; Model H25, Open Collector: 7273 Line driver: 7272, regulated or unregulated

Current Requirements: TTL: 250 mA maximum, see note 5

Quadrature Accuracy: ± 27°, measured at 1/5 maximum frequency response.

Frequency Response: 250 kHz, minimum count width = 1/10 base count.

Output Termination: See table 1

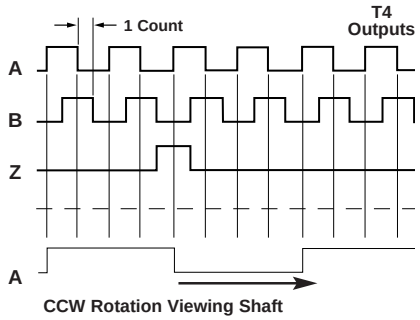
Mechanical Specifications

See standard specifications for the encoder model of interest. Overall length may increase up to 1.20" depending on options. Consult factory.

Interpolation Option T-4

Available on all models except L15, H20, HS35, HS25, HS45

Waveform Pattern



Electrical Specifications

Multiplication Factor: X 4 (T4)

Cycles per Turn: Up to 14,400 (3600 X 4)

Supply Voltages Available: 5-24 VDC ± 5% see note 5

Output Options: (see note 5 for details) Open Collector: 7406 (R), 7406 (R) Regulated, 7273 Line Driver: 4469 or 7272, regulated or unregulated

Current Requirements: TTL: 250 mA maximum

Transition Accuracy: ± 1 Count, measured at 1/5 maximum frequency response

Frequency Response: 400 kHz, minimum count width = 1/10 base count.

Output Termination: See table 1

Mechanical Specifications

See standard specifications for the encoder model of interest. Overall length may increase up to 1.20" depending on options. Consult factory.


Model H25


Model E25

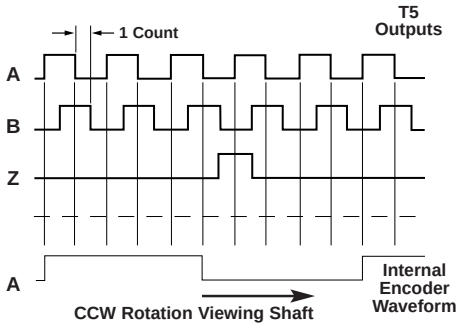

Model L25


Model H40

Interpolation Option T-5

Available on all models except L15, H20, HS35, HS25, HS45

Waveform Pattern



Electrical Specifications

Multiplication Factor: X 5 (T5)

Cycles per Turn: Up to 18,000 (3600 X 5)

Supply Voltages Available: 5-24 VDC ± 5% see note 5

Output Options (see note 5 for details):
Open Collector: 7406 (R), 7406 (R) Regulated, 7273
Line Driver: 4469 or 7272, regulated or unregulated

Current Requirements: TTL: 250 mA maximum

Transition Accuracy: ± 1 Count, measured at 1/5 maximum frequency response

Frequency Response: 500 kHz, minimum count width = 1/10 base count.

Output Termination: See table 1

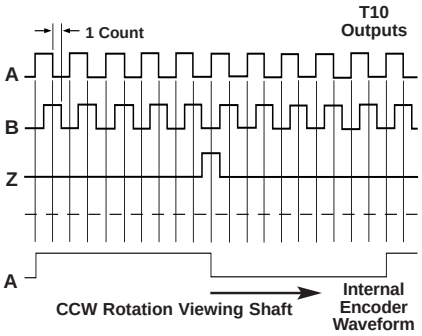
Mechanical Specifications

See standard specifications for the encoder model of interest. Overall length may increase up to 1.20" depending on options. Consult factory.

Interpolation Option T-10

Available on models H25, H38, H40 only

Waveform Pattern



Electrical Specifications

Multiplication Factor: X 10 (T10)

Cycles per Turn: Up to 36,000 (3600 X 10)

Supply Voltages Available: 5-24 VDC ± 5% see note 5

Output Options (see note 5 for details):
Open Collector: 7406 (R), 7406 (R) regulated, 7273
Line Driver: 4469 regulated or unregulated

Current Requirements: TTL: 250 mA maximum

Transition Accuracy: ± 2 Counts

Frequency Response:
1 MHz, min. count width = 1/10 base count.

Output Termination: See table 1

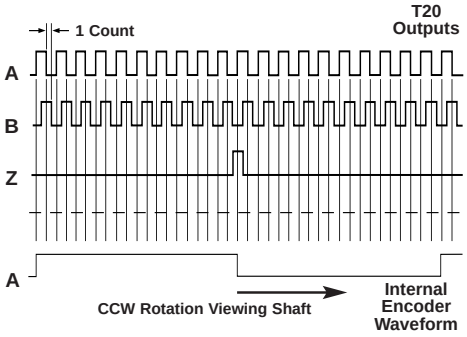
Mechanical Specifications

See standard specifications for the encoder model of interest. Overall length may increase up to 1.20" depending on options. Consult factory.

Interpolation Option T-20

Available on models H25, H38, H40 only

Waveform Pattern



Electrical Specifications

Multiplication Factor: X 20 (T20).

Cycles per Turn: Up to 72,000 (3600 X 20)

Supply Voltages Available: 5-24 VDC ± 5% see note 5

Output Options: (see note 5 for details):
Line Driver: 4469, unregulated to 15V only, 4469 regulated

Current Requirements: TTL: 250 mA maximum

Transition Accuracy: ± 4 Counts

Frequency Response: 1 MHz, consult factory for higher response requirements, minimum count width = 1/10 base count.

Output Termination: See table 1

Mechanical Specifications

See standard specifications for the encoder model of interest. Overall length may increase up to 1.67" depending on options. Consult factory.


Model H38


Model H20


Model HS25


Model HS35


Model L15


Model HS45

H25 Absolute Optical Encoder

Electrical Specifications

Code: 12 or 13 bits NB or GC; excess gray and BCD available

Counts Per Shaft Turn: 4096 or 8192

Count Transition Accuracy: ± 1/2 bit maximum

Supply Voltage: 5 – 28 VDC

Current Requirements: 120 mA typical

Output Formats: Parallel: Gray Code, Natural Binary and Binary Coded Decimal; Serial: Serial Synchronous Interface (SSI) compatible; Analog: 4-20 mA, 0-10V

Output Device: (see note 5)
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 volts (special feature)
7273: Open Collector, accepts 5 – 28 VDC
SSI: See page 40

Protection Level: Reverse, overvoltage and output short circuit protection (7272 only)

Frequency Response: 100kHz (1200 RPM for 12-bits, 600 RPM for 13-bits)

Output Termination Pinouts: See table page 41

Mechanical & Environmental Specs

Reference the H25 Incremental Encoder, pages 16-17

Connector

MS3112E14-19P, 19–pin connector on encoder body, mates to MS3116F14-19S (or equivalent)

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

Figure 1 Gray Code

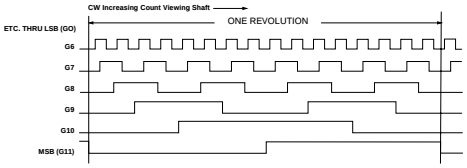
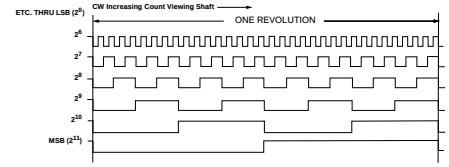


Figure 2 Natural Binary



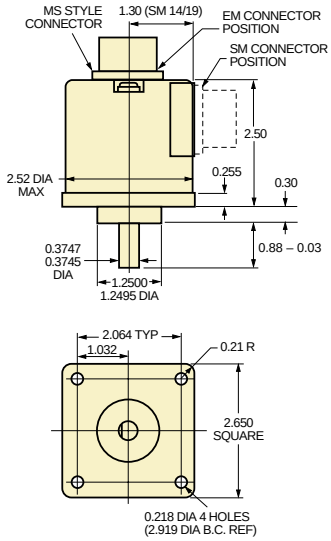
Long considered the industry standard for shafted incremental encoders, the Model H25 is now available in an absolute version up to 13 Bits of resolution. It incorporates many of the great standard features of the incremental version, including: EMI shielding, 40-lb ABEC 7 bearings, matched thermal coefficients on critical components, and custom optics. This encoder features a 12 or 13 Bit absolute parallel gray code output, a selection line for count direction, and an output latch as standard. Output is standard gray code with options for natural binary or SSI compatible signals. Signals can be provided in either a single-ended multi-voltage line driver (TTL compatible when provided with 5 volts) or as an open-collector style of output. Typical applications include dam gate control, cranes, telescopes, tool changers, and robotics.

Certifications

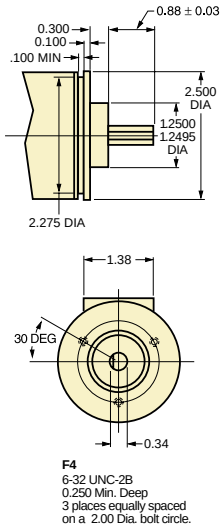
CE EN 55011 and EN 61000-6-2

See Regulatory Information on pages 47–49 for further certification details.

H25D - Square Flange

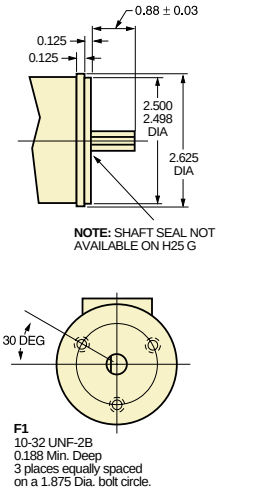


H25E - 2.50 Servo Mount



F4
6-32 UNC-2B
0.250 Min. Deep
3 places equally spaced
on a 2.00 Dia. bolt circle.

H25G - 2.62 Dia Servo Mount



NOTE: SHAFT SEAL NOT AVAILABLE ON H25 G

F1
10-32 UNF-2B
0.188 Min. Deep
3 places equally spaced
on a 1.875 Dia. bolt circle.

TOLERANCES: .XX = ± 0.01, .XXX = ± 0.005

H25 Absolute Encoder Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H25E-F4-SS-12GC-7272-CW-SM14/19).
All notes and tables referred to can be found on pages 50-51.

H25 – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
Heavy Duty
2.5 inch Dia.

HOUSING :
D = Square Flange
E = 2.5 inch dia. servo mount
G = 2.62 inch dia. servo mount
See dimensions

FACE MOUNTS:
F1
F4
See note 1

SHAFT SEAL CONFIGURATION:
SS = Shaft Seal
See note 2

NUMBER OF BITS:
12 = 12-Bits, 4096 counts per turn
13 = 13 Bits, 8192 counts per turn
(Excess gray codes and BCD available–consult factory

CODE TYPE:
GC = Gray Code
NB = Natural Binary
BCD = Binary Coded Decimal
X = Excess gray code

OUTPUT IC TYPE:
A1 = 4-20mA; A2 = 0-10V
7272 = Line Driver
7273 = Open Collector
S3 = Serial Synchronous Interface
See note 5 and page 40 for SSI

DIRECTION CONTROL:
CW = Clockwise increasing count
CCW = Counter clockwise increasing count

OUTPUT TERMINATION LOCATION:
E = End
S = Side

TERMINATION TYPE:
M14/19 = 19 pin connector
CS= Cable with gland seal
Cable length specified in inches
(i.e. C18 = Pigtail 18" long)
See page 41

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.

