

Feedback Devices

2006 Product Catalog

- INCREMENTAL
- ABSOLUTE

ENCODERS



DYNAPAR™ brand
NORTHSTAR™ brand

ABOUT DANAHER INDUSTRIAL CONTROLS

Encoders are an important and prominent part of Danaher Industrial Controls' business and are supported by our worldwide engineering and manufacturing expertise. In addition to Dynapar and NorthStar encoder brands, we also manufacture Hengstler brand Encoders and Harowe brand Resolvers. Our dedication to service is unparalleled in the industry, with company wide commitment to *quality, delivery, cost and innovation*. Every Danaher Industrial Controls field salesman is an experienced application engineer able to provide sound technical guidance, and like all members of our team is committed to customer satisfaction. Our ISO-9001 quality and management practices assures world class products and customer service.

WANT MORE INFORMATION?

Additional publications as well as telephone and fax support are always available to help you in the selection and specification of our Dynapar and NorthStar brand encoder products. Every product in this catalog and local application assistance are readily available from an authorized Danaher Industrial Controls distributor near you. For additional information or the name of your local Danaher Industrial Controls distributor, contact us at the telephone numbers listed below.

DANAHER INDUSTRIAL CONTROLS COMMUNICATIONS

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OUR NEWEST AND 'BEST VALUE' ENCODERS

NORTHSTAR BRAND HEAVY DUTY ENCODERS



A wide range of heavy duty encoders utilize proven magnetoresistive (MR) technology and are designed for direct motor mounting or other demanding industrial applications. Available in through-shaft and end-of-shaft mounting configurations

See page: 3.00

ACURO ABSOLUTE ENCODERS



Family of 58mm diameter absolute encoders in all popular mounts. In addition to Parallel interface, ACURO is offered with industrial bus interfaces for DeviceNet, Profibus, Interbus, BiSS and SSI.

See page: 4.00

HS20 & HS35 SEALED HOLLOWSHAFT ENCODERS



HS20 (2" dia.) and HS35 (3" dia.) Sealed Hollowshaft encoders are designed for easy installation on motor or machine shafts. Hollowshaft design eliminates the need for a flexible shaft coupling, mounting bracket or adapter. This not only reduces the installation depth, but also lowers total cost. A floating shaft mount and spring tether minimize bearing loads thereby reducing wear and maintenance.

See pages: 2.80 & 2.84

F10, F14, F15, F18 & F21 COMMUTATING ENCODERS



Dynapar brand commutating encoders provide high performance, cost effective feedback for stepper and servo motor controls. All offer compact package dimensions and operation to 120°C. Simple mounting with high tolerance to motor shaft movement and easy adjustment for alignment of the signal outputs to the shaft position.

See pages: 2.66, 2.68, 2.70, 2.72 & 2.74

ENCODER LED OUTPUT INDICATOR OPTION



Exclusively available on Dynapar brand encoders, this option assists in correct installation and wiring.

Look for the "LED" symbol in this catalog's encoder listings

Want more information? Need help selecting a product? See the inside rear cover for additional Danaher Industrial Controls materials and services immediately available to you!

Content Guide

Dynapar™ brand
NorthStar™ brand







Encoder Type	Typical Configuration	Encoder Reference
Dynapar brand Incremental Encoders with integral shaft. Industrial standard sizes range from 1 to 2.5 inch diameter.	Shaft sizes range from 1/8" to 1/2". Available mounting configurations include flange, servo and face mounts. Models include electrical interface via side or end mounted MS connectors	Use the Selection Guide on page 2.12 
Dynapar brand Incremental Encoders with hub-shaft, hollow-shaft or ring-mount design. Easily motor mount without requiring adaptors or extra hardware.	Accept thru-shaft or shaft-hub sizes ranging from 1/8" to 2-7/8". Available mounting configurations include flexible spring-tether, flange and ring mounts. Models include electrical interface via side or end mounted MS connectors	Use the Selection Guide on page 2.58 
Dynapar brand High performance encoders with 5000 PPR or greater resolution	Feature precision glass code-disk and high speed electronic components. Ideal for applications where maximum performance and accuracy at high RPM is required.	Look for ❶ symbol in Table of Contents or on Selection Guide pages. 
Dynapar brand Explosion-Proof encoders	For application in hazardous environments where flammable gases, vapors, liquids; combustible dust, or ignitable fibers are present. Approved to UL, Cenelec and CSA standards	Look for ❷ symbol in Table of Contents or on Selection Guide pages. 
NorthStar brand Heavy Duty Encoders	NorthStar brand RIM Tach® and SLIM Tach encoders use proven magnetoresistive (MR) technology to ensure the most rugged and robust feedback device possible.	Use the Selection Guide on page 3.01 
Dynapar brand Single and multi -turn ACURO Absolute Encoders	Signal output is a digital "word" based on the exact rotational position of the encoder's shaft. Unlike encoders that require a counting circuit to track position, absolute encoders provide the correct data after a power-down event.	Use the Selection Guide on page 4.02 

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Pickups & Sensors

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Incremental Accessories

Heavy Duty

Heavy Duty Accessories

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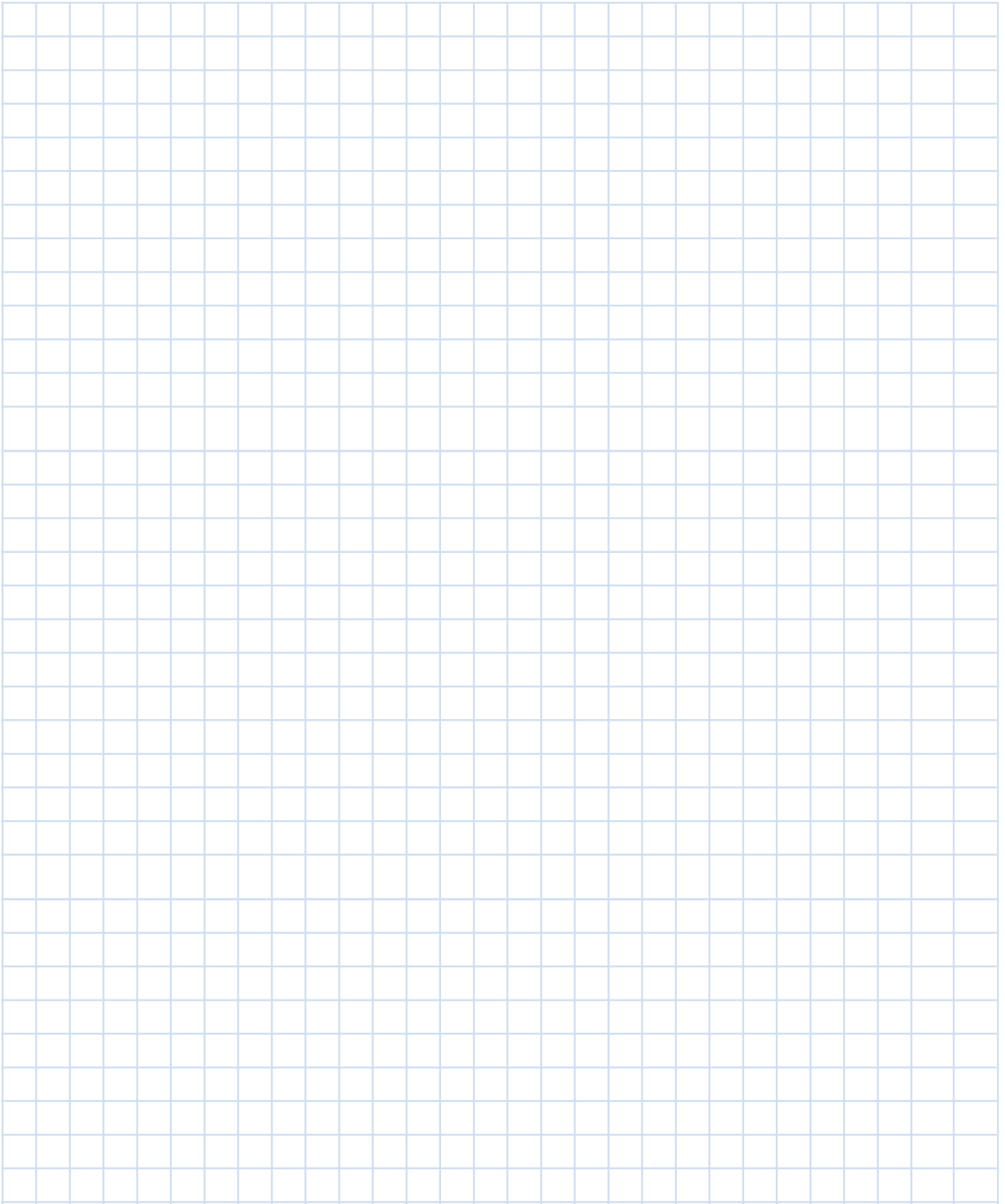
ACURO Absolute

Performance Factor: ① High Performance
 - 5000 PPR or greater resolution available
 ② Hazardous Environment
 -Explosion Proof rating

Notes

A large grid of graph paper for taking notes, consisting of 20 columns and 30 rows of small squares.

Notes

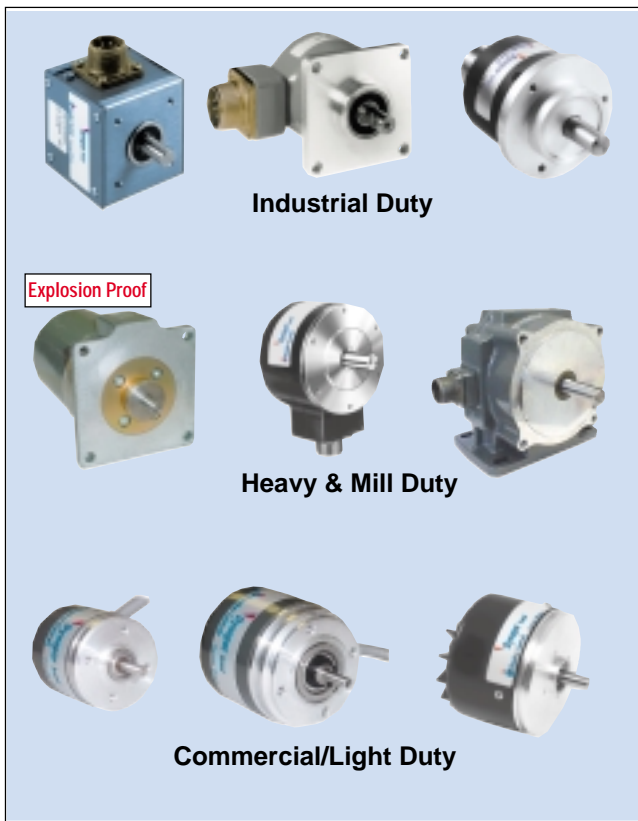


Introduction Incremental Encoders

GENERAL

Incremental Encoders are sensors capable of generating signals in response to rotary shaft movement. In many encoders, the signals contain direction as well as progression information. When used in conjunction with mechanical conversion devices, such as rack-and-pinions, measuring wheels or spindles, incremental shaft encoders can also be used to measure linear movement and/or speed and/or position. The encoder generates an electronic signal for each incremental change in position.

It produces a specific number of equally spaced pulses per revolution (PPR), for example 100 PPR, 1200 PPR, etc, commonly referred to as the encoder's resolution. The pulses can be related to physical position, length, speed, etc.



APPLICATIONS

A host of applications are available for incremental encoders. They can be used as feedback transducers for motor-speed control, as sensors for measuring, cutting and positioning, and as input for speed and rate controls. *The selection guide on page XX can assist you in choosing the right encoder.*

Encoders are typically used on many industrial machines and processes:

- Door control devices
- Robotics
- Lens grinding machines
- Plotters
- Testing machines
- Ultrasonic welding
- Converting Machinery
- Assembly machines
- Labelling machines
- x/y indication
- Analysis devices
- Drilling machines
- Mixing machines
- Medical Equipment

IMPORTANCE OF QUALITY AND RELIABILITY

Encoders are precision instruments that are typically applied in rugged industrial environments. For continuous reliable performance in these applications, encoders require uncompromising design standards and skilled manufacturing.

Dynapar brand encoders offers a complete range of encoders and accessories – from ultraminiature to large heavy duty and mill duty packages. All represent a commitment to technology and quality while providing cost effective solutions. Every Dynapar brand encoder is 100% final tested and includes a one-year full warranty against defects in material and workmanship.

THE DELIVERY DIFFERENCE

Encoder's requirements typically involve combinations of many mechanical optical and electrical options which can produce thousands of model variations within a series of encoders. It is clearly impossible for a manufacturer or distributor to maintain stock of every model variant.

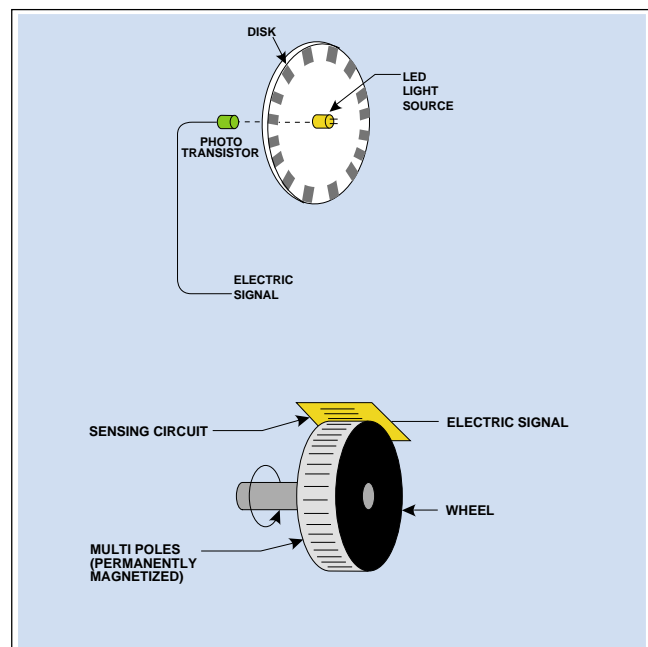
Danaher Controls has overcome this limitation through our expertise in cellular, just-in-time manufacturing. The exact model specification that you require is produced, tested and shipped in 3 days or less – configured as you need it and delivered when you need it!

SENSING TECHNOLOGY

Encoders transmit digital signals in order to achieve high transmission speeds. These signals are generated optically by using a patterned disc, or magnetically using a gear or encoded wheel. Both optical and magnetic operate through zero speed and are available in numerous resolutions.

Optical sensing technology provides high resolutions, high operating speeds, and rugged packaging for reliable, long life operation in most industrial environments.

Magnetic sensing technology provides good resolution, and high operating speeds as well as maximum resistance to dust, moisture, and thermal and mechanical shock.

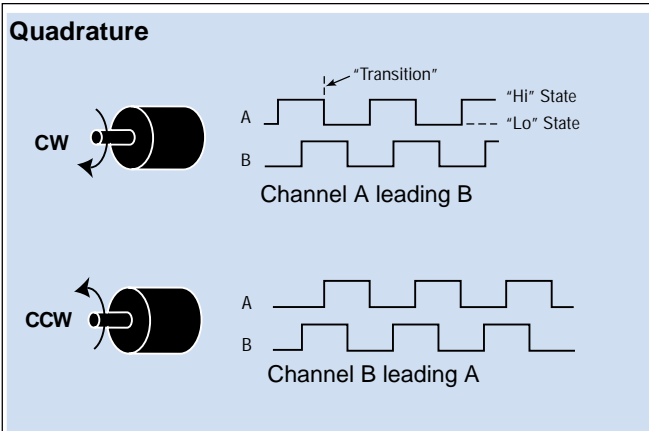


INCREMENTAL CODING

Provides a specific number of equally spaced pulses per revolution (PPR). The pulses will be produced regardless of rotation direction. A single channel output is used for applications where sensing the direction of movement is not important.

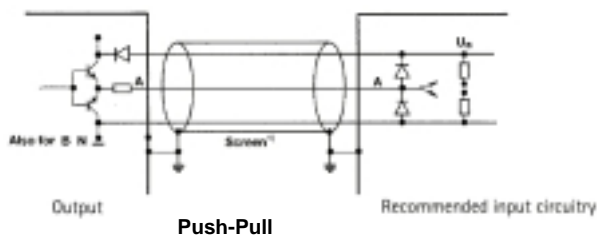
For direction sensing applications, "quadrature output", provides two channels that are coded 90 electrical degrees out of phase. It is used in bidirectional position sensing and length measuring applications.

Quadrature signals are decoded by specialized circuitry that determines direction of movement based on the phase relationship of channel A in respect to Channel B. Quadrature output allows monitoring of direction for processes which can reverse, or must maintain net position when standing still or mechanically oscillating. Bidirectional quadrature is recommended for most position, speed, and length applications

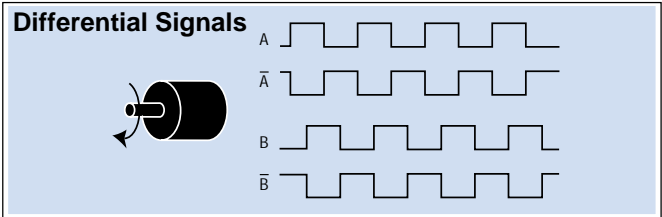
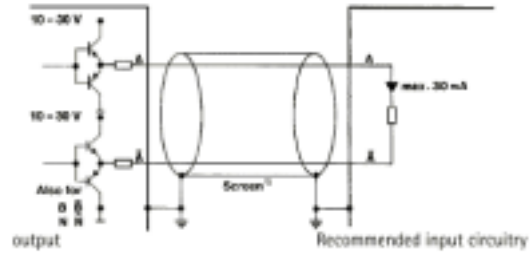


Some incremental encoders also incorporate another signal known as the "marker" or the "Z channel". This signal is produced only once per revolution of the encoder shaft. It is often used to locate a specific position during the shaft's rotation.

In addition to the output's coding, there are choices as to the type of output circuit that is used for signal transmission. Current sinking, current sourcing or push-pull circuits are used when the signal does not have to travel for a great distance and the environment is free of sources of electrical interference. It is important to know the type of circuit the encoder will be connected to in order to select the proper output.

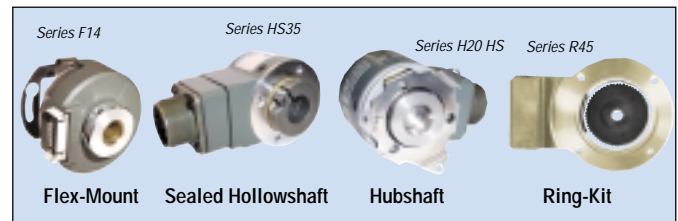


For long distance transmission, and/or when high levels of electrical interference are present, a differential line-driver output circuit is often the best choice. This type of interface provides the A and B signals plus two additional signals which are their inverse complements (shifted 180 electrical degrees). It is able to drive long transmission lines and by comparing the each channel and its complement, common mode interference can be cancelled.



MOTOR MOUNTING

We offer a complete range of encoders that are designed for fast, easy direct-to-motor installation (or mounting to other free shafts). These include sealed hollowshaft and hub-shaft designs and require no mounting adapters or couplings – saving you time and money. They provide the extended temperature range and rugged construction characteristics needed for the most demanding applications. *The selection guide on page XX can assist you in choosing a motor mount encoder.*



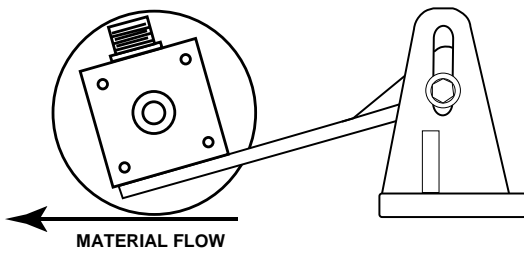
ABSOLUTE AND LINEAR ENCODERS

For specialty applications, our ranges of Absolute and Linear Encoders may be just what you need. Please refer to the separate Introductions and Selection Guides to become familiar with these products.

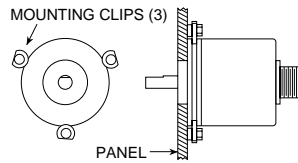
Introduction Incremental Encoders

Typical Encoder Mechanical Installations

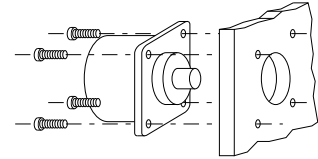
GENERAL MOUNTING



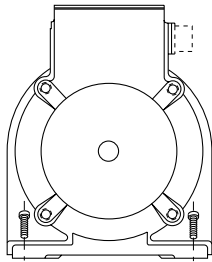
MEASURING WHEEL



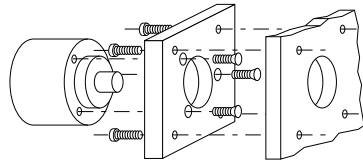
SERVO MOUNT



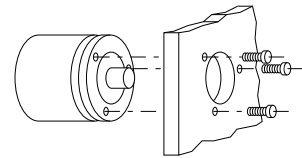
FLANGE MOUNT



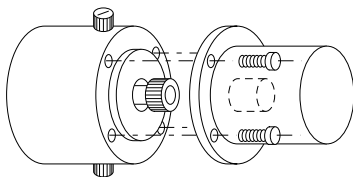
MILL-DUTY FOOT MOUNT



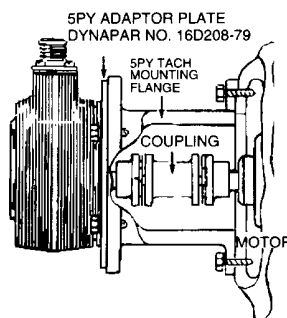
FACE MOUNT



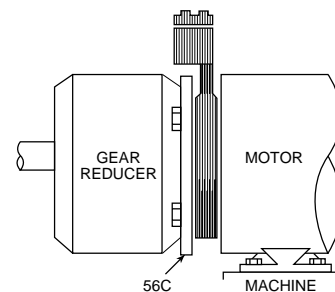
MOTOR MOUNTING



MOTOR MOUNT



5PY (or equivalent) MOUNT



RING MOUNT

Principles of Optical & Magnetic Sensing

(How Optical & Magnetic Sensors Operate)

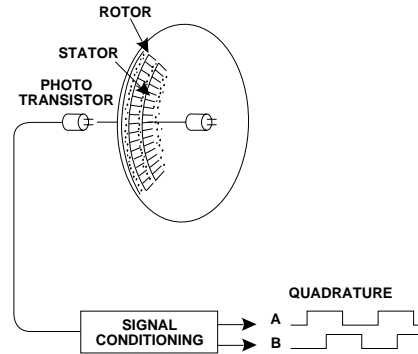
OPTICAL SENSORS

Incremental Sensing

Optical encoders utilize a rotor with a count pattern which interrupts the LED light source and changes the output of phototransistor sensors. The signal is amplified and shaped internally. Optical encoders provide operation through zero speed and have high resolution capability.

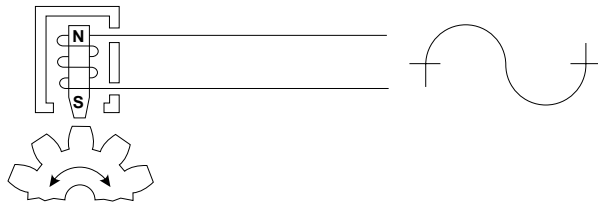
Quadrature

Quadrature output allows monitoring of direction for processes which can reverse, or must maintain net position when standing still or mechanically oscillating. Bidirectional quadrature is recommended for most position, speed, and length applications.



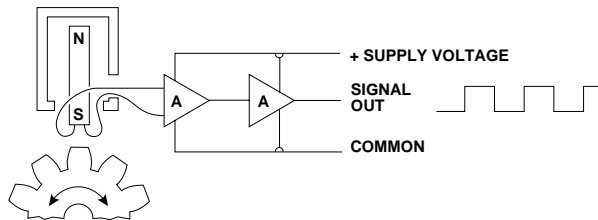
MAGNETIC SENSORS

Variable Reluctance



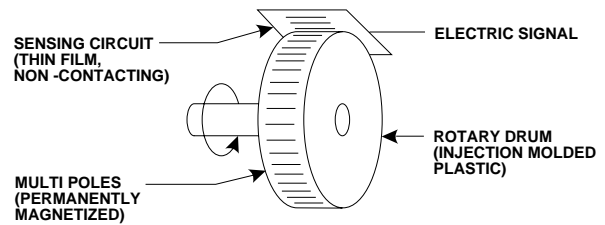
Variable reluctance devices utilize ferromagnetic gear teeth to disturb the flux, causing a change in reluctance. A pulsed voltage, proportional to mechanical motion, is generated in the coil. These are passive devices for maximum reliability. Low speed operation is limited to about 50 RPM. See Fundamentals of Digital Measurements section.

Magneto-Resistive



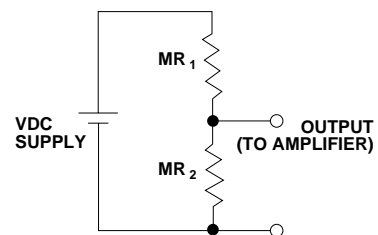
Magneto-resistive devices contain a highly sensitive bridge circuit which reacts to the movement of ferromagnetic gear teeth. This imbalance of the bridge circuit is amplified to create the output signal. Zero speed operation, high reliability, and wide temperature range are the main features.

High Resolution, Magneto-Resistive Rotary Drum Design



The sensing circuit consists of two magneto-resistive elements (MR₁ and MR₂) which alternately respond to the encoded magnetic poles on the rotary drum. The electrical output is then conditioned and amplified to provide a stream of electrical square-waves which correspond to the motion of the drum.

Basic Sensing Circuit



The sensing occurs on the perimeter, rather than the face, of the drum, making the unit more durable and less susceptible to shock and vibration. This non-optical, magnetic sensing technology is more resistant to dust, grease, moisture, and other contaminants commonly encountered in industrial environments.

Introduction Incremental Encoders

Resolution/Incremental Measuring

RESOLUTION is the number of measuring segments or units in one revolution of an encoder shaft. It is the smallest unit of movement detected by the encoder. If one revolution of the transducer shaft is divided into one thousand segments, the resolution would be 0.001. Likewise, if it is divided into ten segments, the resolution would be 0.1, and so on. Encoders can measure motion or position from 1 to 5000 pulses per revolution (PPR). With proper selection of an encoder and a counter/instrument, that resolution range can be extended to 1 to 20,000 PPR. (See **QUADRATURE**) The selected encoder must have resolution equal to or better than that required by the application.

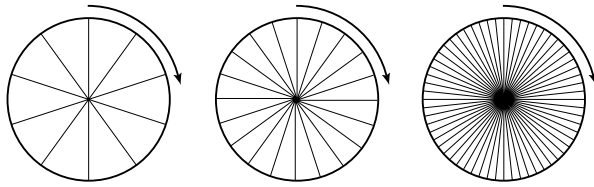


Figure 1

Linear/Straight-Line Measuring Techniques

Encoders are not limited to measuring rotary motion. Through mechanical means, usually through the use of rack and pinions or leadscrews, encoders can measure straight-line or linear motion. These mechanical systems with gears and couplings are commonly used on machines for converting the rotary motion of an electric motor to the desired straight-line motion. When encoders are coupled to these mechanical systems, they can feedback motion and positioning data to the system controllers as it occurs on the machine.

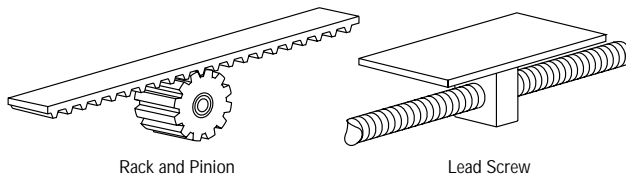


Figure 2: Typical Rotary/Linear Mechanical Elements

Digital Length & Position Measurements

Digitally measuring length or position is accomplished by accumulating and counting digital pulses that are related to the unit of length or travel. Total length or travel is accumulated from a reference point established before beginning the measurement. Calibrating the number of pulses per unit of measure is accomplished via selection of the proper transducer and possibly including a separate calibration step. (See **PULSE CALIBRATION**) Typical industrial devices for accumulating digital measurements from encoders include electronic counters, instruments, programmable logic controllers (PLC's), computerized numerical controllers (CNC's) etc.

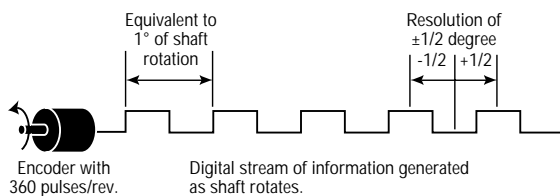


Figure 3

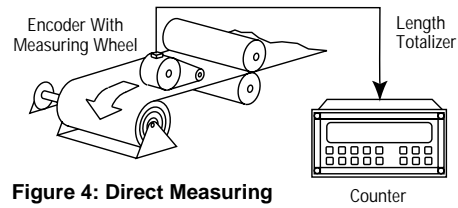


Figure 4: Direct Measuring

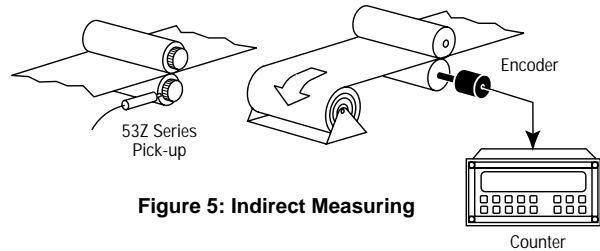


Figure 5: Indirect Measuring

Examples

- To measure 10 inches of travel to 0.01 inch resolution.
Total count = 1000; Resolution 0.01
Assuming that it only requires one full turn of the encoder to measure total travel, a 1000 pulses per rev. encoder can satisfy this requirement. At full travel, the encoder and counter will read 9.99, which is within the stated tolerance of 0.01 inch.
- To measure 360 degrees to 0.1 degree resolution.
Total Count = 3600; Resolution 0.1
An 1800 pulse per turn encoder with x2 multiplication can satisfy this requirement. At full travel the encoder and counter will read 360.0 degrees. For more details, see **PULSE MULTIPLICATION**.
- Typical Application:** An encoder is required on a milling machine to provide a digital readout display. The display must read directly in thousandths of an inch. The total travel of the milling machine bed is 36 inches. The travel is regulated by a precision leadscrew, which moves the milling machine bed 1/10th inch for every revolution (360°) of the leadscrew.
Solution: Since the display must read directly in 1/1000th inch increments, the encoder must provide 100 pulses per revolution where each pulse represents .001 inch. An encoder is connected to the shaft of the leadscrew and the shaft is rotated. A pulse train is generated. These pulses are fed directly into an appropriate electric counter with digital display. Starting from a known reference position, the operator resets the counter to zero. The operator moves the milling machine bed from the zero position until the number 19.031 is shown on the counter. The operator is now exactly 19.031 inches from the zero position.

In some systems, the number 19.031 is entered on the counter's preset function. When the counter counts 19,031 pulses, it stops the travel automatically. At this position, a hole is bored to a specific depth. An encoder on the "z" axis of the machine controls the drilling to a specified depth. Add to this an encoder for bed travel on the other axis, plus programmable control for the preset functions and sequences, and you have assembled some of the fundamental building blocks for an automated numerical control system.

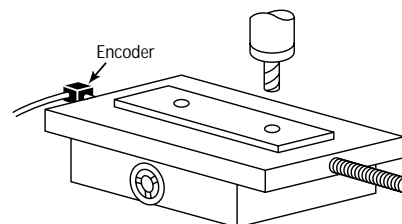


Figure 6

Accuracy and Resolution

The difference between accuracy and resolution in a transducer is important to understand. The fact that it is possible to have one without the other is often overlooked when specifying sensors.

Figure 13 shows a distance X divided into 24 increments or "bits". If X represents 360 degrees of shaft rotation, then one revolution has been resolved into 24 parts. In Figure 13, it is obvious that the 24 parts are not uniform. If this transducer were installed in an application, its output could not be used to measure position, velocity or acceleration with any accuracy.

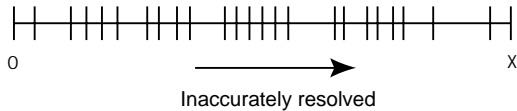


Figure 13

On the other hand, distance X in Figure 14 is divided equally into 24 parts. Each increment represents exactly 1/24 of a revolution. This transducer operates with accuracy as well as resolution. Accuracy, however, can be independent of resolution. A transducer may have a resolution of only two parts per revolution, yet its accuracy could be ± 6 arcseconds.

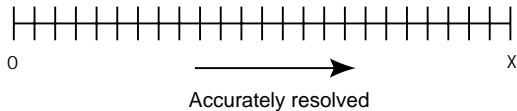


Figure 14

System Application Accuracy & Repeatability

System Accuracy: An encoders performance is typically stated as resolution of a turn, rather than accuracy of measurement. The encoders may be able to resolve one revolution of a shaft into precise bits very accurately, but the accuracy of each bit is limited by the quality of the machine motion being monitored. For example, if there are deflections of machine elements under load, or if there is a drive screw with 0.1 inch of play, using a 1000 count-per-turn encoder with an output reading to 0.001 inch will not improve the 0.1 inch tolerance on the measurement. The encoder only reports position; it cannot improve on the basic accuracy of the shaft motion from which the position is sensed.

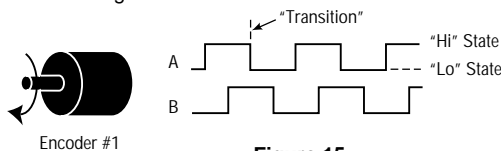
Note: Given a particular machine design, some errors in measuring motion such as mechanical backlash and errors in leadscrews or gearing systems, are conditions that can be electronically compensated by some of the more advanced motion controllers.

System Repeatability: Repeatability is the tolerance to which the controlled machine element can be repeatedly positioned to the same point in its travel. Repeatability is generally less than system resolution, but somewhat better than system accuracy.

Bidirectional Measurements

Quadrature

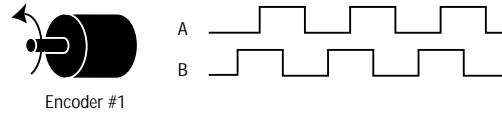
Most incremental systems use two output channels for bidirectional position sensing:



Encoder #1

Figure 15
Channel A Leads Channel B
with CW Rotation of the Encoder Shaft

This allows an electronic counter to increment the count with each transition and to monitor the state of the opposite channel during these transitions. Using this information, we can determine if "A" leads "B", and thus derive direction (up/down count).



Encoder #1

Figure 16
with the Reverse Shaft Rotation,
Channel B will Lead Channel A

In some unidirectional start-stop applications, it is important to have bidirectional information (channel A & B) even if reverse rotation of the shaft is not anticipated. An error in count could occur with a single-channel encoder due to machine vibration inherent in the system. For example, an error in count may occur with a single-channel encoder in a start/stop application if it mechanically stops rotating when the output waveform is in transition. As subsequent mechanical shaft vibration forces the output back and forth across this edge, the counter will up-count with each transition, even though the system is virtually stopped. By utilizing a bidirectional encoder, the counter monitors the transition in its relationship to the state of the opposite channel, and can generate reliable position information.

Pulse Multiplication: Most instruments, electronic counters, and PLC's incorporate high-speed, bidirectional detection circuits in their electronics. Most of these detection circuits have an additional feature to derive 1x, 2x, or 4x the basic encoder resolution. For example, these monitors/controllers can be set to count the leading and trailing edges of the pulse train at channel A input (Figure 17). This doubles (x2) the number of pulses counted for one rotation of the encoder. You can improve the count resolution further by letting the input module count the leading and trailing edges of both pulse trains, thereby counting four times (x4) for the same degree of rotation (Figure 17).

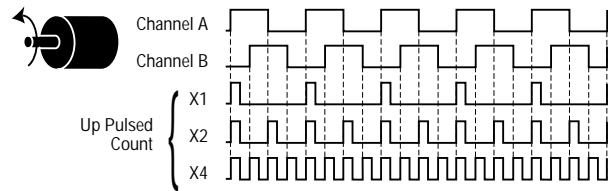


Figure 17

10,000 pulses per turn can be generated from a 2500 cycle, two-channel encoder. Typically with a Dynapar encoder, this 4x signal will be accurate to better than ± 1 count.

Introduction Incremental Encoders

Typical Length Calibration Examples:

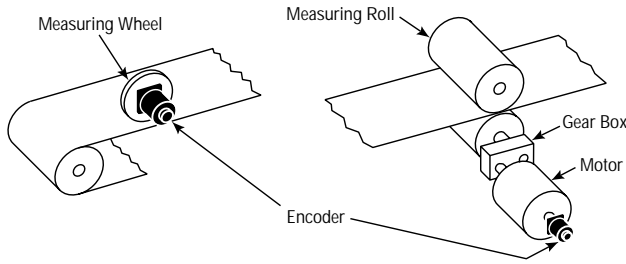


Figure 22

Figure 23

Ratio Calibration Examples:

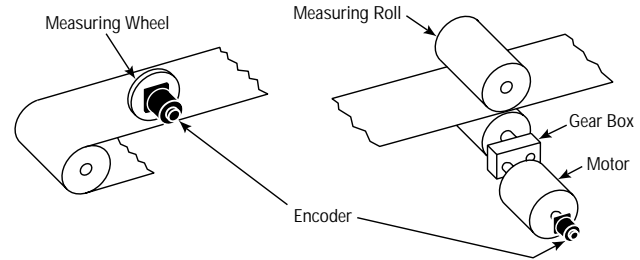


Figure 24

Figure 25

APPLICATION TYPE 1

APPLICATION TYPE 2

APPLICATION TYPE 1

APPLICATION TYPE 2

LENGTH	APPLICATION	
DISPLAY RESOLUTION	TYPE 1 Measuring Wheel	TYPE 2 Measuring Roll
1 Foot	$K = \frac{C}{(12)(N)}$	$K = \frac{(0.2618)(D)}{(G)(N)}$
1 Inch	$K = \frac{C}{(N)}$	$K = \frac{(3.1416)(D)}{(G)(N)}$
0.1 Inch	$K = \frac{(10)(C)}{(N)}$	$K = \frac{(31.416)(D)}{(G)(N)}$
0.01 Inch	$K = \frac{(100)(C)}{(N)}$	$K = \frac{(314.16)(D)}{(G)(N)}$
1 Meter	$K = \frac{M}{(N)}$	$K = \frac{(0.79796)(D)}{(G)(N)}$
1 Decimeter	$K = \frac{(10)(M)}{(N)}$	$K = \frac{(0.797966)(D)}{(G)(N)}$
1 Centimeter	$K = \frac{(100)(M)}{(N)}$	$K = \frac{(7.97966)(D)}{(G)(N)}$
1 Millimeter	$K = \frac{(1000)(M)}{(N)}$	$K = \frac{(79.7966)(D)}{(G)(N)}$
0.1 Millimeter	$K = \frac{(10,000)(M)}{(N)}$	$K = \frac{(797.966)(D)}{(G)(N)}$

WHERE: G = Gear Ratio (increases rpm of encoder in relation to rpm of roll)
 N = Encoder pulses per revolution
 D = Roll diameter in inches
 C = Measuring wheel circumference in inches
 M = Measuring wheel circumference in meters
 K = Value of the calibration

EXAMPLE: In a Type 2 application you wish to display FEET to the nearest 1 foot. From the table above:

$$K = \frac{(0.2618)(D)}{(G)(N)}$$

If G = 2.6, N = 1, X = 1, D = 9.15

$$K = \frac{(0.2618)(9.15)}{(2.6)(1)} = 0.92133$$

RATIO	APPLICATION	
DISPLAY RESOLUTION	TYPE 1	TYPE 2
.001	$K = \frac{(5)(C)}{(N)}$	$K = \frac{(15.708)(D)}{(G)(N)}$
.0001	$K = \frac{(50)(C)}{(N)}$	$K = \frac{(15.708)(D)}{(G)(N)}$

WHERE: G = Gear Ratio (increases rpm of encoder in relation to rpm of roll)
 N = Encoder pulses per revolution
 D = Roll diameter in inches
 C = Measuring wheel circumference in inches

A ratio indicator requires two inputs. However, a single calibrator can adjust one of the inputs in such a way that the correct ratio relationship can be read directly. This is done by calculating a combined calibration constant (K) for both inputs and using the calibrator to modify input A (the numerator) only. The calibrator can be external or a built-in function.

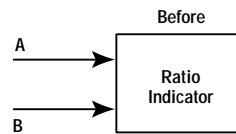


Figure 26

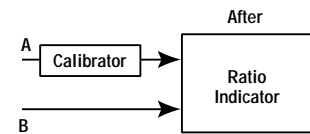


Figure 27

Example: Assume that both inputs are a Type 2 and that you wish to have a 0.001 display resolution.

$$K_A = \frac{\text{Input A}}{(15.708)(D)} \quad \left| \quad K_B = \frac{\text{Input B}}{(15.708)(D)}$$

$$K_A = \frac{\quad}{(N)(G)} \quad \left| \quad K_B = \frac{\quad}{(N)(G)}$$

Assume:

<p>Input A</p> <p>D = 17.0"</p> <p>N = 12</p> <p>G = 3.5</p> <p>Then:</p> $K_A = \frac{(15.708)(17.0)}{(12)(3.5)}$ $= 6.3580$	<p>Input B</p> <p>D = 19.2"</p> <p>N = 12</p> <p>G = 2.8</p> $K_B = \frac{(15.708)(19.2)}{(12)(2.8)}$ $= 8.9760$
---	--

Recalling that:

$$K_R = \frac{K_A \text{ for input A}}{K_B \text{ for input B}} = \frac{K_A}{K_B}$$

Therefore:

$$K_R = \frac{6.3580}{8.9760} = 0.70833$$

Marker Pulse

Reference Pulse

The reference pulse (sometimes called a Marker or Index Pulse) is a once-per-revolution pulse that occurs at precisely the same mechanical point in a 360° revolution of an encoder shaft. The pulse appears on an output separate from the specified pulse train. The duration of the reference pulse is usually the same pulse width as the output pulse. However, the reference pulse width may be different and is dependent on the specific encoder design. The reference pulse is generated and electrically configured similar to Channels A and B previously described.

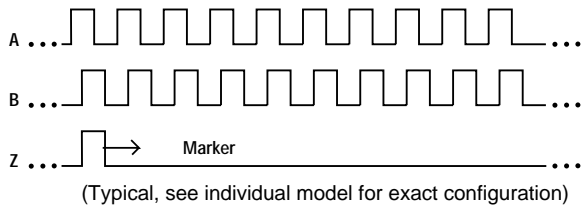


Figure 28

Typical Marker Pulse Applications

A unique shaft position can be identified by using the reference pulse output only, or by logically relating the reference pulse to the A and B data channels. Thus it is most frequently used in positioning and motion control applications as an electronic starting point of known position (a "reference" pulse) from which counting or position tracking begins.

In long travel or multiple turns of the encoder, the reference pulse is sometimes used by the control to initiate an electronic check on the total count received from the encoder. For example, each time a reference pulse is received by the control, the total count received from channels A and B should be an even multiple of the encoder's pulses per revolution.

Establishing Reference Position

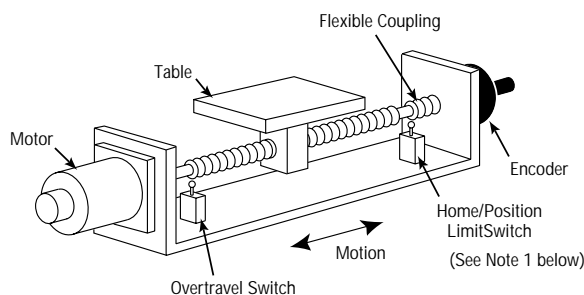


Figure 29
Ballscrew Position Table Example

In motion control encoder applications, a PLC, CNC, or motion controller will usually command a sequence of moves with each axis of a positioning system to bring the table to the same starting position before beginning a task. The purpose of these moves is to establish the starting position. The following is a typical automatic referencing and backlash compensation sequence for establishing a home position through the use of an encoder marker pulse.

1. If the Home Switch is open (indicating a position on the positive side of home) when the command is received, the axis is accelerated in the negative direction at the JOG ACCELERATION rate and moved at the FAST JOG VELOCITY until the Home Switch closes. (See Note 1 below)
2. The axis is stopped at the JOG ACCELERATION rate.
3. The axis is accelerated in the positive direction at the JOG ACCELERATION rate and moved at the FAST JOG VELOCITY until the Home Switch opens.
4. The axis is accelerated in the negative direction at the JOG ACCELERATION rate and moved at the SLOW JOG VELOCITY until the Home Switch closes and an encoder marker pulse is sensed by the control (in that order).
5. The axis is stopped at the JOG ACCELERATION rate.

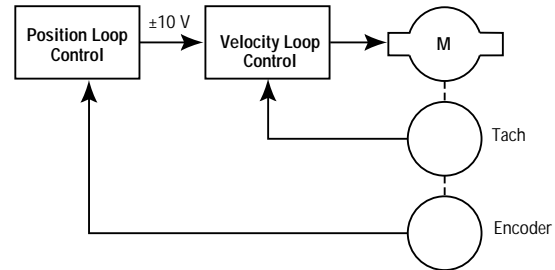


Figure 30
Typical System

Note 1: A home position limit switch is a mechanical device that is usually not repeatably accurate enough for the application. The encoder reference or marker pulse has much greater repeat accuracy and is therefore a better reference point to establish a starting point for subsequent measurements. The home limit switch is required to signal the control that the next marker pulse signal received is "Home" in multi-turn encoder applications.