Mechanical Specifications

Shaft Diameter: 3/8"

Shaft Loading: Up to 25 pounds axial and radial

Shaft Runout: 0.0005 T.I.R. at midpoint regardless of shaft diameter

Starting Torque at 25°C: With shaft seal 8 in-oz

Bearings: Class ABEC 7 standard, ABEC 5 for 1/2" shaft

Shaft Material: 416 stainless steel

Bearing Housing: Die cast aluminum with iridite finish

Cover: Die cast aluminum

Bearing Life: 2 X 10^8 revs (1300 hrs at 2500 RPM) at rated load 1 X 10^{10} revs (67,000 hrs at 2500 RPM) at 10% of rated load

Maximum RPM: 12,000 RPM mechanical,

Moment of Inertia: 4.1 X 10^{-4} oz-in-sec^2

Weight: 13 oz typical

Electrical Specifications

Code: 14 or 15 bits NB or GC

Counts Per Shaft Turn: 16,384 or 32,768

Count Transition Accuracy: ± 1/2 bit maximum

Supply Voltage: 5 VDC or10-24 VDC

Current Requirements: 120 mA typical (10-24V operation), 400mA (5V operation)

Output Formats:
Parallel: Gray Code, Natural Binary
Serial: Serial Synchronous Interface (SSI) compatible

Output Device: (see note 5)
7272: Line Driver, 5 – 24 VDC, $V_{out} = V_{in}$
7273: Open Collector, accepts 5 – 24 VDC
SSI: See page 40

Protection Level: Reverse, overvoltage and output short circuit protection (see note 5)

Frequency Response: 100kHz

Output Termination Pinouts: See table page 40

Environmental Specs

Reference the H25 Incremental Encoder, pages 16-17

Connector

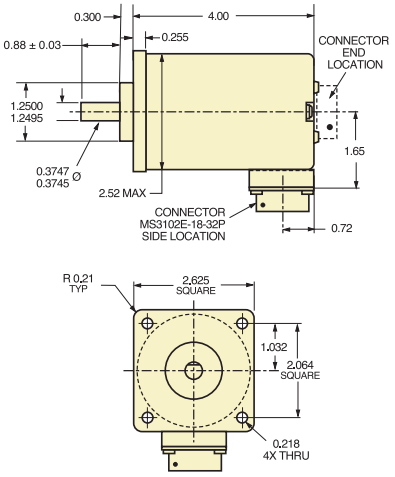
MS3112E14-19P, 19–pin connector on encoder body, mates to MS3116F14-19S (or equivalent)

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

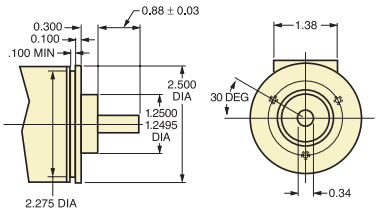
The H25X series single turn encoder is designed for those applications that require 14 or 15 bits of resolution in a compact, easy-to-integrate package. Gray Code and Natural Binary outputs are available for installations using a parallel input with the controller. For simplicity of data transmission, ease of cabling and better noise immunity, an SSI (Synchronous Serial Output) is also offered. This encoder works with the BEI Serial-to-Parallel converter, allowing for system upgrades from parallel output to SSI.

The H25X is built to the exacting mechanical standards used with the H25 design, including: dual preloaded ABEC 7 bearings; matched thermal coefficients on critical components and electronically centered code disks for high accuracy and stability over a range of environments. Specify the H25X when you need high pointing accuracy and ruggedness in a 14 or 15 bit absolute encoder for your telescope, antenna, robotics, material handling or general industrial automation.

H25X - Square Flange



H25X - 2.50 Servo Mount



TOLERANCES: .XX = ± 0.01, .XXX = ± 0.005

Certifications

CE EN 55011 and EN 61000-6-2

See Regulatory Information on pages 47–49 for further certification details.

Figure 1 Gray Code

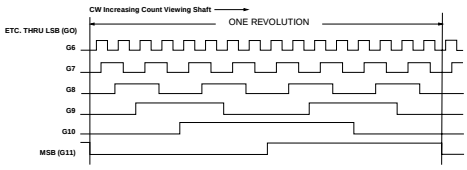
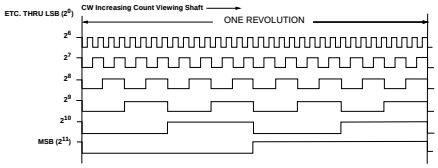


Figure 2 Natural Binary



H25X Absolute Encoder Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H25XE-F4-SS-14GC-7272-CW-SM14/19).
All notes and tables referred to can be found on pages 50-51.

H25X [ ] – [ ] – [ ] – [ ] [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
Heavy Duty
2.5 inch Dia.
X = Extended Resolution

HOUSING :
D = Square Flange
E = 2.5 inch dia. servo mount

FACE MOUNTS:
F4 = 6-32 holes, 3 places equally spaced on 2.00 inch bolt circle
See note 1

SHAFT SEAL CONFIGURATION:
SS = Shaft Seal
See note 2

NUMBER OF BITS:
14 = 14-Bits, 16,384 counts per turn
15 = 15-Bits, 32,768 counts per turn

CODE TYPE:
GC = Gray Code
NB = Natural Binary

OUTPUT IC TYPE:
7272 = Line Driver
7273 = Open Collector
S3 = Serial Synchronous Interface
See note 5 and page 40 for SSI

DIRECTION CONTROL:
See page 34

OUTPUT TERMINATION LOCATION:
E = End (5 V only, 15 bit)
S = Side

TERMINATION TYPE:
M14/19 = 19 pin connector
See page 41

SPECIAL FEATURES:
S = Special features specified on purchase order (consult factory)
See note 6

HS35 Absolute Optical Encoder

Electrical Specifications

Code: 12 bits NB or GC

Counts Per Shaft Turn: 4096

Count Transition Accuracy: ± 1/2 bit maximum

Supply Voltage: 5 – 28 VDC

Current Requirements: 120 mA typical

Output Formats: Parallel: Gray Code, Natural Binary

Output Device: (see note 5)
7272: Line Driver, 5 – 28 VDC, $V_{out} = V_{in}$
7272: Line Driver, 5 – 28 VDC, V_{out} = 5 volts (special feature)
7273: Open Collector, accepts 5 – 28 VDC

Protection Level: Reverse, overvoltage and output short circuit protection

Frequency Response: 100kHz (1200 RPM for 12-bits)

Output Termination Pinouts: See table page 41

Mechanical & Environmental Specs

Reference the H35 Incremental Encoder, pages 22-23

Shaft Bore: 1.000, 0.875, 0.750, 0.625, 0.500. Diameters under 0.875 are supplied with insulated sleeves.

Allowable Misalignment: 0.005" T.I.R. on mating shaft 0.75" from shaft end

Bore Runout: 0.001 T.I.R. maximum

Starting Torque at 25°C: Through shaft version (SS) = 7 in-oz (max); Blind shaft version (BS) = 4 in-oz

Bearings: 52100 SAE High carbon steel

Shaft Material: 416 Stainless Steel

Bearing Housing: Die cast aluminum with iridite finish

Cover: Die cast aluminum with iridite finish

Bearing Life: 7.5 X 10^9 revs (50,000 hours @ 2500 RPM)

Maximum RPM: 6,000 mechanical (see Frequency Response, above)

Moment of Inertia: 0.019 oz-in-sec^2

Weight: 18oz typical

Connector

MS3112E14-19P, 19–pin connector on encoder body, mates to MS3116F14-19S (or equivalent)

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

Built on the same rugged design as the incremental model, the HS35 Absolute Encoder is available with various output options including Gray Code and Natural Binary. Designed with a cast aluminum housing, a sealed connector and shaft seals, it carries an IP65 environmental rating. With the optional insulating inserts, it can be mounted on smaller diameter shafts. It is designed for either a through shaft mounting or blind shaft mounting with a closed cover to maintain its environmental rating.

Certifications

CE EN 55011 and EN 61000-6-2

RFI immunity, emissions and ESD-pending. MS connector version only.

Figure 1 Gray Code

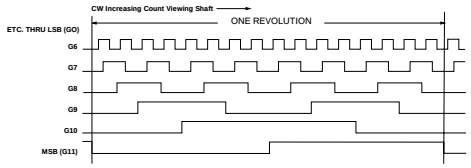
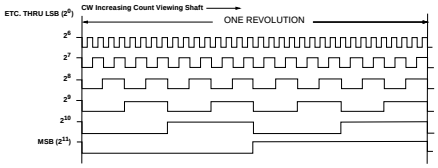
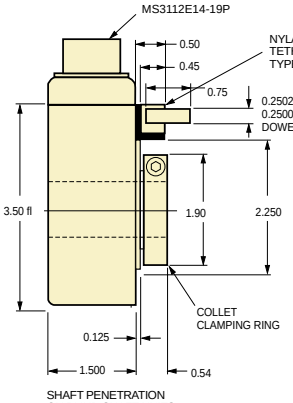


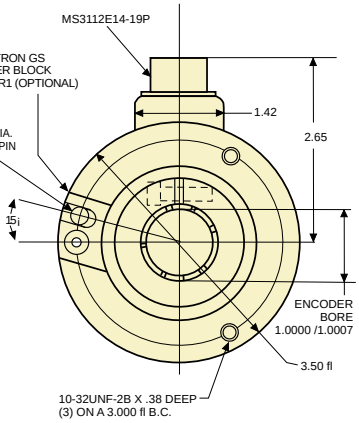
Figure 2 Natural Binary



MS Connector Termination

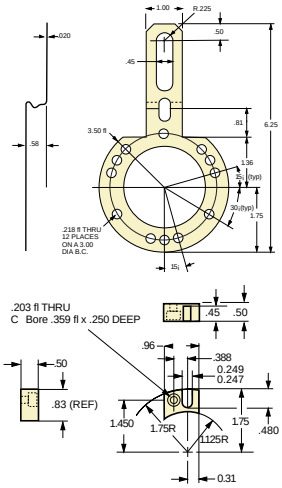


R1 Tether Block and Pin



TOLERANCES: .XX = ±0.01, .XXX = ±0.005

R2 Tether Arm



HS35 Absolute Encoder Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: HS35F-R1-100-SS-12GC-7272-CW-SM14/19).
All notes and tables referred to can be found on pages 50-51.

HS35 – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
HS = Hollow Shaft
35 = 3.5" Encoder Diameter

HOUSING :
F = Standard

SHAFT BORE:
100 = 1.00"
87 = 0.875"
75 = 0.75"
62 = 0.625"
50 = 0.50" etc

TETHER:
R1 = Tether Block and Pin
R2 = Tether Arm

SHAFT SEAL CONFIGURATION:
SS = Dual Shaft Seals
BS = Blind Shaft with single seal and cover
See note 2

NUMBER OF BITS:
12 = 12 Bits, 4096 counts

CODE TYPE:
GC = Gray Code
NB = Natural Binary

OUTPUT IC:
7272 = 5-28 Volt Line Driver
7273 = Open Collector
See note 5

DIRECTION CONTROL:
CW = Clockwise increasing count
CCW = Counter clockwise increasing count

OUTPUT TERMINATION:
SM14/19 = 19 Pin connector;
SCS = Shielded/Jacketed Cable with Cable Seal. Length of Cable is specified in inches (i.e. SCS18 = 18 inches)
See page 41

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.

H38 Absolute Explosion Proof Encoder

This is the same Explosion Proof rated encoder as the H38 Incremental, in an absolute encoder version with output up to 13 bits of resolution. When your application needs the ability to recover position information quickly after a power loss and you are operating in a hazardous area – the H38 may be the answer to your needs.

Electrical Specifications
Reference the H25 Absolute Encoder, page 34

Mechanical & Environmental Specs
Reference the H38 Incremental Encoder, pages 26-27

H38 Absolute Encoder Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H38D-12GC-7272-CW-SC-UL).
All notes and tables referred to can be found on pages 50-51.

H38 [ ] – [ ] [ ] — [ ] — [ ] — [ ] — [ ] — [ ]

TYPE:
H = Heavy Duty;
38 = 3.75" Square

HOUSING CONFIGURATION:
D = Standard

NUMBER OF BITS:
12 = 12-Bits, 4096 counts per turn
13 = 13 Bits, 8192 counts per turn
(Excess gray codes and BCD available–consult factory

CODE TYPE:
GC = Gray Code
NB = Natural Binary
BCD = Binary Coded Decimal
X = Excess gray code

OUTPUT IC TYPE:
A1 = 4-20mA
A2 = 0-10V
7272 = Line Driver
7273 = Open Collector
S3 = Serial Synchronous Interface *(See note 5 and page 40 for SSI*

DIRECTION CONTROL:
CW = Clockwise increasing count
CCW = Counter clockwise increasing count

OUTPUT TERMINATION:
SC = Side Conduit, 1/2–14 NPSF (dryseal) straight pipe threads

UL:
UL = Class I Environments
UL2 = Class I & II Environments

SPECIAL FEATURES:
S= Special features specified on purchase order (consult factory)
See note 6

H40 Absolute Shock Proof Encoder

Built to the same rugged standards as the H40 Incremental Heavy Duty encoder, this unit features an absolute encoder output up to 13 bits of resolution. Designed to take the rigors of physically demanding environments, the H40 has a heavy-duty housing, a 100+ pound bearing, and internal shock absorbers. When you need absolute position in a really tough environment, the H40 absolute is what you need.

Electrical Specifications
Reference the H25 Absolute Encoder, page 34

Mechanical & Environmental Specs
Reference the H40 Incremental Encoder, pages 28-29

H40 Absolute Encoder Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H40A-12GC-7272-CW-SC-UL).
All notes and tables referred to can be found on pages 50-51.

H40 [ ] – [ ] [ ] — [ ] — [ ] — [ ] — [ ] — [ ]

TYPE:
H = Heavy Duty;
40 = 4.00" Square

HOUSING CONFIGURATION:
A = Base Mounted Feet
B = No Mounting Feet

NUMBER OF BITS:
12 = 12-Bits, 4096 counts per turn
13 = 13 Bits, 8192 counts per turn
(Excess gray codes and BCD available–consult factory

CODE TYPE:
GC = Gray Code
NB = Natural Binary
BCD = Binary Coded Decimal
X = Excess gray code

OUTPUT IC TYPE:
A1 = 4-20mA
A2 = 0-10V
7272 = Line Driver
7273 = Open Collector
S3 = Serial Synchronous Interface *(See note 5 and page 40 for SSI*

DIRECTIONCONTROL:
C = Clockwise increasing count
CCW = Counter clockwise increasing count

OUTPUT TERMINATION:
SC = Side Conduit
EC = End Conduit; Conduit uses 1/2-14 NPSF (dryseal) straight pipe threads;
EM18 = MS3102R18-1P

UL:
UL = UL Explosion Proof rating, only available with SC termination

SPECIAL FEATURES:
S= Special features specified on purchase order (consult factory)
See note 6

HMT25 Absolute Multi-Turn Encoder

The HMT25 geared multi-turn encoder provides absolute position information over multiple turns of the input shaft. It keeps track of the exact position even during periods of power loss without the need for a battery backup. The HMT25 series is capable of outputs up to 4096 counts per turn and can count up to 4096 turns—a total of 24 bits or 16,777,216 positions. Units are enclosed in a 2.5-inch diameter sealed package to withstand rugged environments and they carry an IP 66 environmental rating. These encoders meet the long travel and high resolution requirements of robotics, rolling mills, rotary tables, cable winding, printing, converting and material handling systems.

Mechanical Specifications

Shaft Diameter: 0.375" (0.5" optional)
Flat on Shaft: 0.80" long x 0.030" deep
Shaft Loading: 40 lbs axial, 36 lbs radial (90 lbs axial and 80 lbs radial with 0.5" shaft)
Shaft Runout: 0.0005 TIR at midpoint of shaft
Starting Torque at 25°C: 2.5 in-oz (max)
Bearings: Dual, preloaded, Class ABEC 7
Shaft Material: 416 stainless steel
Bearing Housing: Die cast aluminum with iridite finish
Cover: Die cast aluminum
Bearing Life: 1×10^{10} at 10% rated load
Maximum RPM: 6,000 (see Frequency Response, below)
Moment of Inertia: 4.3×10^{-4} oz-in-sec^2
Weight: 16 oz nominal

Electrical Specifications

Code: Natural binary, gray code or SSI compatible
Counts per Shaft Turn: 4096, 12 bits
Number of Turns: up to 4096, 12 bits
Supply Voltage: 5 - 28 VDC
Current Requirements: 130 mA typical
Output: Line driver or open collector
Frequency Response: 100 kHz
Protection Level: Overvoltage, reverse voltage. Outputs short-circuit protected (1 minute max)
Output Termination Pinouts: See Tables, next page

Environmental Specifications

Enclosure Rating: IP66
Temperature: Operating, 0° to 70° C; Extended, -40° to +85°C; Storage, -20° to 90° C (to -40° if extended range is called out)
Shock: 50 g's 11 msec
Vibration: 5 to 2000 Hz @ 20 g's (see special note next page)
Humidity: 98% Non-condensing

HMT25 Multi-Turn Encoder Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: HMT25D-SS-12X12GC-28V/V-CW-SM18/32).
All notes and tables referred to can be found on pages 50-51.

HMT25 [ ] – [ ] – [ ] – [ ] **X** [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
Heavy Duty
Multi-trun
2.5 inch Dia.

HOUSING :
D = Square Flange
E = Servo mount

FACE MOUNTS:
F1 = 3,10-32,1.875 BC
F4 = 3, 6-32, 2.00 BC

SHAFT SEAL CONFIGURATION:
SS = Shaft Seal
See note 2

COUNTS PER TURNS:
12 = 4096 counts

NUMBER OF TURNS:
4 = 16 turns
8 = 256 turns
12 = 4096 turns

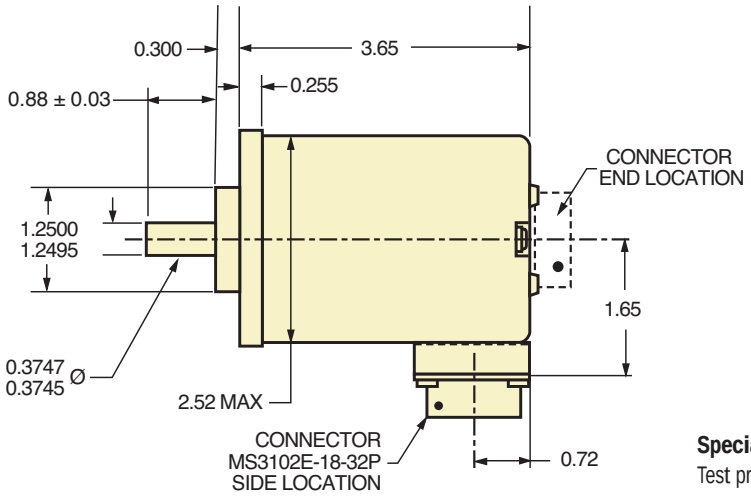
CODE TYPE:
GC = Gray Code
NB = Natural Binary

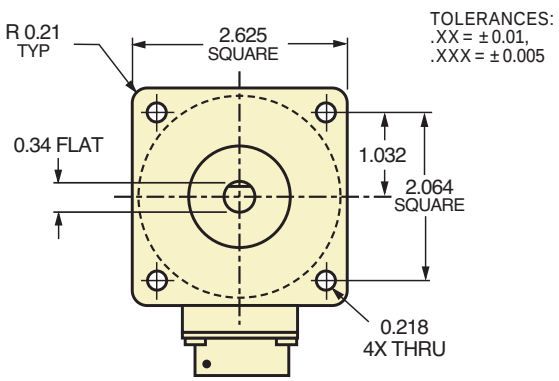
VOLTAGE/OUTPUT
28V/V = 5-28$V_{IN/OUT}$
28V/5 = 5-28V_{IN}/5V_{OUT}
28V/OC = 5-28V_{IN}/OC_{OUT}
S3 = SSI Compatable

COUNT DIRECTION:
CW = Clockwise Increasing count, electrically selectable

OUTPUT TERMINATION:
E = End
S = Side

CONNECTOR:
M18/32 = 32 pin Parallel output
M18 = 10 pin SSI output





Special note on vibration testing:
Test profile is 0.3 g's ramp to 20 g's from 5 to 40 Hz and 20 g's from 40 Hz to 2000 Hz.

HMT25 Output Terminations for Parallel Output[1]

PIN	FUNCTION (2)	PIN	FUNCTION (2)
A	T11 (MSB)	T	F7
B	T10	U	F6
C	T9	V	F5
D	T8	W	F4
E	T7	X	F3
F	T6	Y	F2
G	T5	Z	F1
H	T4	a	F0 (LSB)
J	T3	b	N/C
K	T2	c	LATCH
L	T1	d	DIR CONTROL
M	T0	e	ENABLE (Option)
N	F11	f	N/C
P	F10	g	0 V
R	F9	h	+V
S	F8	j	CASE GND

(1) Parallel output uses a MS3112E18-32P, 32 Pin connector on the encoder body
(2) TXX = Turns counts, FXX = Fine resolution counts

Direction Control: The HMT25 comes standard with a Direction Control bit. Normal operation is CW increasing count when viewed from the shaft end. This pin is normally pulled HI internally. To reverse the count direction, this pin must be pulled LO (Circuit Common). Optionally this can be designated as CCW increasing count when HI, in which case LO will be CW increasing count.

Latch: Outputs are active and provide continuous information when this pin is HI. When this pin is pulled LO (Circuit Common) the outputs are latched at the logic state that is present when the latch is applied and will stay latched until this pin is no longer LO. This pin is pulled HI internally.