Leadscrew/Ballscrew Applications

Measurement systems that use encoders and leadscrews can provide high resolution and high traverse speeds. For example, one system combines a 10 mm-pitch ballscrew with an encoder having 2500 lines. The evaluation of all rising and falling edges of the squarewave signal provides a resolution of 1 μm (0.05 mils) without interpolation.

Encoder PPR's and Servo Resolutions for Typical Leadscrew Applications

Servo Resolution	Encoder PPR and Logic Multiplier		
	0.5-in. Lead (2 pitch)	0.25-in. Lead (4 pitch)	0.2-in. Lead (5 pitch)
Leadscrew			
0.0001 in.	1,250 x 4	625 x 4	500 x 4
0.00005 in.	2,500 x 4	1,250 x 4	1,000 x 4
0.0005 in.	250 x 4	250 x 2	200 x 2
0.00025 in.	500 x 4	250 x 4	200 x 4
0.0002 in.	625 x 4	625 x 2	500 x 2
0.001 mm	3,175 x 4 (special)	3,175 x 2	1,270 x 4
0.002 mm	3,175 x 2	3,175 x 1	635 x 4
0.01 mm	635 x 2	635 x 1	508 x 1
0.005 mm	635 x 4	635 x 2	508 x 2

Introduction Incremental Encoders

Proper resolution keeps the cost of feedback down in a machine. This is best explained by a typical application. Consider that a machine axis is driven by a leadscrew. It is decided to attach the feedback transducer to the screw. It is quite practical to select an arrangement that allows direct coupling to the screw, rather than using gearing or belts and pulleys. In this example, assume a basic system resolution of 0.0001 inch and a four-pitch screw (0.25-inch lead). The feedback transducer would have to produce 2500 increments per revolution to match these characteristics.

A 625-line encoder with times 4 logic would be a perfect choice. Disc/Dynapar encoders offer a wide range of resolutions for most industrial applications.

Transducer Operating Speed

All transducers have inherent mechanical and electronic limitations regarding speed. The combination of several design factors including bearings, frequency response of the electronics, and PPR of the application, etc. combine to determine "maximum operating speed" in any given application. Exceeding the maximum speed may result in incorrect data or premature failure. Dynapar encoder specifications easily exceed most application requirements for speed.

To determine the encoder's maximum operating speed for a given application:

Step 1: Determine maximum electronic operating speed in RPM.

Step 2:

- A. If the RPM calculated in Step 1 is less than or equal to the encoder's maximum mechanical RPM specification, then the RPM calculated in Step 1 is the maximum operating speed specification for this particular encoder application.
- B. If the RPM calculated in Step 1 is greater than the encoder's maximum mechanical RPM specification, then the maximum mechanical RPM specification is the maximum operating speed for this encoder application.

Step 3:

Compare the maximum operating speed as determined in Step 2 above with the application requirements.

Encoder Output Signals, Ratings & Terminology

Encoders transmit digital measurement signals utilizing D.C. circuits to achieve the highest transmission speeds. Transmission is achieved either with current flowing to or from the encoder (current sinking or current sourcing outputs).

Dynapar encoder output circuits are designed to be compatible with most instruments, counters, controllers, and motor drivers so that the user can select and apply a unit with confidence. Standard encoder output circuits also minimize service inventory investments and are available with shorter lead times from the factory.

Standard Output Choices:

5-26 VDC	Current Sinking
5-26 VDC	Differential Line Drivers

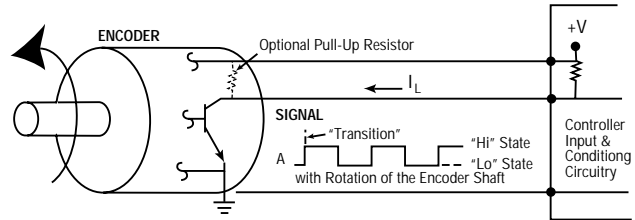


Figure 31
Typical Current Sinking Encoder Circuit

Current sinking derives its name from the fact that it "sinks current from a load." The current flows from the load into the encoder. Like a mechanical switch, the encoder allows current to flow when turned ON and blocks current flow when turned OFF.

Output Signal Terminology

As mentioned previously encoders can have single channel outputs (signal A), dual channels (signals A & B) for bidirectional measurements, and marker pulse channels (signal Z) to serve various functional requirements for feedback applications (speed, length, position, etc.). In addition, the signals are typically transmitted as "single-ended" or with complementary "differential" outputs.

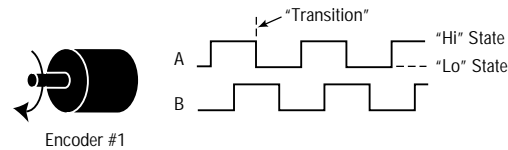


Figure 32
Single-Ended Output Signals

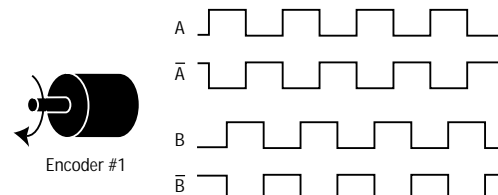


Figure 33
Differential Output Signals

The additional electronics required to utilize differential signals is economically justified most often when:

- A. transmission distances (cable runs) exceed approximately 50 feet. Differential signals used with line driver outputs can successfully be transmitted hundreds of feet with proper wiring and grounding practices.
- B. higher electrical noise immunity for signal lines is necessary.

General Wiring & Installation Guidelines

The most frequent problems encountered in transmitting an encoder's signal(s) to the receiving electronics are signal distortion and electrical noise. Either problem can result in gain or loss of encoder counts. These problems can sometimes arise, but many problems can be avoided with good wiring and installation practices. The following descriptions and recommendations are presented as general guidelines and practices for field-installed equipment.

Protecting Signals from Radiated & Conducted Noise

Reasonable care must be taken when connecting and routing power and signal wiring on a machine or system. Radiated noise from nearby relays (relay coils should have surge suppressors), transformers, other electronic drives, etc. may be induced into the signal lines causing undesired signal pulses. Likewise, the encoder or trackball may induce noise into sensitive equipment lines adjacent to it.

Machine power and signal lines must be routed separately. Signal lines should be shielded, twisted and routed in separate conduits or harnesses spaced at least 12 inches apart. Power leads are defined here as the transformer primary and secondary leads, motor armature leads and any 120 VAC or above control wiring for relays, fans, thermal protectors, etc.

Continuity of wires and shields should be maintained from the encoder or trackball through to the controller avoiding the use of terminals in a junction box. This helps to minimize radiated and induced noise problems and ground loops.

In addition, operation may be influenced by transients in the encoder or trackball power supply. Typically, encoder power should be regulated to within $\pm 5\%$, and it should be free of induced transients.

The encoder case must also be grounded to insure proper and reliable operation of the unit. Dynapar encoders usually have provisions for a case ground connection through the connector/cable if a ground cannot be secured through the mounting bracket/machine ground. **DO NOT** ground the encoder case through both the machine and the cable wiring. Use high quality shielded wire only and connect the shield only at the instrument end, as shown in Figure 34 below.

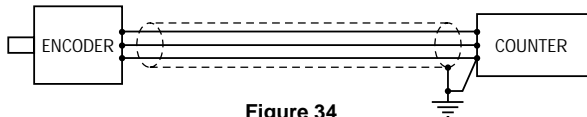


Figure 34

For more protection against electrical noise, specify an encoder with complementary output signals and connect with twisted-pair shielded wire—induced currents will self-cancel, as shown in Figure 35 below.

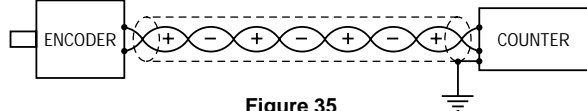


Figure 35

In industrial environments, high current fluxes are created by motors, remote control switches and magnetic fields. This can result in varying electrical potentials at different ground points. To avoid problems, ground the shield, together with all other parts of the system requiring grounding, from a single point at the instrument end, as shown in Figure 36 below.

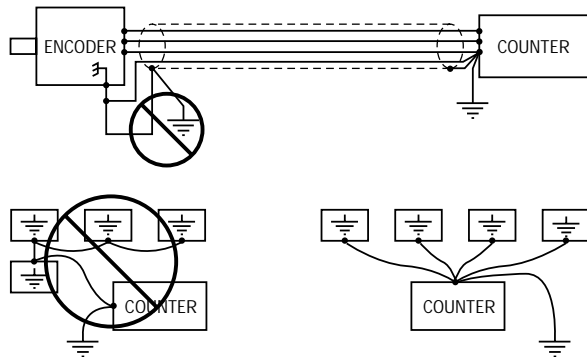


Figure 36

Signal distortion can be eliminated by complementary encoder signals (line drivers), used with differential receivers (line receivers or comparators) at the instrument end, as shown in Figure 37 below.

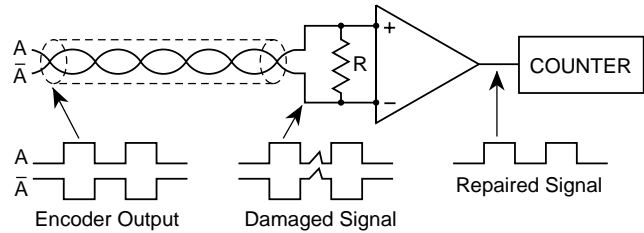


Figure 37

Grounding requirements, conventions and definitions are contained in the National Electrical Code. Local codes will usually dictate the particular rules and regulations that are to be followed concerning system safety grounds.

Signal Distortion

The majority of signal transmission problems involve electrical noise. Severity of the problem increases with transmission distance. Good shielding practice, as described previously, should be observed.

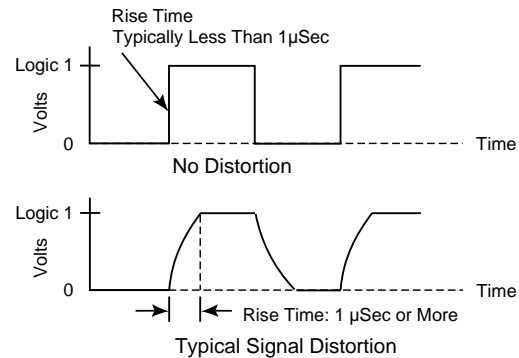


Figure 38

The primary cause of signal distortion is cable length, or more specifically, cable capacitance.

Generally, the receiving electronics will respond to an input signal that is either logical "0" or logical "1". The region between logical 0 and logical 1 is undefined, and the transition through this region must be very rapid (less than about 1 μ sec). As the leading edge of the waveform is distorted, the transition time increases. At some point, the receiver becomes unstable and encoder or trackball counts may be gained or lost.

To minimize distortion, low capacitance cable (typically less than 40 picofarads per foot) should be used. The longer the cable, the greater the potential for signal distortion. Beyond some cable length, the signal must be "reshaped" before it can be used reliably.

Squarewave distortion is not usually significant for cable lengths less than about 50 feet (capacitance up to about 1000 picofarads). Encoders and trackballs supplied with differential line drivers are recommended for applications with cable length requirements of hundreds of feet.

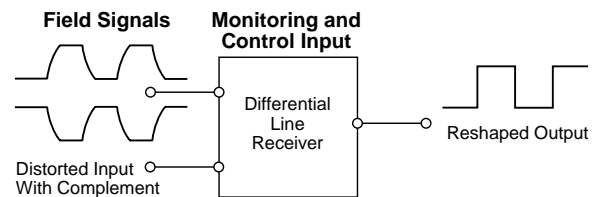


Figure 39

Greater assurance of signal integrity is best achieved when an encoder with line driver outputs is used in conjunction with a line receiver.

Introduction Incremental Encoders

Mechanical Installation

The method of coupling the encoder to the machine where motion is being detected is an important consideration because of possible errors or stresses which can be introduced. Care must be taken that the rated shaft loading, both radial and axial, not be exceeded.

Common causes of difficulty are end thrust, misalignment, and belt or gear thrust. Backlash or modulation in the coupling can cause errors in position indication. Therefore, mechanical coupling is best achieved by using a flexible coupling which compensates for the misalignment between the shaft of the encoder and the machine. This compensation is required because the smallest misalignment can result in high radial loads thereby inducing premature bearing failure.

Why Flexible Couplings?

When shafts are coupled, it is seldom practical to align them perfectly. Alignments can change due to wear in bearings, temperature changes, deflection due to external loading, etc.

When misalignment is greater than that allowed by the coupling, side thrust is created which can cause damage to the encoder shaft and bearings. A good criterion for a flexible coupling is to determine how long the coupling will last under operating misalignment, and the effect of this misalignment on shafts and bearings. This will yield better results than will choosing a coupling solely on the basis of how much misalignment it will take.

A coupling will last indefinitely if there is no misalignment. Generally, the greater the misalignment, the quicker the coupling will fail.

Encoders usually require a precision instrument coupling to prevent errors caused by backlash and to prevent damage to shaft and bearings. **Specifically, do not use fingered motor couplings with rubber spacers.**

For flexible shaft couplings that are specifically designed for use with our encoders, refer to the Dynapar brand CPL Series in this section.

Timing Belts

Use Series XL timing belts. Reliable long-life encoder performance is achievable provided the belt is installed in accordance with the manufacturer's instructions.

Belt Tension: The belt's positive grip eliminates the need for high initial tension. A properly tensioned belt will last longer, cause less wear on encoder bearings, and operate more quietly.

General Guidelines

Encoders are used to provide precise measurements of motion. Never hammer the end of the shaft. Avoid hammering the encoder case when mechanical fits are tight. Encoders provide quality measurements and longer life when common sense, care, and accurate alignments are achieved at the time of installation.

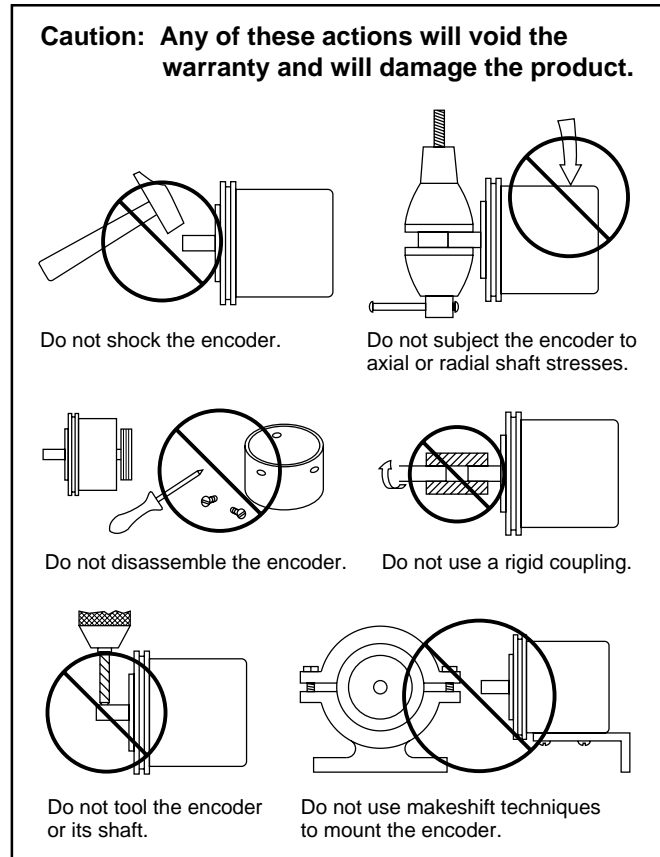


Figure 40

Fundamentals for Applying Magnetic Pickups

Principal of Operation: Variable Reluctance

Ferrous materials provide a low reluctance path for magnetic flux, whereas air provides a high reluctance path. A variable reluctance path, therefore, is one in which the reluctance in the path of the magnetic flux is varied, thereby varying the quantity of magnetic flux that is flowing through the path. Variable reluctance sensors utilize this change in magnetic flux. The path loops through a coil of wire, generating a voltage at the coil terminals that is exactly proportional to the rate of change of magnetic flux.

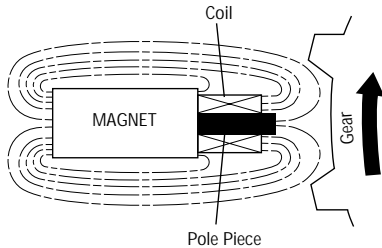


Figure 41
Variable Reluctance Concept

Variable reluctance units require motion to produce changes in magnetic flux which generate a signal. Typically, the positive portion of the electrical signal occurs as the target is moving into the center of the flux field. The negative portion of the electrical signal occurs as the target is moving out and away from the probe. The amplitude of the signals is in direct proportion to the rate of movement. Therefore, linear "surface speed" of the target is an important application consideration for variable reluctance pickups.

Application Consideration: Surface Speed

Dynapar variable reluctance sensors typically require that the target's linear surface speed be at least 180 inches per second. Since many applications use gears as targets, the following definitions, relationships and formulas can be used.

- Typical gear specifications:
- 1) Number of teeth
 - 2) Diametral pitch

Application parameters: The minimum gear RPM for which the sensor will be required to produce a useable signal. Therefore,

$$\text{Surface Speed (in./sec.)} = \frac{\text{RPM} \times \text{Outside Dia.} \times \pi}{60}$$

Outside Diameter (OD): The outside diameter is the overall diameter of the gear to the tops of the teeth. The OD can be determined from the following formula:

$$\text{OD} = \frac{\text{No. of Teeth} + 2}{\text{Diametral Pitch}}$$

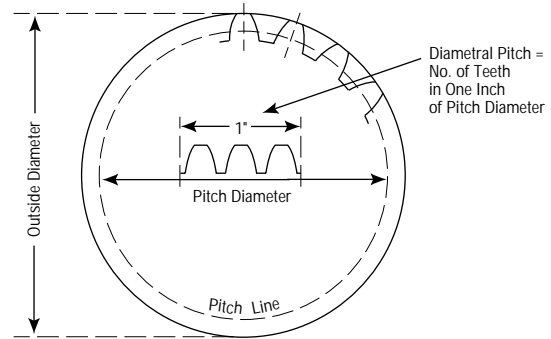


Figure 42

Principal of Operation: Hall Effect

A Hall Effect sensor utilizes the Hall Effect chip and a magnet to sense the change in magnetic field at the edge of a spur-gear tooth. Since pulse generation is based on the Hall Effect principle, the pickup operates down to zero speed without loss of signal. Refer to the pickup's catalog page for the target requirements. See figure 43 for gear and pickup compatibility.

Gear	Dia.	Bore	Pitch	PPR	Hall Effect			Variable Reluctance		
					53Z	53ZK	54Z/54ZT	50	52BH	7143
16002070081	3-1/10"	3/8"	20	60	X	X	X	X		
16002070083	3-7/8"	1/2"	16	60	X	X	X	X		X
16002070184	3-3/4"	5/8"	16	60	X	X	X	X		X
16002070185	3-3/4"	7/8"	16	60	X	X	X	X		X
16002070216	5-1/2"	1-1/8"	11	60		X	X	X	X	X
16002070217	5-1/2"	1-3/8"	11	60		X	X	X	X	X
16002070218	5-1/2"	1-5/8"	11	60		X	X	X	X	X
16002600314	5-1/2"	1-7/8"	11	60		X	X	X	X	X
16002600315	5-1/2"	2"	11	60		X	X	X	X	X
16002600316	5-1/2"	2-1/8"	11	60		X	X	X	X	X
16002600317	5-1/2"	2-1/4"	11	60		X	X	X	X	X
16002600318	5-1/2"	2-3/8"	11	60		X	X	X	X	X
16002600319	5-1/2"	2-1/2"	11	60		X	X	X	X	X
16002600320	5-1/2"	2-7/8"	11	60		X	X	X	X	X
16002070213	3-3/4"	5/8"	32	120	X					
16002070214	3-3/4"	7/8"	32	120	X					
16002070219	5-1/2"	1-1/8"	22	120	X					
16002070220	5-1/2"	1-3/8"	22	120	X					
16002070221	5-1/2"	1-5/8"	22	120	X					
16002600307	5-1/2"	1-7/8"	22	120	X					
16002600308	5-1/2"	2"	22	120	X					
16002600309	5-1/2"	2-1/8"	22	120	X					
16002600310	5-1/2"	2-1/4"	22	120	X					
16002600311	5-1/2"	2-3/8"	22	120	X					
16002600312	5-1/2"	2-1/2"	22	120	X					
16002600313	5-1/2"	2-7/8"	22	120	X					
Key or Keyway				1		X	X			

Figure 43
Gear and Pickup Compatibility






Figure 43 is a chart listing Dynapar brand gears and the pickups with which they are normally used. A "X" indicates that they will work together.

Selection Guide Shafted Incremental Encoders

Our Industrial Duty encoders accommodate a wide range of applications requiring specific size, load and performance characteristics. This Selector Guide can assist you in determining the type of encoder that best fits your application requirements. Condensed description and specification information is provided. Complete information is available on the referenced page number that appears below each product's picture.

Type	H20 Industrial Std - Size20	H58 European Std - Size58	HA/HR/HC25 Heavy Duty	HA725 High Resolution
				
PAGE NUMBER	2.16	2.20	2.24/28/32 ①	2.36 ①
DESCRIPTION AND FEATURES	<ul style="list-style-type: none"> Our most popular industrial encoder Ultra-reliable – unbreakable disk, 80 lb. bearings and complete electrical protection Wide variety of mechanical and electrical options 	<ul style="list-style-type: none"> European standard 58 mm package dimensions Higher reliability than competitive encoders 	<ul style="list-style-type: none"> Popular industry standard 2.5" package dimensions Ultra-reliable – 80 lb. bearings and complete electrical protection Unbreakable code disk (HR) 	<ul style="list-style-type: none"> High resolutions - up to 10,000 PPR direct read - not interpolated Industry standard 2.5" package Environmentally sealed to NEMA 4 / IP66
ELECTRICAL SPECIFICATIONS				
Available Resolutions:	1 to 2540 PPR	1 to 2540 PPR	HA/HR: 1 to 2540 PPR (HC: to 5000 PPR)	8192, 9000, or 10,000 PPR
Output Frequency:	100 kHz	100 kHz	100 kHz (HC: 250 kHz)	300 kHz
Input Power:	5 to 26 VDC, 80 to 135 mA	5 to 26 VDC, 80 to 135 mA	5 to 26 VDC, 80 to 200 mA	5 or 10 to 30 VDC, 40 to 60 mA
Available Output Types:	Open Collector, Push-Pull, or Differential Line Driver	Push-Pull or Differential Line Driver	Open Collector, Push-Pull, or Differential Line Driver	Push-Pull or Differential Line Driver
Terminations:	MS connector, M12 connector or shielded cable	MS, M12 or Conin connector or shielded cable	MS connector, M12 connector or shielded cable	MS connector
MECHANICAL SPECIFICATIONS				
Overall Size:	2.0" dia. x 1.75" dp.	58mm dia. x 46mm dp.	2.5" dia. x 1.7" dp.	2.5" sq. x 2.7" dp.
Shaft Size:	1/4" or 3/8" dia.	6mm or 10mm dia.	1/4" or 3/8" dia.	3/8" dia.
Max. Shaft Speed:	10,000 RPM	10,000 RPM	10,000 RPM	10,000 RPM
Max. Shaft Load:	Axial: 80 lbs. Radial: 80 lbs.	Axial: 356 N (80 lbs.) Radial: 356 N (80 lbs.)	Axial: 80 lbs. Radial: 80 lbs.	Axial: 24 lbs. Radial: 35 lbs.
Mounting:	flange, servo, or face mount	servo or face mount	flange, servo, or face mount	flange mount
ENVIRONMENTAL SPECIFICATIONS				
Operating Temperature:	0° to +70°C, -40° to +85°C opt.	0° to +70°C, -40° to +85°C opt.	0° to +70°C, -40° to +85°C opt.	-10° to +70°C
Enclosure Rating:	NEMA 12 / IP54 NEMA 4 / IP66 opt.	NEMA 12 / IP54 NEMA 4 / IP66 opt.	NEMA 12 / IP54 NEMA 4 / IP66 opt.	NEMA 4 / IP66

Key to Noteworthy features: ① High Performance - 5000 PPR or greater resolution available ② Hazardous Environment - Intrinsically Safe or Explosion Proof rating

<i>H42 Economical</i>	<i>21/22 Qube</i>	<i>60 Rotopulser®</i>	<i>H56 Mill Duty</i>	<i>X25 Explosion Proof</i>
				
2.38	2.40	2.44	2.46	2.48 ① ②
<ul style="list-style-type: none"> ■ Economical 2.5" encoder ■ Popular flange mounting, quadrature line driver output and MS connector simplify selection 	<ul style="list-style-type: none"> ■ Accurate Optical Code Disk ■ Up to 1270 PPR with marker ■ Interchangeable with standard 2.25" square encoders ■ Face and foot mounting available on three sides 	<ul style="list-style-type: none"> ■ Popular dual shaft extension for double measuring wheel applications ■ Unbreakable plastic disk 	<ul style="list-style-type: none"> ■ Mill Duty standard for the steel and paper industries ■ Heavy duty housing and bearings isolate internal encoder from loads ■ Isolated secondary output available for quick backup ■ Foot or C-Face mounting for drive feedback 	<ul style="list-style-type: none"> ■ Explosion proof design, Heavy-duty ABEC precision bearings, stainless steel shaft ■ Heavy-duty cast aluminum housing, and an O-ring seal ■ Approved for National Electrical Code (NEC) Class 1 & 2, Divisions 1 & 2, Groups C, D, E, F, G
1 to 600 PPR	1 to 1270 PPR	1 to 2500 PPR	1 to 2500 PPR	1 to 5000 PPR
100 kHz	100 kHz	50 kHz	100 kHz	100 kHz
5 to 26 VDC, 80 mA	5 to 26 VDC, 100 to 200 mA	5 to 15 VDC, 115 mA	5 to 26 VDC, 80 mA	5 to 26 VDC, 70 to 120 mA
Differential Line Driver	Open Collector or Line Driver	Push-Pull or Line Driver	Push-Pull or Line Driver	Open Collector, Push-Pull, or Line Driver
MS connector	MS connector, M12 connector or shielded cable	MS connector	MS connector or plug-in screw terminals	Internal screw terminals, conduit entry
2.5" dia. x 2.5" dp.	2.25" sq. x 2.25" dp.	3.5" dia. x 2.1" dp.	6.5" ht. x 6.0" wd. x 5.1" dp. (plus mating connectors)	4.0" sq. x 5.6" dp.
3/8" dia.	3/8", 1/4", or 6mm dia., single or double shaft	1/4" or 1/2" dia., single or double shaft	5/8" dia., single or double shaft	1/4" or 3/8" dia.
7200 RPM	6000 RPM	3600 RPM	3600 RPM	5000 RPM
Axial: 80 lbs. Radial: 80 lbs.	Axial: 30 lbs. Radial: 40 lbs.	Axial: 5 lbs. Radial: 15 lbs.	Axial: 50 lbs. Radial: 100 lbs.	Axial: 40 lbs. Radial: 40 lbs.
flange mount	face or foot	servo or face mount	56C face or foot mount	flange mount
0° to +70°C	0° to +70°C	0° to +54°C	-40° to +80°C	0° to +70°C
NEMA 12 / IP54	NEMA 12 / IP54	NEMA 12 / IP54, NEMA 4 / IP66 opt.	NEMA 4 / IP66	NEMA 4, IP56

Selection Guide Commercial Incremental

The following encoders are especially suited for light-duty applications employing small, fractional horse power motors. In such use, they will provide excellent performance and life characteristics. **Do not attempt to adapt to applications that require the heavier duty encoders listed in the preceding pages of this Selection Guide.** Condensed description and specification information is provided. Complete information is available on the referenced page number that appears below each product's picture.

Type	E12 1.1" Encoder	E14 1.5" Encoder	E23/EC23 2.3" Encoder	Please Note: <i>The encoders on this page are especially suited for light-duty applications employing small, fractional horse power motors. In such use, they will provide excellent performance and life characteristics</i>
Image				
PAGE NUMBER	2.54	2.56	2.58/2.60 1	Do not attempt to adapt to applications that require the industrial and heavy duty encoders listed in the preceding pages of this Selection Guide.
DESCRIPTION AND FEATURES	<ul style="list-style-type: none"> ■ Servo or face mount ■ Up to 1024 PPR with optional marker pulse ■ Rugged all-metal housing ■ Shielded cable standard 	<ul style="list-style-type: none"> ■ Rugged all-metal housing ■ Industry standard, 1.5" servo and face mounting dimensions ■ Optional differential line driver outputs ■ Shielded cable standard 	<ul style="list-style-type: none"> ■ Popular, industry standard 2.3" diameter package ■ Resolutions to 5000 PPR ■ Choice of cable exit or screw terminals 	
ELECTRICAL SPECIFICATIONS				
Available Resolutions:	100 to 1024 PPR	100 to 1024 PPR	1 to 2540 PPR (E23) 3000 to 5000 PPR (EC23)	
Output Frequency:	100 kHz	100 kHz	100 kHz	
Input Power:	5, 12, or 15 VDC; 100 to 135 mA	5, 12, or 15 VDC; 100 to 210 mA	5 to 26 VDC, 80 to 200 mA	
Available Output Types:	TTL / CMOS	TTL / CMOS or Line Driver	Open Collector, TTL Totem Pole, or Line Driver	
Terminations:	Shielded cable	Shielded cable	Shielded cable or screw terminals	
MECHANICAL SPECIFICATIONS				
Overall Size:	1.1" dia. x 1.1" dp.	1.5" dia. x 1.5" dp.	2.3" dia. x 1.65" dp.	
Shaft Size:	1/8" dia.	1/8" or 1/4" dia.	1/4" dia.	
Max. Shaft Speed:	5000 RPM	5000 RPM	5000 RPM	
Max. Shaft Load:	Axial: 1 lb. Radial: 1 lb.	Axial: 3 lb Radial: 5 lb.	Axial: 5 lb. Radial: 5 lb.	
Mounting:	servo or face mount	servo or face mount	servo or face mount	
ENVIRONMENTAL SPECIFICATIONS				
Operating Temperature:	0° to +70°C	0° to +70°C	0° to +70°C	
Enclosure Rating:	NEMA 12 / IP54	NEMA 12 / IP54	NEMA 12 / IP54	

1 High Performance - 5000 PPR or greater resolution available

Notes



Series H20

- Ultra-reliable design using long-life bearings
- Unbreakable code disk available
- Complete electrical protection and noise immunity tested to EN5002-2
- Available with environmental sealing to NEMA4 / IP66



APPLICATION/INDUSTRY

The Dynapar brand Series H20 is a rugged, reliable and economical encoder for industrial motion applications.

DESCRIPTION

Models with resolutions of 1024 or less are equipped with an unbreakable code disk that meets the demands of the most severe shock and vibration generating processes; use of long life bearings keep tough loads from disrupting internal alignment, avoiding failure due to the disk "crashes" so typical in competitive encoders. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. A NEMA4 / IP66 sealing option protects against damage from contamination.

Packaged in the industry standard 2.0" enclosure, the Series H20 offers a variety of mechanical options: servo or face mounting, 1/4" or 3/8" shafts, and several types of pilots. Electrical options include: resolutions from 1 to 2540 pulses/revolution; unidirectional or bidirectional operation with optional index; single ended open collector or push-pull outputs, or differential line drivers; and connector or cable exit terminations.

The Series H20 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Unbreakable, code disk and long life bearings
- Extended temperature range option
- Industry Standard, Size 20 Form Factor
- NEMA4 / IP66 washdown rating option

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2540 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) ≤ 1024 PPR (metal disk): ± 7.5 arc-min. > 1024 PPR (glass disk): ± 2.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CCW shaft rotation as viewed from the shaft end of the encoder
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA, sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients.

CONNECTIONS

Mating Connector:
 6 pin, style MS3106A-14S-6S (MCN-N4);
 7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shaft Loading: (at 0.25" from encoder face)
 Resolutions ≤ 1024 PPR: 80 lbs. radial, axial
 Resolutions > 1024 PPR: 40 lbs. radial, axial
Shaft Speed:
 Resolutions ≤ 1024 PPR: 10,000 RPM max.
 Resolutions > 1024 PPR: 5,000 RPM max.
Starting Torque: (max at 25 °C)
 without shaft seal: 1.0 oz-in;
 with shaft seal: 2.0 oz-in
Moment of Inertia: 3.0×10^{-4} oz-in-sec²

Weight: 10 oz. max.

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof); NEMA4/IP66 (dust proof, washdown) when ordered with shaft seal and either MS connector or watertight cable exit

ELECTRICAL CONNECTIONS

Series H20

6, 7 & 10 Pin MS Connectors and Cables - Code 8= 0 to 9, A to M

Connector & mate/accessory cable assembly pin numbers and wire color information is provided here for reference. H20 models with direct cable exit carry the same color coding as shown for each output configuration.

Encoder Function	Cable # 108594-6 Pin Single Ended		Cable # 108595-7 Pin Single Ended		Cable # 108596-7 Pin Dif Line Drv w/o Idx		Cable # 1400635-10 Pin Dif Line Drv w/ Idx	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	E	BRN	A	BRN	A	BRN	A	BRN
Sig. B	D	ORN	B	ORG	B	ORG	B	ORG
Sig. Z	C	YEL	C	YEL	—	—	C	YEL
Power +V	B	RED	D	RED	D	RED	D	RED
Com	A	BLK	F	BLK	F	BLK	F	BLK
Case	—	—	G	GRN	G	GRN	G	GRN
N/C	F	—	E	—	—	—	E	—
Sig. \bar{A}	—	—	—	—	C	BRN/WHT	H	BRN/WHT
Sig. \bar{B}	—	—	—	—	E	ORG/WHT	I	ORG/WHT
Sig. \bar{Z}	—	—	—	—	—	—	J	YEL/WHT

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables when Code 8= N to R

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Cable # 112859-5 Pin Single Ended		Cable # 112860-8 Pin Single Ended		Cable # 112860-8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

* Index not provided on all models. See ordering information

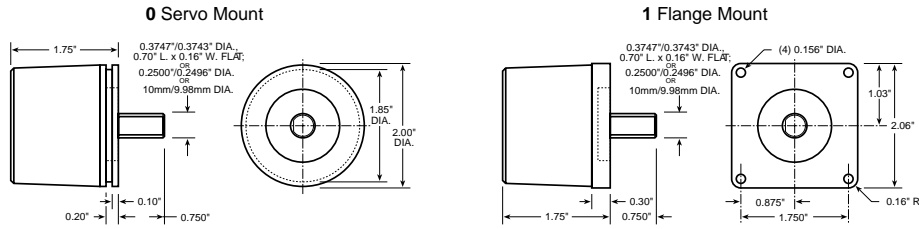
Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

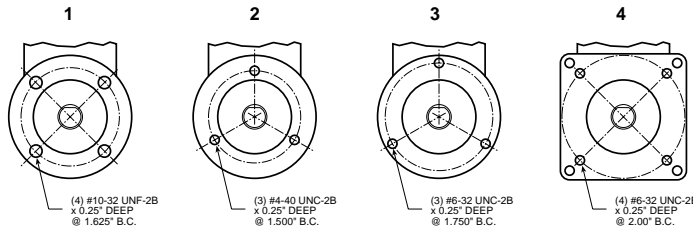
DIMENSIONS

Series H20

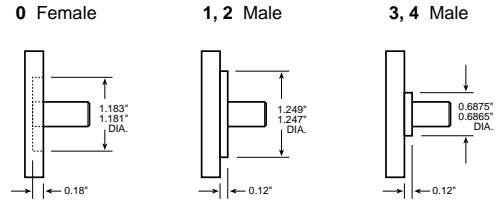
Code 3: Housings



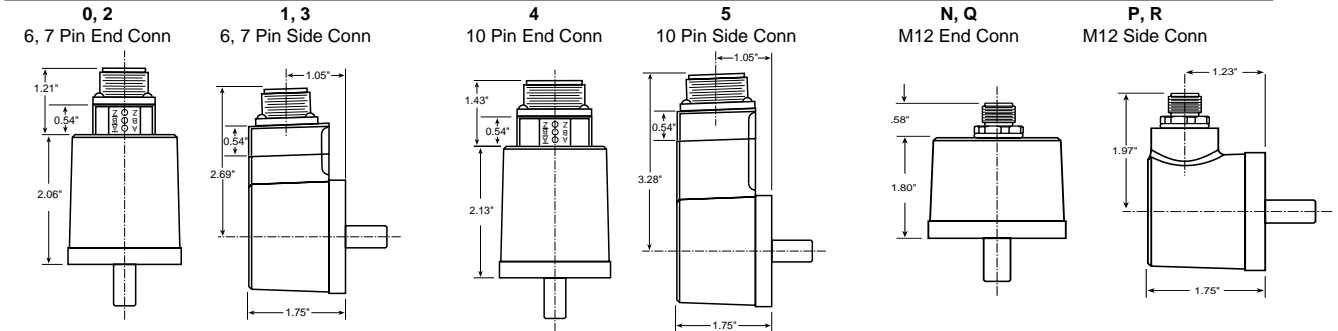
Code 5: Face Mounts



Code 6: Pilots

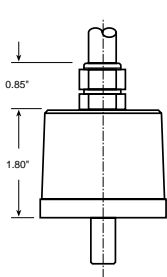


Code 8: Terminations

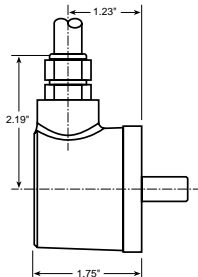


Code 8: 0-5 dimensions shown with LED Output Indicator Option (Code 9: PS)

6, 8, A, C, E, G
End Exit Cable



7, 9, B, D, F, H
Side Exit Cable



ORDERING INFORMATION

Series H20

INDUSTRIAL

Code 1: Model	Code 2: PPR	Code 3: Housing	Code 4: Shaft	Code 5: Face Mount	Code 6: Pilot, Seal	Code 7: Electrical	Code 8: Termination	Code 9: Options
H20	□□□□	□	□	□	□	□	□	□
Ordering Information								
1 Unidirectional	0001 0500 0005 0512 0010 0600	0 Servo Mount	0 3/8" Dia. Shaft with flat	0 no face mount	0 1.18" Dia. Female Pilot	0 5-26V in, 5-26V Open Collector out	0 6 Pin Conn, End Mount	available when Code 8 is 0 to 5: PS LED Output Indicator
2 Bidirectional	0012 0800 0050 0900 0060 1000 0086 1024 0100 1200 0120 1250 0125 1270 0180 1500 0200 1600 0240 1800 0250 1968 0254 2000 0256 2048 0300 2400 0360 2500 0400 2540	1 Flange Mount	1 1/4" Dia. Shaft, no flat	available when Code 3 is 0: 1 (4) #10-32 @ 1.63" BC	1 1.25" Dia. Male Pilot	1 5-26V in, 5-26V Open Collector out with 2.2 kΩ Pullups	1 6 Pin Conn, Side Mount	
3 Bidirectional with Index			4 10mm Dia. Shaft, no flat	2 (3) #4-40 @ 1.50" BC 3 (3) #6-32 @ 1.75" BC	2 1.25" Dia. Male Pilot with Shaft Seal	2 5-26V in, 5-26V Push-Pull out	2 7 Pin Conn, End Mount	
				available when Code 3 is 1: 4 (4) #6-32 @ 2.00" BC	3 0.69" Dia. Male Pilot	A Same as "0" with extend. temp range B Same as "1" with extend. temp range C Same as "2" with extend. temp range	3 7 Pin Conn, Side Mount	
					4 0.69" Dia. Male Pilot with Shaft Seal	available when: Code 1 is 1 or 2 and Code 8 is 2 through M, Q or R; or Code 1 is 3 and Code 8 is 4 thru M, Q or R:	4 10 Pin Conn, End Mount	
						3 5-26V in, 5-26V Differential Line Driver out (7272)	5 10 Pin Conn, Side Mount	
						4 5-26V in, 5V Differential Line Driver out (7272)	6 18" Cable, End Exit	
						5 5-26V in, 5V Differential Line Driver out (4469)	7 18" Cable, Side Exit	
						6 5-15V in, 5-15V Differential Line Driver out (4469)	8 36" Cable, End Exit	
						D Same as "3" with extend. temp range	9 36" Cable, Side Exit	
						E Same as "4" with extend. temp range	A 10' Cable, End Exit	
							B 10' Cable, Side Exit	
							J 25' Cable, End Exit	
							K 25' Cable, Side Exit	
							N 5 Pin M12 Connector, End Mount	
							P 5 Pin M12 Connector, Side Mount	
							available when Code 6 is 2 or 4: C 18" Sealed Cbl, End Exit	
							D 18" Sealed Cbl, Side Exit	
							E 36" Sealed Cbl, End Exit	
							F 36" Sealed Cbl, Side Exit	
							G 10' Sealed Cbl, End Exit	
							H 10' Sealed Cbl, Side Exit	
							L 25' Sealed Cbl, End Exit	
							M 25' Sealed Cbl, Side Exit	

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

Series H58

- Rugged, ultra-reliable design using long-life bearings
- Available unbreakable metal code disk
- Complete electrical protection and noise immunity tested to EN50082-2
- Available with environmental sealing to IP66 / NEMA4
- Economical solution for medium resolution applications
- Industry-standard size 58 packages



APPLICATION/INDUSTRY

The Dynapar brand Series H58 is a rugged, reliable and economical encoder for industrial motion applications.

DESCRIPTION

Models with resolutions of 1024 or less are equipped with an unbreakable code disk that meets the demands of the most severe shock and vibration generating processes. Long life, heavy-duty bearings keep tough loads from disrupting internal alignment, avoiding failure due to the disk "crashes" so typical in competitive encoders. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. An IP66 / NEMA 4 sealing option protects against damage from contamination.

Packaged in the European standard 58mm enclosure, the Series H58 offers a variety of mechanical options: servo or face mounting on 42mm or 48mm bolt circles, 6mm or 10mm shafts, and an optional 36mm pilot. Electrical options include: resolutions from 1 to 2540 pulses/revolution; single ended push-pull or differential line driver outputs; and a choice of connector or cable terminations.

The Series H58 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Long Life bearings
- Extended temperature range option
- Industry Standard, 58mm Form Factor
- IP66/NEMA4 washdown rating option
- Operation to 10,000 RPM

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit protection
- 100 kHz frequency response

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2540 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) ≤ 1024 PPR (metal disk): ± 7.5 arc-min.
 > 1024 PPR (glass disk): ± 2.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CCW shaft rotation as viewed from the shaft end of the encoder
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA, sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Mating Connector:
 7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 12 pin, CW (605560-0001)
 12 pin, CCW (605560-0002)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shaft Loading: (at 6 mm from encoder face)
 Resolutions ≤ 1024 PPR: 356 N radial, axial
 Resolutions > 1024 PPR: 178 N radial, axial
Shaft Speed:
 Resolutions ≤ 1024 PPR: 10,000 RPM max.
 Resolutions > 1024 PPR: 5,000 RPM max.
Starting Torque: (max at 25 °C)
 without shaft seal: 0.007 N-m;
 with shaft seal: 0.014 N-m
Moment of Inertia: 21.2 g-cm²
Weight: 283 g. (10 oz.) max.

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof); NEMA4/IP66 (dust proof, washdown) when ordered with shaft seal and either MS connector or watertight cable exit

ELECTRICAL CONNECTIONS

Series H58

7, 10 and 12 Pin Connectors and Cables - Code 7= 0 to 7

Connector & mate/accessory cable assembly pin numbers and wire color information is provided here for reference. Models with direct cable exit carry the same color coding as shown for each output configuration.

Encoder Function	Cable # 108595-7 Pin (If Used)		Cable # 1400635-10 Pin (If Used)		Cable # 108615-12 Pin CCW (If Used)		Cable # 108616-12 Pin CW (If Used)	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	A	BRN	A	BRN	5	BRN	3	BRN
Sig. B	B	ORN	B	ORG	8	ORG	4	ORG
Sig. Z	C	YEL	C	YEL	3	YEL	7	YEL
Power +V	D	RED	D	RED	12	RED	2	RED
N/C	E	—	E	—	7	—	—	—
Com	F	BLK	F	BLK	10	BLK	1	BLK
Case	G	GRN	G	GRN	9	—	—	—
Sig. \bar{A}	—	—	H	BRN/WHT	6	BRN/WHT	5	BRN/WHT
Sig. \bar{B}	—	—	I	ORG/WHT	1	ORG/WHT	6	ORG/WHT
Sig. \bar{Z}	—	—	J	YEL/WHT	4	YEL/WHT	8	YEL/WHT
5V Sense	—	—	—	—	2	GRN	—	—
0V Sense	—	—	—	—	11	BLK/WHT	—	—

Mating connector/cable assembly wire color information is provided here for reference. H58 models with direct cable exit carry the same color coding as shown for each output configuration.