Enable (optional): This option allows the operator to momentarily deactivate the outputs from the encoder. This may be useful in instances where the outputs from several different encoders must be sampled independently. Output is active when this pin is HI. When pulled LO (Circuit Common) all outputs go to high impendance state (Tri-state) and are inactive until the LO state is removed. This pin is pulled HI internally. To order this option on the HMT25 make sure the model number has –S on the end, followed by the description, –S = output enable.

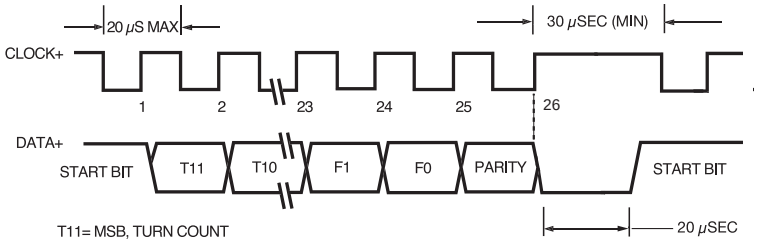
HMT25 Output Terminations for Optional 24 Bit SSI Ouput

FUNCTION	CABLE	CONNECTOR*	TERM BOARD (H38 & H40 ONLY)	
			H38	H40
DATA+	YEL	A	4	1
DATA-	WHT/YEL	H	7	7
CLOCK+	BLU	B	5	2
CLOCK-	WHT/BLU	I	8	8
DIRECTION CONTROL	ORN	C	6	3
ENABLE (Optional)	VIOLET	J	9	9
RESET (Optional)	WHT/ORN	E	10	10
+V (SUPPLY VOLTAGE)	RED	D	3	4
0 V (CIRCUIT COMMON)	BLK	F	2	5
CASE GROUND	BARE/ SHIELD	G	1	6

*Connector is an MS3102E18-1P, 10-pin connector on the encoder body and mates to an MS3106F18-1S connector or can be used with a standard cable/ connector assembly, BEI part 924-31186-18XX. (Where XX = 10, 20, or 30 for a 10, 20 or 30 foot cable length.)

RESET (Optional): The Reset pin (Pin E) is normally HI and is pulled up internally to the positive supply voltage.To activate the Reset function, Pin E must be pulled LO by connecting it to signal common. This causes the present encoder position to be stored into non-volatile memory as an offset value and the output of the encoder is then set to the value of "0". The encoder will retain this offset even if the power is turned off and on again. A new "0" position can be set by rotating the encoder shaft to a new position and then activating the Reset pin again. To order this option for the HMT25, make sure the model number has –S on the end followed by the description, –S = Reset.

24Bit, SSI Compatible Output Timing



T11= MSB, TURN COUNT
F0 = LSB, FINE COUNT
NOTE: ANY UNUSED BITS TRANSMITTED AS LOGICAL ZEROS

Parallel Absolute Output

The two most common types of absolute outputs are the Gray Code and the Natural Binary. Resolution for absolute encoders is expressed in "bits" where each successive bit increases the resolution by a factor of two. For example, 10 bits = 2^{10} = 1024 counts per revolution.

Natural binary code (Figure 1) is constructed so that the code counts up using the natural sequence of binary counting, i.e. 000, 001, 010, 011, 100 . . etc. The drawback to using this code sequence is that at several count positions the code will have transitions on multiple bits simultaneously. Due to the normal variations caused by gate delays, line impedances, etc. the actual transitions will not occur simultaneously. Reading data during one of these times could result in an erroneous reading. This can be overcome by taking multiple readings.

Gray code (Figure 2), by contrast, is designed to avoid the multiple transition problem entirely. It is specifically constructed so that only one bit will transition at a time. This ensures that state changes are much less ambiguous to the controller and is generally considered to be a more robust type of absolute code.

Regardless of the code type, one of the characteristics of absolute encoders is that they can readily be used for any resolution up to and including their maximum resolution. For example, a 12 bit encoder can be used at only 8 bits by ignoring (or disconnecting) the four lowest significant bits (LSB). This enables an installation that uses multiple absolute encoders to use the same encoder throughout with each controller using only the bits that it needs.

Figure 1 Natural Binary

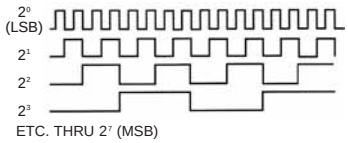
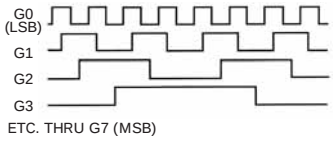


Figure 2 Gray Code



Ordering 8-Bit Absolutes

For years, we produced encoders with a maximum resolution of 8 bits. Lots of those old 8 bit encoders are still around. We update them to newer 12 bit designs on a case-by-case basis. If you have an 8 bit encoder, here is how that model number was constructed: **Direction of Rotation**, **Count, Code** and **Latch** designators were inserted between **Shaft Seal Configuration** and **Output IC** as shown below. To specify an equivalent encoder based on the 12 bit design, please call our Applications Specialists at **800-ENCODER** (800-362-6337) or check our web site at **www.beiied.com.**

Direction of Rotation: CCW or CW
Count: 8
Code: GC = Gray Code or NB = Natural Binary
Latch: L= Latch or Blank=None
Output Terminations: EM20=MS3102R20-29P or ED25=DB25P; SM18 = MS3102R18-1P; C18 = Cable, with length specified in inches. Specify ED25 for Line Driver Outputs.

Example: H25E-F1-SS-CCW-8GC-7406R-EM20
(one possible encoder configuration with the 8-Bit Absolute Option.)

Serial Synchronous Interface (SSI)

SSI output provides effective synchronization in a closed-loop control system. A clock pulse train from a controller is used to clock out sensor data: one bit of position data is transmitted to the controller per one clock pulse received by the sensor. The use of a differential driver permits reliable transmission of data over long distances in environments that may be electrically noisy. The encoder utilizes a clock signal, provided by the user interface, to time the data transmission. Receiving electronics must include an appropriate receiver as well as line terminating resistors.

Features

- Synchronous transmission
- Transmission lengths to 1000 feet
- Accepts clock rates from 100 KHz to 1.8 MHz

Data Transmission Sequence

1. Output driver of the encoder is a MAX 491 transceiver in transmit mode. The recommended receiver is a MAX 491 transceiver in receive mode.
2. Controller provides a series of pulses (or differential pulse pairs) on the CLOCK input lines.
3. On the first HIGH-to-LOW CLOCK transition, the encoder latches its data at the current position and prepares to transmit.
4. Controller reads data on the falling edge of the next 16 clock cycles.
5. The first bit is a START bit and is always HIGH.
6. Next come 12 data bits beginning with the most significant bit (MSB) and ending with the least significant bit (LSB). This is followed by three LOW pulses.
7. After the DATA bits, the DATA line goes LOW and remains LOW for a minimum of 30 microseconds between the end of the DATA bits and the beginning of the next CLOCK series.

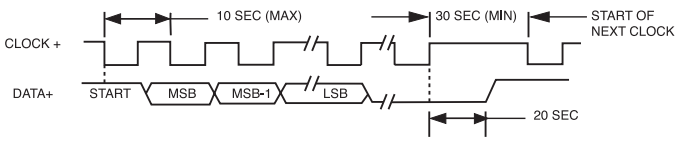
Interfacing Long Data Lines

Cable impedance can create a transmission delay, in effect, shifting the phase relationship between the clock pulse and the data. If this phase shift exceeds 180°, then the wrong bit position will be sampled by the receiver. As a result, the maximum allowable clock frequency is a function of the cable length. For 24 AWG, stranded, 3 pair cable (BEI part number 37048-003 or equivalent) the group delay is 1.36ns/ft. The table below shows the maximum transmission rate allowable as a function of cable length to ensure a phase shift of less than 90°.

CLOCK, Maximum (kHz) = 92,000 / Cable Length (ft)CW

Cable Length (ft)	50	100	200	300	500	1000
Max Freq (kHz)	1800	900	500	300	200	100

SSI Timing



Ordering SSI

HOW TO SPECIFY SSI OUTPUT IN THE ENCODER MODEL NUMBER:

Use the designation, S3 between the **Code Format** designation and the **Connector** designation.

Example: H25D-SS-12GC-S3-CW-SM18

Single Turn Absolute Encoder Options

The tables below are reference for pinouts, connections and operation of BEI's single turn absolute encoders. These absolute options are available in a wide range of package styles with a variety of outputs. The applicability table below shows which combinations are currently available. As always, you can call us at **800-360-ASAP** (2727) for immediate applications assistance should you have any questions.

Output Code and Terminations (12 & 13 Bit)

	PARALLEL CODE					TERMINATION TYPE		
	Gray Code		Natural Binary		Binary Coded Decimal	Cable	Conn	Term Board H38 & H40
	12 Bit	13 Bit	12 Bit	13 Bit				
MSB	G_{11}	G_{12}	2^{11}	2^{12}	A_0	WHT/BLK	A	1
	G_{10}	G_{11}	2^{10}	2^{11}	B_0	WHT/BRN	B	2
	G_9	G_{10}	2^9	2^{10}	C_0	WHT/RED	C	3
	G_8	G_9	2^8	2^9	D_0	WHT/ORN	D	4
	G_7	G_8	2^7	2^8	A_1	WHT/YEL	E	5
	G_6	G^7	2^6	2^7	B_1	WHT/GRN	F	6
	G_5	G_6	2^5	2^6	C_1	WHT/BLU	G	7
	G_4	G_5	2^4	2^5	D_1	WHT/VIO	H	8
	G_3	G_4	2^3	2^4	A_2	WHT/GRY	J	9
	G_2	G_3	2^2	2^3	B_2	WHT	K	10
	G_1	G_2	2^1	2^2	C_2	GRY/BLK	L	11
LSB_{12}	G_0	G_1	2^0	2^1	D_2	GRY/BRN	M	12
LSB_{13}		G_0		2^0	A_3	GRY/RED	N	13
	*0V (CIRCUIT COMMON)				B_3	GRY/RED	P	
	DIRECTION CONTROL					ORN	R	18
	CASE GROUND					GRN	S	16
	0 V (CIRCUIT COMMON)					BLK	T	15
	LATCH CONTROL					YEL	U	17
	+V (SUPPLY VOLTAGE)					RED	V	14
	SHIELD DRAIN					BARE	—	

*Pin P is available for a tri-state option

Output Applicability Table

	12 BITS	13 BITS	14/15 BITS	12x12 BITS	SSI	4–20 mA	0–10 V
H25	•	•			•	•	•
H25X			•				
HS35	•				•		
H38	•	•		•	•	•	•
H40	•	•		•	•	•	•
HMT25				•	•		

Direction Control: Standard is CW increasing when viewed from the shaft end. Pin R is normally HI (or N/C) and is pulled up internally to +V. To reverse the count direction, Pin R must be pulled LO (COMMON).

Latch control: Encoder outputs are active and provide continuous parallel position information when Pin U is HI (or N/C). Pin U is pulled up internally to +V. When Pin U is LO (COMMON) the encoder outputs are latched at the logic state that is present when the latch is applied and will stay latched until Pin U is no longer grounded.

Dir/Latch on 15-Bit Encoders: Due to a limited number of connector pins, either direction control or latch is available on pin U.

Parallel Code (14 & 15 Bit)

	Gray Code		Natural Binary		M14/19 Connector
	14 BIT	15 Bit	14 BIT	15 Bit	
LSB	G_0	G_0	2^0	2^0	A
	G_1	G_1	2^1	2^1	B
	G_2	G_2	2^2	2^2	C
	G_3	G_3	2^3	2^3	D
	G_4	G_4	2^4	2^4	E
	G_5	G_5	2^5	2^5	F
	G_6	G_6	2^6	2^6	G
	G_7	G_7	2^7	2^7	H
	G_8	G_8	2^8	2^8	J
	G_9	G_9	2^9	2^9	K
	G_{10}	G_{10}	2^{10}	2^{10}	L
	G_{11}	G_{11}	2^{11}	2^{11}	M
	G_{12}	G_{12}	2^{12}	2^{12}	N
MSB14	G_{13}	G_{13}	2^{13}	2^{13}	P
MSB15	DIR CONTROL	G_{14}	DIR CONTROL	2^{14}	R
	CASE GROUND	CASE GROUND	CASE GROUND	CASE GROUND	S
	CIRCUIT COMMON	CIRCUIT COMMON	CIRCUIT COMMON	CIRCUIT COMMON	T
	LATCH	DIR/LATCH	LATCH	DIR/LATCH	U
	+V SUPPLY VOLTAGE	+V SUPPLY VOLTAGE	+V SUPPLY VOLTAGE	+V SUPPLY VOLTAGE	V

SSI Output Termination Table

	M18 CONN	M14/19 CONN	CABLE CONN	TERM. BOARD	
				H38	H48
DATA +	A	A	YEL	4	1
DATA-	H	B	WHT/YEL	7	7
CLOCK+	B	C	BLU	5	2
CLOCK-	I	D	WHT/BLU	8	8
DIR CONTROL	C	R	ORN	6	3
CASE GROUND	G	S	BARE/SHIELD	1	6
CIRCUIT COMMON	F	T	BLK	2	5
+V SUPPLY VOLTAGE	D	V	RED	3	4
SHIELD DRAIN	—	—	BARE	—	—

M18 Connector is a MS3102E18-1P, 10-pin connector on the encoder body and mates to an MS3106F18-1S connector or can be used with a standard cable/connector assembly, BEI P/N 924-31186-18XX (Where X = 10, 20 or 30 for a 10, 20, or 30 foot length). This is the preferred connector for SSI output.

M14/19 Connector is a MS3112E14-19P, 19-pin connector on the encoder body and mates to an MS3116F14-19S or equivalent.

Serial-to-Parallel Converter

BEI'S serial-to-parallel converter module takes serial data from any BEI Serial Synchronous Interface (S3) or RS-422 Interface (S1) encoders and converts it to a parallel output. This eliminates the high cost and noise susceptibility of long, parallel cable runs, enabling the simplicity of a serial output encoder and a low cost twisted pair cable to interface with a standard PLC or controller. The bright LED indicators give visual status for deserialization, testing and troubleshooting.

Serial input, either SSI or RS-422 is easily selectable by a Format Select terminal directly on the board. In SSI mode, the on-board clock generates pulses to signal the encoder to provide data. Data is received serially and converted to a parallel format. Clock frequency is selectable by a Speed Select terminal, again directly on the board. For 100 feet or less, the 1.25 MHz mode can be used and for longer distances, up to 500 feet, a 200 kHz rate is available.(See also SSI output, page 40) In RS-422 mode, data is received asynchronously from the encoder and converted to a parallel format. Speed Select input is used to set the baud rate: 19.2 kBaud for most applications, up to 500 feet; 115.2 kBaud for shorter runs below 100 feet.

The module accepts inputs from 5 to 28 VDC and provides three output options: $V_{out} = V_{in}$; V_{out} = 5 V; and V_{out} = Open Collector. The compact DIN rail package is 105 mm wide, 78 mm deep and only 45 mm high and mounts to standard DIN Rail, EN 50 022, 35 mm X 7.5 mm, included with the module.

Use Ordering Option for Electronic Modules on next page

Specifications		
CONTROLLER SIDE		
Pin	**Description**	**Notes**
D14 thru D0	Parallel Data Outputs	For the SSI selection under pin FMT, data is MSB justified. For RS422 selection under pin FMT, data is LSB justified.
DVD	Data Valid	Logic HI = Data Valid, Logic LO = Data not valid (transitioning)
FMT	Format Select	Logic HI (N/C) = SSI Logic LO (0V) = RS422 (Asynchronous)
EN	Output Enable	Logic HI (N/C) = Output active Logic LO (0V) = Inactive (High Impedance)
SPD	Speed Select	**SSI:** Logic HI (N/C) = 1.25 MHz, Logic LO (0V) = 200kHz **RS422:** Logic HI (N/C) = 19.2 kBaud, Logic LO (0V) = 115.2 kBaud
0V	Supply Common	Logic LO available for Format and Speed selections

NOTE: On Format, Enable, and Speed selects, 10K internal pull-ups are used to V_S for Logic HI

ENCODER SIDE		
Pin	**Description**	**Notes**
0V	Supply Common	Connect either 0V pin to power supply common. This should be the same supply common as used on the encoder.
0V	Supply Common	Connected internally – see note above
VS	Supply Voltage	Provide 5 to 28 volts supply.
D -	Data minus	Connect to Data – line from encoder
D +	Data plus	Connect to Data + line from encoder
CL -	Clock minus	Connect to Clock – line from encoder (SSI only). If using RS422, then N/C
CL +	Clock plus	Connect to Clock + line from encoder (SSI only). If using RS422, then N/C
DIR	N/C	Leave this disconnected

NOTE: LED indicators on key data and control lines (Logic HI = Red, Logic LO = Green)

Power Supply
for Encoders & Controllers

The small footprint (only 58mm deep) of this DIN Rail (EN 50 022, 35mm X 7.5mm) mountable power supply makes it easy to fit into small enclosures. With a wide range of acceptable input voltages, both AC and DC, it's usable in virtually all industrial applications worldwide. Transient surge protection is built-in to reduce faults caused by ESD, power-up transients or phase errors. It also has 100% reserve capacity for startup or overload conditions.

This product carries international approval including UL 60950 for IT equipment and UL 508 for industrial control equipment enabling the device to be used globally. It is also CE rated and conforms to EMC directive 89/336/EEC and low voltage directive 73/23/EEC

Power Supply Ordering Options

Output Voltage: 5 Volts
Current: 4.0 Amps
Model #: EM-DR4-PS-TB-5
Part #: 924-60008-001

Output Voltage: 24 Volts
Current: 1.5 Amps
Model #: EM-DR4-PS-TB-24
Part #: 924-60008-002

Specifications	
INPUT	
Voltage range	85 – 264 V AC 110 – 350 V DC
Frequency (AC)	45 – 65 Hz
Switch on time	< 1 s
Transient surge protection	Varistor
Mains buffering	20 ms (120 V AC) >100 ms (230 V AC)
Internal fuse	1.25 Amps to protect power supply
OUTPUT	
Voltage tolerance	±1 %
Nominal output current	4.0 Amps (5 volt supply) 1.5 Amps (24 volt supply)
Maximum output current (<20 sec)	9.0 Amps (5 volt supply), 4.5 Amps (24 volt supply)
Efficiency	> 70% (5 volt supply), > 80% (24 volt supply)
Response time U_{out}	< 100 ms, typical (10% - 90%)
Ripple (20 MHz)	<100 mVpp
ENVIRONMENTAL	
Operating temperature	0 to +55 °C
Storage temperature	-40 to +85 °C

The Electronic Modules on this page provide various signal conditioning or testing functions for optical encoders. They are designed around a standard DIN Rail mounting (Type EN 50 022, 35 mm X 7.5 mm) making them easy to install in standard enclosures.

Optical Isolator

This module is a versatile interface between an incremental optical encoder output and any type of receiving electronics. It accepts single ended or differential inputs and provides single ended or differential outputs in either an open collector or line driver configuration. It accommodates all standard operating voltages: 5VDC (TTL), 12-15 VDC, and 24 VDC. Up to eight Optical Isolator Modules can be daisy-chained to provide multiple, simultaneous outputs to various controllers or PLC's. In addition to being used as a signal splitter, the Optical Isolator can also be used as a repeater to relay signals for installations with especially long lines. If you are plagued by electrical noise caused by the poor impedance characteristics of an open collector output, this product can help clean up noisy signals by converting the output to a differential line driver. With a 1 MHz throughput capability, it can be used wherever a fast, optically isolated interface is required.

Anti-Dither Module

This module performs a specialized, yet critical function for applications that may be subject to position errors due to stop/start cycles or vibration environments that are not using the direction-detection functions provided by a quadrature signal. The Anti-Dither module accepts A and B signals and, through internal discrimination circuitry, passes the signals through only when there has been true movement of the encoder. This acts like 1/4 cycle of hysteresis and avoids encoder signal transition dithering due to mechanical vibration. This is especially useful in web processes, handling and inspection systems that use conveyors, and simple speed control in applications that are subject to vibration.

Encoder Tester

This test module accepts input from any type of incremental optical encoder. It tests for two channels in quadrature, an index pulse, and power to the module. It features a simple and intuitive LED indicator scheme: lights are on to indicate that a signal is HI and off when the signal goes LO. Through combinations of terminal connections and dropping resistors (supplied), it can test open collector outputs, and both single ended and differential outputs at all standard voltages: 5VDC (TTL), 12-15 VDC, and 24 VDC. This tester can also be used for machine set-up (by locating the index pulse) and incoming inspection and diagnostics of encoded motors.

Electronic Modules Ordering Options

FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: EM-DR1-IC-24-TB-24V/V).
All notes and tables referred to can be found on pages 50-51.

EM – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
EM = Electronic Module, DIN Rail mount

PACKAGE STYLE:
DR1 = 114.5 mm x 99mm x 22.5 mm (Used with EI, IC, AD)
DR3 = 105mm x 78mm x 45mm (Used with SP)

FUNCTION:
ET = Encoder Tester
IC = Optical Isolator
AD = Anti-dither
SP = Serial to Parallel Converter

OUTPUT VOLTAGE FROM ENCODER:
5 = 5 VDC (Default for ET)
15 = 12 – 15 VDC
24 = 24 VDC

OUTPUT TERMINATION:
TB = Standard Terminal Block

SUPPLY VOLTAGE/OUTPUT:
24V/V, 24 VDC max, $V_{out} = V_{in}$
24V/5, 24 VDC max, V_{out} = 5 volts
24V/OC, 24 VDC max, V_{out} = Open Collector

SPECIAL FEATURES:
S= Special features specified on purchase order(consult factory)
See note 6

All adapter assemblies can be ordered as a completed assembly with an encoder or separately as a kit. All adapter kits will be provided with the necessary hardware to assemble the adapter onto the encoder only.