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables when Code 7= C to F

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Cable # 112859-5 Pin Single Ended		Cable # 112860-8 Pin Single Ended		Cable # 112860-8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

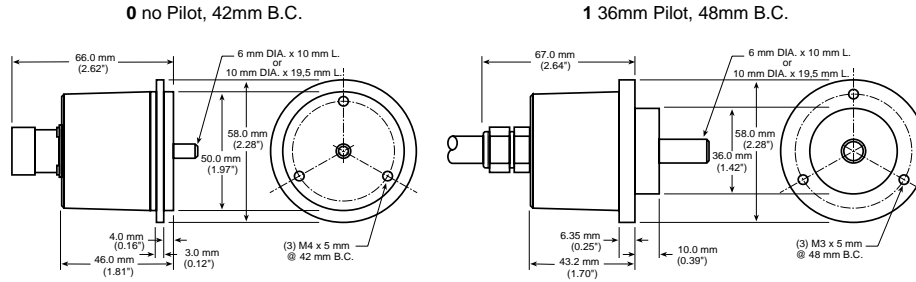
Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

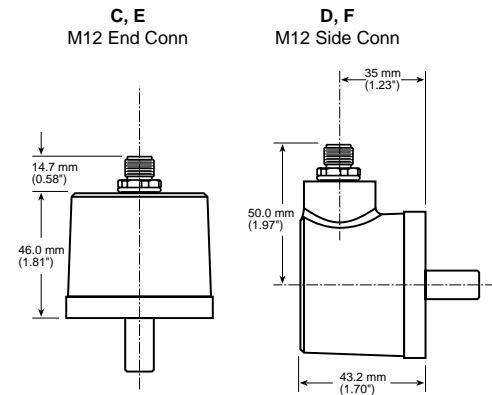
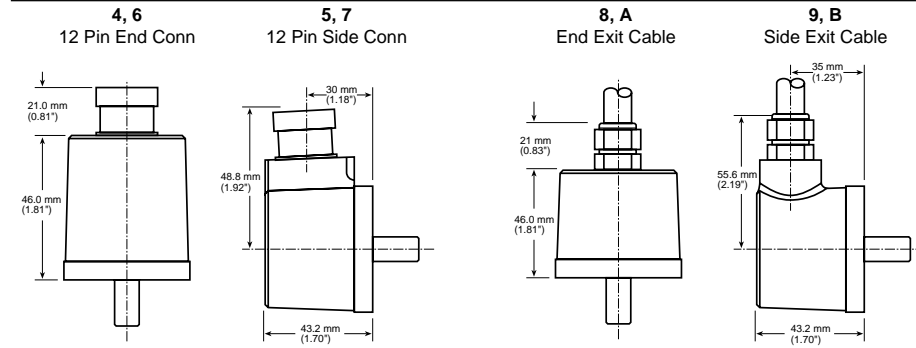
DIMENSIONS

Series H58

Code 3: Pilot, Face Mounts

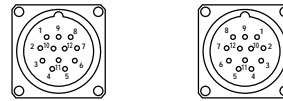


Code 7: Terminations



Code 7: Terminations

4, 5 CCW **6, 7 CW**
(when looking at encoder)



ORDERING INFORMATION

Series H58

Code 1: Model	Code 2: PPR	Code 3: Pilot, Face	Code 4: Shaft	Code 5: Shaft Seal	Code 6: Electrical	Code 7: Termination	Code 8: Connector	
H58	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ordering Information								
H58 Bidirectional with Index (Channels A, B and Z)	0001	0500	0 (3) M4 @	0 6mm Dia. Shaft	0 no Shaft Seal	0 5-26V in, 5-26V Push-Pull out available when Code 7 is 2 thru B, E or F: 1 5-26V in, 5-26V Differential Line Driver out (7272) 2 5-26V in, 5V Differential Line Driver out (7272) 3 5-26V in, 5V Differential Line Driver out (4469) 4 5-15V in, 5-15V Differential Line Driver out (4469) A Same as "0" with extend. temp range B Same as "1" with extend. temp range C Same as "2" with extend. temp range	0 7 Pin Conn, End Mount	0 no Mating Connector
	0005	0512	42mm BC, no Pilot	1 10mm Dia. Shaft	1 Shaft Seal		1 7 Pin Conn, Side Mount	1 7 Pin Mating Connector
	0010	0600					2 10 Pin Conn, End Mount	2 10 Pin Mating Connector
	0012	0800					3 10 Pin Conn, Side Mount	3 12 Pin CCW Mating Connector
	0050	0900	1 (3) M3 @				4 12 Pin CCW Conn, End Mount	4 12 Pin CW Mating Connector
	0060	1000	48mm BC, 36mm Dia. Pilot				5 12 Pin CCW Conn, Side Mount	
	0086	1024					6 12 Pin CW Conn, End Mount	
	0100	1200					7 12 Pin CW Conn, Side Mount	
	0120	1250					C 5 pin M12 Conn, End Mount	
	0125	1270					D 5 pin M12 Conn, Side Mount	
0180	1500				E 8 pin M12 Conn, End Mount			
0200	1600				F 8 pin M12 Conn, Side Mount			
0240	1800				available when Code 5 is 1:			
0250	1968				8 1m Sealed Cbl, End Exit			
0254	2000				9 1m Sealed Cbl, Side Exit			
0256	2048				A 3m Sealed Cbl, End Exit			
0300	2400				B 3m Sealed Cbl, Side Exit			
0360	2500							
0400	2540							

Series HA25

- Ultra-reliable, heavy-duty Size 25 (2.5") encoder
- Complete electrical protection and noise immunity
- Environmentally sealed to NEMA4/IP66
- Up to 2540 PPR with optional marker pulse



APPLICATION/INDUSTRY

The Dynapar brand Series HA25 is a rugged, reliable and economical encoder for industrial motion applications.

DESCRIPTION

Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. A NEMA4 / IP66 sealing option protects against damage from contamination.

Packaged in an industry standard 2.5" enclosure, the Series HA25 offers a variety of mechanical options: servo or face mounting, and 1/4" or 3/8" shafts. Electrical options include: resolutions to 2540 pulses/revolution; bidirectional operation with optional index; single ended open collector or push-pull outputs, or differential line drivers; and connector or cable exit terminations.

The Series HA25 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Long life, 40 lb bearings
- Extended temperature range available
- Industry Standard, Size 25 Form Factor
- NEMA4 / IP66 washdown rating option

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental

Resolution: 1 to 2540 PPR (pulses/revolution)

Accuracy: (Worst case any edge to any other edge) ± 2.5 arc-min.

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

Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information

Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical

Symmetry: $180^\circ \pm 18^\circ$ electrical

Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)

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

ELECTRICAL

Input Power:

4.5 min. to 26 VDC max. at 80 mA max., not including output loads

Outputs:

7273 Open Collector: 30 VDC max., 40 mA sink max.

7272 Push-Pull and Differential Line Driver: 40 mA sink or source

4469 Differential Line Driver: 100 mA, sink or source

Frequency Response: 100 kHz min.

Electrical Protection: Overvoltage, reverse voltage and output short circuit protected

Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Mating Connector:

7 pin, style MS3106A-16S-1S (MCN-N5);

10 pin, style MS3106A-18-1S (MCN-N6)

5 pin, style M12: Cable with connector available

8 pin, style M12: Cable with connector available

MECHANICAL

Shaft Loading: (at 0.25" from encoder face) 35 lbs. radial, 40 lbs. axial

Shaft Speed: 5,000 RPM max.

Starting Torque: (max at 25 °C)

HA525: 1.0 oz-in;

HA625: 2.5 oz.-in

Moment of Inertia: 3.0×10^{-4} oz-in-sec²

ENVIRONMENTAL

Operating Temperature:

Standard: 0 to +70 °C;

Extended: -40 to +85 °C

Storage Temperature: -40 to +90 °C

Shock: 50 G's for 11 milliseconds duration

Vibration: 5 to 2000 Hz at 20 G's

Humidity: to 98% without condensation

Enclosure Rating:

HA525: NEMA12/IP54 (dirt tight, splashproof); HA625: NEMA4/IP66 (dust proof, washdown)

ELECTRICAL CONNECTIONS

Prewired Cable or Accessory Cables with 7 or 10 Pin MS Connector - when Code 4= 0 to 6, or A, B, C, D or G

Table 1 – Differential			
Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	BRN
B	Signal B	ORN	ORN
C	Signal Z	YEL	YEL
D	Power Source	RED	RED
E	No Connection	—	—
F	Common	BLK	BLK
G	Case	GRN	GRN
H	Signal \bar{A}	BRN/WH	BRN/WH
I	Signal \bar{B}	ORN/WH	ORN/WH
J	Signal \bar{Z}	YEL/WH	YEL/WH
*Cable Accessory: P/N 14006350010			

Note: Wire color codes are referenced here for models that are specified with pre-wired cable. Connector/cables are described in the Encoder Accessories section of this catalog and color-coding information is provided here for reference.

Table 2 – Single Ended			
Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	RED
B	Signal B	ORN	BLUE
C	Signal Z	YEL	YEL
D	Power Source	RED	WHT
E	No Connection	—	GRN
F	Common	BLK	BLK
G	Case	GRN	SHIELD
*Cable Accessory: P/N 14004310010			

Table 3 – Differential		
Pin	Function (If Used)	Cable Accessory Color Code
A	Signal A	BRN
B	Signal B	ORN
C	Signal \bar{A}	BRN/WHT
D	Power Source	RED
E	Signal \bar{B}	ORN/WHT
F	Common	BLK
G	Case	GRN
*Cable Accessory: P/N 108596		

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables - when Code 4= H to Z

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Table 4 5 Pin Single Ended		Table 5 8 Pin Single Ended		Table 6 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

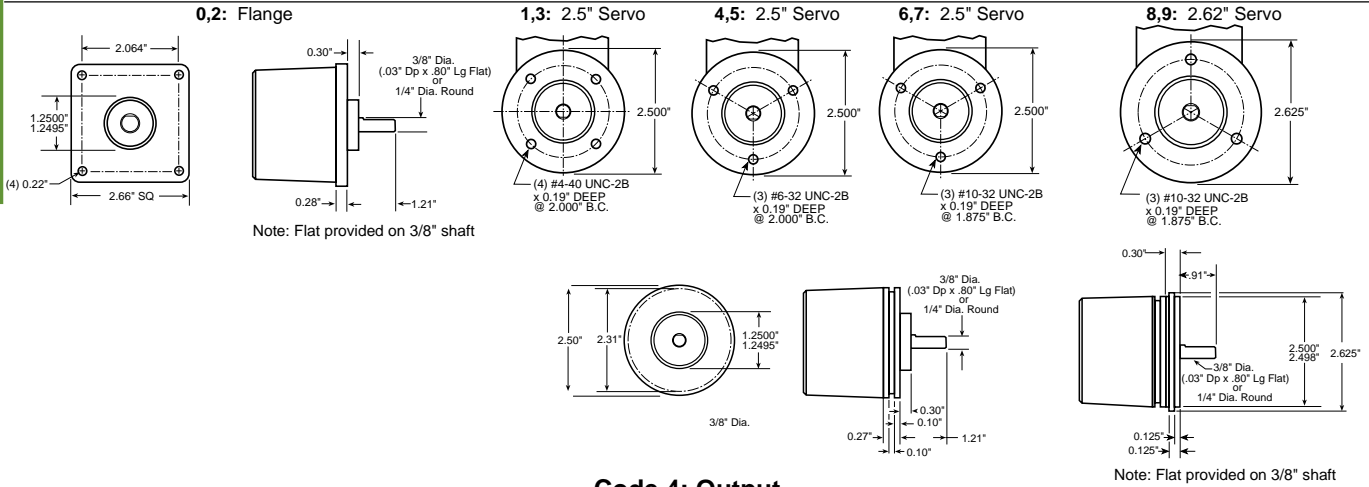
* Index not provided on all models. See ordering information

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

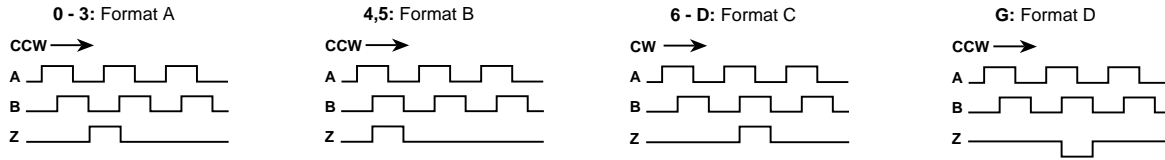
See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

Series HA25

Code 3: Mechanical

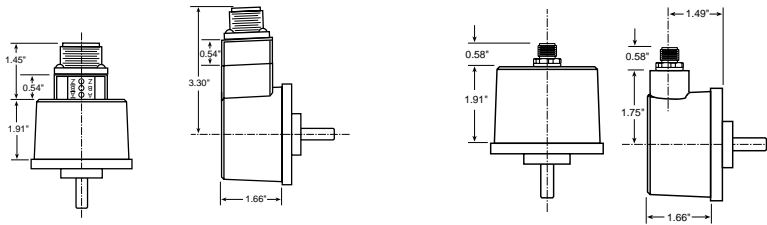


Code 4: Output



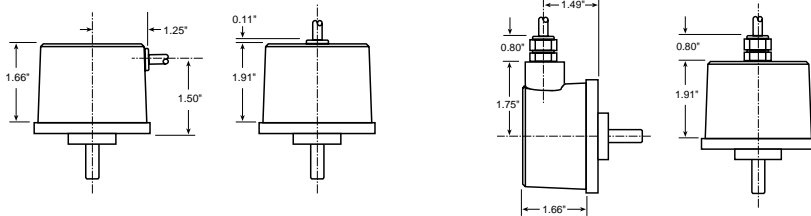
Code 6: Termination

0: End MS Connector 1: Side MS Connector When Code 5 is 0 to 6 or A to G
 0: End M12 Connector 1: Side M12 Connector When Code 5 is H to Z



Code 6: 0 & 1 dimensions shown with LED Output Indicator Option (Code 7: PS)

2-6: Side Cable J-N: End Cable A-F: Side W.T. Cable P-T: End W.T. Cable



ORDERING INFORMATION

Series HA25

INDUSTRIAL

Code 1: Model	Code 2: PPR	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination	Code 7: Options
HA □25	□□□□	□	□	□	□	□□
Ordering Information						
HA525 Size 25 Enclosed, Shielded Bearings, Glass Disk HA625 Size 25 Enclosed, with Shaft Seal, Glass Disk	0001 0600 0005 0625 0010 0635 0012 0720 0050 0800 0060 0900 0100 1000 0120 1024 0150 1200 0180 1250 0200 1270 0240 1500 0250 1600 0256 1800 0300 1968 0360 2000 0400 2048 0500 2400 0512 2500 2540	0 Flange Mount, 3/8" Shaft 1 2.50" Servo Mount/ 4 Hole, 2.00" BC Face Mount, 3/8" Shaft 2 Flange Mount, 1/4" Shaft 3 2.50" Servo Mount/ 4 Hole 2.00" BC Face Mount, 1/4" Shaft 4 2.50" Servo Mount/ 3 Hole, 2.00" BC Face Mount, 3/8" Shaft 5 2.50" Servo Mount/ 3 Hole, 2.00" BC Face Mount, 1/4" Shaft 6 2.50" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 3/8" Shaft 7 2.50" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 1/4" Shaft 8 2.62" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 3/8" Shaft 9 2.62" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 1/4" Shaft	7 Pin MS Connector or Cable 0 Single Ended, no Index, Format A, Table 2 1 Single Ended, with Index, Format A, Table 2 4 Single Ended, with Index, Format B, Table 2 6 Differential, no Index, Format C, Table 3 A Single Ended, with Index, Format C, Table 2 C Single Ended, no Index, Format C, Table 2 G Single Ended, with Index, Format D, Table 2 10 Pin MS Connector or Cable 2 Differential, no Index, Format A, Table 1 3 Differential, with Index, Format A, Table 1 5 Differential, with Index, Format B, Table 1 B Differential, with Index Format C, Table 1 D Differential, no Index, Format C, Table 1 5 Pin M12 Connector H Single ended, no index, Format A, Table 4 J Single ended, with index, Format A, Table 4 K Single ended, with index, Format B, Table 4 L Single ended, with index, Format C, Table 4 M Single ended, no index, Format C, Table 4 N Single ended, with index, Format D, Table 4 8 Pin M12 Connector P Single ended, no index, Format A, Table 5 Q Single ended, with index, Format A, Table 5 R Single ended, with index, Format B, Table 5 S Single ended, with index, Format C, Table 5 T Single ended, no index, Format C, Table 5 U Single ended, with index, Format D, Table 5 V Differential, no index, Format A, Table 6 W Differential, with index, Format A, Table 6 X Differential, with index, Format B, Table 6 Y Differential, with index, Format C, Table 6 Z Differential, no index, Format C, Table 6	0 5-26V in; 5-26V Open Collector with 2.2kΩ Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V Totem Pole out 3 5-26V in; 5V Line Driver out (7272) 4 5-26V in; 5-26V Line Driver out (7272) 5 5-26V in, 5V Differential Line Driver out (4469) 6 5-15V in, 5-15V Differential Line Driver out (4469) A Same as "0" with extend. temp range B Same as "1" with extend. temp range C Same as "2" with extend. temp range D Same as "3" with extend. temp range E Same as "4" with extend. temp range	0 End Mount Connector 1 Side Mount Connector 2 18" Cable, Side 3 3' Cable, Side 4 6' Cable, Side 5 10' Cable, Side 6 15' Cable, Side J 18" Cable, End K 3' Cable, End L 6' Cable, End M 10' Cable, End N 15' Cable, End available when Code 1 is HA625: A 18" Watertight, Side B 3' Watertight, Side C 6' Watertight, Side D 10' Watertight, Side F 15' Watertight, Side P 18" Watertight, End Q 3' Watertight, End R 6' Watertight, End S 10' Watertight, End T 15' Watertight, End	available when Code 4 is 0 thru G, and Code 6 is 0 or 1: PS LED Output Indicator

Series HR25

- Ultra-reliable, heavy-duty Size 25 (2.5") encoder
- Unbreakable code disk
- Complete electrical protection and noise immunity
- Environmentally sealed to NEMA4/IP66
- Up to 1024 PPR with optional marker pulse



APPLICATION/INDUSTRY

The Dynapar brand Series HR25 is a rugged, reliable and economical encoder for industrial motion applications.

DESCRIPTION

The unbreakable code disk meets the demands of the most severe shock and vibration generating processes; and long life bearings that keep tough loads from disrupting internal alignment, avoiding failure due to the disk "crashes" so typical in competitive encoders. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. A NEMA4 / IP66 sealing option protects against damage from contamination.

Packaged in an industry standard 2.5" enclosure, the Series HR25 offers a variety of mechanical options: servo or face mounting, and 1/4" or 3/8" shafts. Electrical options include: resolutions from 1 to 1024 pulses/revolution; bidirectional operation with optional index; single ended open collector or push-pull outputs, or differential line drivers; and connector or cable exit terminations.

The Series HR25 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Unbreakable code disk and long life 80 lb bearings available
- Extended temperature range available
- Industry Standard, Size 25 Form Factor
- NEMA4 / IP66 washdown rating option

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 1024 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) ± 7.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA, sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Mating Connector:

7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shaft Loading: (at 0.25" from encoder face) 80 lbs. radial, 80 lbs. axial
Shaft Speed: 10,000 RPM max.
Shaft Runout: 0.001" max. TIR
Moment of Inertia: 3.0×10^{-4} oz-in-sec²

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating:
 HR525: NEMA12/IP54 (dirt tight, splashproof);
 HR625: NEMA4/IP66 (dust proof, washdown)

ELECTRICAL CONNECTIONS

Prewired Cable or Accessory Cables with 7 or 10 Pin MS Connector - when Code 4= 0 to 6, or A, B, C, D or G

Note: Wire color codes are referenced here for models that are specified with pre-wired cable. Connector/cables are described in the Encoder Accessories section of this catalog and color-coding information is provided here for reference.

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	BRN
B	Signal B	ORN	ORN
C	Signal Z	YEL	YEL
D	Power Source	RED	RED
E	No Connection	—	—
F	Common	BLK	BLK
G	Case	GRN	GRN
H	Signal \bar{A}	BRN/WH	BRN/WH
I	Signal \bar{B}	ORN/WH	ORN/WH
J	Signal \bar{Z}	YEL/WH	YEL/WH

*Cable Accessory: P/N 14006350010

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	RED
B	Signal B	ORN	BLUE
C	Signal Z	YEL	YEL
D	Power Source	RED	WHT
E	No Connection	—	GRN
F	Common	BLK	BLK
G	Case	GRN	SHIELD

*Cable Accessory: P/N 14004310010

Pin	Function (If Used)	Cable Accessory Color Code
A	Signal A	BRN
B	Signal B	ORN
C	Signal \bar{A}	BRN/WHT
D	Power Source	RED
E	Signal \bar{B}	ORN/WHT
F	Common	BLK
G	Case	GRN

*Cable Accessory: P/N 108596

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables - when Code 4= H to Z

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Table 4 5 Pin Single Ended		Table 5 8 Pin Single Ended		Table 6 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

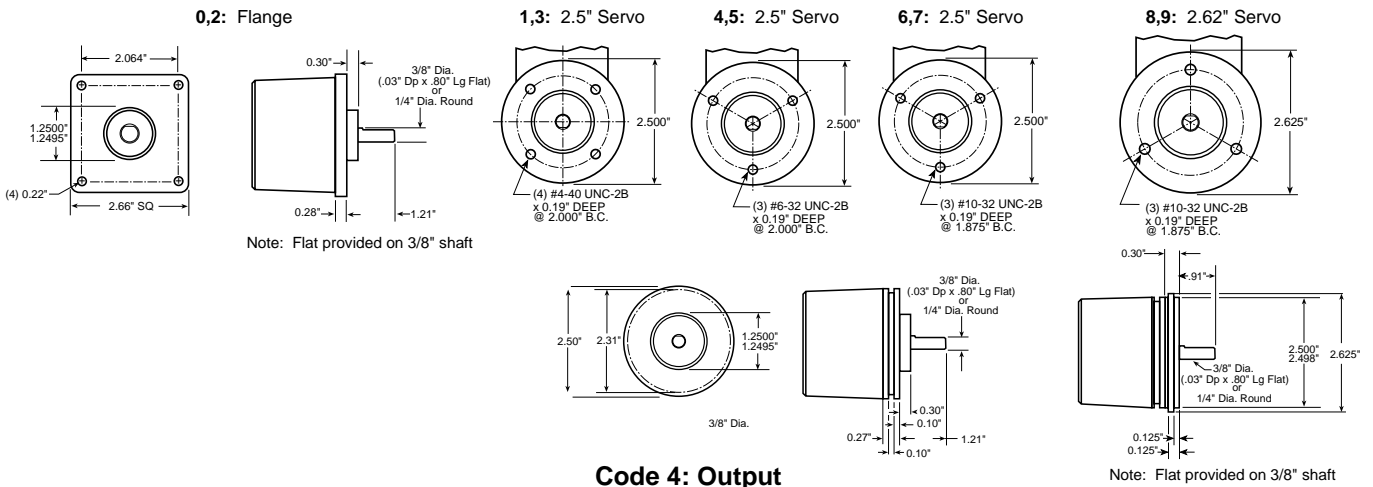
* Index not provided on all models. See ordering information

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

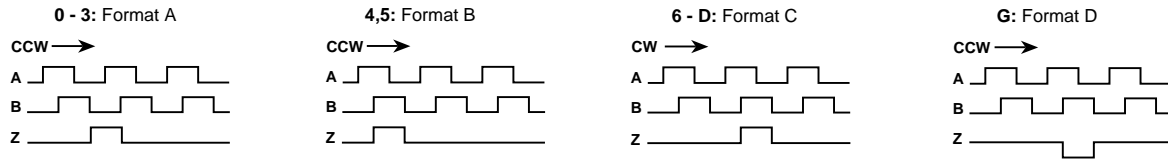
See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

Series HR25

Code 3: Mechanical

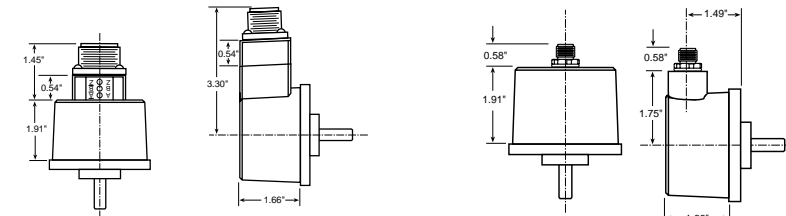


Code 4: Output

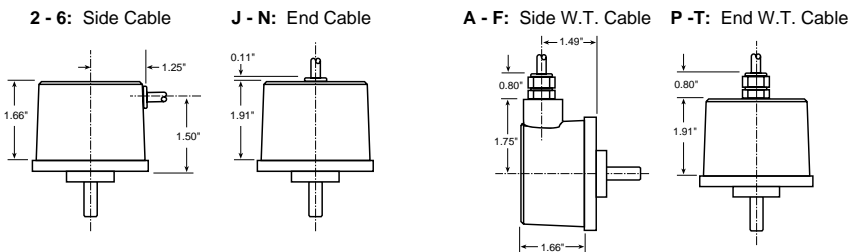


Code 6: Termination

- 0:** End MS Connector **1:** Side MS Connector **0:** End M12 Connector **1:** Side M12 Connector
When Code 5 is 0 to 6 or A to G When Code 5 is H to Z



Code 6: 0 & 1 dimensions shown with LED Output Indicator Option (Code 7: PS)



ORDERING INFORMATION

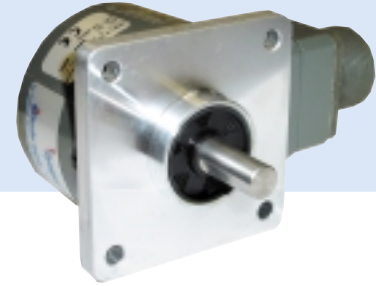
Series HR25

INDUSTRIAL

Code 1: Model	Code 2: PPR	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination	Code 7: Options
HR 25	□□□□	□	□	□	□	□□
Ordering Information						
HR525 Size 25 Enclosed, Shielded Bearings HR625 Size 25 Enclosed, with Shaft Seal	0001 0250 0005 0256 0010 0300 0012 0360 0050 0400 0060 0500 0086 0512 0100 0600 0120 0635 0125 0800 0180 0900 0200 1000 0240 1024	0 Flange Mount, 3/8" Shaft	7 Pin Connector or Cable 0 Single Ended, no Index, Format A, Table 2 1 Single Ended, with Index, Format A, Table 2 4 Single Ended, with Index, Format B, Table 2 6 Differential, no Index, Format C, Table 3 A Single Ended, with Index, Format C, Table 2 C Single Ended, no Index, Format C, Table 2 G Single Ended, with Index, Format D, Table 2	0 5-26V in; 5-26V Open Collector with 2.2kΩ Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V Totem Pole out 3 5-26V in; 5V Line Driver out (7272) 4 5-26V in; 5-26V Line Driver out (7272) 5 5-26V in, 5V Differential Line Driver out (4469) 6 5-15V in, 5- 15V Differential Line Driver out (4469) A Same as "0" with extend. temp range B Same as "1" with extend. temp range C Same as "2" with extend. temp range D Same as "3" with extend. temp range E Same as "4" with extend. temp range	0 End Mount Connector 1 Side Mount Connector 2 18" Cable, Side 3 3' Cable, Side 4 6' Cable, Side 5 10' Cable, Side 6 15' Cable, Side J 18" Cable, End K 3' Cable, End L 6' Cable, End M 10' Cable, End N 15' Cable, End	available when Code 4 is 0 thru G, and Code 6 is 0 or 1: PS LED Output Indicator
		10 Pin Connector or Cable 2 Differential, no Index, Format A, Table 1 3 Differential, with Index, Format A, Table 1 5 Differential, with Index, Format B, Table 1 B Differential, with Index Format C, Table 1 D Differential, no Index, Format C, Table 1	5 Pin M12 Connector H Single ended, no index, Format A, Table 4 J Single ended, with index, Format A, Table 4 K Single ended, with index, Format B, Table 4 L Single ended, with index, Format C, Table 4 M Single ended, no index, Format C, Table 4 N Single ended, with index, Format D, Table 4	8 Pin M12 Connector P Single ended, no index, Format A, Table 5 Q Single ended, with index, Format A, Table 5 R Single ended, with index, Format B, Table 5 S Single ended, with index, Format C, Table 5 T Single ended, no index, Format C, Table 5 U Single ended, with index, Format D, Table 5 V Differential, no index, Format A, Table 6 W Differential, with index, Format A, Table 6 X Differential, with index, Format B, Table 6 Y Differential, with index, Format C, Table 6 Z Differential, no index, Format C, Table 6	available when Code 1 is HR625: A 18" Watertight, Side B 3' Watertight, Side C 6' Watertight, Side D 10' Watertight, Side F 15' Watertight, Side P 18" Watertight, End Q 3' Watertight, End R 6' Watertight, End S 10' Watertight, End T 15' Watertight, End	

Series HC25

- Ultra-reliable, heavy-duty Size 25 (2.5") encoder
- Complete electrical protection and noise immunity
- Environmentally sealed to NEMA 12 / IP54 or NEMA 4 / IP66
- Up to 5000 PPR



APPLICATION/INDUSTRY

The Dynapar brand Series HC25 is a rugged, reliable and economical encoder for industrial motion applications.

DESCRIPTION

Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. A NEMA 4/IP66 sealing option protects against damage from contamination.

Packaged in an industry standard 2.5" enclosure, the Series HC25 offers a variety of mechanical options: servo or face mounting, and 1/4" or 3/8" shafts. Electrical options include: resolutions from 3,000 - 5,000 pulses/revolution; bidirectional operation with optional index; single ended open collector or push-pull outputs, or differential line drivers; and connector or cable exit terminations.

The Series HC25 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Extended temperature range available
- Industry Standard, Size 25 Form Factor
- NEMA12 / IP54 or NEMA 4 / IP66 rating

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 3000 to 5000 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) $\pm 10.8^\circ$ /PPR
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information
Quadrature Phasing: $90^\circ \pm 25^\circ$ electrical
Symmetry: $180^\circ \pm 25^\circ$ electrical
Index: $90^\circ \pm 25^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pF

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
Frequency Response: 250 kHz
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Mating Connector:

7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shaft Loading: 40 lbs. radial, 30 lbs. axial
Shaft Speed: 10,000 RPM max. (See Frequency Response)
Starting Torque: (max at 25 °C)
 HC525: 1.0 oz-in;
 HC625: 2.5 oz.-in
Moment of Inertia: 2.83×10^{-4} oz-in-sec²

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating:
 HC525: NEMA12/IP54 (dirt tight, splashproof);
 HC625: NEMA4/IP66 (dust proof, washdown)

Series HC25

ELECTRICAL CONNECTIONS

Prewired Cable or Accessory Cables with 7 or 10 Pin MS Connector - when Code 4= 0 to 6, or A, B, C, D or G

Note: Wire color codes are referenced here for models that are specified with pre-wired cable. Connector/cables are described in the Encoder Accessories section of this catalog and color-coding information is provided here for reference.

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	BRN
B	Signal B	ORN	ORN
C	Signal Z	YEL	YEL
D	Power Source	RED	RED
E	No Connection	—	—
F	Common	BLK	BLK
G	Case	GRN	GRN
H	Signal \bar{A}	BRN/WH	BRN/WH
I	Signal \bar{B}	ORN/WH	ORN/WH
J	Signal \bar{Z}	YEL/WH	YEL/WH

*Cable Accessory: P/N 14006350010

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	RED
B	Signal B	ORN	BLUE
C	Signal Z	YEL	YEL
D	Power Source	RED	WHT
E	No Connection	—	GRN
F	Common	BLK	BLK
G	Case	GRN	SHIELD

*Cable Accessory: P/N 14004310010

Pin	Function (If Used)	Cable Accessory Color Code
A	Signal A	BRN
B	Signal B	ORN
C	Signal \bar{A}	BRN/WHT
D	Power Source	RED
E	Signal \bar{B}	ORN/WHT
F	Common	BLK
G	Case	GRN

*Cable Accessory: P/N 108596

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables - when Code 4= H to Z

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Table 4 5 Pin Single Ended		Table 5 8 Pin Single Ended		Table 6 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT2	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

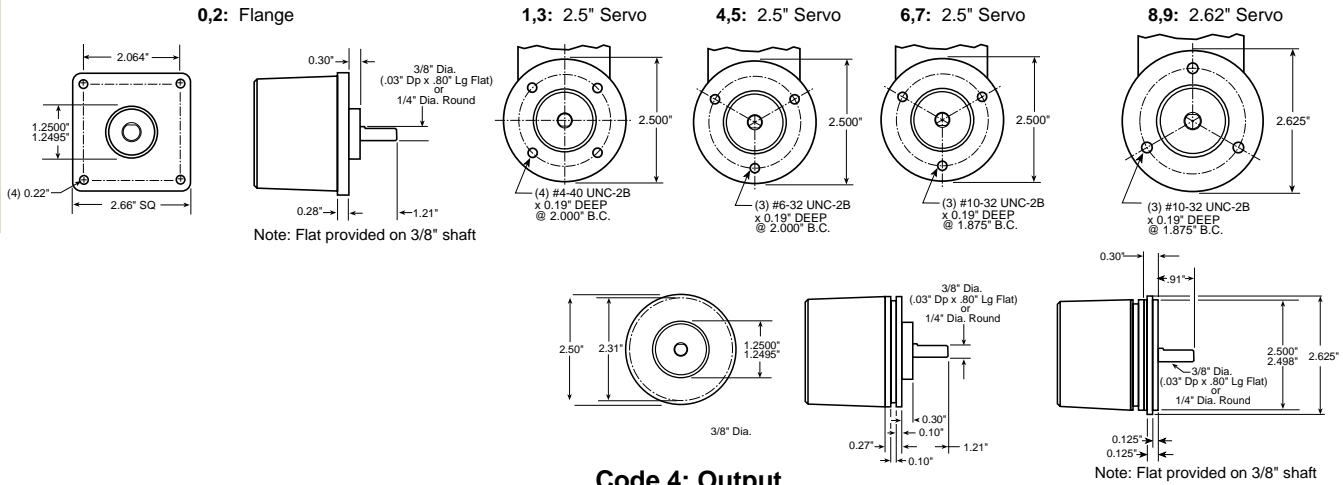
* Index not provided on all models. See ordering information

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

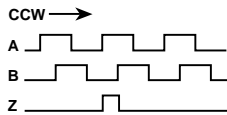
Series HC25

Code 3: Mechanical

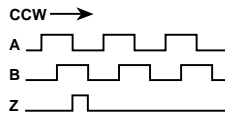


Code 4: Output

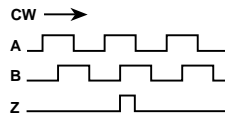
0 - 3: Format A



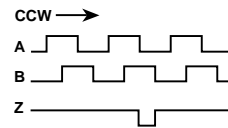
4,5: Format B



6 - D: Format C

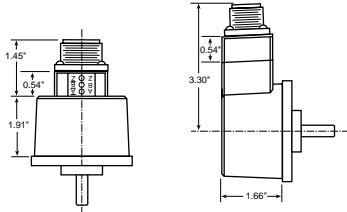


G: Format D

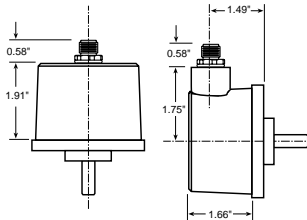


Code 6: Termination

0: End MS Connector 1: Side MS Connector
When Code 5 is 0 to 6 or A to G

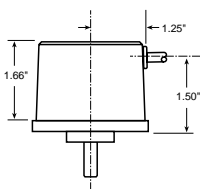


0: End M12 Connector 1: Side M12 Connector
When Code 5 is H to Z

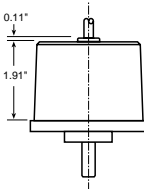


Code 6: 0 & 1 dimensions shown with LED Output Indicator Option (Code 7: PS)

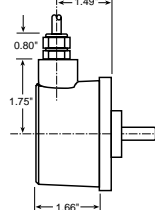
2 - 6: Side Cable



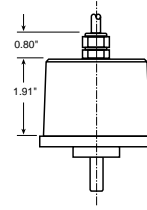
J - N: End Cable



A - F: Side W.T. Cable



P - T: End W.T. Cable



ORDERING INFORMATION

Series HC25

INDUSTRIAL

Code 1: Model	Code 2: PPR	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination	Code 7: Options
HC <input type="checkbox"/> 25 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

Ordering Information

HC525 Size 25 Enclosed, Shielded Bearings 3000 3,000 3600 3,600 4096 4,096 5000 5,000	0 Flange Mount, 3/8" Shaft 1 2.50" Servo Mount/ 4 Hole, 2.00" BC Face Mount, 3/8" Shaft 2 Flange Mount, 1/4" Shaft 3 2.50" Servo Mount/ 4 Hole 2.00" BC Face Mount, 1/4" Shaft 4 2.50" Servo Mount/ 3 Hole, 2.00" BC Face Mount, 3/8" Shaft 5 2.50" Servo Mount/ 3 Hole, 2.00" BC Face Mount, 1/4" Shaft 6 2.50" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 3/8" Shaft 7 2.50" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 1/4" Shaft 8 2.62" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 3/8" Shaft 9 2.62" Servo Mount/ 3 Hole, 1.88" BC Face Mount, 1/4" Shaft	7 Pin Connector or Cable 0 Single Ended, no Index, Format A, Table 2 1 Single Ended, with Index, Format A, Table 2 4 Single Ended, with Index, Format B, Table 2 6 Differential, no Index, Format C, Table 3 A Single Ended, with Index, Format C, Table 2 C Single Ended, no Index, Format C, Table 2 G Single Ended, with Index, Format D, Table 2 10 Pin Connector or Cable 2 Differential, no Index, Format A, Table 1 3 Differential, with Index, Format A, Table 1 5 Differential, with Index, Format B, Table 1 B Differential, with Index Format C, Table 1 D Differential, no Index, Format C, Table 1 5 Pin M12 Connector H Single ended, no index, Format A, Table 4 J Single ended, with index, Format A, Table 4 K Single ended, with index, Format B, Table 4 L Single ended, with index, Format C, Table 4 M Single ended, no index, Format C, Table 4 N Single ended, with index, Format D, Table 4 8 Pin M12 Connector P Single ended, no index, Format A, Table 5 Q Single ended, with index, Format A, Table 5 R Single ended, with index, Format B, Table 5 S Single ended, with index, Format C, Table 5 T Single ended, no index, Format C, Table 5 U Single ended, with index, Format D, Table 5 V Differential, no index, Format A, Table 6 W Differential, with index, Format A, Table 6 X Differential, with index, Format B, Table 6 Y Differential, with index, Format C, Table 6 Z Differential, no index, Format C, Table 6	0 5-26V in; 5-26V Open Collector with 2.2kΩ Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V Totem Pole out 3 5-26V in; 5V Line Driver out 4 5-26V in; 5-26V Line Driver out A Same as "0" with extend. temp range B Same as "1" with extend. temp range C Same as "2" with extend. temp range D Same as "3" with extend. temp range E Same as "4" with extend. temp range	0 End Mount Connector 1 Side Mount Connector Available when Code 1 is HC525: 2 18" Cable, Side 3 3' Cable, Side 4 6' Cable, Side 5 10' Cable, Side 6 15' Cable, Side J 18" Cable, End K 3' Cable, End L 6' Cable, End M 10' Cable, End N 15' Cable, End Available when Code 1 is HC625: A 18" Watertight, Side B 3' Watertight, Side C 6' Watertight, Side D 10' Watertight, Side F 15' Watertight, Side P 18' Watertight, End Q 3' Watertight, End R 6' Watertight, End S 10' Watertight, End T 15' Watertight, End	Blank None available when Code 4 is 0 thru 0 or 1: PS LED Output Indicator
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Series HA725

- High resolutions - up to 10,000 PPR direct read - not interpolated
- Industry standard 2.5" package
- Environmentally sealed to NEMA 4 / IP66



APPLICATION/INDUSTRY

Dynapar brand Series HA725 encoders feature the industry standard size 25 flange mount for easy installation.

DESCRIPTION

Due to their very high resolutions (up to 10,000 PPR), they are ideal for use in precision positioning and cutting applications. All models have

NEMA 4 / IP66 sealing which also allows for use in washdown environments.

The Series HA725 includes push-pull or differential line driver outputs. Terminations are available with either side or end exit MS connectors.

Models are electrically protected from overvoltage and output short circuits. In addition, they are also noise immunity tested for electro static discharge, radio frequency interference, and electrical fast transients.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Industry standard size 2.5 form factor
- NEMA 4 / IP66 washdown rating

Electrical Features

- High resolutions - up to 10,000 PPR
- Overvoltage & output short circuit protection
- Tested to EN50082-2 for noise immunity

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental

Resolution: 8192 to 10,000 PPR (pulses/revolution)

Accuracy:

Any edge to any like edge of the same channel: $\pm 10.8^\circ/\text{PPR}$ (± 3.9 arc-sec at 10,000 PPR)

Any edge to any edge of the opposite channel: $\pm 40^\circ/\text{PPR}$ (± 14 arc-sec at 10,000 PPR)

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

Phase Sense: A leads B for CCW shaft rotation as viewed from the shaft end of the encoder

Quadrature Phasing: $90^\circ \pm 25^\circ$ electrical

Symmetry: $180^\circ \pm 25^\circ$ electrical

Index: $90^\circ \pm 25^\circ$ electrical (gated with A and B high)

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

ELECTRICAL

Input Power: (not including output loads)

Push-pull: 10 min. to 30 VDC max. at 60 mA max.

Line driver: 5 VDC $\pm 10\%$ at 40 mA max.

Outputs:

Push-pull: ± 30 mA, short circuit protected

Line Driver: ± 20 mA

Frequency Response:

Push-pull: 200 kHz min

Line Driver: 300 kHz min.

Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Mating Connector:

7 pin, style MS3106A-16S-1S (MCN-N5);

10 pin, style MS3106A-18-1S (MCN-N6)

MECHANICAL

Shaft Loading: 35 lbs. radial, 24 lbs. axial

Shaft Speed: 10,000 RPM max. mechanical

Bearing Life:

10^9 revolutions at 35% of rated load

10^8 revolutions at 75% of rated load

10^7 revolutions at 100% of rated load

Moment of Inertia: 2.83×10^{-4} oz-in-sec²

ENVIRONMENTAL

Operating Temperature: 0 to +70 °C;

Storage Temperature: -25 to +90 °C

Shock: 50 G's for 11 milliseconds duration

Vibration: 5 to 2000 Hz at 2 G's

Humidity: to 98% without condensation

Enclosure Rating: NEMA4/IP66 (dust proof, washdown)

Electrical Connections

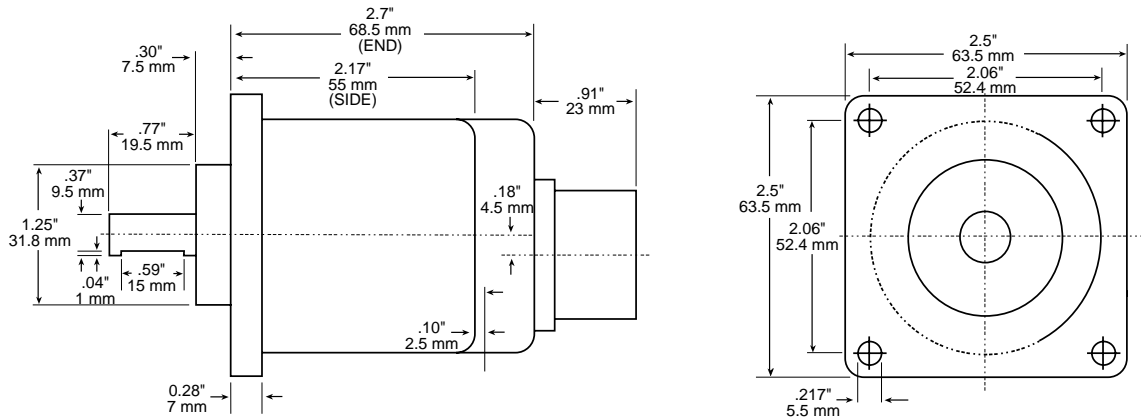
*Mating connector/cable assembly wire color information is provided here for reference.