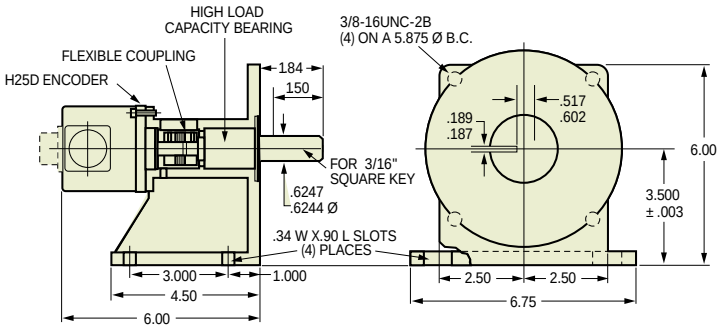
Please contact the factory for applications assistance in determining the proper adapter configuration for your system.

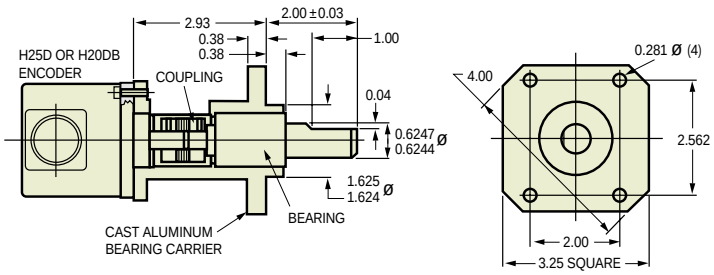
Hi-Load Bearing Assemblies

The high load bearing assemblies come in two styles: foot-mounted and flange-mounted. The foot-mounted version mates to a 56C motor face while the flange-mounted version features a standard 4-hole flange mount. The high load bearing assemblies accommodate the H20D, H25D and H38D square flange series encoders. Optional shaft configurations are available upon request. Consult the factory.

Foot-mounted

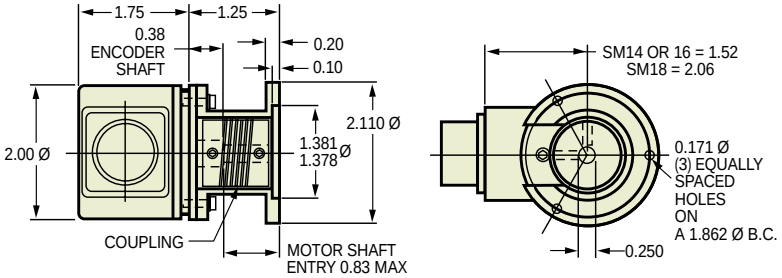
Square Flange-mounted





NEMA 23

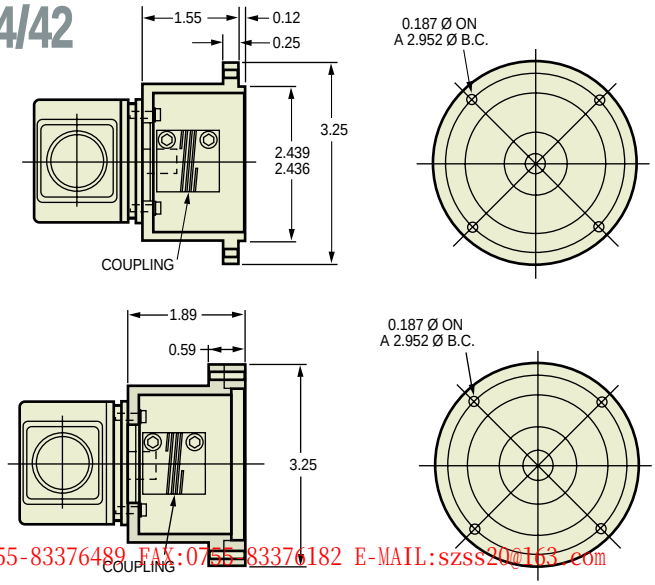
The NEMA 23 flange mount adapter allows for mating a Model H20E with an F28 face mount encoder to a standard NEMA 23 motor frame.



Thermoplastic Adapter & NEMA 34/42

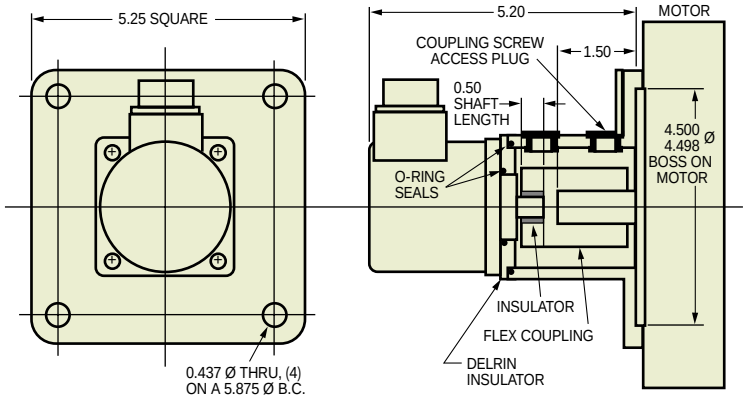
This thermoplastic adapter allows easy mounting of either an H20E with an F12 face mount or an H25E with an F45 face mount. Thermoplastic material provides thermal and electrical isolation. With the addition of the aluminum NEMA 34/42 mounting ring, the encoder will mount directly to a NEMA 34/42 motor housing. Regular or insulated couplings are available. Consult the factory.

Adapter with NEMA 34/42 Mounting Ring



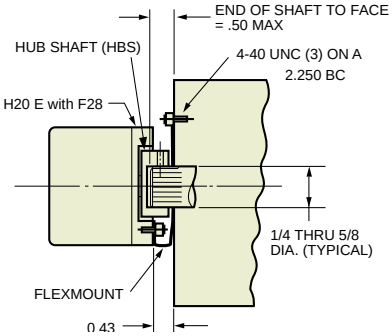
NEMA 56

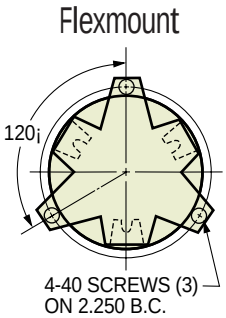
This adapter can be used to mount an H25E with F1 face mount, H25D, or H38D square flange series encoder to a size 56 motor frame. The assembly is provided with a flexible coupling to accommodate a 5/8" diameter shaft.



H20 Hub Shaft

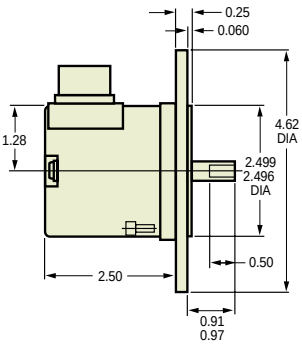
This is also shown under the H20 model description in the Specifying Guide portion of this manual. The Hub Shaft with flexmount is a versatile, general purpose mounting that can accommodate shafts from 1/4" up to 5/8" readily in a compact package. The flexmount kit includes mounting hardware to assemble the flexmount to the encoder only.

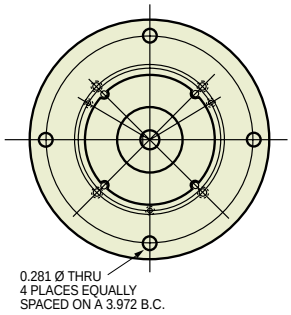




5PY

This is a standard 5PY style motor adapter. It comes in aluminum or Delrin plastic versions and can accommodate a Model H20D, H25D square flange encoder, or H25E with three synchro-clamps (page 46).





Encoder Adapter Ordering Information

HI-LOAD BEARING ASSEMBLIES
Foot-mounted NEMA 56C
H25D series part number 11009-001
H20D series part number 11009-002
H38D series part number 11009-003

Square-flange mount
H25D series part number 11008-000
H20D series part number 11008-003
H38D series part number 11008-004

NEMA 23 ADAPTER
H20 Series: Part Number 38229-001
Note: The NEMA 23 adapter kit can be ordered with either a 1/4" or 3/8" inside diameter coupling, please specify when ordering. Couplings are ordered separately.

THERMOPLASTIC ADAPTER & NEMA 34/42
H20/H25 series part number 31170-001
H20/H25, NEMA 34/42 Kit 31170-003
Note: Includes adapter and mounting hardware only. Couplings are available for shaft diameters from 1/4 to 1/2 inch. Couplings are ordered separately.

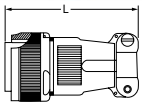
NEMA 56 ADAPTER
H25E Series (incl. Delrin Insul.): Part No. 11012-002
H25D Series (no Delrin Insul.): Part No. 11012-006
NOTE: H25 kits must specify 0.5" long shaft
H38D Series (incl. Delrin Insul.): Part No. 11012-003

H20 HUB SHAFT WITH FLEXMOUNT
Flexmount Kit: Part Number 31134-001

5PY ADAPTER
Aluminum Adapter: Part Number 38228-001
Delrin Adapter: Part Number 38228-002

MS3106 Mating Connectors for Incremental Encoders

These have sealed conductors and are screw-on, military-style connectors with solder cups on the back of the pins (can accept up to 16 gage wire) and a built-in clamping strain relief. The environmentally sealed backshell is waterproof.



Shell Size	Used with	L Max	#of Pins	Part No.
MS14	EM14 or SM14	2.125"	6	MS3106F14S-6S
MS16	EM16 or SM16	2.187"	7	MS3106F16S-1S
MS18	EM18 or SM18	2.656"	10	MS3106F18-1S
MS20	EM20 or SM20	2.656"	17	MS3106F20-29S

MS3116 Mating Connector for 12 Bit Absolute Encoders

These have sealed conductors and use a bayonet (push and turn) shell. Pins have solder cups on the back for 20 gage wire and a built-in clamping strain relief. The environmentally sealed backshell is waterproof.

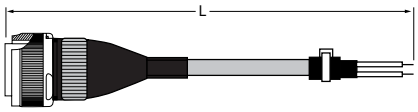
Shell Size	Used with	L Max	#of Pins	Part No.
MS14	SM14/19 or EM14/19	1.800	19	MS3116F14-19S

Protective Housing for Hollow-Shaft Encoders

This cage protects hollow-shaft style encoders from mechanical damage during handling and installation. It is used with either the HS25 or the HS35 encoder and has a side cutout to allow for tether arm placement. It accepts a NEMA56 standard motor face mount and can be used with either through-shaft or blind shaft styles of encoders. Protective cover kits come with installation hardware. **Part Number 26068-001**

Cable Assemblies for Incremental and Absolute Serial Encoders

Cable assemblies are built using high quality custom BEI standard cable (P/N 37048-003) consisting of four, low capacitance shielded twisted pairs with an overall shield, extra large conductors for power, and signal ground all within an abrasion-resistant PVC jacket. Size 16 and 18 cable assemblies utilize a waterproof and UV resistant over-molded backshell.



Part Nos. for MS3106F14S-6S Mating Connector

10 ft. # 31186-1410	20 ft. # 31186-1420	30 ft. #31186-1430

Part Nos. for MS3106F16S-1S Mating Connector

10 ft. # 31186-1610	20 ft. # 31186-1620	30 ft. #31186-1630

Part Nos. for MS3106F18S-1S Mating Connector

10 ft. # 31186-1810	20 ft. # 31186-1820	30 ft. #31186-1830

Cable Reels

Both 100' and 500' reels of encoder cable are available for your own custom wiring requirements. This high quality custom BEI standard cable consisting of four, low capacitance shielded twisted pairs with an overall shield, extra large conductors for power, and signal ground; all within an abrasion-resistant PVC jacket.

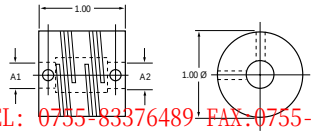
100 ft. reel	Part No. 37048-003-100
500 ft. reel	Part No. 37048-003-500

Couplings

Couplings are high performance, helical-cut beam style providing the best combination of torsional rigidity and compensation for shaft misalignment. They are made of aluminum and are iridite coated to resist chemical attack.

Part No.	Bore Dia +.002/-.000 A1Dia	Bore Dia +.002/-.000 A2 Dia	Torsional Flexibility	Torques (Lbs-inch) Non-Reversing	Torques (Lbs-inch) Shock or Reversing	Torques (Lbs-inch) Momentary
39074-8-8	.250	.250	.165 min/in-oz	19	9.3	37
39074-12-8	.375	.250	.315 min/in-oz	15	7.5	30
39074-12-12	.375	.375	.315 min/in-oz	15	7.5	30

Notes: 1.Bore is relieved to allow shafts to nearly butt 2. Setscrews: Cup point, hex socket, #6-32, two at each end, 90º apart. 3.Permitted axial motion from free length: ±.020 4. Permissible shaft misalignment: Angular up to 5º; Parallel up to .010". Installation note: To avoid coupling failure, be sure the shafts fit freely in the coupling bores and that the coupling is not compressed or subjected to greater deflections than specified above.



Cable Assemblies for 8 Bit Absolute Encoders

Cable assemblies for 8 Bit absolute encoders are built using high quality custom BEI Standard Cable (P/N 37059) consisting of 12, 22 gage conductors, an overall shield, and an abrasion-resistant PVC jacket.

Part Numbers for MS3106F20-29S Mating Connector

10 ft. #31204-2010	20 ft. #31204-2020	30 ft. #31204-20300

Cable Assemblies for 12–15 Bit Absolute Encoders

Cable assemblies for absolute encoders are built using high quality custom BEI standard cable (P/N 37063) consisting of 18, 26 gage conductors and uses larger, 22 gage conductors for power and ground. This cable has an overall shield and an abrasion-resistant PVC jacket.

Part Numbers for MS3116F14-19S Mating Connector

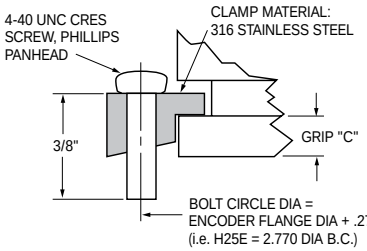
10 ft. #31219-1410	20 ft. #31219-1420	30 ft.#31219-1430

Measuring Wheel

This measuring wheel uses an 80 durometer urethane rolling surface vulcanized to an aluminum hub and then machined to a circumference of 12 inches. It is designed to be used with shafts of a nominal 3/8" diameter and should be installed with the hub side facing away from the encoder housing. Maximum recommended load in service is 15 pounds. **Part Number 31196-001**

Synchro-Clamps

Synchro clamps are used with servo-style bearing housings ("E" or "G" style housings on the encoder model number designation) to hold the face of the encoder against a mounting plate. Clamps are placed at a radius slightly larger than the encoder mounting flange, (see illustration below) and allow for rotational alignment of the encoder during installation for machine set-up.



Grip "C"	Encoder Type	Part No. (3-Piece Kit)
.093	H25E or H20E	924-31165-001
.125	H25G	924-31165-002

Defining A Hazardous Location

Background:

The growth of complex industrial processes created a need for standards and certifications in potentially explosive environments. Different nations developed and implemented standards for equipment and installations in these environments and a patchwork of requirements evolved. Today the various classifications of Hazardous Locations continue to evolve toward harmonized standards. At present each geographic area of the world works under slightly different standards and classification guidelines. These areas can be loosely categorized as North America, Europe, Latin America, Asia-Pacific, Commonwealth of Independent States (CIS) and Other International markets. Each area has its particular certifying and product marking requirements and reciprocity agreements with the different agencies allow for local certifying bodies to test and/or certify to the standards of another region.

What constitutes a hazardous location?

An area can be classified as hazardous based on the following factors:

- The possible presence of an explosive atmosphere such as flammable gases
- The likelihood that the explosive atmosphere is present when equipment is operating
- The ignition-related properties of the explosive atmosphere that is present

This approach is used by the United States (Through the National Electrical Code, NEC), Canada (The Canadian Eletrical Code, CEC), Europe (CENELEC) and the rest of the world (International Electical Code, IEC).

How are Hazardous Locations Classified?

The breakdown of Hazardous Locations classification follows the same general structure for all the different Classes of hazardous materials. The first level is the type of material: Class I (Gases, liquids, vapors), Class II (Combustible dusts) or Class III (Ignitable fibers and flyings). The next level is the Division (or zone) depending on whether the explosive condition is very likely to occur (Division I) or not very likely to occur (Division II). Materials have different levels of ignitability so within each Class there are also Groups and Temperature Codes. For more detail refer to www.ul.com/hazloc under the “Technical Summary” tab.

How can equipment operate in explosive environments?

There are a variety of protection methods available depending on the circumstance of a particular installation, but the most recognized methods and their designations are: flameproof (also called explosionproof) ‘d’, pressurization ‘p’, powder filling ‘q’, oil-immersion ‘o’, increased safety ‘e’, intrinsic safety ‘i’, nonincendive (or nonsparking) ‘n’, and encapsulation ‘m’. For optical encoders, the most commonly used methods are explosion-proof construction and intrinsic safety, detailed below:

EXPLOSION PROOF CONSTRUCTION METHOD

In this protection technique the equipment is contained in an enclosure that can withstand an internal explosion of the most volatile gas-to-air mixture that can penetrate into the interior of the enclosure. The enclosure must contain the explosion without damage and without allowing the flame to leave the enclosure through any joints or other openings.

INTRINSIC SAFETY METHOD

This protection technique uses an apparatus that limits the maximum level of current and voltage (usually measured as energy in millijoules) that can be delivered into the hazardous location. This equipment ensures that even in a double fault condition, there will not be enough energy to ignite the gas or vapor in that area. Note that encoders that use this method of protection, must use energy limiting devices (commonly called Barriers) in their installation. **An Intrinsically Safe encoder, installed without an Intrinsic Safety Barrier is not an Intrinsically Safe system!**

On page 48, you will find tables of the BEI encoders models along with the level of classification that they carry.

BEI provides high quality, environmentally sealed, reliable products for industrial applications. They are qualified to a variety of recognized industrial standards. Qualifying agencies we have worked with include: NEMA, UL, C-UL, CSA, DEMKO, CENELEC and CE.

Protection to Environmental Standards:

National Electric Manufacturers Association (NEMA)

NEMA This organization provides a set of standards for environmental (dust and moisture) protection of components. It is largely associated with the motor industry. We generally conform to the highest standards—NEMA Classes 4 and 13. See Table 1 on page 48.

IEC

The IEC organization provides a similar classification of environmental protection for the European equivalent of NEMA. Our encoders generally conform to the standards of IP (Ingress Protection), standard IP65 or IP66.

Operation in Hazardous Environments

Underwriters Laboratories (UL)

This group provides testing services to NEMA standards as well as for intrinsically safe and explosion proof components. Tables 2.1–2.3 detail the level of hazardous environment operation available for various encoder models.

Underwriters Laboratories (UL)

C This is the UL certification mark for products for the Canadian market. These products have been evaluated to Canadian safety requirements which may be somewhat different from U.S. standards.

Canadian Standards Association (CSA)

The Canadian Standards Association provides, among other things, approvals for intrinsically safe systems. A number of our encoders are available with CSA approvals.

CENELEC

This is the European certifying organization that sets the standard for explosion proof and intrinsically safe components. Each country has its own agency that applies and certifies to the CENELEC standards. The Danish agency is known as DEMKO, the United Kingdom agency is called BASEEFA, etc.

ATEX Directive

On March 1, 1996, a transitional period began for the implementation of ATEX Directive (94/9/EC). This Directive (Directives are national laws for the European Economic Area) applies to electrical and non-electrical equipment/components and protective systems intended for use in potentially explosive atmospheres and became mandatory on July 1, 2003.

Communauté Europeenè (CE)

The Communauté Europeenè requirements are a European standard for electromagnetic compatibility. As of January 1, 1996 all electrical or electronic components supplied to Europe must have the CE mark. Our encoders have been tested to the "Heavy Industrial" standards of CE.

Table 1 NEMA Status of BEI Industrial Encoder Division Encoders

NEMA	NEMA Design Class									
	1	2	3	3R	3S	4	4X	6	12	13
Encoder Type			Minimum Requirement: Shaft Seal, Diecast Cover and MS Connector or Cable Seal							
H40			X	X	X	X	UL	UL	X	X
H38			X	X	X	X	UL	UL	X	X
H25			X	X	X	X	X	X	X	X
H20			X	X	X	X	X	X	X	X
HS25			X	X	X	X	X	X	X	X
HS35			X	X	X	X	X	X	X	X
L25	X	X								
E25	X	X								

UL indicates that the encoders have been tested by Underwriters Laboratories for a specific enclosure type.

X indicates that the encoder is designed to meet the UL requirements but has not been submitted for testing.

Encoders used in a Type 12 environment should be ordered with the hard anodize finish to meet 200 Hour Salt Spray Test. All H38's are hard anodized.

The following tables list the approvals that are available for use of encoders in hazardous locations:

Table 2.1 European and North American Intrinsic Safety Approvals

Encoder Type	Output Driver	Input VDC	CENELEC/ATEX	U.S. Standards Class I, Div I,Group	U.S. Standards Class II, Div I,Group	Canadian Standards Class I, Div I, Zone 0	System Diagram
H25, L25, E25, HS25*, H35, HS35, H37, H38, or H40	4469	5	EEx ia IIC T4	A, B, C, D	E, F, G	Group IIC	924-08062-003
	3904R	5	EEx ia IIC T4	A, B, C, D	E, F, G	Group IIC	924-08063-001 or 002
	3904	5	EEx ia IIC T4	A, B, C, D	E, F, G	Group IIC	924-08064-001 or 002
	3904	9	EEx ia IIB T4	C, D	E, F, G	Group IIB	924-08064-001 or 002

*Rating only available with 4469 output driver

Table 2.2 Canadian Standards Association (CSA) Intrinsic Safety approvals

Encoder Type	Output Driver	Input VDC	Class I, Div I,Group	System Diagram
H25 Incremental	7406(R)	5	C, D	924-08035
H25 Incremental	8830	5	C, D	924-08035
H20 Incremental	3904(R)	5	A, B, C, D	924-08035
H25 8 bit Absolute	7406(R)	5	D	924-08035

Table 3 CE Certification

Encoder Termination	EN 55011 EN 61000-6-2
Connector, Metal	OK
Conduit (H38, H40)	OK
Connector, Plastic	See Factory
Pigtail	See Factory
Shielded/Jacketed Cable	See Factory

Table 2.3 European and North American "Explosion Proof" Approvals

Encoder Type	CENELEC/ATEX (1)	NEMA 7 U.S.Standards Class I, Div I, Group:	NEMA 7 U.S.Standards Class II, Div I, Group:
H38 (Standard)		D	
H38 (with Labyrinth Seal)	EExdIIB,T5	C,D	E, F, G
H40		D	

(1) Available after Q3, 2004.