Encoder Function	Cable #108595-* 7 Pin Single Ended		Cable #1400635-* 10 Pin Dif Line Drv w/Inx	
	Pin	Wire Color	Pin	Wire Color
Sig. A	A	BRN	A	BRN
Sig. B	B	ORG	B	ORG
Sig. Z	C	YEL	C	YEL
Power +V	D	RED	D	RED
Com	F	BLK	F	BLK
Case	G	GRN	G	GRN
N/C	E	—	E	—
Sig. \bar{A}	—	—	H	BRN/WHT
Sig. \bar{B}	—	—	I	ORG/WHT
Sig. \bar{Z}	—	—	J	YEL/WHT

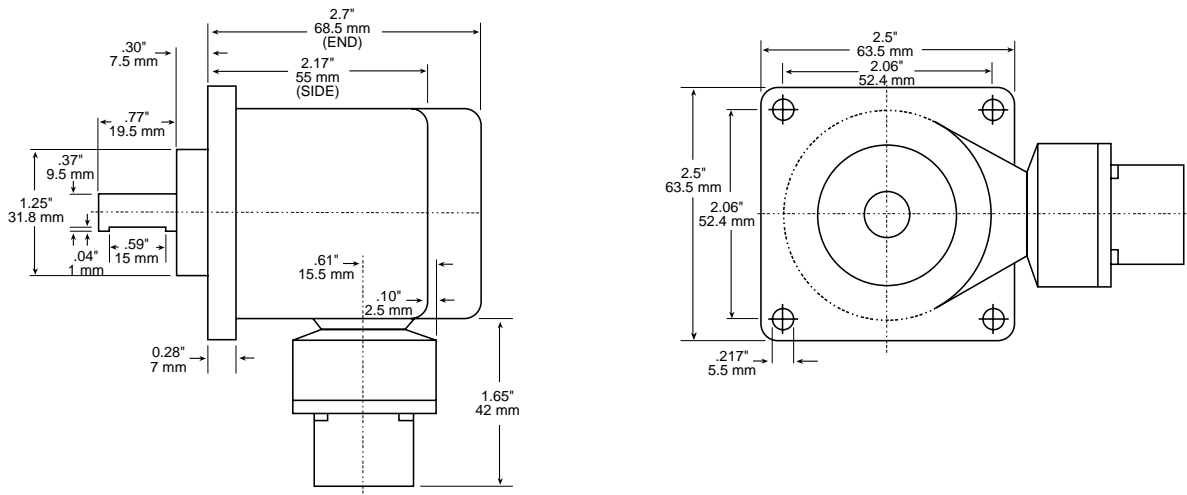
Series HA725

Dimensions

Code 6: Termination: 0



Code 6: Termination: 1



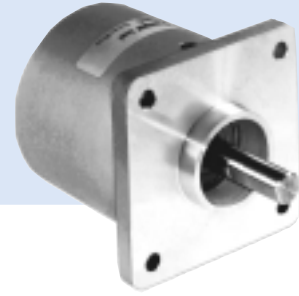
Ordering Information

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

Code 1: Model	Code 2: PPR	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination
HA725	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HA725 Size 25, High Resolution	08192 09000 10000	0 Flange Mount, 3/8" Shaft	0 Single Ended 2 Differential	Available when Code 4 = 0: 0 10-30V in; 10-30V Push-Pull out	0 Connector, End Mount 1 Connector, Side Mount
				Available when Code 4 = 2: 4 5V in; 5V Line Driver out	

Series H42

- Economical, industry standard 2.5" industrial duty encoder
- Ultra-reliable, "no glass" design – uses unbreakable code disk
- ESD/RFI and transient electrical noise immunity tested to EN50082-2
- Complete electrical protection for overvoltage and reverse polarity
- Rugged cast aluminum housing
- Same-day shipment of all models



APPLICATION/INDUSTRY

The Dynapar brand Series H42 encoder is an economical, rugged, general-purpose, optical encoder that generates an accurate pulse output proportional to shaft rotation.

DESCRIPTION

An unbreakable code disk meets the demands of the most severe shock and vibration generating processes. Use of long life bearings keep tough loads from disrupting internal alignment, avoiding failure due to the disk "crashes" so typical in competitive encoders. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact.

Resolutions from 1 to 600 pulses per revolution; quadrature coding; and differential line driver outputs lets the Series H42 fit well into a wide range of unidirectional and bidirectional applications.

Series H42 is a direct, modernized replacement for the popular Series 42 encoders. Use of latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components, delivers high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Unbreakable code disk
- Rugged, industrial duty cast aluminum housing
- Long life, 80 pound bearings
- Up to 7200 RPM
- 0 to 70°C operating range
- Quick connect/disconnect MS connector
- 3/8" stainless steel shaft

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- Over-Voltage protection
- Reverse Voltage protection
- High current outputs
- 100 kHz frequency response

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Resolution: 1 to 600 PPR (pulses/revolution)
 Accuracy: (Worst case any edge to any other edge) ± 7.5 arc-min.
 Format: Two channel quadrature (AB) with complementary outputs
 Phase Sense: A leads B for CW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information
 Quadrature Phasing: $90^\circ \pm 20^\circ$ electrical
 Symmetry: $180^\circ \pm 18^\circ$ electrical
 Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 90 mA max., not including output loads
 Outputs:
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 Frequency Response: 100 kHz min.
 Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
 Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Connector Termination:
 7 pin, style MS3102E-16S-1P
 Mating Connector:
 7 pin, style MS3106A-16S-1S (MCN-N5);

MECHANICAL

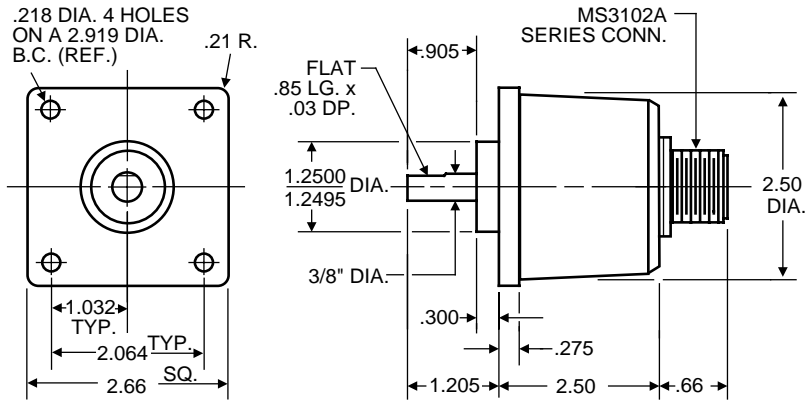
Shaft Loading: (at 0.25" from encoder face) 80 lbs. radial, 80 lbs. axial
 Shaft Speed: 7200 RPM max.
 Shaft Runout: 0.001" max. TIR
 Moment of Inertia: 3.0×10^{-4} oz-in-sec²
 Weight: 13 oz.

ENVIRONMENTAL

Operating Temperature: 0 to +70 °C
 Storage Temperature: -40 to +90 °C
 Shock: 50 G's for 11 milliseconds duration
 Vibration: 5 to 2000 Hz at 20 G's
 Humidity: to 98% without condensation
 Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof)

Series H42

Approximate Dimensions (in inches)



Electrical Connections

With Line Driver Output		
Pin	Function (If Used)	#14004310010* Cable Accessory Color Code
A	Signal A	RED
B	Signal B	BLUE
C	Signal \bar{A}	YELLOW
D	Power Source	WHITE
E	Signal B	GREEN
F	Common	BLACK
G	Case	SHIELD

*This is a mating connector/cable assembly described in the Encoder Accessories section of this catalog. Color-coding information is provided here for reference.

Ordering Information

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

Code 1: Model	Code 2: Pulses/Rev
H42	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
H42 Size 25, Economical	0001 0012 0060 0100 0120 0500 0600

Series 21/22

- Up to 1270 PPR with marker
- Compact 2.25" cube shape
- Economical design



APPLICATION/INDUSTRY

The Series 21/22 QUBE encoder is designed for application in industrial environments, and is stable in temperatures from 0° to 70°C.

- Measuring, cut-to-length or size for textile, metal, lumber and rubber industries
- Tracking, storage & retrieval, pick & place, conveying, and elevating for material handling applications
- Winding, including films, foils, wire and extrusions
- Measuring mechanical motion for processing, labeling, filling, mixing, batching, and packaging
- Position control, for flexible and automatic assembly equipment
- Speed feedback, for precise drive and machine monitoring and control

DESCRIPTION

The Series 21/22 QUBE generates digital incremental position data proportional to shaft rotation. Through higher mechanical and electronic operating speeds, the Series 21/22 QUBE can boost system speeds, cycle times, and productivity.

Its general-purpose design makes the Series 21/22 QUBE compatible with most programmable controllers, electronic counters, motion controllers, and motor drives. The Series 21/22 QUBE is electrically and physically interchangeable with most cube-style encoders on the market. It can easily be applied with belts and pulleys, leadscrews, rack and pinions, lineshafts, etc..

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Environmentally sealed enclosure
- Large 3/8", 1/4" or 6 mm diameter stainless steel shafts
- Durable anodized aluminum housing with 5/16" thick housing walls
- Extra-wide bearing span with heavy-duty sealed bearings front and rear
- 6000 RPM capability

Electrical Features

- Wide selection of resolutions up to 1270 PPR
- Wide input voltage range eliminates the need for multiple models
- Unidirectional or quadrature outputs
- Optional complementary (differential) outputs

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 1270 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) ± 2.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW shaft rotation as viewed from the shaft end of the encoder farthest from the connector or cable
Quadrature Phasing: $90^\circ \pm 18^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $225^\circ \pm 90^\circ$ electrical (active high)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 110 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
Frequency Response: 120 kHz min. data, 50 kHz min. Index
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Mating Connector:
 6 pin, style MS3106A-14S-6S (MCN-N4)
 7 pin, style MS3106A-16S-1S (MCN-N5)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shaft Loading: 40 lbs. radial, 30 lbs. axial
Shaft Speed: 6,000 RPM max.
Shaft Tolerance: Nominal -0.0003"/-0.0007"
Starting Torque: 2.5 oz-in max.
Moment of Inertia: 1.3×10^{-4} oz-in-sec²
Weight: 14 oz. max.

ENVIRONMENTAL

Operating Temperature: 0 to +70 °C;
Storage Temperature: -40 to +90 °C
Enclosure: Environmentally sealed

ELECTRICAL CONNECTIONS

MS Connector Accessory Cables - when Code 4= 0 to 4

Table 1 – Current Sink Output

Pin	Function	Wire Color Code	Cable Acc'y #14006070010 Color Code
A	Common	BLK	BLK
B	Power Source	RED	RED
C	Case (Ground)	GRN/BLK	GRN
D	Signal A	GRN	BRN
E	Signal B	ORN	ORN
F	Supply Common	BLK	BLK

Table 2 – 7 Pin Line Driver Output

Pin	Function	Wire Color Code	Cable Acc'y #14004310010 Color Code
A	Signal A	GRN	RED
B	Signal B	ORN	BLU
C	Signal A	RED/BLK	YEL
D	Power Source	RED	WHT
E	Signal B	WHT/BLK	GRN
F	Common	BLK	BLK
G	Case (Ground)	GRN/BLK	

Table 3 – Current Sink Output w/Marker

Pin	Function	Wire Color Code	Cable Acc'y #108241-0010 Color Code
A	Common	BLK	BLK
B	Power Source	RED	RED
C	Signal Z	WHT	GRN
D	Signal A	GRN	BRN
E	Signal B	ORN	ORN
F	Common	BLK	BLK

Table 4 – 6-Pin Line Driver

Pin	Function	Wire Color Code	Cable Acc'y #14006640010 Color Code
A	Common	BLK	BLK
B	Power Source	RED	RED
C	Signal A	GRN	BRN
D	Signal A	RED/BLK	BRN/WHT
E	Signal B	ORN	ORN
F	Signal B	WHT/BLK	ORN/WHT

Table 5 – Cable termination Line Driver Output with Marker

Function	Wire Color Code
Signal A	GRN
Signal B	ORN
Signal Z	WHT
Power Source	RED
Supply Common	BLK
Case (Ground)	GRN/BLK
Signal A	RED/BLK
Signal B	WHT/BLK
Signal Z	BLU

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables - when Code 4= 5 to 9 and A

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Table 6 5 Pin Single Ended		Table 7 8 Pin Single Ended		Table 8 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. A̅	–	–	–	–	3	BRN/WHT
Sig. B̅	–	–	–	–	5	ORG/WHT
*Sig. Z̅	–	–	–	–	8	YEL/WHT

* Index not provided on all models. See ordering information

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

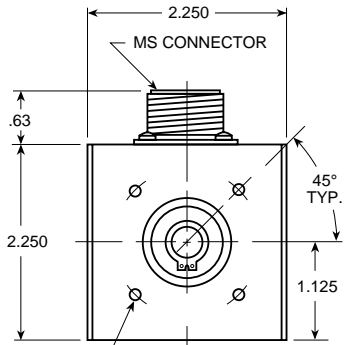
See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

DIMENSIONS

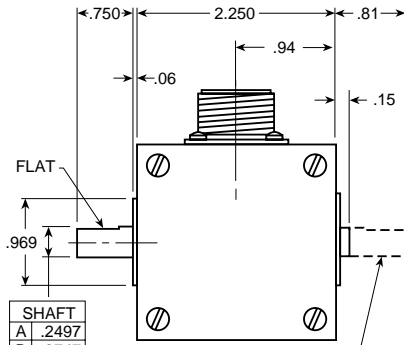
Series 21/22

MS Connector Models

Approximate Dimensions (in inches)



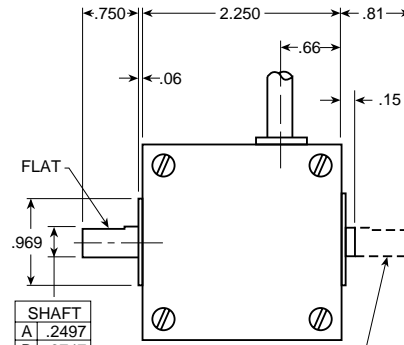
6-32 UNC-2B THREADS x .187 DEEP ON 2.00 DIA. B.C., 4 HOLES ON 3 FACES (FRONT, REAR & BOTTOM).
FOR MODELS 22M ONLY: M3 x 0.5^{RH} THREADS x 5mm DEEP ON A 50.8mm DIA. B.C. ON (3) FACES



SHAFT	
A	.2497
B	.3747
C	6 mm

OPTIONAL DOUBLE-ENDED SHAFT

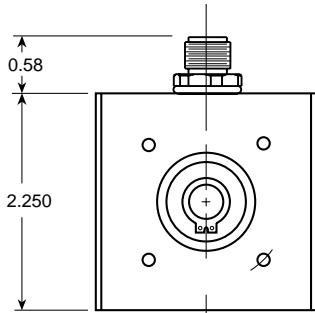
Prewired Cable Models



SHAFT	
A	.2497
B	.3747
C	6 mm

OPTIONAL DOUBLE-ENDED SHAFT

M12 Connector Models



ORDERING INFORMATION

Series 21/22

INDUSTRIAL

Code 1: Model	Code 2: Pulses/Rev	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination
□ □ □	□ □ □ □	□	□	□	□
Ordering Information					
21 Qube Encoder, Unidirectional	0001 0360 0010 0400 0012 0480	0 3/8" Double Ended Shaft 1 3/8" Single Ended Shaft	0 Single Ended, Table 1 2 Differential, Table 2	available when Code4 = 0, 1, 5, 6, 7 or 8: 0 5-26 VDC in, 5-26 VDC Open Collector w/2.2k pull-ups out	0 MS Connector 1 18' Cable 2 3' Cable 3 6' Cable 4 10' Cable 5 15' Cable 6 M12 Connector
22 Qube Encoder, Bidirectional	0050 0500 0060 0512 0100 0600	2 1/4" Double Ended Shaft 3 1/4" Single Ended Shaft	available only when code 6 is 0: 4 Differential, Table 4	1 5-26 VDC in, 5-26 VDC Open Collector w/o pull-up out 2 5-26 VDC in, 5V Totem Pole out	
22M Metric Qube Encoder, Bidirectional	0120 0720 0125 0800 0150 0900 0180 1000 0192 1024 0200 1200 0250 1250 0256 1270 0300	available when Code 1 = 22M: 4 6mm Double Ended Shaft 5 6mm Single Ended Shaft	available only when Code 1 is 22 or 22M: 1 Single Ended, with Index, Table 3 available only when Code 6 is 1 to 5: 3 Differential, with Index, Table 5 available only when Code 6 is 6: 5 5 pin M12 connector, single ended, no index, Table 6 6 5 pin M12 connector, single ended, with index, Table 6 7 8 pin M12 connector, single ended, no index, Table 7 8 8 pin M12 connector, single ended, with index, Table 7 9 8 pin M12 connector, differential, no index, Table 8 A 8 pin M12 connector, differential, with index, Table 8	available when Code4 = 2, 3, 4, 9 or A: 3 5-26 VDC in, 5V Line Driver out 4 5-26 VDC in, 5-26 VDC CMOS Line Driver	

Series 60 Rotopulser[®]

- Heavy-duty bearings with 1/2" diameter shaft
- LED optical light source
- Unbreakable disk
- Wide selection of resolutions available up to 2500 PPR
- Servo ring and face mount options



APPLICATION/INDUSTRY

The Series 60 is a rugged, incremental, optical encoder for speed, position, and motion applications. The standard mechanical size 35 package is designed for high resolution applications and rugged industrial environments.

- Length measurements
- Motor drive speed feedback
- Cut-to-length (textile, paper, wood, metal, rubber, plastics, etc.)
- Back-gage positioning
- PLC's and electronic counters

DESCRIPTION

Dual shafts and measuring wheels are recommended for better parallel tracking in measuring applications.

Series 60 Rotopulser encoders are available with line driver outputs for applications with longer cabling requirements (hundreds of feet) and/or higher signal noise immunity.

FEATURES AND BENEFITS

Mechanical & Environmental Features

- Heavy-duty 1/2" single and dual shafts available
- Rugged mylar or photoplast discs (no glass discs)
- Up to 3600 RPM
- 0-54°C operating range
- Precision machined die-cast aluminum housing with optional shaft seals
- Extra wide bearing span with precision ball bearings front and rear

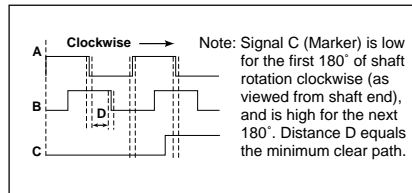
Electrical Features

- Up to 2500 pulses/rev.
- LED light source for long-term reliability and trouble-free operation
- Built-in low impedance amplifier for driving long lines
- Switches from line-to-line for current sourcing and sinking
- Up to 50 kHz electronic operating speeds

SPECIFICATIONS

ELECTRICAL

Power Requirements: 5 to 15 VDC max. 115 mA max. plus load requirements
Frequency Response: 50 kHz
Minimum Free Path: Between any A and B transition, will not be less than 12.5% of one full electrical cycle. This includes effects of jitter, phase and symmetry shifts.



MECHANICAL

Weight: 26 oz.
Speed Range: Up to 3600 RPM
Shaft Loading: Radial: 15 lbs. overhung; Axial: 5 lbs.
Inertia: 170 gm-cm²
Starting Torque: 0.45 oz-in (0.30 oz-in for 1/4 in. dia. shaft)
Running Torque: 0.35 oz-in (0.15 oz-in for 1/4 in. dia. shaft)
Shaft Diameters: 1/4", 1/2" (-0.0003"/-0.0007")

ENVIRONMENTAL

Enclosure Rating: NEMA 12 / IP54;
Temperature Range: 0-54°C

Differential Output: 7272, 40 mA sink/source;

CONNECTIONS

Mating Connector: Style MS3106A-18-1S;
 Dynapar Part No. MCN-N6
Single-Ended Output: 7272, 40 mA sink/source;
Mating Connector: Style MS3106A-14S-6S;
 Dynapar Part No. MCN-N4

Hand-Held Speed Monitor



(Includes a Series 60 and dual 12" measuring wheels)

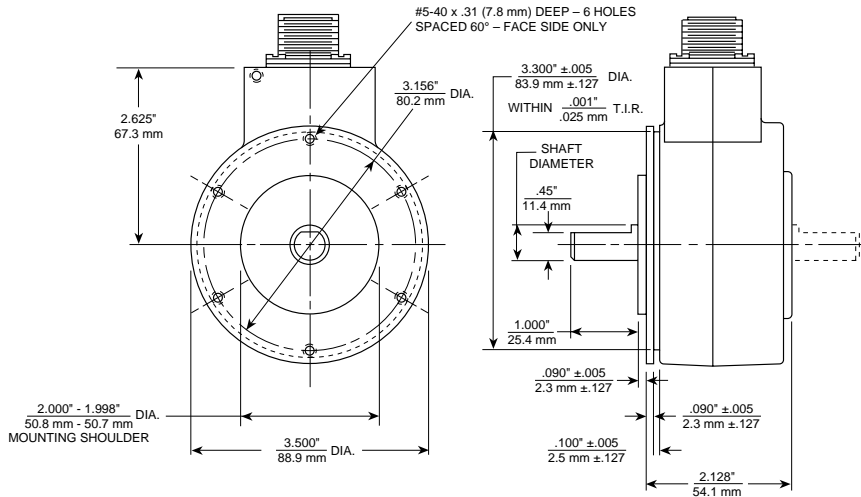
A Series 60H hand-held speed monitor is available as an accessory for web or roll calibration of steel, rubber, or paper continuous processes. These units are typically used as accessories for occasional calibration of a system speed, draw, or readout.

These hand-held monitors may be ordered with any PPR from the Series 60 code table. However, typical calibration applications with 12" measuring wheels use 60 PPR or 120 PPR, and provide excellent calibration resolution from zero up to full speeds. Refer to electrical connections 6-pin chart for pin-out functions of Series 62H.

Order Model No. 62H-AEF-____-AO.

Series 60 Rotopulser®

Approximate Dimensions (inches/mm)



Electrical Connections

Single-Ended Output (6-pin)		
Function (If Used)	MS Pin No.	Dyn. #14002090010* Cable Accessory Color Code
Signal A	B	RED
Signal B	D	BLUE
Signal C (Marker)	A	GREEN
+V	E	WHITE
Common	C	BLACK
Shield	F	SHIELD

Differential Line Driver (10-pin)		
Function (If Used)	MS Pin No.	Dyn. #14004190010* Cable Accessory Color Code
Signal A	B	RED
Signal A	G	BLACK
Signal B	D	BLUE
Signal B	H	BLACK
Signal C (Marker)	A	GREEN
Signal C	I	BLACK
+V	E	WHITE
Common	C	BLACK
Shield	F	SHIELD
Not Used	J	

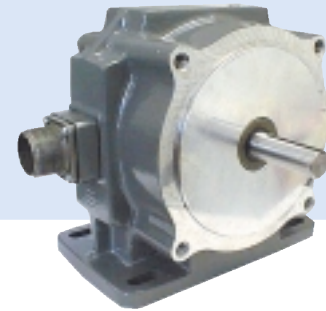
*This is a mating connector/cable assembly described in the Encoder Accessories section of this catalog. Color-coding information is provided here for reference.

Ordering Information

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

Code 1: Model	Code 2: Housing	Code 3: Shaft	Code 4: Output	Code 5: Voltage	Code 6: Pulses/Rev	Code 7: Wiring	Code 8: Misc
6 □	□	□	□	F	□ □ □ □	A	□
2 Bidirectional, Heavy Duty	A Standard Housing for Single Shaft	A 1/2" Dia, 1.0" Len with Flat	E Single Ended	F 5 to 15 VDC	0001 0150 0530	A MS Connector	0 No Shaft Seals
3 Bidirectional with Marker, Heavy Duty	C Standard Housing for Double Shaft	B 1/2" Dia, 1.0" Len without Flat	Available when Code 2 = A or C: D Differential		0002 0180 0550		Available when Code 3 = A, B, C, or D: B Shaft Seals
	H Hand-Held Housing with Double Shaft and two 12" Circumference Measuring Wheels	C 1/2" Dia, 1.5" Len with Flat			0004 0192 0600		
		D 1/2" Dia, 1.5" Len without Flat		0005 0200 0625	0006 0203 0720		
		Available when Code 2 = A or C:		0010 0240 0750	0012 0250 0800		
		G 1/4" Dia, 1.0" Len without Flat		0015 0256 0805	0018 0300 0833		
		H 1/4" Dia, 1.0" Len with Flat		0020 0306 0900	0025 0315 1000		
				0040 0360 1024	0045 0375 1200		
				0050 0382 1270	0060 0384 1500		
				0064 0390 1800	0090 0400 2000		
				0096 0402 2160	0100 0430 2250		
				0120 0450 2400	0125 0500 2500		
				0127 0508	0128 0512		

Series H56 Rotopulser®



- The most rugged and reliable pulse generator available
- Suitable for severe duty in paper, steel, and lumber mills
- Large outer bearings isolate internal encoder from excessive shaft loads

APPLICATION/INDUSTRY

The Series H56 Rotopulser® is the most rugged and reliable digital pulse generator available for heavy industrial speed, length, and position applications.

DESCRIPTION

The H56 Rotopulser® design employs an "encoder within an encoder" construction. The internal, high performance hollowshaft encoder is isolated from severe application environments. The heavy duty, cast aluminum housing features two heavy duty bearings and a 5/8" diameter shaft that is available with an optional drive shaft. The housing is completely sealed for washdown and temperature rated for outdoor use.

Complete electrical protection guards against failure due to overvoltage, reverse voltage, and output short circuits. For downtime critical applications, a second, redundant output can be ordered to allow quick changeover. The optional dual isolated outputs are completely independent, so one pulse generator can be used to provide drive feedback while the other provides input to a process controller or PLC.

FEATURES AND BENEFITS

Dynapar Exclusive:

The Series H56 Rotopulser® electronics offers the greatest flexibility and reliability. It operates from 5 to 26 VDC power and provides wide voltage, line driver outputs that are compatible with all common motor drives, PLCs, and process controllers. Additionally, the outputs are protected from overvoltage or reverse voltage input power, and the outputs are protected against short circuits.

Dynapar Exclusive:

The Series H56 Rotopulser® is tested to meet the stringent noise immunity requirements of the Electromagnetic Compatibility Directive of the European Union, EN50082-2. Stable performance is guaranteed, even in the presence of high current switchgear, radio transmitters, and noisy equipment.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2500 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) ±7.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW shaft rotation as viewed from the C-face of the encoder
Quadrature Phasing: 90° ± 22.5° electrical
Symmetry: 180° ± 18° electrical
Index: 180° ± 18° electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power: (each output)
 4.5 min. to 26 VDC max. at 100 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA, sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

CONNECTIONS

Mating Connector:
 6 pin, style MS3106A-14S-6S (MCN-N4);
 10 pin, style MS3106A-18-1S (MCN-N6)
 Pluggable Screw-Terminal (110532-0001)
Mechanical
Bearing Life: see table, below
Shaft Loading: 100 lbs. radial, 50 lbs. axial
Shaft Speed: 3600 RPM max.
Starting Torque: 15 oz-in max.;
Moment of Inertia: 7.9 x 10⁻⁴ oz-in-sec²
Weight: 144 oz. (9 lbs.)

ENVIRONMENTAL

Operating Temperature: -40 to +80 °C
Storage Temperature: -40 to +80 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 2.5 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA4/IP66 (dust proof, washdown)

Electrical Connections

* This is a mating connector/cable assembly described in the Encoder Accessories section of this catalog. Color-coding information is provided here for reference.

Function (If Used)	Cable #14002090010*		Twisted Pairs Cable #14004190010*		Pluggable Screw Terminal Pin Number
	Pin	Wire Color	Pin	Wire Color	
Sig. A	B	RED	B	RED	3
Sig. \bar{A}	—	—	G	BLK	8
Sig. B	D	BLU	D	BLU	7
Sig. \bar{B}	—	—	H	BLK	2
Sig. Z	A	GRN	A	GRN	4
Sig. \bar{Z}	—	—	I	BLK	9
+V	E	WHT	E	WHT	6
Common	C	BLK	C	BLK	1
Shield	F	SHIELD	F	SHIELD	10

Bearing Life versus Load

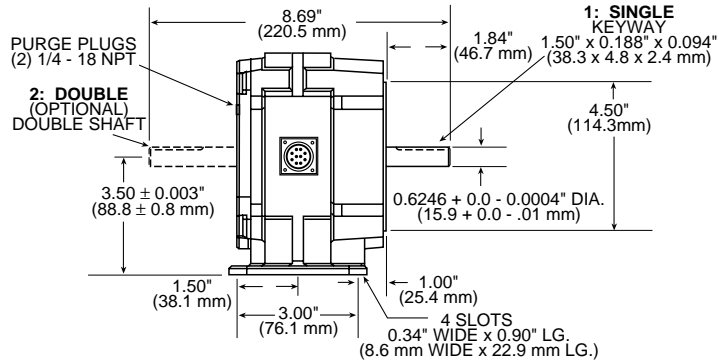
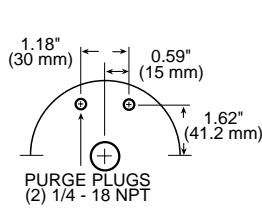
Radial	Axial	Revolutions
75	15	1.3 x 10 ¹⁰
75	25	6.4 x 10 ⁹
100	25	4.1 x 10 ⁹
100	50	1.3 x 10 ⁹

Series H56 Rotopulser[®]

Code 3: Shaft

INDUSTRIAL

Purge Plug Location



Code 6: Termination

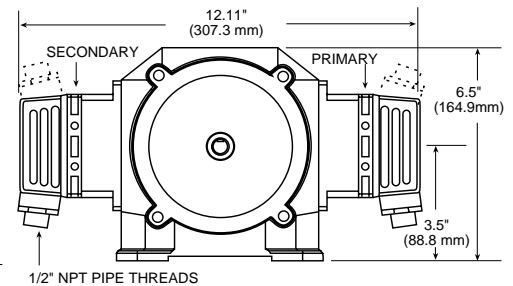
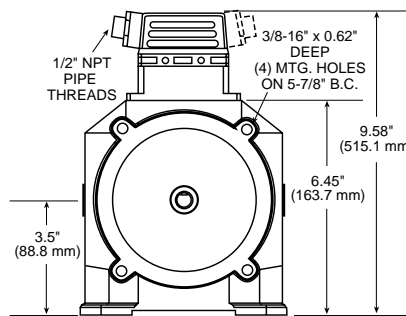
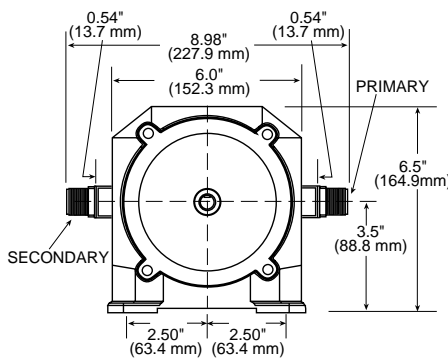
0,1: MS Connectors
Shown with LED Output Indicator Option
Code 9: PS

2,3: Pluggable Screw Terminals

Code 4: Format

2,3: Single

4,6: Dual, Isolated



Ordering Information

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

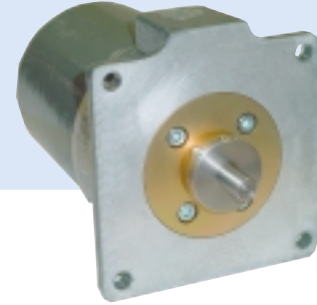
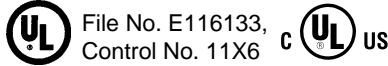
Code 1: Model	Code 2: PPR	Code 3: Shaft	Code 4: Format	Code 5: Electrical	Code 6: Termination	Code 7: Options
H56	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

Ordering Information

Code 1: Model	Code 2: PPR	Code 3: Shaft	Code 4: Format	Code 5: Electrical	Code 6: Termination	Code 7: Options
H56 Mill Duty, 56C-Face or Foot Mount Rotopulser [®]	0001 0300 0002 0360 0003 0400 0005 0500 0006 0512 0010 0600 0012 0625 0025 0720 0050 0900 0060 1000 0064 1024 0100 1200 0120 1270 0128 1500 0180 1800 0200 2000 0240 2048 0250 2400 2500	1 Single 2 Double	Compliments available when Code 5 is 3 or 4 2 Single, bidirectional quadrature (AB) 3 Single, bidirectional quadrature with index (ABZ) 4 Dual, isolated bidirectional quadrature (dual AB) 6 Dual, isolated bidirectional quadrature with index (dual ABZ)	0 5-26V in, 5-26V open collector out 1 5-26V in, 5-26V open collector out w/ 2.2kΩ pullups 2 5-26V in, 5-26V single ended push-pull out 3 5-26V in, 5V differential line driver out (7272) 4 5-26V in, 5-26V differential line driver out (7272) 5 5-26V in, 5V Differential Line Driver out (4469) 6 5-15V in, 5-15V Differential Line Driver out (4469)	0 MS Connector(s) 1 MS Connector(s), plus mating connector(s) 2 Pluggable screw terminal connector(s) 3 Pluggable screw terminal(s), plus mating connector(s)	available when Code 6 is 0 or 1: PS LED Output Indicator

Series X25

- Heavy duty industrial enclosure with 1/2" diameter conduit entry
- Up to 5000 PPR with optional marker
- Approved for National Electrical Code (NEC) Class 1 & 2, Divisions 1 & 2, Groups C,D,E,F,G



APPLICATION/INDUSTRY

These rugged, high-performance, incremental optical encoders are suitable for hazardous locations feature environmentally sealed, cast aluminum housings with 4-inch square flange mounting, and 1/2" conduit entry. A stainless steel shaft and a clear anodized housing provide corrosion resistance.

DESCRIPTION

Electrical outputs are electronically compatible with almost all drives and PLC's. Differential line driver outputs are available for long cable runs (hundreds of feet) and higher noise immunity.

Series X25 encoders are designed for use in environments stated in: UL Class I, Group C: atmospheres such as ethyl ether and ethylene; UL Class I Group D: atmospheres such as acetone, ammonia, benzene, butane, cyclopropane, ethanol, gasoline, hexane, methanol, methane, natural gas, naphtha, and propane; Class II, Groups E, F & G: combustible metal dusts, including aluminum, magnesium, and their commercial alloys, and atmospheres containing combustible carbonaceous dusts, including carbon black, charcoal, coal, or coke dusts, and combustible dusts including flour, grain, wood, plastic, and chemicals.

Classifications of hazardous locations are subject to the approval of the authority having jurisdiction. Refer to Article 500 of the National Electrical Code (NEC).

FEATURES AND BENEFITS

Mechanical & Environmental Features

- Large stainless steel shaft (1/4" or 3/8") and shaft seal
- Heavy-duty cast aluminum housing, and an O-ring seal
- Heavy-duty ABEC precision bearings standard
- Up to 5000 RPM slew speed

Electrical Features

- Noise immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 5000 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) ≤ 1024 PPR (metal disk): ± 7.5 arc-min. > 1024 PPR (glass disk): ± 2.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CCW shaft rotation as viewed from the shaft end of the encoder
Quadrature Phasing: $90^\circ \pm 25^\circ$ electrical
Symmetry: $90^\circ \pm 25^\circ$ electrical
Index: 2540 PPR and below: $180^\circ \pm 25^\circ$ electrical; Greater than 2540 PPR: $90^\circ \pm 25^\circ$ electrical
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power: 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

MECHANICAL

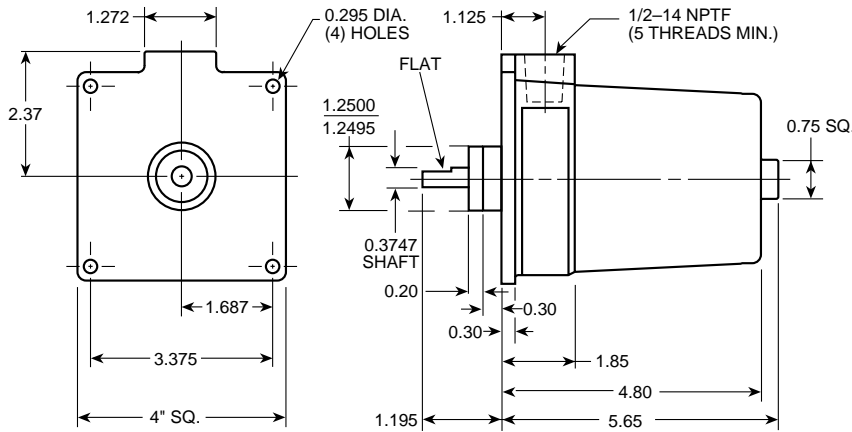
Shaft Loading: 40 lbs. radial, 40 lbs. axial
Shaft Speed: 5,000 RPM max.
Shaft Runout: 0.001" max. TIR
Starting Torque: (max at 25 °C) 2.0 oz.-in
Moment of Inertia: 9.0×10^{-4} oz-in-sec²

ENVIRONMENTAL

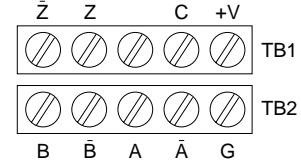
Operating Temperature: 0 to +70 °C;
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 2 G's
Humidity: to 98% without condensation
Weight: 4.5 lbs. (2.0 kg)
Enclosure Rating: NEMA4X/IP56 (dust proof, washdown)

Series X25

Approximate Dimensions (in inches)

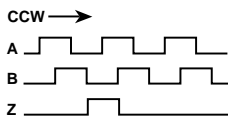


Terminal Board Connections

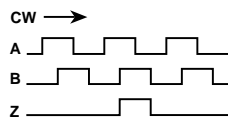


Screw terminals with pressure plates that accept #14 AWG to #22 AWG.

Format A

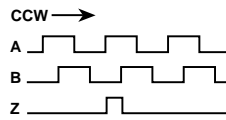


Format C

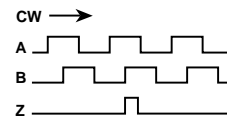


If Code 2 PPR > 2540

Format A



Format C



Ordering Information

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

Code 1: Model	Code 2: Pulses/Rev			Code 3: Mechanical	Code 4: Output	Code 5: Electrical
X25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X25 Explosion Proof, Shielded Bearings with Shaft Seal	0001 0005 0010 0012 0025 0050 0060 0086 0100 0120 0180 0200 0240 0250 0254 0256 0300 0360 0400 0500 0512	0600 0635 0720 0768 0800 0900 1000 1024 1200 1250 1270 1500 1600 1800 1968	2000 2048 2400 2500 2540 3000 3400 3600 3750 4000 4096 4800 5000	0 3/8" Shaft 1 1/4" Shaft	0 Single Ended, no index, Format C 1 Single Ended, with index, Format C 2 Differential, no Index, Format C 3 Differential, with index, Format C 4 Single Ended, with index, Format A 5 Differential, with index, Format A	0 5-26V in; 5-26V Open Collector with 2.2kΩ Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V Totem Pole out 3 5-26V in; 5V Line Driver out 4 5-26V in; 5-26V Line Driver out

Series E12

- Servo or face mount
(1.2" diameter)
- Up to 1024 PPR with optional marker pulse
- Rugged all-metal housing
- Shielded cable standard



COMMERCIAL

APPLICATION/INDUSTRY

The Series E12 ultraminiature incremental optical encoder is packaged for commercial and lighter-duty industrial applications.

Typical Applications

- Industrial equipment
- Assembly machinery
- Phototypesetters and printers
- Robotics
- Medical diagnostic equipment
- Motor-mounted feedback
- Computer peripherals

DESCRIPTION

The E12 is standard Size 12 (1.2" diameter), servo or face-mount, with a rugged metal housing. It includes precision bearings, an O-ring housing seal, and a rugged 1/8" diameter stainless steel shaft. Series E12 incorporates the latest in micro-electronic packaging, LED light sources, and matched sensors. Outputs are designed to be compatible with most 5V TTL circuits with options for higher voltage 12 and 15 VDC. Shielded cable is standard.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Durable metal housing
- O-ring housing seal
- Rugged 1/8" diameter stainless steel shaft
- Up to 5000 RPM
- 0 to 70 °C operating temperature

Electrical Features

- Up to 1024 pulses per revolution including an optional marker pulse
- Higher electronic operating speed up to 100 kHz
- LED light source and matched sensor
- Choice of 5, 12, or 15 VDC units

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 100 to 1024 PPR (pulses/revolution)
Format: Two channel quadrature (AB) with optional Index (Z) outputs
Phase Sense: A leads B for CW shaft rotation as viewed from the shaft end of the encoder
Accuracy: $\pm 3^\circ$ (360° \pm PPR) or ± 2.5 arc-min worst case pulse to any other pulse, whichever is less
Quadrature Phasing: $90^\circ \pm 36^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $90^\circ \pm 25^\circ$ (gated with A and B high)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power: 5 VDC $\pm 5\%$ at 80 mA max.; 12 or 15 VDC $\pm 10\%$ at 80 mA max.; not including output loads
Outputs: 7272 line driver (or equivalent), 40 mA sink and source
Frequency Response: 100 kHz min.

MECHANICAL

Mechanical Bearing Life: 16×10^6 revolutions at max. load
Shaft Loading: 1 lb. radial, 1 lb. axial max.
Shaft Speed: 5,000 RPM max.
Starting Torque:
 Shielded Bearing: 0.1 oz-in max. at 25 °C
 Sealed Bearing: 0.3 oz-in max. at 25 °C
Running Torque:
 Shielded Bearing: 0.08 oz-in max. at 25 °C
 Sealed Bearing: 0.2 oz-in max. at 25 °C
Moment of Inertia: 1.13×10^{-5} oz-in $^{-2}$
Weight: 3.0 oz. max.

ENVIRONMENTAL

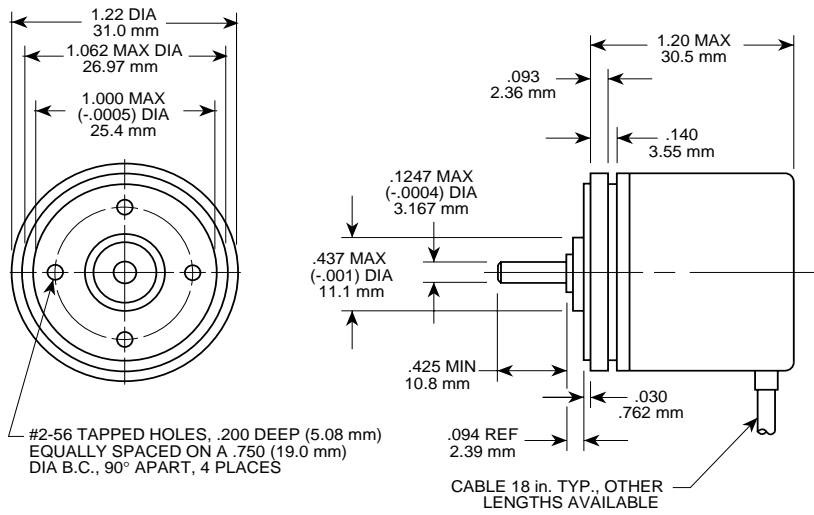
Operating Temperature: 0 to +70 °C
Storage Temperature: -25 to +70 °C
Humidity: to 98% without condensation
Enclosure Rating: NEMA 12/IP54 (dirt tight, splashproof) Optional: NEMA 3/IP64 rating available (consult factory)

Electrical Connections

Function (If Used)	Wire Color Code
Supply	Red
Common	Black
Signal A	White
Signal B	Green
Signal Z	Orange
Floating	Shield

Series E12

Approximate Dimensions (inches/mm)



COMMERCIAL

Ordering Information

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

Code 1: Model	Code 2: Pulses/Rev	Code 3: Mechanical	Code 4: Output	Code 5: Voltage	Code 6: Termination
E12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E12 Size 12, Light Duty Enclosed	0100 0250 0256 0360 0500 0600 1000 1024	0 Sealed Bearing 1 Shielded Bearing	0 Unidirectional 2 Bidirectional, no Index 3 Bidirectional, with Index	0 5 VDC 1 12 VDC 2 15 VDC	0 18" Cable 1 3' Cable 2 6' Cable 3 10' Cable 4 15' Cable

Series E14

- Servo or face mount (1.44" diameter)
- Up to 2540 PPR with optional marker pulse
- Face mount 2.0" diameter
- Rugged all-metal housing
- Shielded cable standard



COMMERCIAL

APPLICATION/INDUSTRY

The Series E14 is a totally enclosed, easy-to-install, incremental encoder designed for commercial and industrial applications with limited space.

Typical Applications

- Industrial equipment
- Assembly machinery
- Phototypesetters and printers
- Robotics
- Medical diagnostic equipment
- Motor-mounted feedback
- Computer peripherals
- Instrumentation

DESCRIPTION

It is an industry-standard Size 14 (1.44" diameter), servo or face-mount unit with a rugged, metal housing. The Series E14 includes precision bearings, an O-ring seal, and a choice of 1/4" or 1/8" diameter stainless steel shaft. Series E14 incorporates the latest in microelectronic packaging, LED light sources, and matched sensors. Outputs are designed to be compatible with most 5V TTL circuits with options for higher voltage 12 and 15 VDC. Shielded cable is standard. Line drivers with complementary outputs are available for longer cable runs and/or higher ambient electrical noise immunity.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Durable metal housing
- O-ring housing seal
- Rugged 1/4" or 1/8" diameter stainless steel shafts
- Up to 5000 RPM

Electrical Features

- Up to 1024 pulses per revolution including an optional marker pulse
- Higher electronic operating speed up to 100 kHz
- LED light source and matched sensors
- Choice of 5, 12, or 15 VDC units
- Shielded cable and line driver available for higher electrical noise immunity

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental

Resolution: 100 to 2540 PPR (pulses/revolution)

Format: Two channel quadrature (AB) with optional Index (Z) outputs

Phase Sense: A leads B for CW shaft rotation as viewed from the shaft end of the encoder

Accuracy: $\pm 3^\circ$ (360° ÷ PPR) or ± 2.5 arc-min worst case pulse to any other pulse, whichever is less

Quadrature Phasing: $90^\circ \pm 36^\circ$ electrical

Symmetry: $180^\circ \pm 18^\circ$ electrical

Index: $90^\circ \pm 25^\circ$ (gated with A and B high)

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

ELECTRICAL

Input Power: 5 VDC $\pm 5\%$ at 80 mA max.; 12 or 15 VDC $\pm 10\%$ at 80 mA max.; not including output loads

Outputs: 7272 (or equivalent) line driver, 40 mA sink and source

Frequency Response: 100 kHz min.

MECHANICAL

Bearing Life: (16 x 10⁶ ÷ RPM) hours at max. load

Shaft Loading: 5 lb. radial, 3 lb. axial max.

Shaft Speed: 5,000 RPM max.

Starting Torque:

Shielded Bearing: 0.1 oz-in max. at 25 °C
Sealed Bearing: 0.43 oz-in max. at 25 °C

Running Torque:

Shielded Bearing: 0.08 oz-in max. at 25 °C
Sealed Bearing: 0.42 oz-in max. at 25 °C

Moment of Inertia: 3.8×10^{-5} oz-in-sec²

Weight: 3.0 oz. max.