Table 4 Haz Environment Groups

GAS GROUPS		DUST GROUPS
Class I		Class II
Division 1 & 2	Zone 0,1 & 2	Division 1 & 2
A (acetylene)	IIC (acetylene & hydrogen)	E (metals)
B (hydrogen)		F (coal)
C (ethylene)	IIB (ethylene)	G (grain)
D (propane)	IIA (propane)	

This Galvanically Isolated Electronic Module is the perfect complement to our Intrinsically Safe Encoders. Together with our cable assemblies they constitute a completely engineered solution to operation in Class I and Class II Division 1 Hazardous Environments. This single barrier provides both power and signal isolation for an incremental encoder with differential quadrature outputs and an index. This all-in-one approach saves the cost and inconvenience of buying separate power and signal barriers as required by other systems. This barrier is galvanically isolated and saves the added cost of maintaining a high integrity earth ground. With differential line driver outputs, this barrier can be used to carry signals up to 500 feet with a bandwidth of up to 250 kHz.

The Intrinsic Safety Barrier Module is designed around a standard DIN Rail mounting (Type EN 50 022, 35 mm X 7.5 mm) for easy installation in standard enclosures.

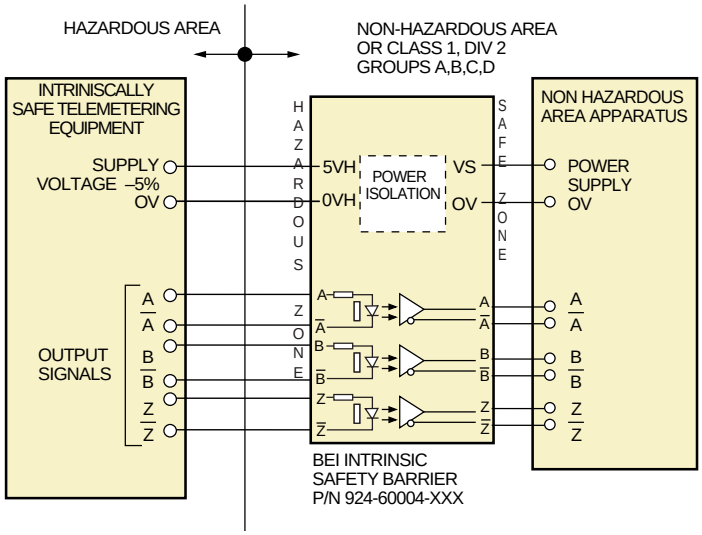
Intrinsic Safety Barrier Specifications

POWER SUPPLY/OUTPUT TYPE

Part Number:	Barrier Supply Vs +/-5%	Output logic to Non-Hazardous Area Apparatutus:	
924-60004-002	12-24 Volts	V_{OUT} = 5V	Line Driver 100mA Source/Sink
924-60004-003	12-24 Volts	$V_{OUT} = V_{IN}$ (Nominal)	Line Driver 100mA Source/Sink
924-60004-004	12-24 Volts	Open Collector	NPN 80mA Source/Sink

BARRIER PARAMETERS

Voltage Supply	Voc (Uo) Isc (Io)	Class I,Group D Class II, Groups E,F,G Group IIA	Class I, Group C Group IIB	Class I, Groups A,B Group IIC
+5V DC±5%	8.9V 345mA	Ca(Co) La(Io) 590 µF 2.0 mH	Ca(Co) La(Io) 43 µF 0.75 mH	Ca(Co) La(Io) 5.6 µF 0.4 mH



NOTE: This system diagram is for general information only.
installation must be consistent with BEI Installation Drawing 924-08067-001.

Intrinisic Safety Barrier Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: EM-DR1-IS-5-RTB-24V/V).
All notes and tables referred to can be found on pages 50-51.

EM – **DR1** – **IS** – **5** – **RTB** – ____

TYPE:
EM = Electronic Module, DIN Rail mount

PACKAGE STYLE:
DR1 = 114.5 mm H X 99 mm D X 22.5 mm W

FUNCTION:
IS = Intrinsically Safe

OUTPUT VOLTAGE FROM ENCODER:
5 = 5 VDC

OUTPUT TERMINATION:
RTB = Removable Terminal

SUPPLY VOLTAGE/OUTPUT:
24V/V, 24 VDC max, $V_{out} = V_{in}$
24V/5, 24 VDC max, V_{out} = 5 volts
24V/OC, 24 VDC max, V_{out} = Open Collector

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 in either Line Driver (LD) or Open Collector (OC) types. Open Collectors require pull-up resistors and so have higher output impedance. In general it is recommended to use a Line Driver style of output. They can either source or sink current and their lower impedance mean better noise immunity and faster switching times. Our applications specialists would be pleased to discuss your system requirements and the compatibility of your receiving electronics with Line Driver type outputs.

7272

Multi-voltage Line Driver: 100 mA source/sink. Input voltage 5 to 28 VDC standard (Note: $V_{out} = V_{in}$). Available with voltage regulator for 5 to 28 VDC input/TTL output (called out as a special feature). This driver is TTL compatible when used with 5 volt supply or with a voltage regulator option. 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 outouts with internal pullup resistors. This is also a direct replacement for any 4469, 88C30, 8830 or 26LS31 line driver

4469

Multi-voltage Line Driver: 100 mA source/sink. Input voltage 5 to 15 VDC standard (Note: $V_{out} = V_{in}$). Available with voltage regulator for 5 to 24 VDC input/5V output (called out as a special feature). TTL compatible when used with 5 volt supply or with voltage regulator. 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 the replacement for 3904R and 7406R outputs for systems operating at 15 volts and below. This is also a direct replacement for any 88C30, 8830, or 26LS31 Line Driver.

7273

Open Collector: 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 standard. Supply current is 120 mA typical. This replaces prior IC's with designations of 3904, 7406, 3302, 681 and 689.

7406 (R)

Open Collector: Current sink of 40 mA max. Current sourced by external pull-up resistor. When called out as 7406R, pull-ups are internal and sized at approximately 100 ohms/volt and current sink is limited to 30 mA. Output can be pulled up to voltage other than supply voltage (30 V max) when the 7406 is used without internal pull-ups. Voltage regulator can be used to allow supply voltage up to 24 V (called out as a special feature). Supply current is 100 mA typical, 120 mA with internal pull-ups. The 7406R is replaced by the 4469 or the 7272 in system upgrades, or with the 7273 if external pull-ups are used.

3904 (R)

Open Collector: Current sink of 80 mA max. Current sourced by external pull-up resistor. When called out as 3904R, pull-ups are internal and sized at approximately 100 ohms/volt and current sink is limited to 70 mA. Output can be pulled up to voltage other than supply voltage (30 V max) when the 3904 is used without internal pull-ups. Supply Current is 80 mA typical, 100 mA with internal pull-ups. The 3904R is replaced by the 4469 or the 7272 in system upgrades, or with the 7273 if external pull-ups are used.

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 M14 use MS3106F14S-6S
For M14/19 use MS3116F14-19S
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 GROUND)	
	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 GROUND)		
GRN	9	CASE GROUND (CG) (except H20)		
WHITE		SHIELD DRAIN (Shielded Cable Only)		

Table 2: Disc Resolutions for Incremental Encoder Models H25, H38, H40, L25, 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, 1680, 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, 3600, 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 HS25 Resolutions See Table A on Page 20.
For Model HS45 Resolutions See “Cycles per Turn” in Ordering Information.
For Model HS35 Resolutions See Table A on Page 23.
For Model L15 Resolutions See Table A on Page 31.

BEI

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SUNSTAR商斯达实业集团是集研发、生产、工程、销售、代理经销 、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有 10 多年历史的专业电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一,是一家专业代理和分銷世界各大品牌IC芯片和電子元器件的连锁经营綜合性国际公司。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商，已在全国范围内建成强大统一的供货和代理分销网络。 我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。**专业以现代信息产业（计算机、通讯及传感器）三大支柱之一的传感器为主营业务，专业经营各类传感器的代理、销售生产、网络信息、科技图书资料及配套产品设计、工程开发。我们的专业网站——中国传感器科技信息网（全球传感器数据库） www.SENSOR-IC.COM 服务于全球高科技生产商及贸易商，为企业科技产品开发提供技术交流平台。欢迎各厂商互通有无、交换信息、交换链接、发布寻求代理信息。欢迎国外高科技传感器、变送器、执行器、自动控制产品厂商介绍产品到 中国，共同开拓市场。**本网站是关于各种传感器-变送器-仪器仪表及工业自动化大型专业网站,深入到工业控制、系统工程计 测计量、自动化、安防报警、消费电子等众多领域，把最新的传感器-变送器-仪器仪表买卖信息,最新技术供求,最新采购商,行业动态，发展方向，最新的技术应用和市场资讯及时的传递给广大科技开发、科学研究、产品设计人员。本网站已成功为石油、化工、电力、医药、生物、航空、航天、国防、能源、冶金、电子、工业、农业、交通、汽车、矿山、煤炭、纺织、信息、通信、IT、安防、环保、印刷、科研、气象、仪器仪表等领域从事科学研究、产品设计、开发、生产制造的科技人员、管理人员 、和采购人员提供满意服务。 **我公司专业开发生产、代理、经销、**销售各种传感器、变送器、敏感元器件、开关、执行器、仪器仪表、自动化控制系统： 专门从事设计、生产、销售各种传感器、变送器、各种测控仪表、热工仪表、现场控制器、计算机控制系统、数据采集系统、各类环境监控系统、专用控制系统应用软件以及嵌入式系统开发及应用等工作。如热敏电阻、压敏电阻、温度传感器、温度变送器、湿度传感器、 湿度变送器、气体传感器、 气体变送器、压力传感器、 压力变送、称重传感器、物（液）位传感器、物（液）位变送器、流量传感器、 流量变送器、电流（压）传感器、溶氧传感器、霍尔传感器 、图像传感器、超声波传感器、位移传感器、速度传感器、加速度传感器、扭距传感器、红外传感器、紫外传感器、 火焰传感器、激光传感器、振动传感器、轴角传感器、光电传感器、接近传感器、干簧管传感器、继电器传感器、微型电泵、磁敏（阻）传感器 、压力开关、接近开关、光电开关、色标传感器、光纤传感器、齿轮测速传感器、 时间继电器、计数器、计米器、温控仪、固态继电器、调压模块、电磁铁、电压表、电流表等特殊传感器 。 同时承接传感器应用电路、产品设计和自动化工程项目。

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