ENVIRONMENTAL

Operating Temperature: 0 to +70 °C

Storage Temperature: -25 to +70 °C

Humidity: to 98% without condensation

Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof) Optional: NEMA 3/IP64 rating available (consult factory)

Electrical Connections

Wire Color Code	Function		
	Standard Outputs 5, 12, or 15 VDC	w/ Line Driver Outputs	
		Unidirectional	Bidirectional
Red	Power Source	Power Source	Power Source
Black	Common	Common	Common
White	Signal A	Signal A	Signal A
Green	Signal B (if used)	Signal A	Signal B
Orange	Signal Z (if used)	No Connection	Signal B
Blue	No Connection	No Connection	Signal A
Shield	Floating	Floating	Floating
White/Black	—	—	Signal Z (if used)
Red/Black	—	—	Signal Z̄ (if used)

Series E23

- Compact Size 23 encoder
- Up to 2540 PPR with optional marker pulse
- Economical high performance



COMMERCIAL

APPLICATION/INDUSTRY

The Series E23 is a high resolution, optical incremental encoder designed for light industrial and commercial applications. A standard Size 23 (2.3" dia.), the E23 is ideal for machine and equipment designs with limited space and high performance requirements.

Applications

- Motor mounted feedback for servo systems
- Assembly machines
- Robotics and material handling
- Printers, X/Y plotters, and phototypesetters
- Semiconductor I.C. bonders
- Medical diagnostic equipment (X-ray & CAT scanners)
- Position and/or velocity input for CNC's, PLC's, motion controllers, etc.

DESCRIPTION

A pre-wired cable or terminal screw connections are included with either servo clip or face mounting options.

Its bidirectional and optional marker pulse, current sink or differential line driver outputs are compatible with most electronic counters, instruments, PLC's, robot controls, CNC's, and industrial computers. The E23 is mechanically interchangeable with other Size 23 encoders on the market.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- 1/4" stainless steel shaft
- Low inertia, low starting torque
- Up to 5000 RPM
- 0 to 70°C operating range
- Outline dimensions: 2.3" Dia. x 1.65" L.

Electrical Features

- Shielded cable or terminal screw options
- Up to 2540 pulses per revolution
- Bidirectional outputs and gated marker available
- 100 kHz frequency response
- 5-26 VDC supply voltage
- Single LED light source

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2540 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) ±2.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) outputs
Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder, see Ordering Information
Quadrature Phasing: 90° ± 18° electrical
Symmetry: 180° ± 9° electrical
Index: 180° ± 9° electrical, gated with B
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 Open Collector or Totem Pole outputs: 4.5 VDC min. to 26 VDC max. at 200 mA max.;
 Line Driver: 4.5 VDC min. to 26 VDC max. at 80 mA max.
Outputs:
 Open Collector 7273:
 V_{OH} : 30 V max.; V_{OL} : 0.4 V max. at 20 mA sink
 Totem Pole, Line Driver 7272:
 40 mA min. sink or source
 4469 Differential Line Driver: 100 mA, sink or source
Frequency Response: 100 kHz min.

Electrical Connections

Note: Wire color codes are referenced here for models that are specified with pre-wired cable.

Single Ended		
Term.	Function (If Used)	Wire Color Code
A	Signal A	BRN
B	Signal B	ORN
C	Signal Z	YEL
D	Power Source	RED
E	No Connection	—
F	Common	BLK
G	Case	GRN

Differential		
Term.	Function (If Used)	Wire Color Code
A	Signal A	BRN
B	Signal B	ORN
C	Signal Z	YEL
D	Power Source	RED
E	No Connection	—
F	Common	BLK
G	Case	GRN
H	Signal \bar{A}	BRN/WH
I	Signal \bar{B}	ORN/WH
J	Signal \bar{Z}	YEL/WH

MECHANICAL

Shaft Loading: 5 lbs. max. radial and axial
Shaft Speed: 5,000 RPM max.
Starting Torque: 0.2 oz-in max. at 25 °C
Moment of Inertia: 3.7 x 10⁻⁴ oz-in-sec²
Weight: 13 oz. max.

ENVIRONMENTAL

Operating Temperature: 0 to +70 °C
Storage Temperature: -40 to +80 °C
Humidity: to 98% without condensation
Shock: 50 G's for 11 msec duration
Vibration: 5 to 2000 Hz at 2 G's
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof)

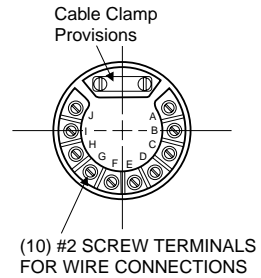
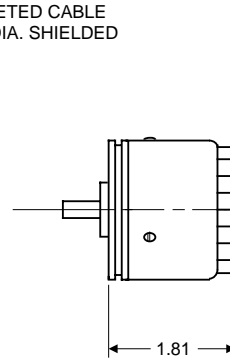
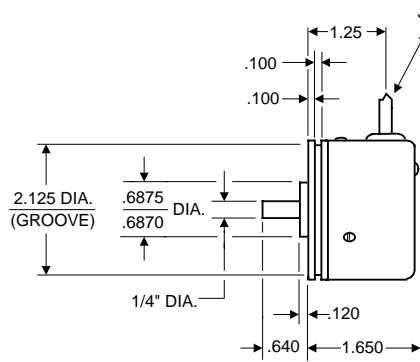
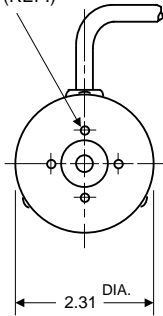
Series E23

Code 6: Termination

0 - 4: Cable

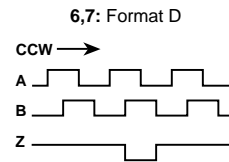
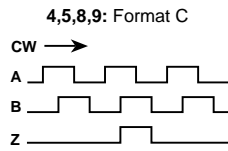
8: Terminals

(4) #4-40 UNC-2B THD.
3/16" DP. MIN. EQUALLY
SPACED ON A 1.000 DIA.
B.C. (REF.)



COMMERCIAL

Code 4: Output



Ordering Information

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

Code 1: Model	Code 2: Pulses/Rev	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination
E23	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E23 Size 23 Enclosed	0001 0300 1024 0005 0344 1200 0010 0360 1250 0012 0400 1270 0050 0500 1500 0060 0512 1600 0100 0600 1800 0120 0625 1968 0150 0635 2000 0180 0720 2048 0200 0800 2400 0240 0900 2500 0250 1000 2540 0256 For Resolutions above 2540, see Series EC23	0 1/4" Shaft, Shielded Bearings 1 1/4" Shaft, Sealed Bearings	4 Single Ended, with Index, Format C 5 Differential, with Index, Format C 6 Single Ended, with Index, Format D 7 Differential, with Index, Format D 8 Single Ended, no Index, Format C 9 Differential, no Index, Format C	0 5-26V in; 5-26V Open Collector w/2.2kΩ Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V TTL Totem Pole out 3 5-26V in; 5V Line Driver out (7272) 4 5-26V in; 5-26V Line Driver out (7272) 5 5-26V in, 5V Differential Line Driver out (4469) 6 5-15V in, 5-15V Differential Line Driver out (4469)	0 18" Cable 1 3' Cable 2 6' Cable 3 10' Cable 4 15' Cable 8 Screw Terminals

Series EC23

- Compact Size 23 encoder
- Up to 10000 PPR with optional marker pulse
- Economical high performance



COMMERCIAL

APPLICATION/INDUSTRY

The Series EC23 is a high resolution, optical incremental encoder designed for light industrial and commercial applications. A standard Size 23 (2.3" dia.), the EC23 is ideal for machine and equipment designs with limited space and high performance requirements.

Applications

- Motor-mounted feedback for servo systems
- Assembly machines
- Robotics and material handling
- Printers, X/Y plotters, and phototypesetters
- Semiconductor I.C. bonders
- Medical diagnostic equipment (X-ray & CAT scanners)
- Position and/or velocity input for CNC's, PLC's, motion controllers, etc.

DESCRIPTION

A pre-wired cable or terminal screw connections are included with either servo clip or face mounting options.

Its bidirectional and optional marker pulse, current sink or differential line driver outputs are compatible with most electronic counters, instruments, PLC's, robot controls, CNC's, and industrial computers. The EC23 is mechanically interchangeable with the all popular Size 23 encoders.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- 1/4" stainless steel shaft
- Low inertia, low starting torque
- Up to 10,000 RPM
- 0 to 70°C operating range
- Outline dimensions: 2.3" Dia. x 1.65" L.

Electrical Features

- Shielded cable or terminal screw options
- 3,000 to 5,000 pulses per revolution
- Bidirectional outputs and gated marker available
- 250 kHz frequency response
- 5-26 VDC supply voltage
- Single LED light source

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 3000 to 5000 PPR (pulses/revolution)
Accuracy: (Worst case any edge to any other edge) $\pm 10.8^\circ$ /PPR
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information
Quadrature Phasing: $90^\circ \pm 25^\circ$ electrical
Symmetry: $180^\circ \pm 25^\circ$ electrical
Index: $90^\circ \pm 25^\circ$ electrical, gated with B
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power: 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
Frequency Response: 250 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference
Cable: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

Electrical Connections

Note: Wire color codes are referenced here for models that are specified with pre-wired cable.

Single Ended		
Term.	Function (If Used)	Wire Color Code
A	Signal A	BRN
B	Signal B	ORN
C	Signal Z	YEL
D	Power Source	RED
E	No Connection	—
F	Common	BLK
G	Case	GRN

Differential		
Term.	Function (If Used)	Wire Color Code
A	Signal A	BRN
B	Signal B	ORN
C	Signal Z	YEL
D	Power Source	RED
E	No Connection	—
F	Common	BLK
G	Case	GRN
H	Signal \bar{A}	BRN/WH
I	Signal \bar{B}	ORN/WH
J	Signal \bar{Z}	YEL/WH

MECHANICAL

Bearing Life: 1×10^9 revolutions at max. load
Shaft Loading: 5 lbs. max radial and axial
Shaft Runout: 0.001" max. TIR
Shaft Speed: 10,000 RPM max. mechanical
Shaft Tolerance: Nominal -0.0004"/-0.0007"
Starting Torque:
 Shielded bearings: 0.1 oz-in max.;
 Sealed bearings: 0.2 oz.-in max.
Moment of Inertia: 2.83×10^{-4} oz-in-sec²
Weight: 13 oz. max.

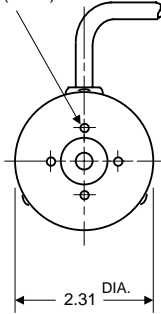
ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof)

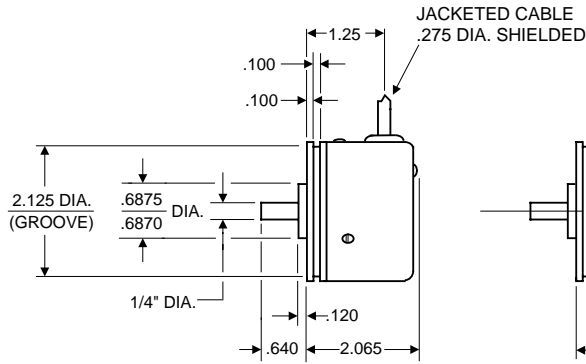
Series EC23

Code 6: Termination

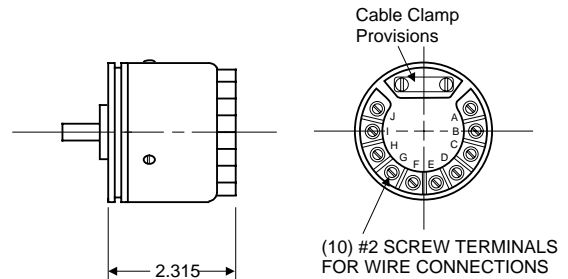
(4) #4-40 UNC-2B THD.
3/16" DP. MIN. EQUALLY
SPACED ON A 1.000 DIA.
B.C. (REF.)



0 - 4: Cable



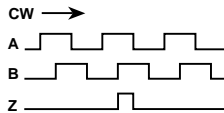
8: Terminals



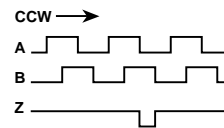
COMMERCIAL

Code 4: Output

4,5,8,9: Format C



6,7: Format D



Code 1: Model	Code 2: Pulses/Rev	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination
EC23	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information					
EC23 Size 23 Enclosed	3000 3,000 3600 3,600 4096 4,096 5000 5,000	0 1/4" Shaft, Shielded Bearings, 2.31" Dia. Servo Mount w/ 4-Hole Face Mount 1 1/4" Shaft, Sealed Bearings, 2.31" Dia. Servo Mount w/ 4-Hole Face Mount	4 Single Ended, with Index, Format C 5 Differential, with Index, Format C 6 Single Ended, with Index, Format D 7 Differential, with Index, Format D 8 Single Ended, No Index, Format C 9 Differential, No Index, Format C	0 5-26V in, 5-26V Open Collector w/2.2kΩ Pullups out 1 5-26V in, 5-26V Open Collector out 2 5-26V in; 5V out, Push-Pull out 3 5-26V in; 5V Line Driver out 4 5-26V in, 5-26V Line Driver out	0 18" Cable, Side Exit 1 3' Cable, Side Exit 2 6' Cable, Side Exit 3 10' Cable, Side Exit 4 15' Cable, Side Exit 8 Screw Terminals

Selection Guide Incremental Motor Mount

Our motor mount encoders are especially well suited for fast, easy installation to motor shafts with minimal extra parts. This Selector Guide can assist you in determining the type of encoder that best fits your application requirements. Condensed description and specification information is provided. Complete information is available on the referenced page number that appears below each product's picture.

MOTOR MOUNT

Type	M15 Modular Encoder	M21 Modular Encoder	F10 Commutating Encoder	F14 Commutating Encoder
				
PAGE NUMBER	2.62	2.64	2.66	2.68
DESCRIPTION AND FEATURES	<ul style="list-style-type: none"> 1.5" diameter package Direct shaft mounting on small servo and stepper motors Optional line driver outputs for increased noise immunity Factory aligned and gapped Operation to 120°C 	<ul style="list-style-type: none"> 2.1" diameter package Direct shaft mounting on small servo and stepper motors Optional line driver outputs for increased noise immunity Factory aligned and gapped Operation to 120°C 	<ul style="list-style-type: none"> Replaces Size 10 Pancake Resolver (1.25" Diameter) Resolution to 2048 PPR Accuracy to ±2.5 arc-min Operating temperature to 120° C does not limit motor performance Operating frequency to 300 kHz for fast servo loops 	<ul style="list-style-type: none"> Servo motor feedback in an easy-to-install package Outside diameter 1.55" (40 mm) Resolution to 5,000 PPR - output frequency to 500 kHz Operation to 120°C doesn't limit machine performance
ELECTRICAL SPECIFICATIONS				
Available Resolutions:	200 to 1024 PPR 4,6 or 8 pole commutation	500 to 2048 PPR 4,6 or 8 pole commutation	1024 or 2048 PPR 6 pole commutation	200 to 5000 PPR 4,6 or 8 pole commutation
Output Frequency:	200 kHz	200 kHz	300 kHz	500 kHz
Input Power:	5 or 12 VDC; 75 to 100 mA	5 or 12 VDC; 75 to 100 mA	5±10% VDC at 100 mA max	5VDC; 175 mA
Available Output Types:	Open Collector or Line Driver	Open Collector or Line Driver	Incremental: Diff. Line Driver Commutation: Open Collector	Open Collector or Line Driver
Terminations:	PCB mounted connector or shielded cable	PCB mounted connector or shielded cable	Flying leads (6.5" long)	PCB mounted connector
MECHANICAL SPECIFICATIONS				
Overall Size:	1.5" dia. x 1.1" dp.	2.1" dia. x 0.8" dp.	1.25" dia. x 0.89" dp.	1.45" dia. x 1.36" dp.
Shaft Size:	1/8" to 3/8"; 6 to 10 mm	1/4" to 1/2"; 6 to 12 mm	6mm	1/4", 6mm, 8mm
Max. Shaft Speed:	12,000 RPM	12,000 RPM	5,000 RPM continuous 12,000 RPM peak	12,000 RPM
Max. Shaft Load:	Modular design accomodates ±0.015" endplay	Modular design accomodates +0.005"/-0.015" endplay	Accomodates ±0.010" (±0.25 mm) endplay	Tether design accomodates ±0.060" (±1.52mm) endplay
Mounting:	shaft mount	shaft mount	servo ring with integral flexure	shaft mount
ENVIRONMENTAL SPECIFICATIONS				
Operating Temperature:	-40° to +120°C	-40° to +120°C	0° to +120°C	0° to +120°C
Enclosure Rating:	NEMA 1/ IP50 (with cover)	NEMA 1/ IP50 (with cover)	N/A	NEMA 1/ IP40 (with cover)

Key to Noteworthy features: ① High Performance - 5000 PPR or greater resolution available ② Hazardous Environment - Intrinsically Safe or Explosion Proof rating


F15 Commutating Encoder	F18 Commutating Encoder	F21 Commutating Encoder	R45 Rotopulser®	
				
2.70	2.72	2.74	2.100	
<ul style="list-style-type: none"> Replaces Size 15 Pancake Resolver (1.45" Diameter) Resolution to 2048 PPR Accuracy to ±2.5 arc-min Operating temperature to 120° C does not limit motor performance Operating frequency to 300 kHz for fast servo loops 	<ul style="list-style-type: none"> Servo motor feedback in an easy-to-install package Outside diameter 1.96" (50 mm) Resolution to 10,000 PPR - output frequency to 500 kHz Operation to 120°C doesn't limit machine performance 	<ul style="list-style-type: none"> Replaces Size 21 Pancake Resolver (2.06" Diameter) Resolution to 2048 PPR Accuracy to ±2.5 arc-min Operating temperature to 120° C does not limit motor performance Operating frequency to 300 kHz for fast servo loops 	<ul style="list-style-type: none"> Direct mount to 4-1/2" NEMA C-Face AC and DC motors Thin profile allows mounting on drive or accessory end Unidirectional or Bidirectional output 	
1024 or 2048 PPR 6 or 8 pole commutation 300 kHz 5±10% VDC at 100 mA max Incremental: Diff. Line Driver Commutation: Open Collector Flying leads (6.5" long)	500 to 10,000 PPR 4,6 or 8 pole commutation 500 kHz 5VDC; 175 mA Open Collector or Line Driver PCB mounted connector	1024 or 2048 PPR 8 or 10 pole commutation 300 kHz 5±10% VDC at 100 mA max Incremental: Diff. Line Driver Commutation: Open Collector Flying leads (6.5" long)	60 PPR 10 kHz 5 to 26 VDC, 50 to 75 mA Open Collector or Differential Line Driver Wire leads or screw terminals	
1.45" dia. x 0.95" dp. 0.375" 5,000 RPM continuous 12,000 RPM peak Accommodates ±0.010" (±0.25 mm) endplay servo ring with integral flexure	1.96" dia. x 1.71" dp. 1/4" to 1/2", 6mm to 12mm 12,000 RPM Tether design accommodates ±0.060" (±1.52mm) endplay shaft mount	2.06" dia. x 0.90" dp. 0.50" 5,000 RPM continuous 12,000 RPM peak Accommodates ±0.010" (±0.25 mm) endplay servo ring with integral flexure	9.5" ht. x 6.5" wd. x .625" dp. 5/8" or 7/8" 5000 RPM Modular design accommodates ±0.060" endplay Direct mount to NEMA 4-1/2" C-face motors	
0° to +120°C N/A	0° to +120°C NEMA 1/ IP40 (with cover)	0° to +120°C N/A	-40° to +85°C N/A	

MOTOR MOUNT

Selection Guide Incremental Motor Mount

Our motor mount encoders are especially well suited for fast, easy installation to motor shafts with minimal extra parts. This Selector Guide can assist you in determining the type of encoder that best fits your application requirements. Condensed description and specification information is provided. Complete information is available on the referenced page number that appears below each product's picture.

MOTOR MOUNT

Type	H20 Hub-Shaft	HS20 Sealed Hollow Shaft	HS35 Sealed Hollow Shaft	HA/HR/HC26 Flange Mount
				
PAGE NUMBER	2.76	2.80	2.84	2.88, 2.92, 2.96 ¹
DESCRIPTION AND FEATURES	<ul style="list-style-type: none"> Female hub shaft and flexible spring mount directly to motor High reliability features – metal disk, heavy duty bearing, electrical protection and high noise immunity 	<ul style="list-style-type: none"> 2.0" diameter, hollowshaft design eliminates mounting bracket and flexible shaft coupling Flexible tether minimizes bearing load Robust metal hubshaft 	<ul style="list-style-type: none"> 3.54" diameter, hollowshaft design eliminates mounting bracket and flexible shaft coupling 1-1/2" installation depth Unbreakable code disk 	<ul style="list-style-type: none"> Integral coupling and flange adapter to fit NEMA frame size 42 motors Thermally and electrically isolated from motor heat and noise Models with high resolution and intrinsically safe design
ELECTRICAL SPECIFICATIONS				
Available Resolutions:	1 to 2540 PPR	1 to 2540 PPR	1 to 2500 PPR	1 to 5000 PPR
Output Frequency:	100 kHz	100 kHz	100 kHz	100 kHz
Input Power:	5 to 26 VDC, 80 to 135 mA	5 to 26 VDC, 100 mA	5 to 26 VDC, 100 mA	5 to 26 VDC, 80 mA
Available Output Types:	Open Collector, Push-Pull, or Differential Line Driver	Open Collector, Push-Pull, or Differential Line Driver	Open Collector, Push-Pull, or Differential Line Driver	Open Collector, Push-Pull, or Differential Line Driver
Terminations:	MS connector, M12 connector or shielded cable	MS connector, M12 connector or shielded cable	MS connector, M12 connector or shielded cable	MS connector, M12 connector or shielded cable
MECHANICAL SPECIFICATIONS				
Overall Size:	2.0" dia. x 1.75" dp.	2.0" dia. x 1.9" dp.	3.54" dia. x 1.8" dp.	3.25" dia. x 3.94" dp.
Shaft Size:	3/8" or 5/8"	6 to 16mm; 1/4" to 5/8"	6 to 24mm; 1/4" to 1-1/8"	1/4", 3/8", or 1/2"
Max. Shaft Speed:	10,000 RPM	3600 RPM	3600 RPM	10,000 RPM
Max. Shaft Load:	Tether design accomodates ±0.025" endplay	Tether design accomodates ±0.025" endplay	Tether design accomodates ±0.050" endplay	Integral Coupling
Mounting:	Robust, metal hubshaft	Robust, metal thru-hubshaft	Robust, metal thru-hubshaft	Flange mount with or without pilot; NEMA size 42 motor flange
ENVIRONMENTAL SPECIFICATIONS				
Operating Temperature:	0° to +70°C, -40° to +85°C opt.	0° to +70°C, -40° to +85°C opt.	-40° to +70°C, 0° to +100°C opt.	0° to +70°C, -40° to +85°C opt.
Enclosure Rating:	NEMA 12 / IP54 NEMA 4 / IP66 opt.	NEMA 4 / IP65	NEMA 4 / IP66	NEMA 12 / IP54

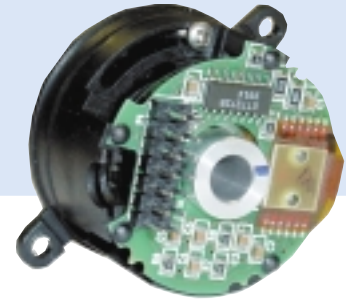
Key to Noteworthy features: ① High Performance - 5000 PPR or greater resolution available ② Hazardous Environment - Intrinsically Safe or Explosion Proof rating

M9 & E9 0.9 Inch Miniature	M14 1.5 Inch Miniature	E14 Hub-Shaft	E14 w/Integral Coupling	<p>Please Note: The encoders on this page are especially suited for light-duty applications employing small, fractional horse power motors. In such use, they will provide excellent performance and life characteristics</p> <p>Do not attempt to adapt to applications that require the industrial and heavy duty encoders listed in the preceding pages of this Selection Guide.</p>
 2.106, 2.108	 2.110	 2.102	 2.104	
<ul style="list-style-type: none"> ■ Ideal for position and speed sensing in small machines and actuators ■ 200 kHz operating frequency ■ Resolution to 512 PPR 	<ul style="list-style-type: none"> ■ Economical feedback device for servo and stepper motors ■ Easy “snap-on” installation ■ High resolution to 1024 PPR and 200 kHz bandwidth ■ Drop-in replacement for HP 5540 	<ul style="list-style-type: none"> ■ Easy installation on motor or machine shafts ■ Hub shaft design and flexible spring mount eliminate need for mounting flange adapter and flexible coupling ■ Large and small hub availability 	<ul style="list-style-type: none"> ■ Standard mounting on NEMA Size 23 and 24 motors ■ Optional differential line driver outputs 	
100 to 512 PPR	200 to 1024 PPR	100 to 2540 PPR	100 to 2540 PPR	
200 kHz	200 kHz	100 kHz	100 kHz	
5 VDC; 10 mA, typ.	5 VDC; 10 mA, typ.	5, 12, or 15 VDC; 80 mA	5, 12, or 15 VDC; 80 mA	
Sink/Source	Sink/Source	Differential Line Driver	Differential Line Driver	
Pin Header	Pin Header	Shielded cable with or without DB25 connector	Shielded cable with or without DB25 connector	
0.9" dia. x 0.8" dp.	1.5" dia. x 0.7" dp.	1.5" dia. x 1.5" dp. (2.01" dp. if bore is 12mm to 5/8")	1.5" dia. x 3.4" dp, max.	
1.5 to 4.0 mm; 0.125 to 0.156 inch	3 mm to 8 mm; 0.125" to 0.375"	6 mm to 14 mm; 1/4" to 5/8"	1/4" or 3/8"	
–	–	5000 RPM	5000 RPM	
–	–	Tether design accommodates ±0.010" endplay	Integral coupling	
Mounting base provided	Mounting base provided	Hub shaft mount	NEMA Size 23 and 24	
–40° to +100°C	–40° to +100°C	0° to +70°C	0° to +70°C	
NA	NA	NEMA 12/ IP56	NEMA 12/ IP56	

MOTOR MOUNT

Series M15 Modular

- *Modular, Incremental Encoder for Stepper and Small Servo Motor Feedback*
- *Phased Array Sensor Technology Provides High Temperature and Operating Frequency and Allows 0.03" (0.76 mm) of Axial Play*
- *Resolutions to 1024 PPR with Index Standard; Optional 4, 6, or 8 Pole Commutation Tracks for Brushless Servo Motors*
- *Easy Installation and Removal without Special Tools or Parts*



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand M15 modular encoder provides high-performance, cost effective feedback for stepper and servo motor controls.

DESCRIPTION

Using industry standard package dimensions, the M15 is easily installed onto the motor without time-consuming adjustments or special tools. Its unique mechanical design automatically centers and gaps the disc during installation.

For Brushless DC (BLDC) servo control, optional 3 phase commutation tracks replace the traditional Hall Effect sensors. These optically-generated signals provide higher accuracy and reliability, improving the performance and reliability of the servo system.

FEATURES AND BENEFITS

- Operates up to 120°C. The high temperature plastics, phased array sensor, and low current requirements stabilize the output signals over a wide range of input voltage, ambient temperature, or output frequencies.
- Provides 30 degrees of adjustment to align the signal outputs to the shaft position. Using an industry standard Size 15 modular mounting pattern, the index mark on the disc hub can be coarse aligned to the index sensor position on the housing. The housing rotates to allow further adjustment of the index or fine alignment of the commutation channels to the BLDC motor windings.
- Enclosure is dirt-tight, rated NEMA 1 / IP40. The cover is gasketed to seal the disc and optics from contamination. Additionally, the base can be sealed to the motor for further environmental protection.
- Outputs are protected from short circuits, and operate on 5 or 12 VDC power.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: (pulses/revolution)
 Incremental: 200 to 1024 PPR;
 Commutation: 4, 6, or 8 pole
Accuracy:
 Incremental: ± 5 arc-mins. max. edge to edge;
 Commutation: ± 6 arc-mins. max.
Sense: (viewing encoder mounting surface)
 Incremental: A leads B by 90° for CCW rotation of motor shaft;
 Commutation: U leads V, V leads W by 120° for CW rotation of motor shaft
Phasing:
 Incremental: 90° $\pm 18^\circ$ electrical
 Commutation: 8 Pole: 30°; 6 Pole: 40°; 4 Pole: 60° mechanical
 Index to U Channel: $\pm 1^\circ$ mechanical - Index center to U channel edge
Symmetry:
 Incremental: 180° $\pm 18^\circ$ electrical
 Commutation: 8 Pole: 45°; 6 Pole: 60°; 4 Pole: 90° mechanical
Index Pulse Width: 180° $\pm 36^\circ$ electrical (Gated with B low) standard

ELECTRICAL

Input Power Requirements:
 Incremental: 5 or 12 VDC $\pm 10\%$ at 100 mA max. (excluding output load);
 Incremental w/Commutation: 5 or 12 VDC $\pm 10\%$ at 120 mA max. (excluding output load)
Output Signals:
 7272 Line Driver: 40 mA sink/source max.;
 Open Collector w/2.0 k Ω pull-ups: 16 mA sink max.
Frequency Response: 200 kHz min.
Termination:
 Connector: PCB mounted dual row head with 0.1" x 0.1" pin spacing, 10 pins (incremental only), 14 pins (w/commutation);
 Cable: conductors - 28 AWG, stranded (7/36), insulation - black, PVC; Shield: aluminum/polyester foil plus tinned, copper drain wire (28 AWG, 7/36)
Noise Immunity: Conforms to EN50082-1 Light Industrial for Electro-Static Discharge, Radio Frequency Interference, Electrical Fast Transients, and Magnetic Fields (for models or applications with shielded cable)

MECHANICAL

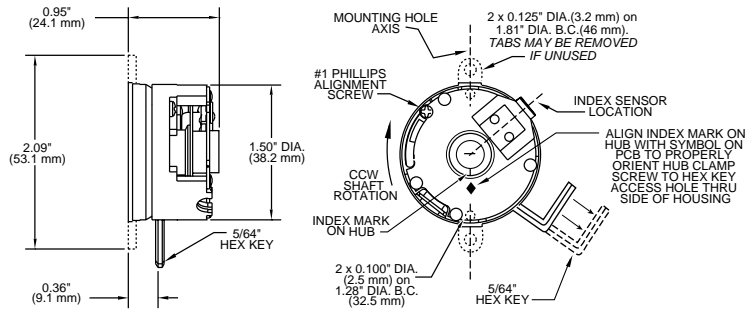
Weight:
 Connector: 0.8 oz. (23 gm) typ.
 Connector w/cover: 1.0 oz. (28 gm) typ.
 Cable: 1.3 oz (37 gm) typ.
 Cable w/cover: 1.5 oz. (43 gm) typ.
Dimensions:
 Outside Diameter: 1.60" (40.7 mm) max. w/ cover, 1.50" (38.2 mm) max. without cover;
 Height: 1.27" (32.3 mm) max. (w/cover, excluding connector);
 Emitter to Detector Gap: 0.070" (1.8 mm) min.
Material:
 Base, Housing, & Cover: high temperature, glass filled polymer;
 Hub: Aluminum; Disk: 0.030" thick glass
Finish:
 Base & Housing: black;
 Cover: RAL 7010 (dark grey)
Moment of Inertia: 3.40 x 10⁻⁵ in-oz sec.² (2.4 gm-cm²)
Hub Diameters: 1/8", 1/4", 3/8", 3/16", 6 mm, 8 mm, 10 mm nominal
Hub Dia. Tolerance: +0.001"/-0.000" (+0.026 mm/-0.000 mm)
Mating Shaft Length: 0.45" (12 mm) min.; 0.85" (22 mm) max. inside cover
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Endplay: +0.015"/-0.015" (+0.38 mm/-0.38 mm) nominal ("+" indicates away from mounting face)
Mounting:
 Base: (2) #4-40 (M2.5) #1 Phillips fillister head cap screw on 1.812" (46 mm) B.C., or (2) #2-56 (M2.0) hex socket cap screw on 1.28" (32.5 mm) B.C.; 0.01" (0.254 mm) true position to shaft.
 Shaft: split hub w/collar clamp, #2-56 hex socket cap screw (5/64" hex wrench included)
Electrical/Mechanical Alignment Range: $\pm 15^\circ$ mechanical
Acceleration: 100,000 rad/sec.² max.
Velocity: 12,000 RPM max.

ENVIRONMENTAL

Operating Temperature: -40° to 120°C
Storage Temperature: -40° to 85°C
Shock: 50 G's for 11 msec duration
Vibration: 2.5 G's at 5 to 2000 Hz
Relative Humidity: 90% non-condensing
Enclosure Rating: NEMA 1 / IP40 dirt-tight (for models with cover)

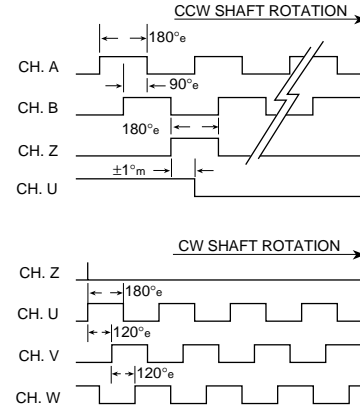
Series M15 Modular

Dimensions/Installation



Installation Instructions:
 Incremental only models: Drawing #200638-0001
 Commutation models: Drawing #200638-0002

Output Waveforms (For clarity, compliments are not shown.)



Code 6: Terminations (Not all signals present on all models)

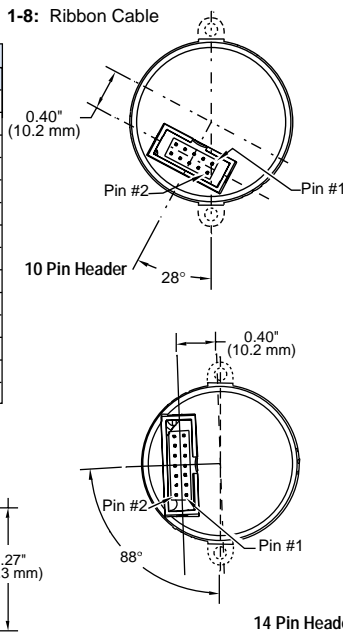
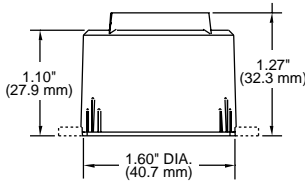
0: Pin Header

1-8: Ribbon Cable

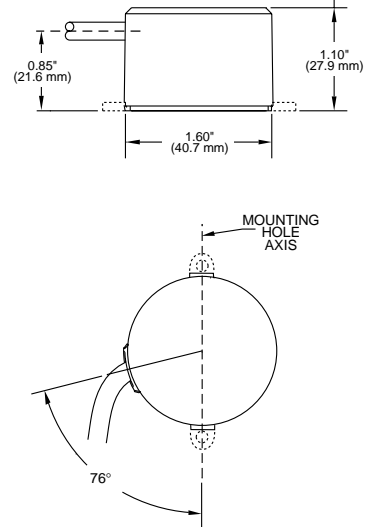
A-H: Shielded Cable

Pin	10 Pin		14 Pin
	O.C.	L.D.	
1	A	—	Vcc
2	Vcc	Vcc	U
3	GND	GND	U'
4	—	—	V
5	—	A'	V'
6	—	A	W
7	—	B'	W'
8	B	B	A'
9	—	Z'	A
10	Z	Z	B
11	—	—	B'
12	—	—	Z
13	—	—	GND
14	—	—	Z'

Mating Cable Assembly:
 10 pin, 109524-000x
 14 pin, 110527-000x
 x = length in feet



Function	Wire Color	
	Incr. Only	Incr. & Comm.
Vcc com	—	RED/WHT
Vcc Inc	RED	RED
GND Inc	BLK	BLK
GND com	—	BLK/WHT
A'	RED/BLK	BLU/BLK
A	GRN	BLU
B'	WHT/BLK	GRN/BLK
B	ORN	GRN
Z'	BLU	VIO/BLK
Z	WHT	VIO
U'	—	BRN/BLK
U	—	BRN
V'	—	GRY/BLK
V	—	GRY
W'	—	WHT/BLK
W	—	WHT



Ordering Information

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

Code 1: Model	Code 2: PPR, Poles	Code 3: Cover	Code 4: Electrical	Code 5: Hub	Code 6: Termination
M15	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Ordering Information						
M15	Size 15 Commutating Modular	Incremental channels only		0 No cover 1 Enclosed, end-of-shaft mount 2 Through shaft	0 5V in, open collector out incremental only 1 12V in, open collector out incremental only 3 5V in, line driver out incremental only Available when Code 2 is XXXX/4, XXXX/6, or XXXX/8 6 5V in, line driver out incr.; 5V in, open collector out comm. 7 5V in, line driver out incr.; 12V in, open collector out comm. 9 5V in, line driver out incr.; 5V in, line driver out comm.	0 1/4 in. 1 3/8 in. 4 6 mm 5 8 mm 6 10 mm 8 3/16 in. 9 1/8 in.
		Incremental plus Commutation channels				
		0200/0	1000/0			
		0400/0	1024/0			
		0500/0				
		0500/6	1024/4			
		1000/4	1024/6			
		1000/6	1024/8			
		1000/8				

MOTOR MOUNT

Series M21 Modular



- *Modular, Incremental Encoder for Stepper and Small Servo Motor Feedback*
- *Phased Array Sensor Technology Provides High Temperature and Operating Frequency and Allows 0.020" (0.5 mm) of Axial Play*
- *Resolutions to 2048 PPR with Index Standard; Optional 4, 6, 8 or 12 Pole Commutation Tracks for Brushless Servo Motors*
- *Easy Installation and Removal without Special Tools or Parts*

MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand M21 modular encoder provides high-performance, cost effective feedback for stepper and servo motor controls.

DESCRIPTION

Using industry standard package dimensions, the M21 is easily installed onto the motor without time-consuming adjustments or special tools. Its unique mechanical design automatically centers and gaps the disc during installation.

For Brushless DC (BLDC) servo control, optional 3 phase commutation tracks replace the traditional Hall Effect sensors. These optically-generated signals provide higher accuracy and reliability, improving the performance and reliability of the servo system.

FEATURES AND BENEFITS

- The M21 design operates up to 120°C. The high temperature plastics, phased array sensor, and low current requirements stabilize the output signals over a wide range of input voltage, ambient temperature, or output frequencies.
- The M21 provides 30 degrees of adjustment to align the signal outputs to the shaft position. Using an industry standard Size 21 modular mounting pattern, the index mark on the disc hub can be coarse aligned to the index sensor position on the housing. The housing rotates to allow further adjustment of the index or fine alignment of the commutation channels to the BLDC motor windings.
- The M21 enclosure is dirt-tight, rated NEMA 1 / IP50. The cover is gasketed to seal the disc and optics from contamination. Additionally, the base can be sealed to the motor for further environmental protection.
- The M21 outputs are protected from short circuits, and operate on 5 or 12 VDC power.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: (pulses/revolution)
 Incremental: 500 to 2048 PPR
 Commutation: 4, 6, 8 or 12 pole
Accuracy:
 Incremental: ± 5 arc-mins. max. edge to edge;
 Commutation: ± 6 arc-mins. max.
Sense: (viewing encoder mounting surface)
 Incremental: A leads B by 90° for CCW rotation of motor shaft;
 Commutation: U leads V, V leads W by 120° for CW rotation of motor shaft
Phasing:
 Incremental: 90° $\pm 18^\circ$ electrical
 Commutation: 8 Pole: 30°; 6 Pole: 40°; 4 Pole: 60° mechanical
 Index to U Channel: $\pm 1^\circ$ mechanical - Index center to U channel edge
Symmetry:
 Incremental: 180° $\pm 18^\circ$ electrical
 Commutation: 8 Pole: 45°;
 6 Pole: 60°; 4 Pole: 90° mechanical
Index Pulse Width: 180° $\pm 36^\circ$ electrical (Gated with B low) standard

ELECTRICAL

Input Power Requirements:
 Incremental: 5 or 12 VDC $\pm 10\%$ at 100 mA max. (excluding output load);
 Commutation: 5 or 12 VDC $\pm 10\%$ at 75 mA max. (excluding output load)
Output Signals:
 7272 Line Driver: 40 mA sink/source max.;
 Open Collector w/2.0 k Ω pull-ups: 16 mA sink max.
Frequency Response: 200 kHz min.
Termination:
 Connector: PCB mounted dual row head with 0.1" x 0.1" pin spacing, 10 pins (incremental only), 16 pins (w/commutation); Cable: conductors - 28 AWG, stranded (7/36), insulation - black, PVC; Shield: aluminum/polyester foil plus tinned, copper drain wire (28 AWG, 7/36)
Noise Immunity: Conforms to EN50082-1 Light Industrial for Electro-Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted Interference, and Magnetic Fields (for models or applications with shielded cable)

MECHANICAL

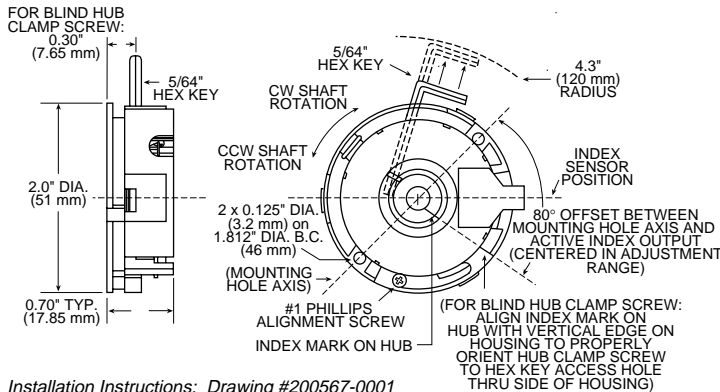
Weight:
 Connector: 1 oz. (28 gm) typ.
 Connector w/cover: 1.5 oz. (43 gm) typ.
 Cable: 2.5 oz (71 gm) typ.
 Cable w/cover: 3 oz. (85 gm) typ.
Dimensions:
 Outside Diameter: 2.1" (53 mm) max. w/cover, 2.0" (51 mm) max. without cover; Height: 0.8" (20.3 mm) max. (w/cover, excluding connector);
 Emitter to Detector Gap: 0.070" (1.8 mm) min.
Material:
 Base, Housing, & Cover: high temperature, glass filled polymer;
 Hub: Aluminum; Disk: 0.030" thick glass
Finish:
 Base & Housing: black;
 Cover: RAL 7010 (dark grey)
Moment of Inertia: 6.64 x 10⁻⁵ in-oz sec.² (4.7 gm-cm²)
Hub Diameters: 1/4", 3/8", 7/16", 1/2", 6 mm, 8 mm, 10 mm, 12 mm nominal
Hub Dia. Tolerance: +0.001"/-0.000" (+0.026 mm/-0.000 mm)
Mating Shaft Length: 0.45" (12 mm) min. blind hub clamp screw, 0.65" (16.5 mm) exposed hub clamp screw; 0.75" (19 mm) max. inside cover
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Endplay: +0.005"/-0.015" (+0.13 mm/-0.38 mm) nominal ("+" indicates away from mounting face)
Mounting:
 Base: (2) #4-40 (M2.5) #1 Phillips fillister head cap screw on 1.812" (46 mm) B.C., 0.01" (0.254 mm) true position to shaft; Shaft: split hub w/ collar clamp, #2-56 hex socket cap screw (5/64" hex wrench included)
Electrical/Mechanical Alignment Range: $\pm 15^\circ$ mechanical
Acceleration: 100,000 rad/sec.² max.
Velocity: 12,000 RPM max.

ENVIRONMENTAL

Operating Temperature: -40° to 120°C
Storage Temperature: -40° to 85°C
Shock: 50 G's for 11 msec duration
Vibration: 2.5 G's at 5 to 2000 Hz
Relative Humidity: 90% non-condensing
Enclosure Rating: NEMA 1 / IP50 dirt-tight (for models with cover)

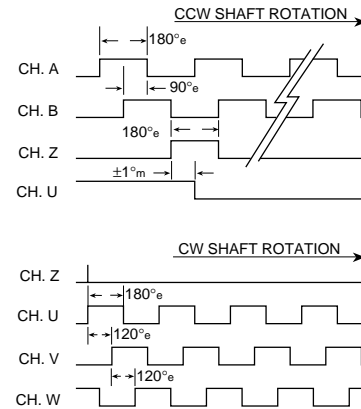
Series M21 Modular

Dimensions/Installation



Installation Instructions: Drawing #200567-0001
 Alignment Instructions: Drawing #200567-0002

Output Waveforms (For clarity, compliments are not shown.)



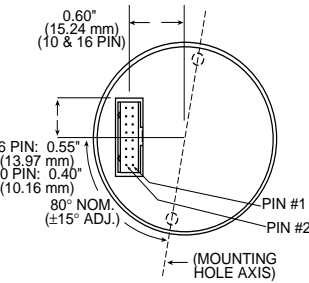
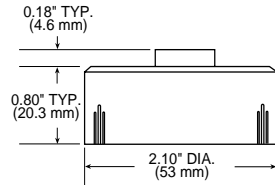
Code 6: Terminations (Not all signals present on all models)

0: Pin Header

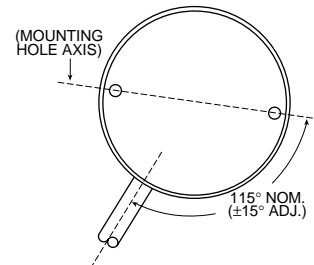
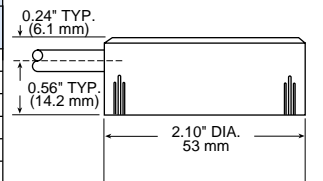
1-8: Ribbon Cable

A-H: Shielded Cable

Pin	10 Pin		16 Pin	
	O.C.	L.D.		
1	A	—	Vcc com	
2	Vcc	Vcc	Vcc Inc	
3	GND	GND	GND Inc	
4	—	—	GND com	
5	—	A'	A'	
6	—	A	A	
7	—	B'	B'	
8	B	B	B	
9	—	Z'	Z'	
10	Z	Z	Z	
11	—	—	U'	
12	—	—	U	
13	—	—	V'	
14	—	—	V	
15	—	—	W'	
16	—	—	W	



Function	Wire Color	
	Incr. Only	Incr. & Comm.
Vcc com	—	RED/WHT
Vcc Inc	RED	RED
GND Inc	BLK	BLK
GND com	—	BLK/WHT
A'	RED/BLK	BLU/BLK
A	GRN	BLU
B'	WHT/BLK	GRN/BLK
B	ORN	GRN
Z'	BLU	VIO/BLK
Z	WHT	VIO
U'	—	BRN/BLK
U	—	BRN
V'	—	GRY/BLK
V	—	GRY
W'	—	WHT/BLK
W	—	WHT



Mating Cable Assembly:
 10 pin, 109524-000x
 16 pin, 109523-000x
 x= length in feet

Ordering Information

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

Code 1: Model	Code 2: PPR, Poles	Code 3: Cover	Code 4: Electrical	Code 5: Hub	Code 6: Termination
M21	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> / <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Ordering Information							
M21	Size 20 Commutating Modular	Incremental channels only		0 No cover 1 Enclosed, end-of-shaft mount 2 Through shaft	0 5V in, open collector out incremental only 1 12V in, open collector out incremental only 3 5V in, line driver out incremental only	Blind hub clamp screw: 0 1/4 in. 1 3/8 in. 2 7/16 in. 3 1/2 in. 4 6 mm 5 8 mm 6 10 mm 7 12 mm	0 Pin Header 1-8 Mating ribbon cable included; 1=1 ft., 2=2 ft., etc. Available when Code 4 is 3 or higher: A-H Shielded cable; A=1 ft., B=2 ft., etc.
		Incremental plus Commutation channels					
		† Available with 4, 6, 8 or 12* pole (12 pole is designated by character "C") Examples: 1024/8 is 1024PPR, 8 pole; 2000/C is 2000PPR, 12 pole					

MOTOR MOUNT

Series F10 Commutating

- Replaces Size 10 Pancake Resolver
- Compact (1.25" Diameter)
- Resolution to 2048 PPR
- Accuracy to ± 2.5 arc-min
- Operating temperature to 120° C does not limit motor performance
- Operating frequency to 300 kHz for fast servo loops



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APPLICATION/INDUSTRY

The Dynapar brand Series F10 encoder provides high performance, cost effective feedback for stepper and servo motor applications.

DESCRIPTION

The F10 offers compact package dimensions and flying leads for a low-profile installation. A size 10 servo ring allows easy mounting and replacement of pancake resolvers with high tolerance to motor shaft movement and 360 degrees of adjustment to align the signal outputs to the shaft position.

A superior optical configuration allows for generous internal component clearance eliminating potential damage at high ambient operating temperatures. High temperature rated grease is standard for extended bearing life.

The use of optically-generated signals for Brushless DC (BLDC) servo control provides higher accuracy and reliability by eliminating the hysteresis found in competitive units with hall-effect sensors, ensuring maximum performance and reliability of the servo system. Compared to most resolvers with accuracy of ± 10 arc-min, the F10 enables superior shaft positioning with accuracy to ± 2.5 arc-min.

FEATURES AND BENEFITS

- The F10 design operates up to 120°C. High temperature materials, innovative phased array sensor technology, and low current requirements stabilize the output signals over a wide range of ambient temperature and output frequencies.
- The F10 mounting configuration allows for direct pancake resolver replacement featuring a jamb nut and tethered servo ring.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental with commutation option, Optical
Resolution: 1024 or 2048 PPR incremental with 6 pole commutation channels
Accuracy: Incremental: ± 2.5 arc-mins. max. edge to any edge; Commutation: ± 6 arc-mins. max.
Phasing for CCW rotation of motor shaft : B leads A by 90° and U leads V leads W by 120°.
Minimum edge separation A to B is 45°.
Index to U channel: +/- 1° mech. index pulse center to U channel edge.
Index Pulse Width: 90° gated A and B low

ELECTRICAL

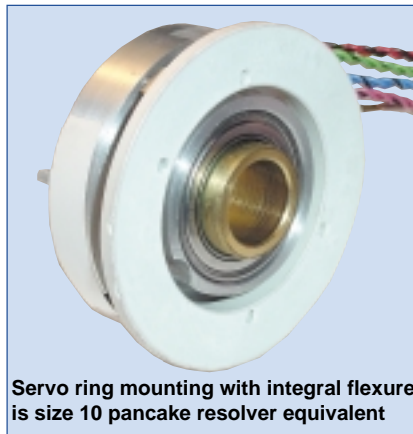
Input Power Requirements: 5 \pm 10% VDC at 100 mA max (incremental and commutation), excluding output load
Output Signals:
Incremental: 26LS31 Differential Line Driver, sink / source 40 mA max.
Commutation: Open Collector w/2.0 k Ω pull-ups, 8 mA sink max.; or 26LS31 Differential Line Driver, sink / source 40 mA max.
Frequency Response: 300 kHz, max.
Termination: Flying leads, stranded 26 AWG, twisted pair, PVC insulation, 6.5" length ± 0.5 "

MECHANICAL

Weight: 1.6 oz. (45 gm) typ.
Dimensions: Outside Diameter : 1.25" (31.7mm), max.; Height: 0.89" (24.1mm), max.
Material: Housing: cast-aluminum;
 Servo Ring: glass reinforced engineering resin;
 Hub: Brass; Disk: 0.030" (0.76mm) thick glass
Moment of Inertia: 2.22X10⁻⁵ in-oz-sec.² (1.6 gm-cm²)
Bore Diameter: 6mm
Bore Dia. Tolerance: +0.001"/-0.000" (+0.025 mm/-0.000 mm)
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Axial movement: ± 0.010 " (± 0.25 mm)
Mounting: 1.045" (26.54mm) servo ring with integral flexure (size 10 pancake resolver equivalent)
Acceleration: 100,000 rad/sec.² max.
Velocity: 5,000 RPM continuous; 12,000 RPM peak
Bearing Life: [(3.6 X 10⁹) / RPM] Hours ; e.g. 605,000 hours @6,000 RPM

ENVIRONMENTAL

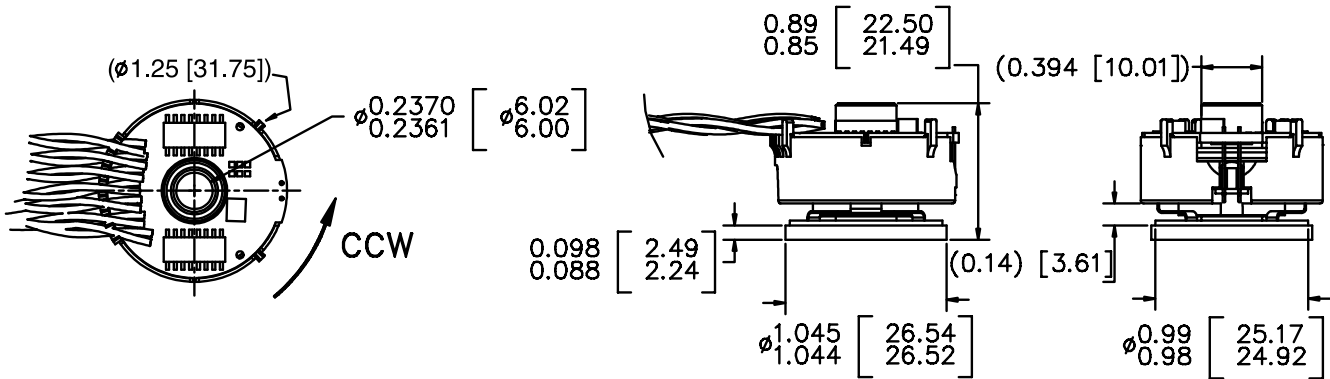
Operating Temperature: 0° to +120°C
Storage Temperature: 0° to +120°C
Shock: 50 Gs for 6 msec duration
Vibration: 2.5 Gs at 5 to 2000 Hz
Relative Humidity: 90% non-condensing



Servo ring mounting with integral flexure is size 10 pancake resolver equivalent

Series F10 Commutating

Dimensions

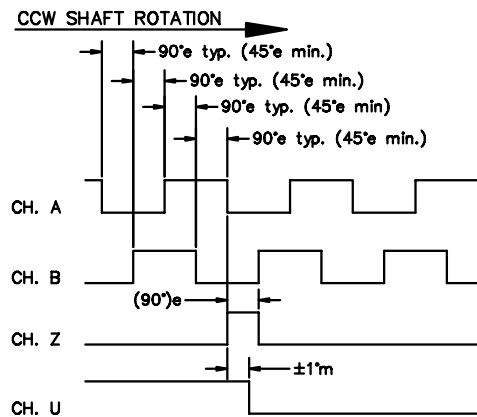


Connections

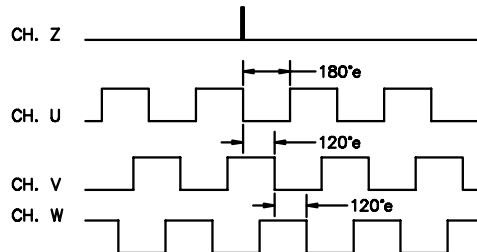
Function*	Cable Wire Color
VCC	RED
GND	BLACK
A	BLUE/BLACK
A	BLUE
B	GREEN/BLACK
B	GREEN
Z	VIOLET/BLACK
Z	VIOLET
U	BROWN/BLACK
U	BROWN
V	GRAY/BLACK
V	GRAY
W	WHITE/BLACK
W	WHITE

* Function availability dependant on Model

Waveforms



Waveforms below show relationship between CH. Z, U, V & W (scale differs from above)



Ordering Information

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

Code 1: Model	Code 2: PPR, Poles	Code 3: Mount	Code 4: Electrical	Code 5: Shaft/Bore	Code 6: Termination
F10	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Ordering Information					
F10 Size 10 Commutating Encoder	Incremental channels only 1024/0 2048/0	0 Servo mount 1.045 Diameter x .095 thick	Available when Code 2 is XXXX/0 3 5V in, line driver out incremental only	4 6mm thru bore	0 6.5" ±0.5" Twisted Pair Flying Leads
	Incremental plus Commutation channels 1024/6 2048/6		Available when Code 2 is XXXX/6 6 5V in, line driver out for incremental; 5V in, open collector out for commutation 9 5V in, line driver out for incremental; 5V in, line driver out for commutation		

MOTOR MOUNT

Series F14 Commutating

- Premium servo motor feedback in a compact, reliable, and easy-to-install package
- Outside diameter 1.55" (40 mm)
- Resolution to 5,000 PPR for low speed smoothness
- Frequency response to 500 kHz
- Operation to 120° C doesn't limit machine performance



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series F14 encoder provides high performance, cost effective feedback for stepper and servo motor controls.

DESCRIPTION

The F14 offers compact package dimensions and a pluggable pin header. A compliant tether allows easy mounting with high tolerance to motor shaft movement and 30 degrees of adjustment to align the signal outputs to the shaft position.

A superior optical configuration allows for generous internal component clearance eliminating potential damage at high ambient operating temperatures. High temperature rated grease is standard for extended bearing life. No special tools are required for installation.

The use of optically-generated signals for Brushless DC (BLDC) servo control provides higher accuracy and reliability by eliminating the hysteresis found in competitive units with hall effect sensors, ensuring maximum performance and reliability of the servo system.

FEATURES AND BENEFITS

- The F14 design operates up to 120°C. The high temperature materials, phased array sensor, and low current requirements stabilize the output signals over a wide range of input voltage, ambient temperature, or output frequencies.
- The F14 features a clamping system, available in top or bottom locations, which does not mar the shaft, will not loosen over time and provides superior clamping force.
- For fast, easy installation a slot is provided on the encoder hollow shaft, which when aligned to molded mark on cover, sets the index. The housing may be rotated to allow further adjustment of the index, or fine alignment of the commutation channels to the BLDC motor windings.
- The F14 outputs are protected from short circuits and operate on 5 VDC power.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental with commutation option, Optical
Resolution: 200, 400, 500, 1000, 1024, 2000, 2048, 2500, 4096, 5000 PPR incremental with 4, 6 and 8 pole commutation channels
Accuracy: Incremental: ± 2.5 arc-mins. max. edge to any edge; Commutation: ± 6 arc-mins. max.
Phasing for CCW rotation of motor shaft (viewing encoder cover): A leads B by 90° and U leads V leads W by 120°.
Minimum edge separation A to B is 45°.
Index to U channel: +/- 1° mech. index pulse center to U channel edge.
Index Pulse Width: 90° gated A and B high; (180° gated B high gating options available - consult factory)

ELECTRICAL

Input Power Requirements: 5 \pm 10% VDC at 150 mA max (incremental only); 175 mA max. (incremental and commutation), excluding output load
Output Signals:
 Line Driver: sink / source 40 mA max.,
 Open Collector Incremental (\leq 1024 PPR): 16 mA sink max.
 Open Collector Commutation: 30 mA sink max. (2.0 k Ω pull-ups in encoder)
Frequency Response:
 PPR \leq 1024: 250 kHz; PPR $>$ 1024: 500 kHz
Termination: 16 pin, fully shielded, 2mm pitch, double row header. Accessory mating cable assembly available: 26 AWG twisted pair, jacketed and shielded with copper drain wire

MECHANICAL

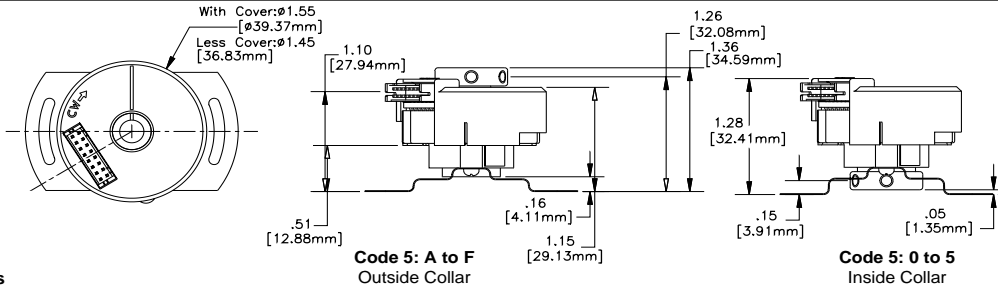
Weight: 1.6 oz. (45gm) typ.
Dimensions: Outside Diameter with cover: 1.55" (39.8mm), without cover 1.45" (36.8mm); Outside collar height 1.36" (34.6mm), inside collar height 1.28" (32.4mm)
Material: Bearing housing: aluminum; Cover: high temperature, glass filled polymer; Hub: Brass; Disk: 0.030" thick glass
Finish: Cover: RAL 7010 (dark grey)
Moment of Inertia: 8.2X10⁻⁵ in-oz sec.² (5.8 gm-cm²)
Hub Diameters: 1/4", 6mm, 8mm standard
Bore Dia. Tolerance: +0.001"/-0.000" (+0.025 mm/-0.000 mm)
Mating Shaft Length: 1.35" (34.3 mm) minimum for outside shaft collar. 0.50 inch minimum for inside shaft collar
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Axial movement: ± 0.060 " (± 1.52 mm)
Mounting: Two standard configurations are available for tethers. A choice of U.S. or Metric screws are included. Mounting holes should be 0.01" (0.254 mm) true position to shaft for best encoder operation.
Shaft clamp: 2 #6-32 set screws in collar around hub shaft (will not mar shaft)
Electrical/Mechanical Alignment Range: $\pm 15^\circ$ mechanical typical (see tether options)
Acceleration: 100,000 rad/sec.² max.
Max. Velocity: RPM = (Frequency / PPR) x 60; or 12,000 RPM, whichever is less;
Bearing Life: [(1.4 X 10⁹) / RPM] Hours ; e.g. 230,000 hours @ 6,000 RPM
(Based on bearing manufacturer's suggested calculation for 6801ZZ with 44N equivalent dynamic load - including preload and tether reaction loads - at 6000 RPM continuous with adequate lubrication)

ENVIRONMENTAL

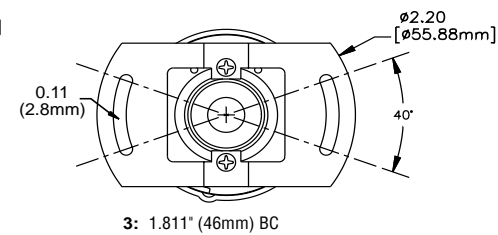
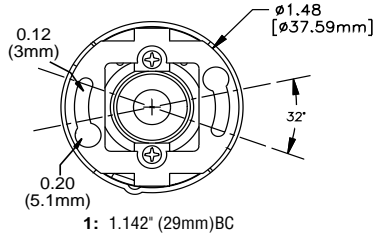
Operating Temperature: 0° to +120°C
Storage Temperature: -40° to +120°C
Shock: 100 Gs for 6 msec duration
Vibration: 2.5 Gs at 5 to 2000 Hz
Relative Humidity: 90% non-condensing
Enclosure Rating: NEMA 1 / IP40 (for models with cover)

Series F14 Commutating

Dimensions



Code 3: Tethers



Electrical Connections

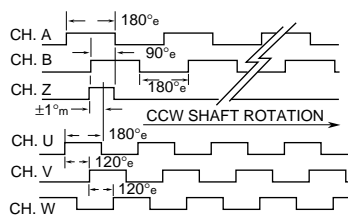
Pin	Function*	Cable Wire Color
1	VCC	RED
2	U	Brown
3	GND	BLACK
4	V	GRAY
5	A	BLUE
6	W	WHITE
7	A̅	BLUE/BLACK
8	NONE	NONE
9	B	GREEN
10	U̅	BROWN/BLACK
11	B̅	GREEN/BLACK
12	V̅	GRAY/BLACK
13	Z	VIOLET
14	W̅	WHITE/BLACK
15	Z̅	VIOLET/BLACK
16	NONE	NONE

* Function availability dependent on Model

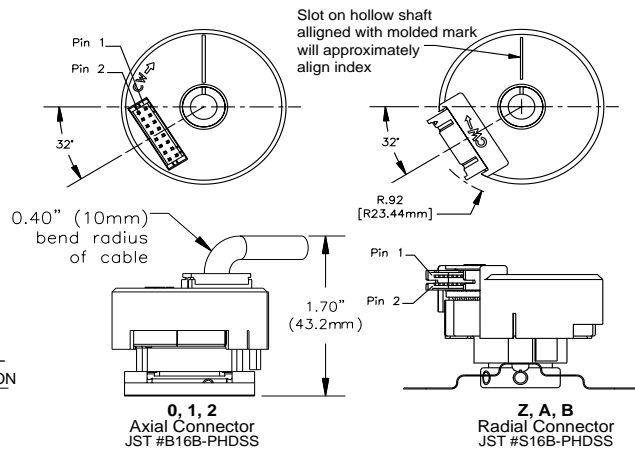
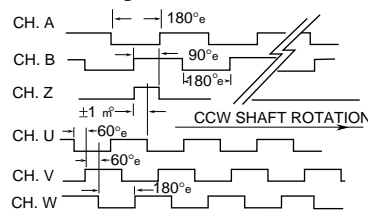
Mating Cable Assembly:
 Incremental only, 111752-000x
 Incremental + Comm., 111753-000x
 x = length in feet

Output Waveforms

Signal Format A



Signal Format B



Ordering Information

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

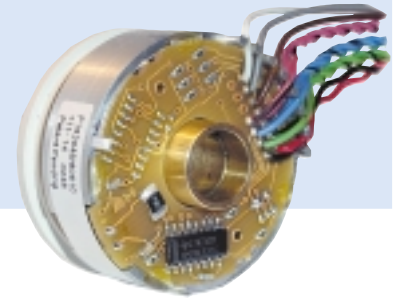
Code 1: Model	Code 2: PPR, Poles	Code 3: Tether	Code 4: Electrical	Code 5: Shaft/Bore	Code 6: Termination																																									
F14	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>																																									
Ordering Information																																														
F14	Size 14 Commutating Encoder	Incremental channels only	0 No Tether	Available when Code 2 is ≤ 1024/0	Inside Collar: 0 1/4 in. 4 6 mm 5 8 mm Outside Collar: A 1/4 in. E 6 mm F 8 mm																																									
		0200/0 2000/0 0400/0 2048/0 0500/0 2500/0 1000/0 4096/0 1024/0 5000/0	1 2 #2 on 1.181" Diameter 3 2 #4 on 1.811" Diameter 6 2 M2.5 on 30 mm Diameter 8 2 M3 on 46 mm Diameter	0 5V in, open collector out incremental only - Format A C 5V in, open collector out incremental only - Format B Available when Code 2 is XXXX/0 3 5V in, line driver out incremental only - Format A D 5V in, line driver out incremental only - Format B Available when Code 2 is XXXX/4, XXXX/6, or XXXX/8 6 5V in, line driver out incr.; 5V in, open collector out comm. Format A E 5V in, line driver out incr.; 5V in, open collector out comm. - Format B 9 5V in, line driver out incr.; 5V in, line driver out comm. Format A F 5V in, line driver out incr.; 5V in, line driver out comm. - Format B		<table border="1"> <thead> <tr> <th rowspan="2">Code</th> <th colspan="2">Connector/Cable/Wire</th> <th rowspan="2">Length</th> </tr> <tr> <th>Axial</th> <th>Radial</th> <th>Pigtail</th> </tr> </thead> <tbody> <tr><td>0</td><td>Z</td><td>N/A</td><td>None</td></tr> <tr><td>1</td><td>A</td><td>J</td><td>1 Ft.</td></tr> <tr><td>2</td><td>B</td><td>K</td><td>2 Ft.</td></tr> <tr><td>3</td><td>C</td><td>L</td><td>3 Ft.</td></tr> <tr><td>4</td><td>D</td><td>M</td><td>4 Ft.</td></tr> <tr><td>5</td><td>E</td><td>N</td><td>5 Ft.</td></tr> <tr><td>6</td><td>F</td><td>P</td><td>6 Ft.</td></tr> <tr><td>7</td><td>G</td><td>Q</td><td>7 Ft.</td></tr> <tr><td>8</td><td>H</td><td>R</td><td>8 Ft.</td></tr> </tbody> </table>	Code	Connector/Cable/Wire		Length	Axial	Radial	Pigtail	0	Z	N/A	None	1	A	J	1 Ft.	2	B	K	2 Ft.	3	C	L	3 Ft.	4	D	M	4 Ft.	5	E	N	5 Ft.	6	F	P	6 Ft.	7	G	Q	7 Ft.	8
Code	Connector/Cable/Wire		Length																																											
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8	H	R	8 Ft.																																											
		Incremental plus Commutation channels 0500/t 2048/t 1000/t 2500/t 1024/t 4096/t 2000/t 5000/t	<table border="1"> <thead> <tr> <th colspan="4">CONNECTION OPTIONS</th> </tr> </thead> <tbody> <tr> <td colspan="4">You may choose an integral connector mounted in axial or radial position. Available with or without mating connector/cable.</td> </tr> <tr> <td colspan="4">Alternatively, a direct-solder pigtail cable is offered.</td> </tr> </tbody> </table>			CONNECTION OPTIONS				You may choose an integral connector mounted in axial or radial position. Available with or without mating connector/cable.				Alternatively, a direct-solder pigtail cable is offered.																																
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Alternatively, a direct-solder pigtail cable is offered.																																														

† Available with 4, 6 or 8 pole.
 e.g. 1000/6 is 1000PPR with 6 poles

MOTOR MOUNT

Series F15 Commutating

- Replaces Size 15 Pancake Resolver
- Compact (1.45" Diameter)
- Resolution to 2048 PPR
- Accuracy to ± 2.5 arc-min
- Operating temperature to 120° C does not limit motor performance
- Operating frequency to 300 kHz for fast servo loops



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series F15 encoder provides high performance, cost effective feedback for stepper and servo motor applications. The F15 offers compact package dimensions and flying leads for a low-profile installation.

DESCRIPTION

A size 15 servo ring allows easy mounting and replacement of pancake resolvers with high tolerance to motor shaft movement and 360 degrees of adjustment to align the signal outputs to the shaft position.

A superior optical configuration allows for generous internal component clearance eliminating potential damage at high ambient operating temperatures. High temperature rated grease is standard for extended bearing life.

The use of optically-generated signals for Brushless DC (BLDC) servo control provides higher accuracy and reliability by eliminating the hysteresis found in competitive units with hall-effect sensors, ensuring maximum performance and reliability of the servo system. Compared to most resolvers with accuracy of ± 10 arc-min, the F15 enables superior shaft positioning with accuracy to ± 2.5 arc-min.

FEATURES AND BENEFITS

- The F15 design operates up to 120°C. The High temperature materials, innovative sensor technology, and low current requirements stabilize the output signals over a wide range of ambient temperature and output frequencies.
- The F15 mounting configuration allows for direct pancake resolver replacement featuring a jamb nut and tethered servo ring.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental with commutation option, Optical
Resolution: 1024 or 2048 PPR incremental with 6 or 8 pole commutation channels
Accuracy: Incremental: ± 2.5 arc-mins. max. edge to any edge; Commutation: ± 6 arc-mins. max.
Phasing for CCW rotation of motor shaft : B leads A by 90° and U leads V leads W by 120 °.
Minimum edge separation A to B is 45°.
Index to U channel: +/- 1 °mech. index pulse center to U channel edge.
Index Pulse Width: 90° gated A and B low

ELECTRICAL

Input Power Requirements: 5 \pm 10% VDC at 100 mA max (incremental and commutation), excluding output load
Output Signals:
Incremental: 26LS31 Differential Line Driver, sink / source 40 mA max.
Commutation: Open Collector w/2.0 k Ω pull-ups, 8 mA sink max.; or 26LS31 Differential Line Driver, sink / source 40 mA max.
Frequency Response: 300 kHz, max.
Termination: Flying leads, stranded 26 AWG, twisted pair, PVC insulation, 6.5" length ± 0.5 "



Servo ring mounting with integral flexure is size 15 pancake resolver equivalent

MECHANICAL

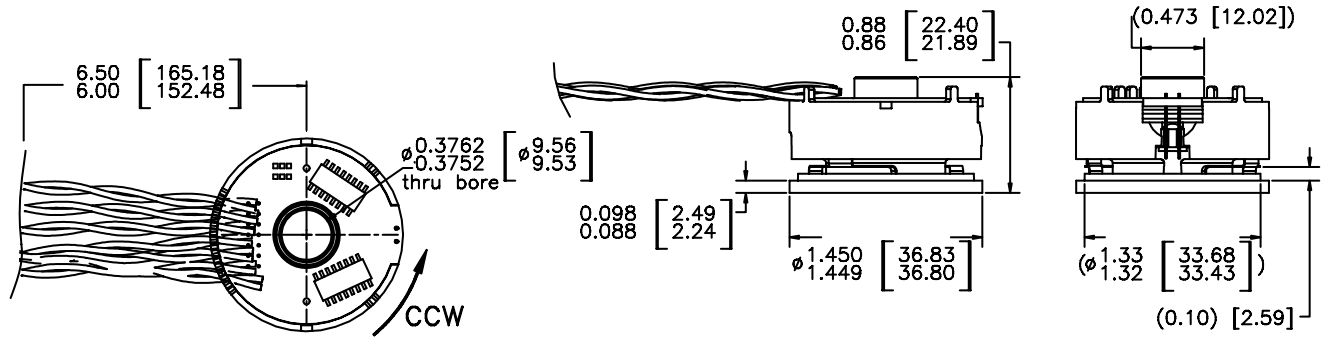
Weight: 1.6 oz. (45 gm) typ.
Dimensions: Outside Diameter : 1.45" (36.8mm), max.; Height: 0.87" (22.1mm), max.
Material: Housing: cast-aluminum;
 Servo Ring: glass reinforced engineering resin;
 Hub: Brass; Disk: 0.030" (0.76mm) thick glass
Moment of Inertia: 3.59X10⁻⁵ in-oz-sec.² (2.5 gm-cm²)
Bore Diameter: 0.375" (9.53mm)
Bore Dia. Tolerance: +0.001"/-0.000" (+0.025 mm/-0.000 mm)
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Axial movement: ± 0.010 " (± 0.25 mm), max.
Mounting: 1.450" (36.83mm) servo ring with integral flexure (size 15 pancake resolver equivalent)
Acceleration: 100,000 rad/sec.² max.
Velocity: 5,000 RPM continuous; 12,000 RPM peak
Bearing Life: [(3.6 X 10⁹) / RPM] Hours ; e.g. 605,000 hours @6,000 RPM

ENVIRONMENTAL

Operating Temperature: 0° to +120°C
Storage Temperature: 0° to +120°C
Shock: 50 Gs for 6 msec duration
Vibration: 2.5 Gs at 5 to 2000 Hz
Relative Humidity: 90% non-condensing

Series F15 Commutating

Dimensions

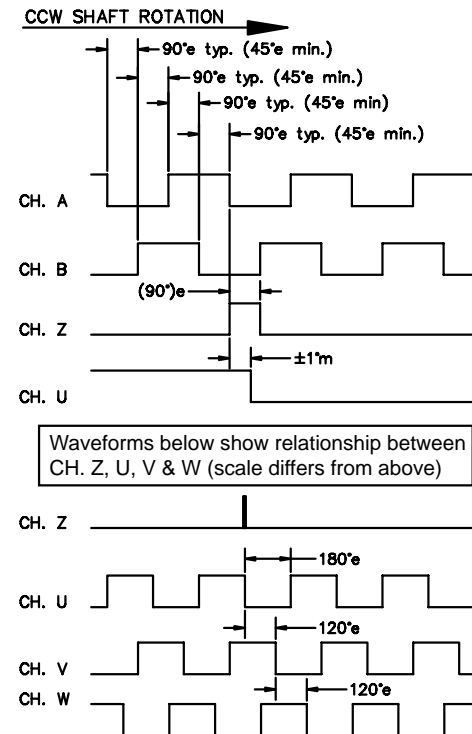


Connections

Function*	Cable Wire Color
VCC	RED
GND	BLACK
A	BLUE/BLACK
A	BLUE
B	GREEN/BLACK
B	GREEN
Z ⁻	VIOLET/BLACK
Z	VIOLET
U ⁻	BROWN/BLACK
U	BROWN
V ⁻	GRAY/BLACK
V	GRAY
W ⁻	WHITE/BLACK
W	WHITE

* Function availability dependant on Model

Waveforms



MOTOR MOUNT

Ordering Information

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

Code 1: Model	Code 2: PPR, Poles	Code 3: Mount	Code 4: Electrical	Code 5: Shaft/Bore	Code 6: Termination
F15	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	0	<input type="checkbox"/>	1	0
Ordering Information					
F15 Size 15 Commutating Encoder	Incremental channels only 1024/0 2048/0	0 Servo mount 1.450 Diameter x .095 thick	Available when Code 2 is XXXX/0 3 5V in, line driver out incremental only	1 3/8 in. thru bore	0 6.5" ±0.5" Twisted Pair Flying Leads
	Incremental plus Commutation channels 1024/6 2048/6 Consult factory for other configurations 1024/8 2048/8		Available when Code 2 is XXXX/6 or 8 6 5V in, line driver out for incremental; 5V in, open collector out for commutation 9 5V in, line driver out for incremental; 5V in, line driver out for commutation		

Series F18 Commutating

- Premium servo motor feedback in a compact, reliable, and easy-to-install package
- Outside diameter 1.96" (50 mm)
- Resolution to 10,000 PPR for low speed smoothness
- Frequency response to 500 kHz
- Operation to 120° C doesn't limit machine performance



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series F18 encoder provides high performance, cost effective feedback for stepper and servo motor controls. The F18 offers compact package dimensions and a pluggable pin header.

DESCRIPTION

A compliant tether allows easy mounting with high tolerance to motor shaft movement and 30 degrees of adjustment to align the signal outputs to the shaft position.

A superior optical configuration allows for generous internal component clearance eliminating potential damage at high ambient operating temperatures. High temperature rated grease is standard for extended bearing life. No special tools are required for installation.

The use of optically-generated signals for Brushless DC (BLDC) servo control provides higher accuracy and reliability by eliminating the hysteresis found in competitive units with hall effect sensors, ensuring maximum performance and reliability of the servo system.

FEATURES AND BENEFITS

- The F18 design operates up to 120°C. The high temperature materials, phased array sensor, and low current requirements stabilize the output signals over a wide range of input voltage, ambient temperature, or output frequencies.
- The F18 features a clamping system, available in top or bottom locations, which does not mar the shaft, will not loosen over time and provides superior clamping force.
- For fast, easy installation a slot is provided on the encoder hollow shaft, which when is aligned to molded mark on cover, sets the index. The housing may be rotated to allow further adjustment of the index, or fine alignment of the commutation channels to the BLDC motor windings.
- The F18 outputs are protected from short circuits and operate on 5 VDC power.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental with commutation option, Optical
Resolution: 500, 512, 1000, 1024, 2000, 2048, 2500, 4096, 5000, 8192, 10,000 PPR incremental with 4, 6, 8 or 12 pole commutation channels
Accuracy: Incremental: ± 2.5 arc-mins. max. edge to any edge; Commutation: ± 6 arc-mins. max.
Phasing for CCW rotation of motor shaft (viewing encoder cover): A leads B by 90° and U leads V leads W by 120°.
Minimum edge separation A to B is 45°.
Index to U channel: +/- 1° mech. index pulse center to U channel edge.
Index Pulse Width: 90° gated A and B high; (180° gated B high gating options available - consult factory)

ELECTRICAL

Input Power Requirements: 5 \pm 10% VDC at 150 mA max (incremental only); 175 mA max. (incremental and commutation), excluding output load
Output Signals:
 Line Driver: sink / source 40 mA max.,
 Open Collector Incremental (\leq 2048 PPR): 16 mA sink max.
 Open Collector Commutation: 30 mA sink max. (2.0 k Ω pull-ups in encoder)
Frequency Response:
 PPR \leq 2048: 250 kHz; PPR > 2048: 500 kHz
Termination: 16 pin, fully shielded, 2mm pitch, double row header. Accessory mating cable assembly available: 26 AWG twisted pair, jacketed and shielded with copper drain wire

MECHANICAL

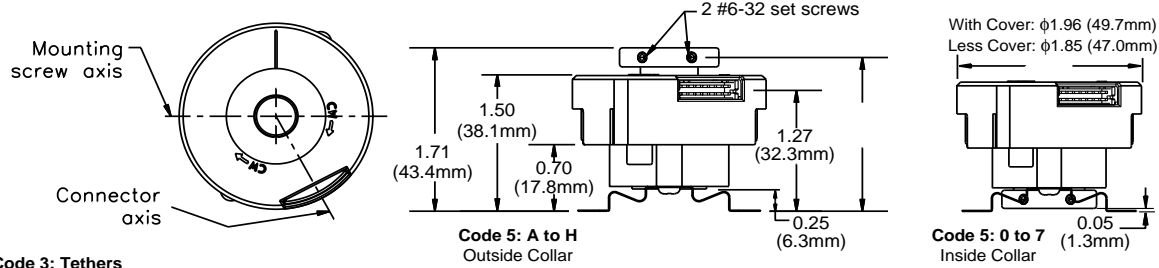
Weight: 4 oz. (110 gm) typ.
Dimensions: Outside Diameter with cover: 1.96" (49.8mm), without cover 1.85" (47.0mm); Outside collar height 1.71" (43.4mm), inside collar height 1.50" (38.1mm)
Material: Bearing housing: aluminum; Cover: high temperature, glass filled polymer; Hub: Brass; Disk: 0.030" thick glass
Finish: Cover: RAL 7010 (dark grey)
Moment of Inertia: 5.3X10⁻⁴ in-oz sec.² (37.3 gm-cm²)
Hub Diameters: 1/4", 3/8", 7/16", 1/2", 6mm, 8mm, 10mm, 12mm standard
Bore Dia. Tolerance: +0.001"/-0.000" (+0.025 mm/-0.000 mm)
Mating Shaft Length: 1.62" (41 mm) minimum for outside shaft collar. 0.50 inch minimum for inside shaft collar
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Axial movement: ± 0.060 " (± 1.52 mm)
Mounting: Four standard configurations are available for tethers. A choice of U.S. and Metric screws are included. Mounting holes should be 0.01" (0.254 mm) true position to shaft for best encoder operation.
Shaft clamp: 2 #6-32 set screws in collar around hub shaft (will not mar shaft)
Electrical/Mechanical Alignment Range: $\pm 15^\circ$ mechanical typical (see tether options)
Acceleration: 100,000 rad/sec.² max.
Max. Velocity: RPM = (Frequency / PPR) x 60; or 12,000 RPM, whichever is less;
Bearing Life: [(3.6 X 10⁹) / RPM] Hours ; e.g. 605,000 hours @6,000 RPM
(Based on bearing manufacturer's suggested calculation for 6803ZZ with 37N equivalent dynamic load - including preload and tether reaction loads - at 6000 RPM continuous with adequate lubrication)

ENVIRONMENTAL

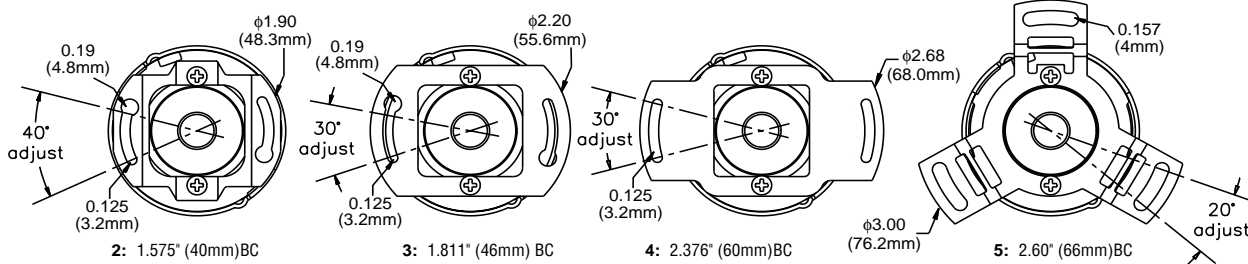
Operating Temperature: 0° to +120°C
Storage Temperature: -40° to +120°C
Shock: 100 Gs for 6 msec duration
Vibration: 2.5 Gs at 5 to 2000 Hz
Relative Humidity: 90% non-condensing
Enclosure Rating: NEMA 1 / IP40 (for models with cover)

Series F18 Commutating

Dimensions



Code 3: Tethers



Electrical Connections

Output Waveforms

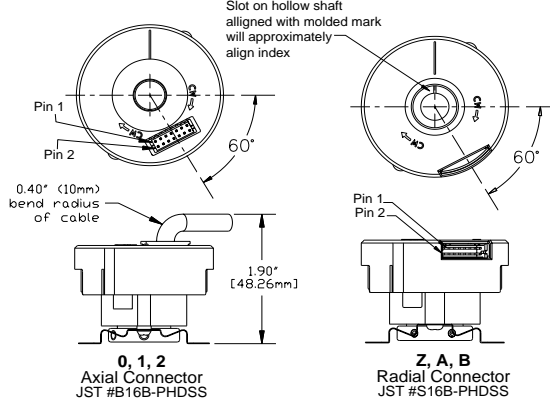
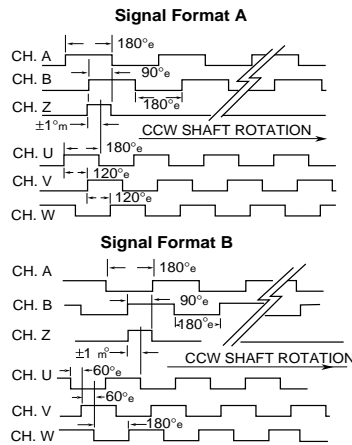
Code 6: Termination

Pin	Function*	Cable Wire Color
1	VCC	RED
2	U	Brown
3	GND	BLACK
4	V	GRAY
5	A	BLUE
6	W	WHITE
7	A	BLUE/BLACK
8	NONE	NONE
9	B	GREEN
10	U	BROWN/BLACK
11	B	GREEN/BLACK
12	V	GRAY/BLACK
13	Z	VIOLET
14	W	WHITE/BLACK
15	Z	VIOLET/BLACK
16	NONE	NONE

* Function availability dependant on Model

Mating Cable Assembly:

Incremental only, 111752-000x
Incremental + Comm., 111753-000x
x= length in feet



Ordering Information

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

Code 1: Model	Code 2: PPR, Poles	Code 3: Tether	Code 4: Electrical	Code 5: Shaft/Bore	Code 6: Termination
F18	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Ordering Information

F18	Size 18 Commutating Encoder	Incremental channels only		Code 3: Tether	Code 4: Electrical	Code 5: Shaft/Bore	Code 6: Termination			Length
		Connector/Cable	Wire				Length			
		0500/0	2500/0	0 No Tether	Available when Code 2 is $\leq 2048/0$	Inside Collar:	0	1/4 in.		
		0512/0	4096/0	2 2 #2 on 1.575" Diameter	0 5V in, open collector out incremental only	0	3/8 in.			
		1000/0	5000/0	3 2 #4 on 1.811" Diameter	C 5V in, open collector out incremental only - reverse phase	1	7/16 in.			
		1024/0	8192/0	4 2 #4 on 2.376" Diameter	Available when Code 2 is XXXX/0	2	1 1/2 in.			
		2000/0	10E3/0*	5 3 #4 on 2.60" Diameter	3 5V in, line driver out incremental only	3	6 mm			
		2048/0	*= 10000/0	7 2 M2.5 on 40 mm Diameter	D 5V in, line driver out incremental only - reverse phase	4	8 mm			
		Incremental plus Commutation channels		8 2 M3 on 46 mm Diameter	Available when Code 2 is XXXX/4, XXXX/6, XXXX/8 or XXXX/C	5	10 mm			
		0500/t	2500/t	9 2 M3 on 60 mm Diameter	6 5V in, line driver out for incremental; 5V in, open collector out for commutation	6	12 mm			
		0512/t	4096/t	8 2 M3 on 46 mm Diameter	E 5V in, line driver out for incremental; 5V in, open collector out for commutation - reverse phase	7		Outside Collar:		
		1000/t	5000/t	9 2 M3 on 60 mm Diameter	9 5V in, line driver out for incremental; 5V in, line driver out for commutation	A	1/4 in.	A	J	1 Ft.
		1024/t	8192/t	A 3 M3 on 66 mm Diameter	F 5V in, line driver out for incremental; 5V in, line driver out for commutation - reverse phase	B	3/8 in.	B	K	2 Ft.
		2000/t	10E3/t*			C	7/16 in.	C	L	3 Ft.
		2048/t	*= 10000/t			D	1/2 in.	D	M	4 Ft.
						E	6 mm	E	N	5 Ft.
						F	8 mm	F	P	6 Ft.
						G	10 mm	G	Q	7 Ft.
						H	12 mm	H	R	8 Ft.

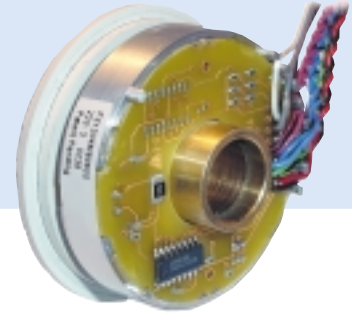
† Available with 4, 6, 8 or 12 pole. (12 pole is designated by character "C")
Examples: 1024/8 is 1024PPR, 8 pole; 2000/C is 2000PPR, 12 pole

CONNECTION OPTIONS
You may choose an integral connector mounted in axial or radial position. Available with or without mating connector/cable.
Alternatively, a direct-solder pigtail cable is offered.

MOTOR MOUNT

Series F21 Commutating

- Replaces Size 21 Pancake Resolver
- Compact (2.06" Diameter)
- Resolution to 2048 PPR
- Accuracy to ± 2.5 arc-min
- Operating temperature to 120° C does not limit motor performance
- Operating frequency to 300 kHz for fast servo loops



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series F21 encoder provides high performance, cost effective feedback for stepper and servo motor applications. The F21 offers compact package dimensions and flying leads for a low-profile installation.

DESCRIPTION

A size 21 servo ring allows easy mounting and replacement of pancake resolvers with high tolerance to motor shaft movement and 360 degrees of adjustment to align the signal outputs to the shaft position.

A superior optical configuration allows for generous internal component clearance eliminating potential damage at high ambient operating temperatures. High temperature rated grease is standard for extended bearing life.

The use of optically-generated signals for Brushless DC (BLDC) servo control provides higher accuracy and reliability by eliminating the hysteresis found in competitive units with hall-effect sensors, ensuring maximum performance and reliability of the servo system. Compared to most resolvers with accuracy of ± 10 arc-min, the F21 enables superior shaft positioning with accuracy to ± 2.5 arc-min.

FEATURES AND BENEFITS

- The F21 design operates up to 120°C. The High temperature materials, innovative sensor technology, and low current requirements stabilize the output signals over a wide range of ambient temperature and output frequencies.
- The F21 mounting configuration allows for direct pancake resolver replacement featuring a jamb nut and tethered servo ring.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental with commutation option, Optical
Resolution: 1024 or 2048 PPR incremental with 8 or 10 pole commutation channels
Accuracy: Incremental: ± 2.5 arc-mins. max. edge to any edge; Commutation: ± 6 arc-mins. max.
Phasing for CCW rotation of motor shaft :
 B leads A by 90° and U leads V leads W by 120°.
Minimum edge separation A to B is 45°.
Index to U channel: +/- 1° mech. index pulse center to U channel rising edge.
Index Pulse Width: 90° gated A and B low

ELECTRICAL

Input Power Requirements: 5 \pm 10% VDC at 100 mA max (incremental and commutation), excluding output load
Output Signals:
Incremental: 26LS31 Differential Line Driver, sink / source 40 mA max.
Commutation: Open Collector w/2.0 k Ω pull-ups, 8 mA sink max.; or 26LS31 Differential Line Driver, sink / source 40 mA max.
Frequency Response: 300 kHz, max.
Termination: Flying leads, stranded 26 AWG, twisted pair, PVC insulation, 6.5" length ± 0.5 "

MECHANICAL

Weight: 3.5 oz. (90 gm) typ.
Dimensions: Outside Diameter : 2.062" (52.4mm), max.; Height: 1.01" (25.65mm), max.
Material: Housing: cast-aluminum; Servo Ring: glass reinforced engineering resin; Hub: Brass; Disk: 0.030" (0.76mm) thick glass
Moment of Inertia: 2.66X10⁻⁴ in-oz-sec.² (18.8 gm-cm²)
Bore Diameter: 0.50" (12.7mm)
Bore Dia. Tolerance: +0.0017/-0.000" (+0.025 mm/-0.000 mm)
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Axial movement: ± 0.010 " (± 0.25 mm), max.
Mounting: 2.062" (52.4mm) servo ring with integral flexure (size 21 pancake resolver equivalent)
Acceleration: 100,000 rad/sec.² max.
Velocity: 5,000 RPM continuous; 12,000 RPM peak
Bearing Life: [(3.6 X 10⁹) / RPM] Hours ; e.g. 605,000 hours @6,000 RPM

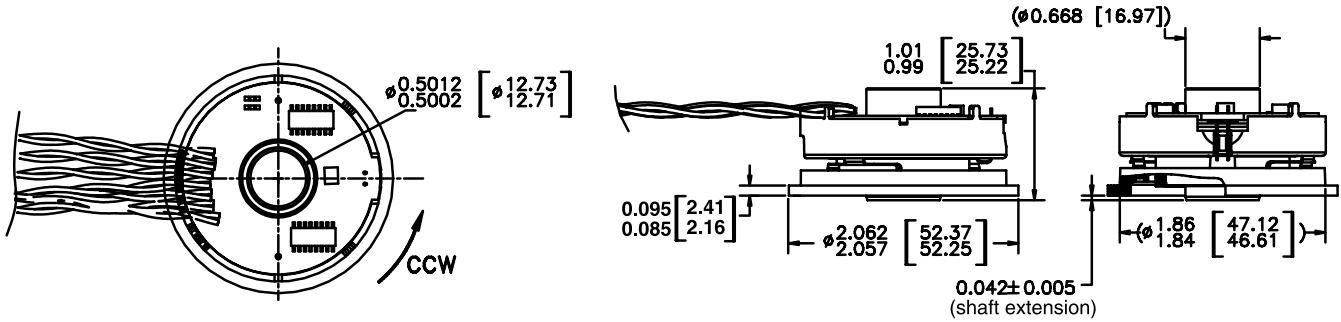
ENVIRONMENTAL

Operating Temperature: 0° to +120°C
Storage Temperature: 0° to +120°C
Shock: 50 Gs for 6 msec duration
Vibration: 2.5 Gs at 5 to 2000 Hz
Relative Humidity: 90% non-condensing



Series F21 Commutating

Dimensions

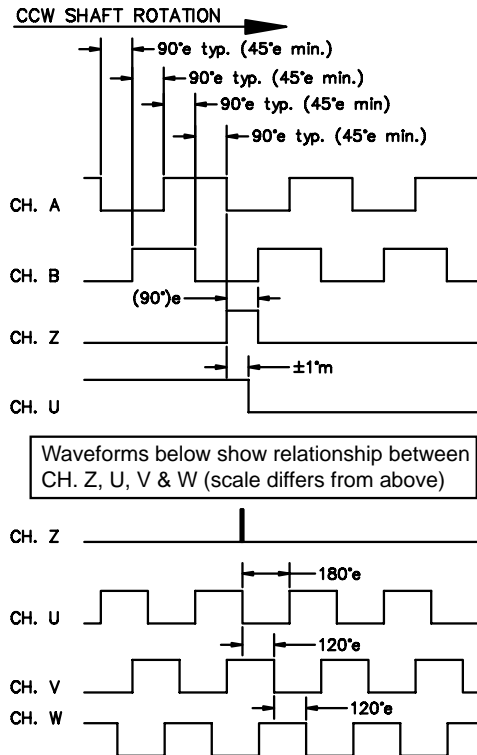


Connections

Function*	Cable Wire Color
VCC	RED
GND	BLACK
A	BLUE/BLACK
A	BLUE
B	GREEN/BLACK
B	GREEN
Z	VIOLET/BLACK
Z	VIOLET
U	BROWN/BLACK
U	BROWN
V	GRAY/BLACK
V	GRAY
W	WHITE/BLACK
W	WHITE

* Function availability dependant on Model

Waveforms



Waveforms below show relationship between CH. Z, U, V & W (scale differs from above)

MOTOR MOUNT

Ordering Information

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

Code 1: Model	Code 2: PPR, Poles	Code 3: Mount	Code 4: Electrical	Code 5: Shaft/Bore	Code 6: Termination	
F21	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Ordering Information						
F21	Size 21 Commutating Encoder	Incremental channels only 1024/0 2048/0	0 Servo mount 2.062 Diameter x.090 thick	Available when Code 2 is XXXX/0 3 5V in, line driver out incremental only Available when Code 2 is XXXX/8 or C 6 5V in, line driver out for incremental; 5V in, open collector out for commutation 9 5V in, line driver out for incremental; 5V in, line driver out for commutation	3 1/2 in. thru bore	0 6.5" ±0.5" Twisted Pair Flying Leads
		Incremental plus Commutation channels 1024/8 Note: "C"= 10 poles. 2048/8 Consult factory for other configurations 1024/C 2048/C				

Series H20 Hub Shaft

- Simple installation on motor or machine with hub shaft and flexible spring mount
- Ultra-reliable design using long-life bearing
- Available unbreakable code disk
- Complete electrical protection and noise immunity tested to EN50082-2
- Available with environmental sealing to NEMA4 / IP66
- Economical solution for medium resolution applications



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series H20 Hub Shaft encoder is a rugged, reliable and economical encoder for direct coupling to motors or machine shafts.

DESCRIPTION

The flexible mount and integral hub shaft reduces cost, simplifies installation and reduces the overall depth by eliminating the traditional flange adapter and flexible coupling. Models with resolutions of 1024 or less are equipped with an unbreakable code disk that meets the demands of the most severe shock and vibration generating processes; use of long life bearings maintains internal alignment, avoiding failure due to the disk "crashes" so typical in competitive encoders. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. A NEMA4 / IP66 sealing option protects against damage from contamination.

The Series H20 Hub Shaft encoder is available with 3/8" or 5/8" I.D. hub shafts. Electrical options include: resolutions from 1 to 2540 pulses/revolution; unidirectional or bidirectional operation with optional index; single ended open collector or push-pull outputs, or differential line drivers; and a connector or cable exit terminations.

The Series H20 utilize the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Integral hub shaft and flexible spring mount
- Unbreakable, code disk and long life 80 lb. bearing option
- Extended temperature range available
- NEMA4 / IP66 washdown rating option

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2540 PPR (pulses/revolution)
Accuracy: (worst case any edge to any other edge) ≤ 1024 PPR (metal disk): ± 7.5 arc-min.
 > 1024 PPR (glass disk): ± 2.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CCW shaft rotation as viewed from the shaft end of the encoder
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

Mating Connector:

6 pin, style MS3106A-14S-6S (MCN-N4);
 7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Mating Shaft Requirements:

Length: 0.38" min., 0.50" max.
 Runout: 0.010" max. TIR
 Endplay: ± 0.025 " max.
Shaft Speed:
 Resolutions ≤ 1024 PPR: 10,000 RPM max.
 Resolutions > 1024 PPR: 5,000 RPM max.
Starting Torque: (max at 25 °C)
 without shaft seal: 1.0 oz-in;
 with shaft seal: 3.0 oz-in
Moment of Inertia: 3.0×10^{-4} oz-in-sec²
Weight: 10 oz. max.

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof); NEMA4/IP66 (dust proof, washdown) when ordered with shaft seal and either MS connector or watertight cable exit

ELECTRICAL CONNECTIONS

Series H20 Hub Shaft

6, 7 & 10 Pin MS Connectors and Cables - Code 8= 0 to 9, B to M

Connector & mate/accessory cable assembly pin numbers and wire color information is provided here for reference. H20 models with direct cable exit carry the same color coding as shown for each output configuration.

Encoder Function	Cable # 108594-6 Pin Single Ended		Cable # 108595-7 Pin Single Ended		Cable # 108596-7 Pin Dif Line Drv w/o Idx		Cable # 1400635-10 Pin Dif Line Drv w/ Idx	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	E	BRN	A	BRN	A	BRN	A	BRN
Sig. B	D	ORN	B	ORG	B	ORG	B	ORG
Sig. Z	C	YEL	C	YEL	—	—	C	YEL
Power +V	B	RED	D	RED	D	RED	D	RED
Com	A	BLK	F	BLK	F	BLK	F	BLK
Case	—	—	G	GRN	G	GRN	G	GRN
N/C	F	—	E	—	—	—	E	—
Sig. \bar{A}	—	—	—	—	C	BRN/WHT	H	BRN/WHT
Sig. \bar{B}	—	—	—	—	E	ORG/WHT	I	ORG/WHT
Sig. \bar{Z}	—	—	—	—	—	—	J	YEL/WHT

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables when Code 8= N to R

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Cable # 112859-5 Pin Single Ended		Cable # 112860-8 Pin Single Ended		Cable # 112860-8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

* Index not provided on all models. See ordering information

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

ORDERING INFORMATION

Series H20 Hub Shaft

Code 1: Model	Code 2: PPR	Code 3: Housing	Code 4: Shaft	Code 5: Face Mount	Code 6: Shaft Seal	Code 7: Electrical	Code 8: Termination	Code 9: Options
H2 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	0 <input type="checkbox"/>	<input type="checkbox"/>	2 <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Ordering Information								
1 Unidirectional (Channel A only)	0001 0500 0005 0512 0010 0600 0012 0800	0 Servo Mount	2 5/8" Dia. Hub Shaft and flex coupling	2 (3) #4-40 @ 1.50" BC	0 no Shaft Seal 5 Shaft Seal	0 5-26V in, 5-26V Open Collector out 1 5-26V in, 5-26V Open Collector out with 2.2 kΩ Pullups 2 5-26V in, 5-26V Push-Pull out A Same as "0" with extend. temp range B Same as "1" with extend. temp range C Same as "2" with extend. temp range	0 6 Pin Conn, End Mount 1 6 Pin Conn, Side Mount 2 7 Pin Conn, End Mount 3 7 Pin Conn, Side Mount 4 10 Pin Conn, End Mount 5 10 Pin Conn, Side Mount 7 18" Cable, Side Exit 9 36" Cable, Side Exit B 10' Cable, Side Exit K 25' Cable, Side Exit N 5 Pin M12 Connector, End Mount P 5 Pin M12 Connector, Side Mount Q 8 Pin M12 Connector, End Mount R 8 Pin M12 Connector, Side Mount	available when Code 8 is 0 to 5: PS LED Output Indicator Option
2 Bidirectional (Channels A and B)	0050 0900 0060 1000 0086 1024 0100 1200	C Same as "0" above includes protective cover kit for mounting on 4 1/2" C-face	3 3/8" Dia. Hub Shaft and flex coupling			3 5-26V in, 5-26V Differential Line Driver out (7272) 4 5-26V in, 5V Differential Line Driver out (7272) 5 5-26V in, 5 V Differential Line Driver out (4469) 6 5-15V in, 5-15 V Differential Line Driver out (4469) D Same as "3" with extend. temp range E Same as "4" with extend. temp range	available when Code 6 is 5: D 18" Sealed Cbl, Side Exit F 36" Sealed Cbl, Side Exit H 10' Sealed Cbl, Side Exit M 25' Sealed Cbl., Side Exit	
3 Bidirectional with Index (Channels A, B and Z)	0120 1250 0125 1270 0180 1500 0200 1600 0240 1800 0250 1968 0254 2000 0256 2048 0300 2400 0360 2500 0400 2540	F Same as "0" above includes protective cover kit for mounting on fan cover	5 1/2" Dia. Hub Shaft and flex coupling 6 1/4" Dia. Hub Shaft and flex coupling					

MOTOR MOUNT

109296-0001 Replacement flexible mount for Series H20 Hub Shaft

Series HS20 Sealed Hollow Shaft

- Hollowshaft design eliminates mounting bracket, flexible shaft coupling, and installation labor
- Direct shaft mount eliminates shaft alignment procedures
- Flexible tether minimizes bearing load
- Robust metal hubshaft
- Electrically isolated



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series HS20 Sealed Hollowshaft encoder is designed for easy installation on motor or machine shafts. Its hollowshaft design eliminates the need for a flexible shaft coupling, mounting bracket, flower pot, or flange adapter. This not only reduces the installation depth, but also lowers total cost.

DESCRIPTION

The Series HS20 Sealed Hollowshaft's floating shaft mount and spring tether minimize bearing loads and eliminate flexible shaft couplings to reduce wear and maintenance.

Series HS20 has complete electrical protection from overvoltage, reverse voltage, and output short circuits. In addition, the Series HS20 is electrically isolated, and environmentally sealed with shaft seals at both ends.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Flexible mounting
- Minimal bearing loads
- Shaft seals at both ends of hollowshaft
- Sealed connector or cable exit

Electrical Features

- Overvoltage, reverse voltage, & output short circuit protection
- Noise immunity to EN50082-2
- Electrically isolated

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental

Resolution: 1 to 2540 PPR (pulses/revolution)

Accuracy: (worst case any edge to any other edge) ≤ 1024 PPR (metal disk): ± 7.5 arc-min.

> 1024 PPR (glass disk): ± 2.5 arc-min.

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

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

Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical

Symmetry: $180^\circ \pm 18^\circ$ electrical

Index: $180^\circ + 18^\circ / -135^\circ$ electrical (gated with B low)

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

ELECTRICAL

Input Power:

4.5 min. to 26 VDC max. at 100 mA max., not including output loads

Outputs:

7273 Open Collector: 30 VDC max., 40 mA sink max.

7272 Push-Pull and Differential Line Driver: 40 mA sink or source

Frequency Response: 100 kHz min.

Electrical Protection: Overvoltage, reverse voltage and output short circuit protected

Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference

Mating Connector:

6 pin, style MS3106A-14S-6S (MCN-N4);

7 pin, style MS3106A-16S-1S (MCN-N5);

10 pin, style MS3106A-18-1S (MCN-N6);

5 pin, style M12: Cable with connector available

8 pin, style M12: Cable with connector available

MECHANICAL

Bearing Life: (at maximum tether loading)

Standard tether: 5×10^9 revolutions

Slotted tether: 8×10^9 revolutions

Shaft Speed: 6000 RPM max.

Shaft Bore Tolerance: Nominal $+0.0002"/+0.0008"$ ($+0.005/+0.020$ mm)

Mating Shaft Requirements:

Runout: $\pm 0.005"$ (± 0.13 mm) radial, max.

Endplay: $\pm 0.050"$ (± 1.27 mm) axial, max.

Length: 0.80" (20 mm), minimum

Starting Torque: 3.0 oz-in max.

Moment of Inertia: 5.1×10^{-4} oz-in-sec²

Weight: 10 oz. max.

ENVIRONMENTAL

Operating Temperature:

Standard: 0 to $+70^\circ$ C

Extended: -40 to $+85^\circ$ C

Storage Temperature: -40 to $+85^\circ$ C

Shock: 50 G's for 11 milliseconds duration

Vibration: 5 to 2000 Hz at 2.5 G's

Humidity: to 98% without condensation

Enclosure Rating: NEMA4/IP65 (dust proof, washdown)

Series HS20 Sealed Hollow Shaft

ELECTRICAL CONNECTIONS

6, 7 & 10 Pin MS Connectors and Cables - Code 7= 0 to 7, A to G

Connector & mate/accessory cable assembly pin numbers and wire color information is provided here for reference. HS20 models with direct cable exit carry the same color coding as shown for each output configuration.

Encoder Function	Cable #108594-* 6 Pin Single Ended		Cable #112123-* 6 Pin Dif Line Drv w/o Idx		Cable #108596-* 7 Pin Dif Line Drv w/o Idx		Cable #108595-* 7 Pin (If Used)		Cable #1400635-* 10 Pin (If Used)	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	E	BRN	E	BRN	A	BRN	A	BRN	A	BRN
Sig. B	D	ORN	D	ORN	B	ORN	B	ORN	B	ORN
Sig. Z	C	YEL	—	—	—	—	C	YEL	C	YEL
Power +V	B	RED	B	RED	D	RED	D	RED	D	RED
N/C	F	—	—	—	—	—	E	—	E	—
Com	A	BLK	A	BLK	F	BLK	F	BLK	F	BLK
Case	—	—	—	—	G	GRN	G	GRN	G	GRN
Sig. A	—	—	C	BRN/WHT	C	BRN/WHT	—	—	H	BRN/WHT
Sig. B	—	—	F	ORN/WHT	E	ORN/WHT	—	—	I	ORN/WHT
Sig. Z	—	—	—	—	—	—	—	—	J	YEL/WHT

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables when Code 7= H or J

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Cable # 112859- 5 Pin Single Ended		Cable # 112860- 8 Pin Single Ended		Cable # 112860- 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. A	—	—	—	—	3	BRN/WHT
Sig. B	—	—	—	—	5	ORG/WHT
*Sig. Z	—	—	—	—	8	YEL/WHT

* Index not provided on all models. See ordering information

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

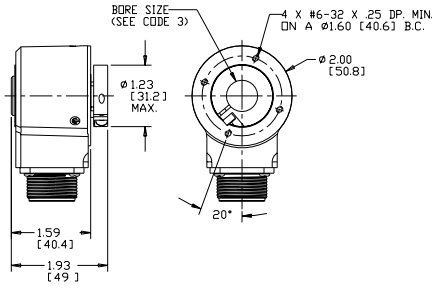
See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

Series HS20 Sealed Hollow Shaft

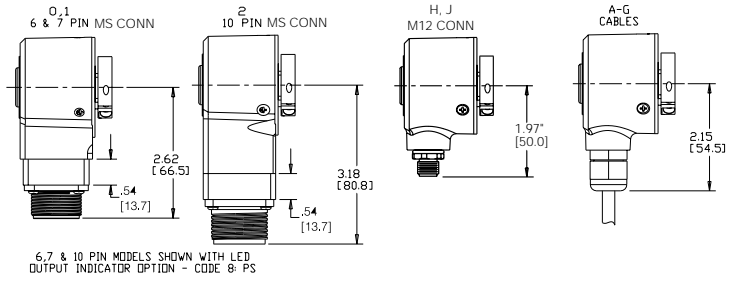
DIMENSIONS

MOTOR MOUNT

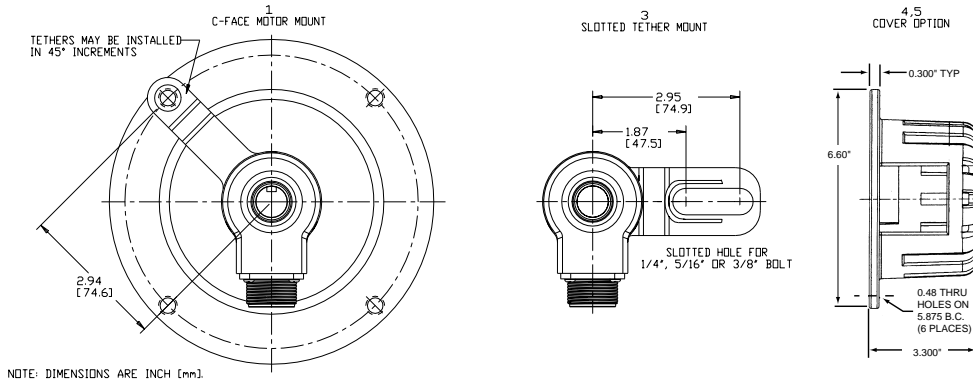
DIMENSIONS



CODE 7: TERMINATION



CODE 4: FIXING



Series HS20 Sealed Hollow Shaft

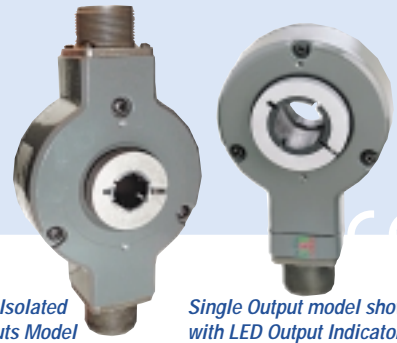
ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Bore Size	Code 4: Fixing	Code 5: Format	Code 6: Output	Code 7: Termination	Code 8: Options
HS20	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Ordering Information							
HS20 Size 20 heavy-duty, sealed hollowshaft encoder	Metal Disk:	0 6 mm 1 1/4" 2 5/16" 3 8 mm 4 3/8" 5 10 mm 6 12 mm 7 1/2" 8 5/8" 9 15 mm A 16 mm	0 None - customer supplied 1 Clearance hole for 3/8" bolt on 5.88" dia. bolt circle (to fit 4-1/2" NEMA C-face) 3 Slotted hole for bolt on 1.87" to 2.95" radius 4 Same as '1', w/ protective cover kit 5 Same as '3', w/ Protective cover kit	0 single ended, unidirectional (A) 1 single ended, bidirectional (AB) 2 single ended, bidirectional with index (ABZ) available when Code 6 is 3, 4, A or B: 3 differential, bidirectional (AĀ BB)	0 5-26V in, 5-26V open collector out 1 5-26V in, 5-26V open collector out w/ 2.2kΩ pullups 2 5-26V in, 5-26V push-pull out available when Code 5 is 3 or 4: 3 5-26V in, 5V line driver out 4 5-26V in, 5-26V line driver out A same as '3' with extended temp. -40° to 85°C B same as '4' with extended temp. -40° to 85°C	0 6 pin connector 1 7 pin connector 2 10 pin connector 5 6 pin connector, plus mating connector 6 7 pin connector, plus mating connector 7 10 pin connector, plus mating connector A 18" (.5m) cable B 36" (1m) cable C 72" (2m) cable D 10' (3m) cable F 13" (.3m) cable with 10 pin connector plus mating connector G 13" (.3m) cable J 8 Pin M12 Connector	available when Code 7 is 0 - 7 PS LED Output Indicator
	Glass Disk:	1200 1968 1250 2000 1270 2048 1500 2400 1600 2500 1800 2540	4 differential, bidirectional with index (AĀ BB ZĀ)	4 differential, bidirectional with index (AĀ BB ZĀ)	available when Code 5 is 0 thru 2 H 5 Pin M12 Connector		
112096-0001 Tether Kit (clearance hole for 3/8" bolt on 5.88" diameter bolt-circle) 112096-0002 Tether Kit (slotted hole for bolt on 1.87" to 2.75" radius) 112105-0001 Protective Cover Accessory							

MOTOR MOUNT

Series HS35 Sealed Hollow Shaft

- *Hollow Shaft design eliminates mounting bracket, flexible shaft coupling, and installation labor*
- *Direct shaft mount eliminates shaft alignment procedures*
- *Flexible tether minimizes bearing load*
- *Unbreakable disk*
- *Robust metal hubshaft*
- *Electrically isolated and Thermally insulated*



Dual Isolated Outputs Model

Single Output model shown with LED Output Indicators

MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series HS35 Sealed Hollowshaft encoder is designed for easy installation on motor or machine shafts. Its hollowshaft design eliminates the need for a flexible shaft coupling, mounting bracket, flower pot, or flange adapter. This not only reduces the installation depth, but also lowers total cost.

DESCRIPTION

The Series HS35 Sealed Hollowshaft is equipped with an unbreakable disk that meets the demands of the most severe shock and vibration generating processes. Its floating shaft mount and spring tether eliminate bearing loads and flexible shaft couplings to eliminate wear and maintenance.

Series HS35 has complete electrical protection from overvoltage, reverse voltage, and output short circuits. In addition, the Series HS35 is not only electrically & thermally isolated, but also environmentally sealed with shaft seals at both ends.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Unbreakable code disk
- Flexible mounting
- Eliminated bearing loads
- Shaft seals at both ends of hollowshaft
- Sealed connector or cable exit
- Insulated from motor housing/shaft temperatures to 125°C

Electrical Features

- Overvoltage, reverse voltage, & output short circuit protection
- Noise immunity to EN50082-2
- Electrically isolated

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2500 PPR (pulses/revolution)
Accuracy: (worst case any edge to any other edge) ± 7.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW shaft rotation viewing the shaft clamp end of the encoder
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power: (each output)
 4.5 min. to 26 VDC max. at 100 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference
Mating Connector:
 6 pin, style MS3106A-14S-6S (MCN-N4);
 7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Bearing Life: 80,000 hours at 3600 RPM; 128,000 hours at 1800 RPM
Shaft Loading: 40 lbs. radial, 30 lbs. axial
Shaft Speed: 3600 RPM max. (*Important: see Operating Temperature derating for >1800 RPM*)
Shaft Bore Tolerance: Nominal $+0.0003"/+0.0005"$ ($+0.008/+0.013$ mm)

Mating Shaft Requirements:

Runout: $\pm 0.025"$ (± 0.63 mm) radial typical;
 Endplay: $\pm 0.050"$ (± 1.27 mm) axial typical;
 Minimum: 1.25" (32 mm) recommended;
 Maximum: 2.0" (51 mm) to fit inside cover;
 Solid shaft recommended; keyway allowed; flatted shaft should not be used
Starting Torque: 5.0 oz-in max.
Running Torque: 4.5 oz.-in max.
Moment of Inertia:
 $\leq 5/8"$ bore: 7.9×10^{-4} oz-in-sec²
 $> 5/8"$ bore: 25.6×10^{-4} oz-in-sec²
Weight: 16 oz. max.

ENVIRONMENTAL

Operating Temperature:
 Standard: -40 to $+70$ °C;
 Extended: 0 to $+100$ °C;
 $\leq 5/8"$ bore: Derate 5 °C per 1000 RPM above 1800 RPM;
 $> 5/8"$ bore: Derate 10 °C per 1000 RPM above 1800 RPM.
Storage Temperature: -40 to $+90$ °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA4/IP66 (dust proof, washdown)

Series HS35 Sealed Hollow Shaft

ELECTRICAL CONNECTIONS

6, 7 & 10 Pin MS Connectors and Cables - Code 7= 0 to 8, A to G

Connector & mate/accessory cable assembly pin numbers and wire color information is provided here for reference. HS35 models with direct cable exit carry the same color coding as shown for each output configuration.

Encoder Function	Cable #108594-* 6 Pin Single Ended		Cable #112123-* 6 Pin Dif Line Drv w/o ldx		Cable #108596-* 7 Pin Dif Line Drv w/o ldx		Cable #108595-* 7 Pin (If Used)		Cable #1400635-* 10 Pin (If Used)		Cable #108615-* 12 Pin CCW (If Used)	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
	Sig. A	E	BRN	E	BRN	A	BRN	A	BRN	A	BRN	5
Sig. B	D	ORN	D	ORN	B	ORN	B	ORN	B	ORN	8	ORN
Sig. Z	C	YEL	—	—	—	—	C	YEL	C	YEL	3	YEL
Power +V	B	RED	B	RED	D	RED	D	RED	D	RED	12	RED
N/C	F	—	—	—	—	—	E	—	E	—	7	—
Com	A	BLK	A	BLK	F	BLK	F	BLK	F	BLK	10	BLK
Case	—	—	—	—	G	GRN	G	GRN	G	GRN	9	—
Sig. \bar{A}	—	—	C	BRN/WHT	C	BRN/WHT	—	—	H	BRN/WHT	6	BRN/WHT
Sig. \bar{B}	—	—	F	ORN/WHT	E	ORN/WHT	—	—	I	ORN/WHT	1	ORN/WHT
Sig. Z	—	—	—	—	—	—	—	—	J	YEL/WHT	4	YEL/WHT
0V Sense	—	—	—	—	—	—	—	—	—	—	2	GRN
5V Sense	—	—	—	—	—	—	—	—	—	—	11	BLK/WHT

MOTOR MOUNT

5 & 8 Pin M12 Accessory Cables when Code 7= H or J

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Cable # 112859- 5 Pin Single Ended		Cable # 112860- 8 Pin Single Ended		Cable # 112860- 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

* Index not provided on all models. See ordering information

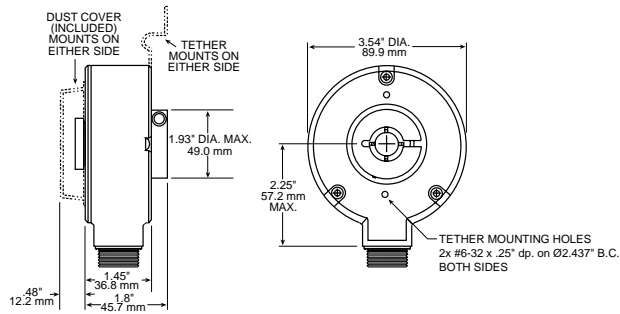
Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

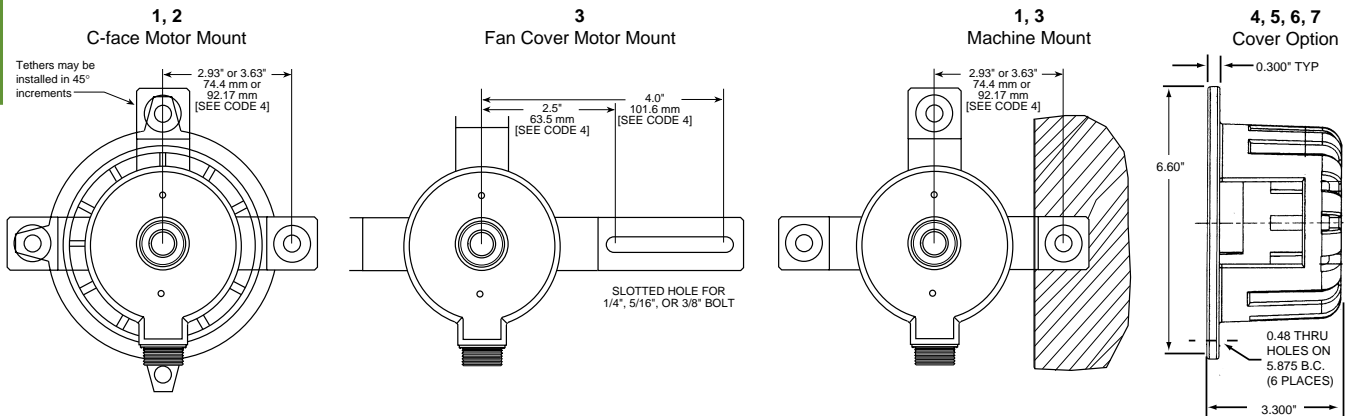
Series HS35 Sealed Hollow Shaft

DIMENSIONS

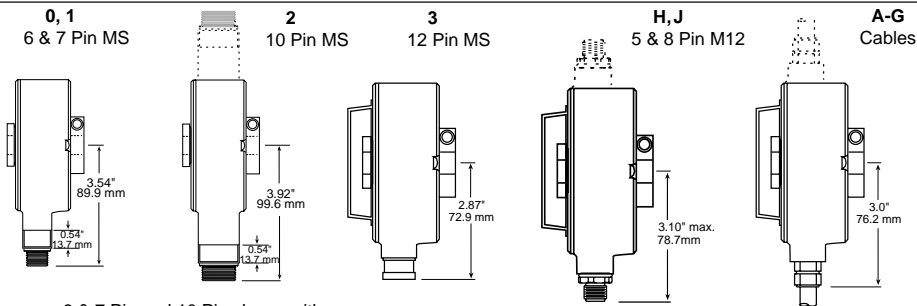
Dimensions



Code 4: Fixing



Code 7: Termination



6 & 7 Pin and 10 Pin shown with LED Output Indicator Option - Code 8: PS

MOTOR MOUNT

Series HS35 Sealed Hollow Shaft

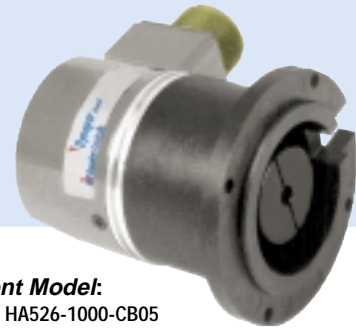
ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Bore Size	Code 4: Fixing	Code 5: Format	Code 6: Output	Code 7: Termination	Code 8: Options	
HS35	□□□□	□	□	□	□	□	□□	
Ordering Information								
HS35 Size 35 heavy-duty, sealed hollowshaft encoder	0001 0500 0003 0512 0010 0600 0012 0900 0050 1000 0060 1024 0064 1200 0100 1270 0120 1500 0240 1800 0250 2000 0300 2048 0360 2400 2500	0 6 mm 1 1/4" 2 5/16" 3 8 mm 4 3/8" 5 10 mm 6 12 mm 7 1/2" 8 5/8" 9 15 mm A 16 mm B 19 mm C 3/4" D 20 mm E 7/8" F 24 mm G 1" H 1-1/8"	0 None - customer supplied 1 Clearance hole for 3/8" bolt on 5.88" dia. bolt circle (to fit 4-1/2" NEMA C-face) 2 Clearance hole for 1/2" bolt on 7.25" dia. bolt circle (to fit 8-1/2" NEMA C-face) 3 Slotted hole for bolt on 2.5" to 4.0" radius (to fit standard AC motor fan cover slots) Available when Code 5 is 0-4: 4 Same as '1', w/ cover kit 5 Same as '3', w/ cover kit Available when Code 5 is 5: 6 Same as '1' w/ dual cover kit 7 Same as '3' w/ dual cover kit	0 single ended, unidirectional (A) 1 single ended, bidirectional (AB) 2 single ended, bidirectional with index (ABZ) available when Code 6 is 3, 4, 5, 6, A or B: 3 differential, bidirectional (AĀ BB̄) available when Code 6 is 3, 4, 5, 6, A or B and Code 7 is 2, 3, or 7 thru G: 4 differential, bidirectional with index (AA BB ZZ) available when Code 6 is 3, 4, 5, 6, A or B, and Code 7 is 2, 7, A thru G: 5 Dual isolated differential, bidirectional w/index (AABBZZ)	0 5-26V in, 5-26V open collector out 1 5-26V in, 5-26V open collector out w/ 2.2kΩ pullups 2 5-26V in, 5-26V push-pull out available when Code 5 is 3 or 4: 3 5-26V in, 5V line driver out (7272) 4 5-26V in, 5-26V line driver out (7272) 5 5-26V in, 5V Differential Line Driver out (4469) 6 5-15V in, 5-15V Differential Line Driver out (4469) A same as '3' with high temp. to 100°C B same as '4' with high temp. to 100°C	0 6 pin connector 1 7 pin connector 2 10 pin connector 3 12 pin connector 5 6 pin connector, plus mating connector 6 7 pin connector, plus mating connector 7 10 pin connector, plus mating connector 8 12 pin connector, plus mating connector A 18" (.5m) cable B 36" (1m) cable C 72" (2m) cable D 10' (3m) cable F 13" (.3m) cable with 10 pin connector plus mating connector G 13" (.3m) cable J 8 Pin M12 Connector available when Code 5 is 0 thru 2 H 5 Pin M12 Connector	available when Code 7 is 0 - 2 or 5 - 7: PS LED Output Indicator	
109473-0001	Tether kit (clearance hole for 3/8" bolt on 5.88" dia. bolt circle)			110533-0001 Cover Kit, 56C face				
109473-0002	Tether kit (clearance hole for 1/2" bolt on 7.25" dia. bolt circle)			110533-0002 Cover Kit, fan cover				
109473-0003	Tether kit (slotted hole for bolt on 2.5" to 4.0" radius)			110533-0003 Dual Cover Kit, 56C face				
112121-0001	Spare Hub Clamp (Bore size Code 3: 0 - 9)			110533-0004 Dual Cover Kit, fan cover				
112121-0002	Spare Hub Clamp (Bore size Code 3: A - H)							

MOTOR MOUNT

Series HA26

- Ultra-reliable, heavy duty
- Complete electrical protection and noise immunity
- Up to 2540 PPR with optional marker
- Coupling & flange provide thermal and electrical isolation for the encoder
- Field replaceable coupling



Compumotor Equivalent Model:
For Size 42 Stepper Motor: HA526-1000-CB05

MOTOR MOUNT

APPLICATION/INDUSTRY

The Series HA26 is designed for rugged industrial applications. The integral shaft coupling and mounting flange allows it to be installed on the end of a motor or shaft assembly without the addition of a bracket or coupling.

Typical Applications

- Servo and stepper motor mounting
- Machine tools
- Position tables
- Robotics

DESCRIPTION

A high impact fiber reinforced integral housing provides thermal and electrical isolation for the encoder. The coupling includes an insulator at the encoder for isolation of the shaft. Long life bearings keep tough loads from disrupting internal alignment. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. The Series HA26 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Extended temperature range available

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2540 PPR (pulses/revolution)
Accuracy: (worst case any edge to any other edge) ± 2.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference
Mating Connector:
 7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shafts coupling: accepts 1/4", 3/8" and 1/2" motor or machinery shafts
Shafts alignment: 0.002" max. TIR runout; 0.005" max. radial offset; 3° max. angular
Shaft Speed: 5,000 RPM max.
Starting Torque: (max at 25 °C) 1.0 oz-in;
Moment of Inertia: 4.3×10^{-4} oz-in-sec²

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof)

ELECTRICAL CONNECTIONS

Series HA26

Prewired Cable or Accessory Cables with 7 or 10 Pin MS Connector - when Code 4= 0 to 5, or A, B, C, D or G

Note: Wire color codes are referenced here for models that are specified with pre-wired cable. Connector/cables are described in the Encoder Accessories section of this catalog and color-coding information is provided here for reference.

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	RED
B	Signal B	ORN	BLUE
C	Signal Z	YEL	YEL
D	Power Source	RED	WHT
E	No Connection	—	GRN
F	Common	BLK	BLK
G	Case	GRN	SHIELD

*Cable Accessory: P/N 14004310010

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	BRN
B	Signal B	ORN	ORN
C	Signal Z	YEL	YEL
D	Power Source	RED	RED
E	No Connection	—	—
F	Common	BLK	BLK
G	Case	GRN	GRN
H	Signal \bar{A}	BRN/WH	BRN/WH
I	Signal \bar{B}	ORN/WH	ORN/WH
J	Signal \bar{Z}	YEL/WH	YEL/WH

*Cable Accessory: P/N 14006350010

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables - when Code 4= H to Z

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Table 4 5 Pin Single Ended		Table 5 8 Pin Single Ended		Table 6 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Encoder Function	Cable # 112859-	Cable # 112860-	Cable # 112860-			
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

* Index not provided on all models. See ordering information

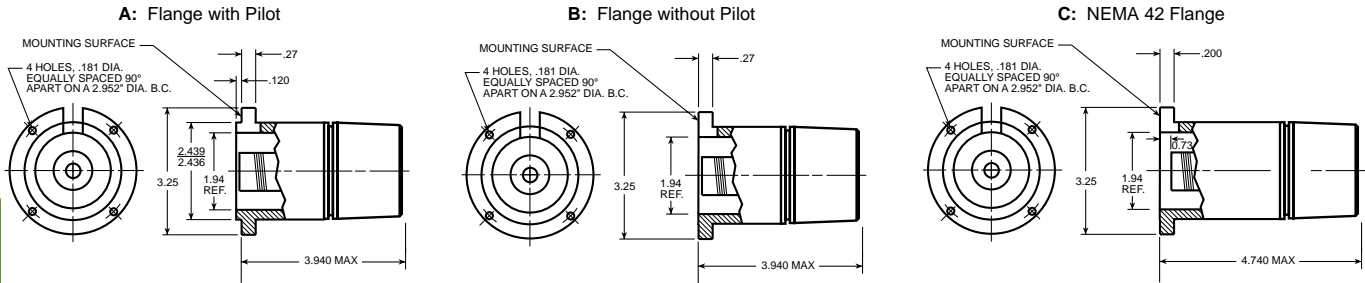
Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

Series HA26

DIMENSIONS

Code 3: Mechanical

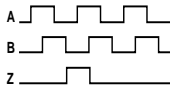


Mating shaft lengths: Typically: 0.5" max. available into the coupling as measured from the A/B mounting surface.
1.3" max. available into the coupling as measured from the C mounting surface.

Code 4: Output

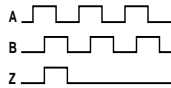
0 - 3: Format A

CCW →



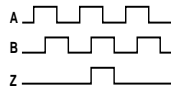
4 - 5: Format B

CCW →



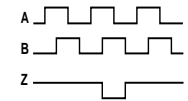
6 - D: Format C

CW →



G: Format D

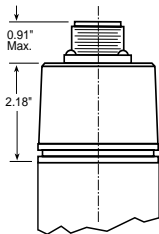
CCW →



Code 6: Termination

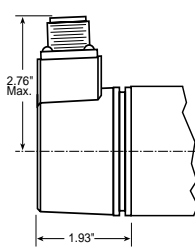
0: End MS Connector

When Code 5 is 0 to 5 or A to G

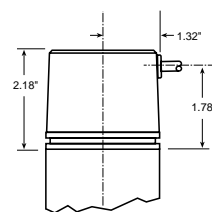


1: Side MS Connector

When Code 5 is 0 to 5 or A to G

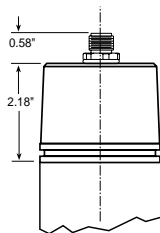


2 - A: Side Cable



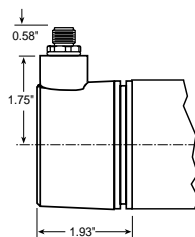
0: End M12 Connector

When Code 5 is H to Z



1: Side M12 Connector

When Code 5 is H to Z



ORDERING INFORMATION

Series HA26

Code 1: Model	Code 2: PPR	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination	Code 7: Options
HA526	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

Ordering Information

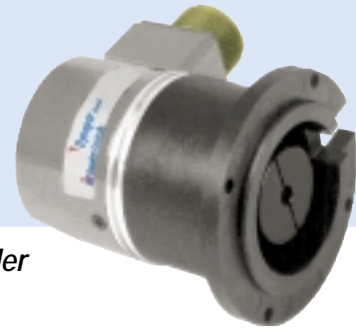
HA526 Size 25 with Integral Coupling and Flange Adapter, Glass Code Disk	0001 0600 0005 0625 0010 0635 0012 0720 0050 0800 0060 0900 0100 1000 0120 1024 0150 1200 0180 1250 0200 1270 0240 1500 0250 1600 0256 1800 0300 1968 0360 2000 0400 2048 0500 2400 0512 2500 2540 For Resolutions above 2540, see Series HC526	A Flange Adapter with Pilot B Flange Adapter without Pilot C Flange Adapter for NEMA Size 42 Motors	7 Pin Connector or Cable 0 Single Ended, no Index, Format A, Table 2 1 Single Ended, with Index, Format A, Table 2 4 Single Ended, with Index, Format B, Table 2 A Single Ended, with Index, Format C, Table 2 C Single Ended, no Index, Format C, Table 2 G Single Ended, with Index, Format D, Table 2	0 5-26V in; 5-26V Open Collector with 2.2kΩ Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V Totem Pole out 3 5-26V in; 5V Differential Line Driver out (7272) 4 5-26V in; 5-26V Differential Line Driver out (7272) 5 5-26V in, 5 V Differential Line Driver out (4469) 6 5-15V in, 5-15 V Differential Line Driver out (4469)	0 End Mount Connector 1 Side Mount Connector 2 18" Cable, Side 3 3' Cable, Side 4 6' Cable, Side 5 10' Cable, Side 6 15' Cable, Side	available when Code 4 is 0 thru G, and Code 6 is 0 or 1: PS LED Output Indicator
			10 Pin Connector or Cable 2 Differential, no Index, Format A, Table 1 3 Differential, with Index, Format A, Table 1 5 Differential, with Index, Format B, Table 1 B Differential, with Index Format C, Table 1 D Differential, no Index, Format C, Table 1			

605512-0020 Flexible Coupling 3/8"; 1/4", 3/8", 1/2"

MOTOR MOUNT

Series HR26

- Ultra-reliable, heavy duty
- Unbreakable code disk available
- Complete electrical protection and noise immunity
- Up to 1024 PPR with optional marker
- Coupling & flange provide thermal and electrical isolation for the encoder
- Field replaceable coupling



MOTOR MOUNT

APPLICATION/INDUSTRY

The Series HR26 is designed for rugged industrial applications. The integral shaft coupling and mounting flange allows it to be installed on the end of a motor or shaft assembly without the addition of a bracket or coupling.

Typical Applications

- Servo and stepper motor mounting
- Machine tools
- Position tables
- Robotics

DESCRIPTION

A high impact fiber reinforced integral housing provides thermal and electrical isolation for the encoder. The coupling includes an insulator at the encoder for isolation of the shaft. An unbreakable code disk meets the demands of the most severe shock and vibration generating processes; and long life bearings that keep tough loads from disrupting internal alignment, avoiding failure due to the disk "crashes" so typical in competitive encoders. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. The Series HR26 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver a high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Unbreakable, code disk and long life 80 lb. bearings
- Extended temperature range available

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 1024 PPR (pulses/revolution)
Accuracy: (worst case any edge to any other edge) ± 7.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference
Mating Connector:
 7 pin, style MS3106A-16S-1S (MCN-N5)
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shafts coupling: accepts 1/4", 3/8" and 1/2" motor or machinery shafts
Shafts alignment: 0.002" max. TIR runout; 0.005" max. radial offset; 3° max. angular
Shaft Speed: 10,000 RPM max.
Starting Torque: (max at 25 °C) 1.0 oz-in
Moment of Inertia: 4.3×10^{-4} oz-in-sec²

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof)

ELECTRICAL CONNECTIONS

Series HR26

Prewired Cable or Accessory Cables with 7 or 10 Pin MS Connector - when Code 4= 0 to 5, or A, B, C, D or G

Note: Wire color codes are referenced here for models that are specified with pre-wired cable. Connector/cables are described in the Encoder Accessories section of this catalog and color-coding information is provided here for reference.

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	RED
B	Signal B	ORN	BLUE
C	Signal Z	YEL	YEL
D	Power Source	RED	WHT
E	No Connection	—	GRN
F	Common	BLK	BLK
G	Case	GRN	SHIELD

*Cable Accessory: P/N 14004310010

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	BRN
B	Signal B	ORN	ORN
C	Signal Z	YEL	YEL
D	Power Source	RED	RED
E	No Connection	—	—
F	Common	BLK	BLK
G	Case	GRN	GRN
H	Signal \bar{A}	BRN/WH	BRN/WH
I	Signal \bar{B}	ORN/WH	ORN/WH
J	Signal \bar{Z}	YEL/WH	YEL/WH

*Cable Accessory: P/N 14006350010

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables - when Code 4= H to Z

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Table 4 5 Pin Single Ended		Table 5 8 Pin Single Ended		Table 6 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

* Index not provided on all models. See ordering information

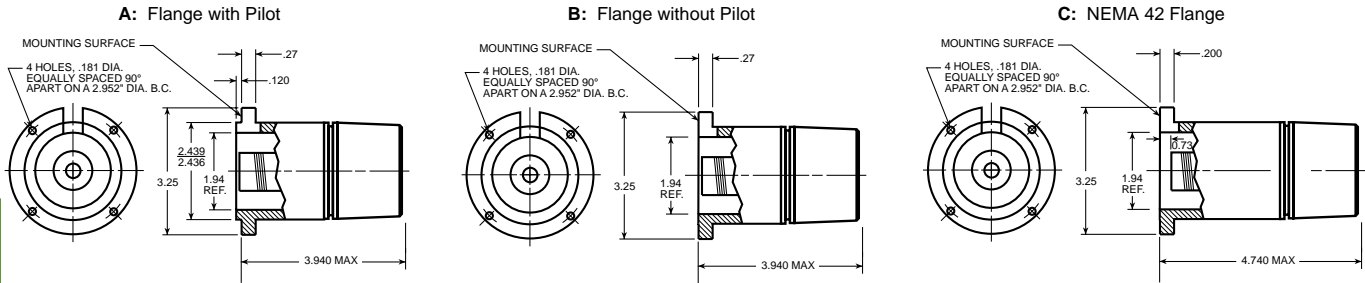
Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

DIMENSIONS

Series HR26

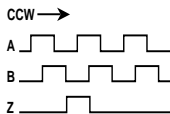
Code 3: Mechanical



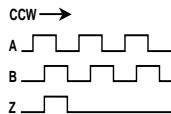
Mating shaft lengths: Typically: 0.5" max. available into the coupling as measured from the A/B mounting surface.
1.3" max. available into the coupling as measured from the C mounting surface.

Code 4: Output

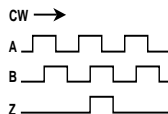
0 - 3: Format A



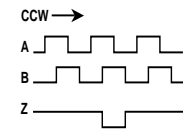
4 - 5: Format B



6 - D: Format C



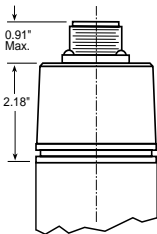
G: Format D



Code 6: Termination

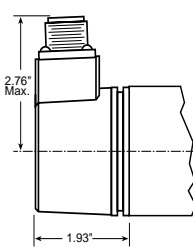
0: End MS Connector

When Code 5 is 0 to 5 or A to G

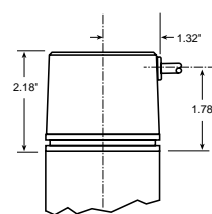


1: Side MS Connector

When Code 5 is 0 to 5 or A to G

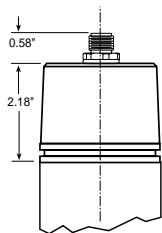


2 - A: Side Cable



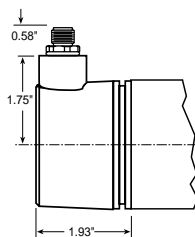
0: End M12 Connector

When Code 5 is H to Z



1: Side M12 Connector

When Code 5 is H to Z



MOTOR MOUNT

ORDERING INFORMATION

Series HR26

Code 1: Model	Code 2: PPR	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination	Code 7: Options
HR526	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Ordering Information						
HR526 Size 25 with Integral Coupling and Flange Adapter	0001 0250 0005 0256 0010 0300 0012 0360 0050 0400 0060 0500 0086 0512 0100 0600 0120 0635 0125 0800 0180 0900 0200 1000 0240 1024	A Flange Adapter with Pilot B Flange Adapter without Pilot C Flange Adapter for NEMA Size 42 Motors	7 Pin Connector or Cable 0 Single Ended, no Index, Format A, Table 2 1 Single Ended, with Index, Format A, Table 2 4 Single Ended, with Index, Format B, Table 2	0 5-26V in; 5-26V Open Collector with 2.2kΩ Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V Totem Pole out 3 5-26V in; 5V Differential Line Driver out (7272) 4 5-26V in; 5-26V Differential Line Driver out (7272) 5 5-26V in, 5 V Differential Line Driver out (4469) 6 5-15V in, 5-15 V Differential Line Driver out (4469)	0 End Mount Connector 1 Side Mount Connector 2 18" Cable, Side 3 3' Cable, Side 4 6' Cable, Side 5 10' Cable, Side 6 15' Cable, Side	available when Code 4 is 0 thru G, and Code 6 is 0 or 1: PS LED Output Indicator
			10 Pin Connector or Cable 2 Differential, no Index, Format A, Table 1 3 Differential, with Index, Format A, Table 1 5 Differential, with Index, Format B, Table 1 B Differential, with Index Format C, Table 1 D Differential, no Index, Format C, Table 1			
			5 Pin M12 Connector H Single ended, no index, Format A, Table 4 J Single ended, with index, Format A, Table 4 K Single ended, with index, Format B, Table 4 L Single ended, with index, Format C, Table 4 M Single ended, no index, Format C, Table 4 N Single ended, with index, Format D, Table 4			
			8 Pin M12 Connector P Single ended, no index, Format A, Table 5 Q Single ended, with index, Format A, Table 5 R Single ended, with index, Format B, Table 5 S Single ended, with index, Format C, Table 5 T Single ended, no index, Format C, Table 5 U Single ended, with index, Format D, Table 5 V Differential, no index, Format A, Table 6 W Differential, with index, Format A, Table 6 X Differential, with index, Format B, Table 6 Y Differential, with index, Format C, Table 6 Z Differential, no index, Format C, Table 6	A Same as "0" with extend. temp range B Same as "1" with extend. temp range C Same as "2" with extend. temp range D Same as "3" with extend. temp range E Same as "4" with extend. temp range		
605512-0020	Flexible Coupling 3/8"; 1/4", 3/8", 1/2"					

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Series HC26

- Ultra-reliable, heavy duty
- Complete electrical protection and noise immunity
- Up to 5000 PPR with optional marker
- Coupling & flange provide thermal and electrical isolation for the encoder
- Field replaceable coupling



MOTOR MOUNT

APPLICATION/INDUSTRY

The Series HC526 is designed for rugged industrial applications. The integral shaft coupling and mounting flange allows it to be installed on the end of a motor or shaft assembly without the addition of a bracket or coupling.

Typical Applications

- Servo and stepper motor mounting
- Machine tools
- Position tables
- Robotics

DESCRIPTION

A high impact fiber reinforced integral housing provides thermal and electrical isolation for the encoder. The coupling includes an insulator at the encoder for isolation of the shaft. Protection against installation problems such as wiring errors prevents the encoder from damage, while immunity to electrical noise keeps the encoder signals intact. The Series HC526 utilizes the latest technology optical emitters and sensors, surface mount assembly and precisely fabricated metal components to deliver high reliability and performance in a compact and economical package.

FEATURES AND BENEFITS

Mechanical / Environmental Features

- Extended temperature range available

Electrical Features

- Noise Immune to ESD, RFI and electrical transients
- High current outputs
- Over-Voltage protection
- Reverse Voltage protection
- Output Short-Circuit Protection

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 3000 to 5000 PPR (pulses/revolution)
Accuracy: (worst case any edge to any other edge) $\pm 10.8^\circ$ /PPR
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW or CCW shaft rotation as viewed from the shaft end of the encoder; see Ordering Information
Quadrature Phasing: $90^\circ \pm 25^\circ$ electrical
Symmetry: $180^\circ \pm 25^\circ$ electrical
Index: $90^\circ \pm 25^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 4.5 min. to 26 VDC max. at 80 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
Frequency Response: 250 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference
Mating Connector:
 7 pin, style MS3106A-16S-1S (MCN-N5);
 10 pin, style MS3106A-18-1S (MCN-N6)
 5 pin, style M12: Cable with connector available
 8 pin, style M12: Cable with connector available

MECHANICAL

Shafts coupling: accepts 1/4", 3/8" and 1/2" motor or machinery shafts
Shafts alignment: 0.002" max. TIR runout; 0.005" max. radial offset; 3° max. angular
Shaft Speed: 10,000 RPM max.
Starting Torque: (max at 25 °C) 1.0 oz-in
Moment of Inertia: 4.3×10^{-4} oz-in-sec²

ENVIRONMENTAL

Operating Temperature:
 Standard: 0 to +70 °C;
 Extended: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof)

ELECTRICAL CONNECTIONS

Series HC26

Prewired Cable or Accessory Cables with 7 or 10 Pin MS Connector - when Code 4= 0 to 5, or A, B, C, D or G

Note: Wire color codes are referenced here for models that are specified with pre-wired cable. Connector/cables are described in the Encoder Accessories section of this catalog and color-coding information is provided here for reference.

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	RED
B	Signal B	ORN	BLUE
C	Signal Z	YEL	YEL
D	Power Source	RED	WHT
E	No Connection	—	GRN
F	Common	BLK	BLK
G	Case	GRN	SHIELD

*Cable Accessory: P/N 14004310010

Pin	Function (If Used)	Wire Color Code	Cable* Accessory Color Code
A	Signal A	BRN	BRN
B	Signal B	ORN	ORN
C	Signal Z	YEL	YEL
D	Power Source	RED	RED
E	No Connection	—	—
F	Common	BLK	BLK
G	Case	GRN	GRN
H	Signal \bar{A}	BRN/WH	BRN/WH
I	Signal \bar{B}	ORN/WH	ORN/WH
J	Signal \bar{Z}	YEL/WH	YEL/WH

*Cable Accessory: P/N 14006350010

Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 3 twisted pairs 26 AWG (output signals), plus 2 twisted pairs 24 AWG (input power)

5 & 8 Pin M12 Accessory Cables - when Code 4= H to Z

Connector pin numbers and cable assembly wire color information is provided here for reference.

Encoder Function	Table 4 5 Pin Single Ended		Table 5 8 Pin Single Ended		Table 6 8 Pin Differential	
	Pin	Wire Color	Pin	Wire Color	Pin	Wire Color
Sig. A	4	BLK	1	BRN	1	BRN
Sig. B	2	WHT	4	ORG	4	ORG
*Sig. Z	5	GRY	6	YEL	6	YEL
Power +V	1	BRN	2	RED	2	RED
Com	3	BLU	7	BLK	7	BLK
Sig. \bar{A}	—	—	—	—	3	BRN/WHT
Sig. \bar{B}	—	—	—	—	5	ORG/WHT
*Sig. \bar{Z}	—	—	—	—	8	YEL/WHT

* Index not provided on all models. See ordering information

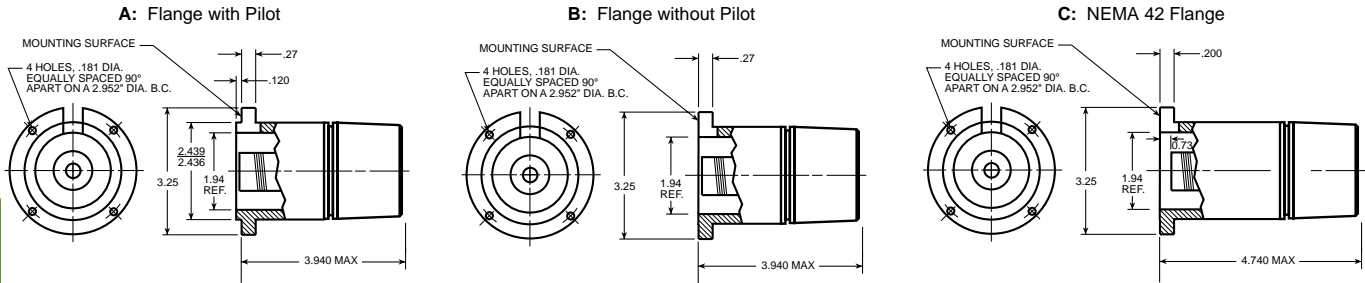
Cable Configuration: PVC jacket, 105 °C rated, overall foil shield; 24 AWG conductors, minimum

See "Accessories" Section for Connectors and Cable Assemblies Ordering Information

DIMENSIONS

Series HC26

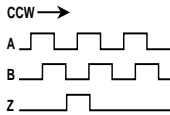
Code 3: Mechanical



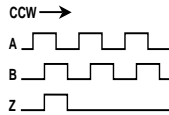
Mating shaft lengths: Typically: 0.5" max. available into the coupling as measured from the A/B mounting surface.
1.3" max. available into the coupling as measured from the C mounting surface.

Code 4: Output

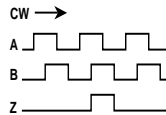
0 - 3: Format A



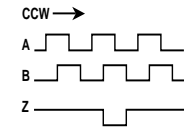
4 - 5: Format B



6 - D: Format C



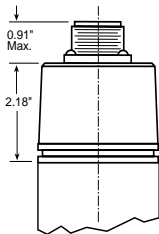
G: Format D



Code 6: Termination

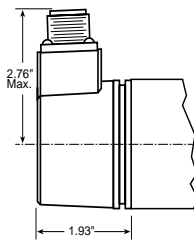
0: End MS Connector

When Code 5 is 0 to 5 or A to G

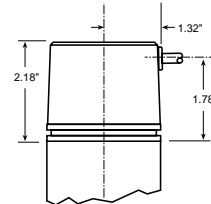


1: Side MS Connector

When Code 5 is 0 to 5 or A to G

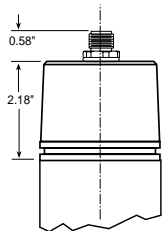


2 - A: Side Cable



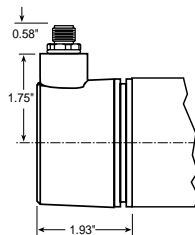
0: End M12 Connector

When Code 5 is H to Z



1: Side M12 Connector

When Code 5 is H to Z



MOTOR MOUNT

ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Mechanical	Code 4: Output	Code 5: Electrical	Code 6: Termination	Code 7: Options
HC526	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Ordering Information						
HC526 Size 25 Enclosed with Integral Coupling and Flange Adapter	3000 3,000 3600 3,600 4096 4,096 5000 5,000	A Flange Adapter with Pilot B Flange Adapter without Pilot C Flange Adapter for NEMA Size 42 Motors	7 Pin Connector or Cable 0 Single Ended, no Index, Format A, Table 2 1 Single Ended, with Index, Format A, Table 2 4 Single Ended, with Index, Format B, Table 2 A Single Ended, with Index, Format C, Table 2 C Single Ended, no Index, Format C, Table 2 G Single Ended, with Index, Format D, Table 2 10 Pin Connector or Cable 2 Differential, no Index, Format A, Table 1 3 Differential, with Index, Format A, Table 1 5 Differential, with Index, Format B, Table 1 B Differential, with Index Format C, Table 1 D Differential, no Index, Format C, Table 1 5 Pin M12 Connector H Single ended, no index, Format A, Table 4 J Single ended, with index, Format A, Table 4 K Single ended, with index, Format B, Table 4 L Single ended, with index, Format C, Table 4 M Single ended, no index, Format C, Table 4 N Single ended, with index, Format D, Table 4 8 Pin M12 Connector P Single ended, no index, Format A, Table 5 Q Single ended, with index, Format A, Table 5 R Single ended, with index, Format B, Table 5 S Single ended, with index, Format C, Table 5 T Single ended, no index, Format C, Table 5 U Single ended, with index, Format D, Table 5 V Differential, no index, Format A, Table 6 W Differential, with index, Format A, Table 6 X Differential, with index, Format B, Table 6 Y Differential, with index, Format C, Table 6 Z Differential, no index, Format C, Table 6	0 5-26V in; 5-26V Open Collector with 2.2k Ω Pullup out 1 5-26V in; 5-26V Open Collector out 2 5-26V in; 5V Totem Pole out 3 5-26V in; 5V Differential Line Driver out (7272) 4 5-26V in; 5-26V Differential Line Driver out (7272)	0 End Mount Connector 1 Side Mount Connector 2 18" Cable, Side 3 3' Cable, Side 4 6' Cable, Side 5 10' Cable, Side 6 15' Cable, Side	available when Code 4 is 0 thru G, and Code 6 is 0 or 1: PS LED Output Indicator
	CPLX1250375	Flexible Coupling 3/8" to 1/4", 3/8" or 1/2"				

MOTOR MOUNT

Series R45 Rotopulser®

- Direct mount to NEMA 56C through 184C AC or DC motors
- Field replaceable readhead for easy service
- Complete electrical protection and proven noise immunity
- Optional line driver outputs, screw terminal connections
- Thin profile – only 5/8" thick



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series R45 Rotopulser® mounts directly to motors with a front or rear 4-1/2" NEMA C-face to provide digital feedback for RPM readout, speed control, and positioning.

DESCRIPTION

The separately mounted ring and gear are designed to function without any setup or adjustments. Operation is reliable even in wet, dirty, and extreme industrial temperature environments. No flexible shaft coupling is required, and there are no bearings to wear out, meaning greater mechanical reliability.

Coupled with a frequency-to-voltage converter, such as the Dynapar brand FV3, the R45 Rotopulser® provides a precise, brushless feedback, at a lower cost than expensive DC tachometer-generators.

An optional, X2 speed output provides twice the number of pulses per revolution for improved low speed operation. Line driver outputs are available for installations with long cable runs. A screw terminal option further simplifies field wiring. The Series R45 Rotopulser® comes with all necessary mounting hardware included.

FEATURES AND BENEFITS

- Unique hub design uses a split collar clamp that provides better gear retention than set screws and will not raise burrs on the motor shaft which can make removal difficult.
- Thinnest package available, allowing more through shaft extension for clutches and brakes.
- "Overhung" conduit box allows mounting to the rear accessory flange of larger motors without mechanical interference.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 60 PPR (pulses/revolution), optional 120 PPR with X2 output
Format: Single channel unidirectional (A), or two channel quadrature (AB) outputs
Quadrature Phasing: 90° ± 45° electrical
Symmetry: 180° ± 36° electrical

ELECTRICAL

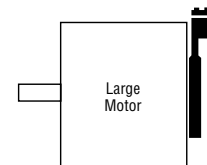
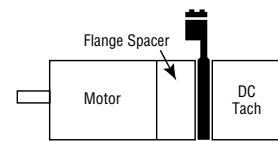
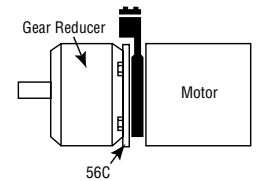
Input Power: (not including output loads)
 Single ended 4.5 min. to 16.5 VDC max. at 50 mA max.;
 Open collector and differential line driver: 4.5 min. to 26 VDC max. at 75 mA max.
Outputs:
 Single ended with 2 kΩ pullup: 16.5 VDC max., 20 mA sink at 0.5 V max.;
 Open Collector: 30 VDC max., 40 mA sink max.;
 7272 Differential Line Driver: 40 mA sink or source
Frequency Response: 10 kHz min.
Electrical Protection: Overvoltage and reverse voltage to 30 VDC; output short circuit protected to Common or other outputs, to +V (differential line driver only)
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference
Terminations:
 Wire leads: 7" long min., 18 AWG;
 Screw terminals: accept 22 to 14 AWG solid or stranded wires

MECHANICAL

Motor frame sizes: 56C, 143TC, 145TC, 182C and 184C
Motor shaft/hub sizes: 5/8", 7/8" nominal
Housing: Cast Aluminum, chromate finish
Gear: 1010 Steel
Moment of Inertia: 0.0035 in-lb-sec²
Shaft Speed: 5,000 RPM max.
Readhead to gear gap: 0.020" nominal, 0.030 max.
Allowable Endplay: ±0.060

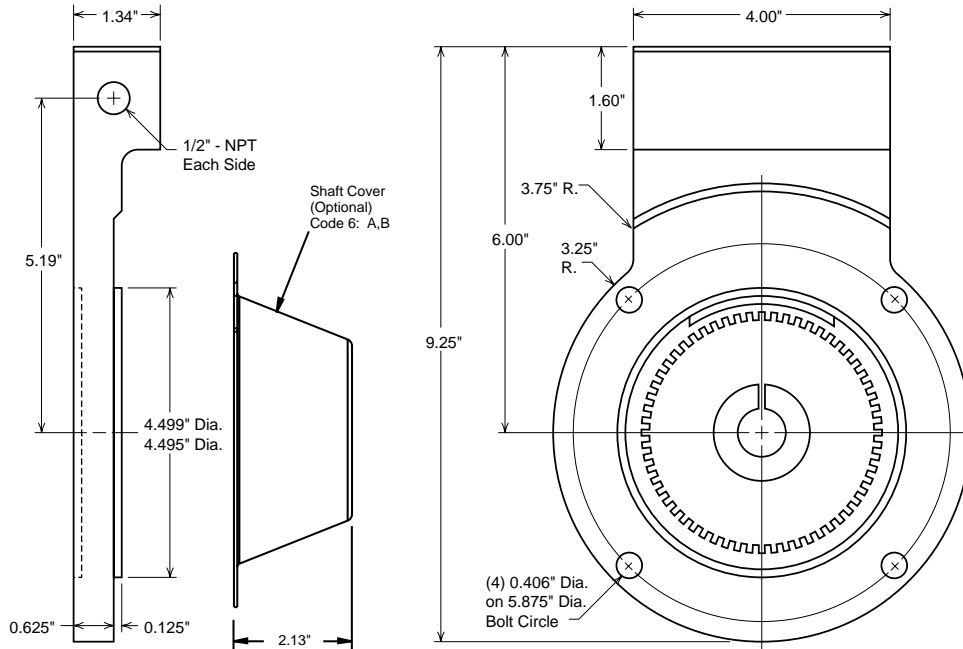
ENVIRONMENTAL

Operating Temperature: -40 to +85 °C
Storage Temperature: -40 to +90 °C
Shock: 20 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 2.5 G's
Humidity: to 98% without condensation



Series R45 Rotopulser®

Outline Dimensions



MOTOR MOUNT

Electrical Connections

Function (If Used)	Wire Color	Terminal
Signal X2	ORG	1
Signal B	BRN	2
Signal A	YEL	3
+V in	RED	4
Common	BLK	5
Signal \bar{A}	WHT	6
Signal \bar{B}	GRN	7
Signal $\bar{X2}$	BLU	8

Ordering Information

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

Code 1: Model	Code 2: PPR	Code 3: Gear, Bore	Code 4: Output	Code 5: Electrical	Code 6: Termination
R45	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information					
R45 Motor Mount Ring, for NEMA 4-1/2" C-Face Motors	0060	0 no gear, readhead only 1 5/8" bore (56C) 2 7/8" bore (143TC, 145TC, 182C, 184C)	0 no readhead, gear only 1 single channel (A), unidirectional 2 dual channel (AB), bidirectional 3 dual channel (AB), bidirectional with unidirectional (X2) speed output	0 no readhead, gear only Available when Code 4 is 1, 2 or 3: 1 5-15V in, 5-15V single ended out 2 5-26V in, 5-26V differential line driver out 3 5-26V in, 5-26V open collector out	0 no readhead, gear only Available when Code 4 is 1, 2 or 3: 1 wire leads 2 screw terminals A Same as 1, with protective cover B Same as 2, with protective cover
R00 No Ring (gear or readhead only)					
112122-0001	R45 protective shaft cover accessory				

Example Model number: 5/8" bore, gear only = R00 0060 1000

Series E14 Hub Shaft

- Easy installation on motor or machine shafts
- Large and small hub availability



MOTOR MOUNT

APPLICATION/INDUSTRY

The Dynapar brand Series E14 Hub Shaft encoder is designed for easy installation on motor or machine shafts. Its hub shaft design and flexible spring mount eliminate the need for a mounting flange adapter and flexible coupling. This not only reduces the encoder's depth, but also lowers installation cost.

DESCRIPTION

The Series E14 Hub Shaft includes precision bearings, an O-ring seal, and a selection of bore sizes ranging from 6 mm to 5/8".

Series E14 incorporates the latest in microelectronic packaging, LED light sources, and matched sensors. Outputs are designed to be compatible with most 5V TTL circuits with options for higher voltage 12 and 15 VDC. Shielded cable is standard. A 5V line driver with complementary outputs is available for longer cable runs and higher electrical noise immunity.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Durable metal housing
- O-ring housing seal
- Hub sizes ranging from 6 mm to 5/8"
- Up to 5000 RPM
- NEMA 12 / IP56

Electrical Features

- Up to 2540 pulses per revolution, optional marker pulse
- Operating speed up to 100 kHz
- LED light source and matched sensors
- Choice of 5, 12, or 15 VDC power
- Shielded cable and line driver available for higher electrical noise immunity

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 100 to 2540 PPR (pulses/revolution)
Format: Two channel quadrature (AB) with optional Index (Z) outputs
Phase Sense: A leads B for CW shaft rotation as viewed from the shaft end of the encoder
Accuracy: $\pm 3 \times (360^\circ \div \text{PPR})$ or ± 2.5 arc-min worst case pulse to any other pulse, whichever is less
Quadrature Phasing: $90^\circ \pm 36^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $90^\circ \pm 25^\circ$ (gated with A and B high)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power:
 5 VDC $\pm 5\%$ at 80 mA max.;
 12 or 15 VDC $\pm 10\%$ at 80 mA max.; not including output loads
Outputs:
 7272 line driver (or equivalent), 40 mA sink and source
Frequency Response: 100 kHz min.

MECHANICAL

Bearing Life: $(16 \times 10^6 \div \text{RPM})$ hours at max. load
Shaft Speed: 5,000 RPM max.
Hub Dia. Tolerance: nominal $-0/+0.0005"$ (0.013mm)
Mating Shaft Length: 0.25" (6 mm) min.; 0.50" (12 mm) max.
Mating Shaft Runout: 0.008" (0.2 mm) max. TIR
Mating Shaft Endplay: $\pm 0.010"$ (0.25 mm) max.
Starting Torque: 0.9 oz-in max. at 25 °C
Running Torque: 0.8 oz-in max. at 25 °C
Moment of Inertia:
 6 to 10 mm hub: 6.03×10^{-5} oz-in-sec²
 12 mm to 5/8" hub: 2.4×10^{-4} oz-in-sec²
Weight:
 6 to 10 mm hub: 3.5 oz. max.
 12 mm to 5/8" hub: 4.5 oz. max.

ENVIRONMENTAL

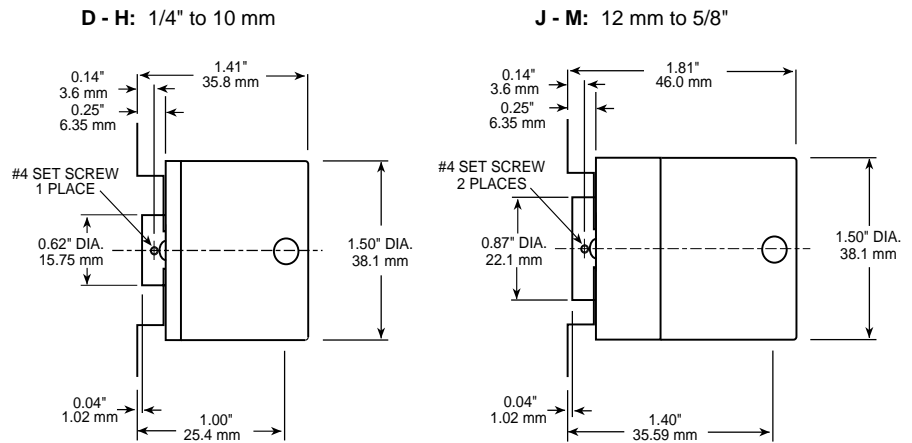
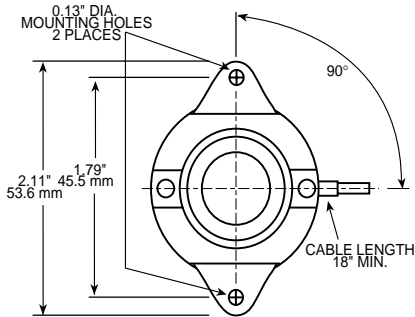
Operating Temperature: 0 to +70 °C
Storage Temperature: -25 to +70 °C
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof) Optional: NEMA 3/IP64 rating available (consult factory)

Electrical Connections

Wire Color Code	Function		
	Single-Ended Outputs	Differential Outputs	
		Unidirectional	Bidirectional
Red	Power Source	Power Source	Power Source
Black	Common	Common	Common
White	Signal A	Signal A	Signal A
Green	Signal B (if used)	Signal \bar{A}	Signal B
Orange	Signal Z (if used)	No Connection	Signal B
Blue	No Connection	No Connection	Signal \bar{A}
Shield	Floating	Floating	Floating
White/Black	—	—	Signal Z (if used)
Red/Black	—	—	Signal \bar{Z} (if used)

Series E14 Hub Shaft

Code 4: Mechanical



MOTOR
MOUNT

Ordering Information

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

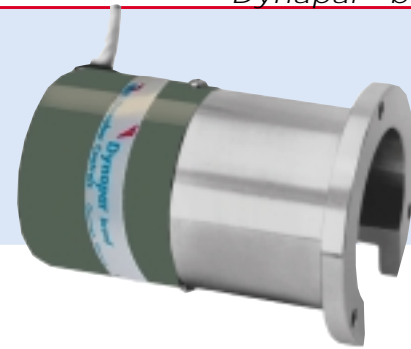
Code 1: Model	Code 2: Pulses/Rev	Code 3: Mounting	Code 4: Mechanical	Code 5: Output	Code 6: Electrical	Code 7: Termination
E14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E14 Size 14, Hub Shaft	0100 1000 0200 1024 0240 1250 0250 1500 0256 2000 0300 2048 0360 2500 0400 2540 0500 0600 0720 0750 0900	0 Size E14	Hub I.D. D 6 mm E 1/4" F 5/16" G 3/8" H 10 mm J 12 mm K 1/2" L 14 mm M 5/8" N 8 mm	0 Single Ended, Unidirectional 2 Single Ended, Bidirectional, no Index 3 Single Ended, Bidirectional, with Index 4 Differential, Unidirectional 6 Differential, Bidirectional, no Index 7 Differential, Bidirectional, with Index	0 5 VDC 1 12 VDC 2 15 VDC	0 18" Cable 1 3' Cable 2 6' Cable 3 10' Cable 4 15' Cable

Series E14 Integral Coupling

- Standard Mounting on NEMA Size 23 and 34 Motors
- Direct Replacements for Compumotor –E Option for Stepper Motors/Drives

Compumotor Equivalent Models:

For Size 23 Stepper Motor: E14-1000-A863
For Size 34 Stepper Motor: E14-1000-C863



MOTOR MOUNT

APPLICATION/INDUSTRY

The E14 with Integral Shaft Coupling is designed for convenient motor installation. It mounts on industry standard bolt circle patterns and is available to accommodate a choice of shaft sizes.

Typical Applications

- Motor-mounted feedback
- Industrial equipment
- Assembly machinery
- Robotics

DESCRIPTION

The Series E14 includes precision bearings and an O-ring seal and accommodates a 1/4" or 3/8" diameter stainless steel shaft.

Series E14 incorporates the latest in microelectronic packaging, LED light sources, and matched sensors. Outputs are designed to be compatible with most 5V TTL circuits with options for higher voltage 12 and 15 VDC. Shielded cable is standard. Line drivers with complementary outputs are available for longer cable runs and/or higher ambient electrical noise immunity.

FEATURES AND BENEFITS

Mechanical and Environmental Features

- Durable metal housing
- O-ring housing seal
- Accommodates rugged 1/4" or 3/8" diameter stainless steel shafts
- Up to 5000 RPM

Electrical Features

- Up to 2540 pulses per revolution including an optional marker pulse
- Higher electronic operating speed up to 100 kHz
- LED light source and matched sensors
- Choice of 5, 12, or 15 VDC units
- Shielded cable and line driver available for higher electrical noise immunity

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 100 to 2540 PPR (pulses/revolution)
Format: Two channel quadrature (AB) with optional Index (Z) outputs
Phase Sense: A leads B for CW shaft rotation as viewed from the shaft end of the encoder; Reverse phasing available, see Ordering Information
Accuracy: $\pm 3 \times (360^\circ \div \text{PPR})$ or ± 2.5 arc-min worst case pulse to any other pulse, whichever is less
Quadrature Phasing: $90^\circ \pm 36^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $90^\circ \pm 25^\circ$ (gated with A and B high)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pF

ELECTRICAL

Input Power:
5 VDC $\pm 5\%$ at 80 mA max.;
12 or 15 VDC $\pm 10\%$ at 80 mA max.; not including output loads
Outputs:
7272 line driver (or equivalent), 40 mA sink and source
Frequency Response: 100 kHz min.

MECHANICAL

Bearing Life: $(16 \times 10^6 \div \text{RPM})$ hours min.
Shaft Speed: 5,000 RPM max.
Starting Torque: 0.1 oz-in max. at 25 °C
Running Torque: 0.08 oz-in max. at 25 °C
Moment of Inertia: 3.8×10^{-5} oz-in-sec²
Weight: 7.0 oz. max.

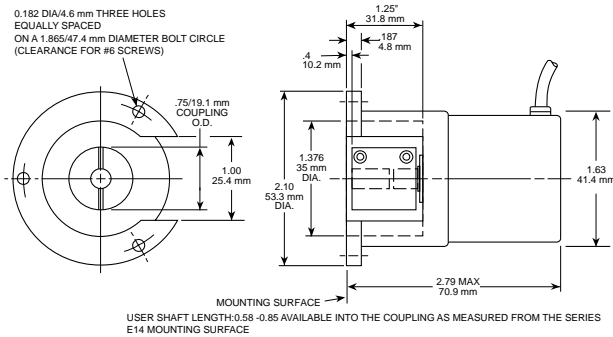
ENVIRONMENTAL

Operating Temperature: 0 to +70 °C
Storage Temperature: -25 to +70 °C
Humidity: to 98% without condensation
Enclosure Rating: NEMA12/IP54 (dirt tight, splashproof) Optional: NEMA 3/IP64 rating available (consult factory)

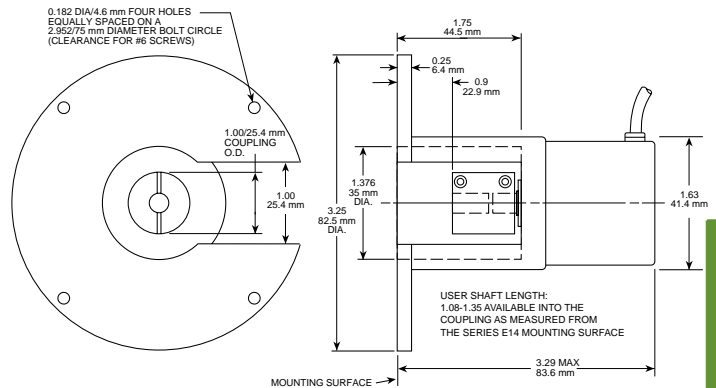
Series E14 Integral Coupling

Approximate Dimensions (inches/mm)

E14 for NEMA Size 23 Motors



E14 for NEMA Size 34 Motors



MOTOR MOUNT

Electrical Connections

Wire Color Code	Function			DB 25 Connector Pin Number
	Single Ended Outputs	Differential Outputs		
		Unidirectional	Bidirectional	
Red	Power Source	Power Source	Power Source	23
Black	Common	Common	Common	14
White	Signal A	Signal A	Signal A	1
Green	Signal B (if used)	Signal A	Signal B	3
Orange	Signal Z (if used)	No Connection	Signal B	4
Blue	No Connection	No Connection	Signal A	2
Shield	Floating	Floating	Floating	8
White/Black	—	—	Signal Z (if used)	5
Red/Black	—	—	Signal Z (if used)	6

Flange Adapter Ordering Codes

Factory Option Code	Motor Frame Size	Motor Shaft Diameter	Model No. of Coupling Only
A	23	1/4"	605106-1
B	23	3/8"	605106-3
C	34	3/8"	605106-3

Other couplings available; consult factory.

Field Installed Kit:

Field installed kits are available by ordering either Model No. E14-N1 (integral housing and mounting hardware for NEMA size 23 motors) or Model No. E14-N2 (integral housing & mounting hardware for NEMA size 34 motors), and the appropriate coupling listed in the table above.

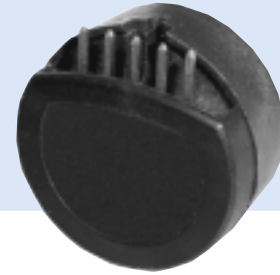
Ordering Information

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

Code 1: Model	Code 2: Pulses/Rev	Code 3: Mounting	Code 4: Mechanical	Code 5: Output	Code 6: Electrical	Code 7: Termination
E14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E14 Size 14, with Integral Shaft Coupling	0100 1000 0200 1024 0240 1250 0250 1500 0256 2000 0300 2048 0360 2500 0400 2540 0500 0600 0720 0750 0900	0 Size E14	A NEMA Size 23 Flange Mount with 1/4" Motor Shaft Coupling B NEMA Size 23 Flange Mount with 3/8" Motor Shaft Coupling C NEMA Size 34 Flange Mount with 3/8" Motor Shaft Coupling	0 Single Ended, Unidirectional 2 Single Ended, Bidirectional, no Index 3 Single Ended, Bidirectional, with Index 4 Differential, Unidirectional 6 Differential, Bidirectional, no Index 7 Differential, Bidirectional, with Index 8 Differential, Bidirectional, with Index, Reversed Phasing	0 5 VDC 1 12 VDC 2 15 VDC	0 18" Cable 1 3' Cable 2 6' Cable 3 10' Cable 4 15' Cable available when Code 5 = 7 or 8: 5 10' Cable, DB25 Connector 7 25' Cable, DB25 Connector

Series M9 Miniature Encoder

- Ideal for position and speed sensing in small machines and actuators
- 200 kHz operating frequency
- Resolution to 512 lines/rev
- CE Qualified



MOTOR MOUNT

APPLICATION/INDUSTRY

With a total length less than 15mm and a very low mass, the M9 series incremental optical encoder is ideally suited for use on the moving heads of pick-and-place type machines.

DESCRIPTION

The M9 may be used as direct replacements for most Hewlett Packard HEDS-5XXX encoders with no changes to the motor or cable.

The M9 provides high performance feedback for precision motion control in a very small package. Its small envelope makes it ideal for instrument axes for position and speed control in mechanisms too small to accept standard encoders. Its high performance, advanced features, and competitive pricing make it the encoder of choice for a broad range of applications.

It utilizes a patent-pending ASIC that integrates all encoder electronics, including the optoelectronic sensors, which enhances reliability and accuracy.

Outputs are single-ended quadrature A and B channels with up to 512 lines per rev plus an index pulse.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

- Code:** Incremental, Optical
Resolution: Incremental pulses per revolution; 100 to 512
Phasing: 90° ±18° electrical
Symmetry: 180° ±18° electrical
Index Pulse Width: 90° ±36° electrical

ELECTRICAL

- Supply Voltage:** 5 VDC ±10%
Supply Current: 10 mA, typ.
Output Signals: 2.5 V min. high (V_{OH}); 0.5 V max. low (V_{OL}); 6 mA sink/source (25°C), 4 mA (100°C)
Frequency Response: 200 kHz
Termination: 5 pin header (accessory 12" wires w/connector, part no. CA0050012) or flying leads
Recommended Mating Connector: AMP part number 103675-4

MECHANICAL

- Weight:** 0.15 oz (4.14 g)
Moment of Inertia: 0.15 x 10⁻⁵ oz-in-sec² (0.11 gm-cm²)
Hub Bore: 1.5, 2.0, 2.5, 3.0, 4.0 mm; 0.125, 0.156 inch
Hub Dia. Tolerance: +0.0004"/-0.0000" (+0.010 mm/-0.000 mm)
Mating Shaft Length: See table
Mating Shaft Runout: 0.001 TIR
Mating Shaft Endplay: >256 ppr: ±0.003" (±0.076mm); 250, 256 ppr: +0.005/-0.003" (+0.127/-0.076mm); <250 ppr: +0.007/-0.003" (+0.178/-0.076mm)

ENVIRONMENTAL

- Operating Temperature:** -40° to 100°C
Storage Temperature: -50° to 125°C
Relative Humidity: 90% non-condensing

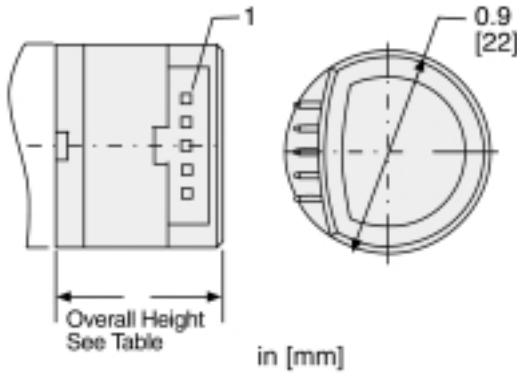
Output Waveforms & Connections

PIN	FUNCTION	CABLE WIRE
1	GND	BLACK
2	CH Z	BLUE
3	CH A	WHITE
4	Vcc	RED
5	CH B	BROWN

(Direction CCW viewing encoder cover)

Series M9 Miniature Encoder

Dimensions/Installation



MOTOR MOUNT

Base (Code 3)	Overall Height inch (MM)	Motor Shaft Length inch (MM)	
		Max.	Min
A	0.583 (14.80)	0.437 (11.10)	0.377 (9.57)
C, D, E	0.717 (18.20)	0.571 (14.50)	0.511 (12.97)

Bases C and D provide clearance for motor-bosses with maximum dimensions of 0.5 in. Dia. x 0.15 in. high. Base E provides clearance for motor-bosses with maximum dimensions of 1.0 in. x 0.15 in. high

Ordering Information

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

Code 1: Model	Code 2: PPR	Code 3: Mounting Description	Code 4: Hub Bore Description	Code 5: Termination Description
M9	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> /0	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>
Ordering Information				
M9 0.9" Diameter Incremental Modular Encoder	0100/0 0144/0 0200/0 0256/0 0300/0 0360/0 0500/0 0512/0	0 No mounting base A 4x M1.6 on 0.728" BC, C 2x #2-56 on 0.75" BC D 3x #0-80 on 0.823" BC E 2x #2-56 on 1.812" BC	1.5 1.5 mm 2.0 2.0 mm 2.5 2.5 mm 3.0 3.0 mm 4.0 4.0 mm 125 0.125 in 156 0.156 in	1 5 pin header 2 flying leads

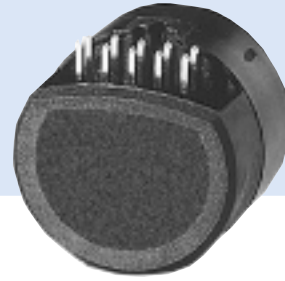
IMPORTANT: To properly install Series M9, a specialized mounting kit must be purchased. Only one kit is required to install any number of encoders with the same hub bore size.

Kit Part Number: MK M9 Code 4 (from Models Table, above) designating Hub Bore requirement.

Example: Kit for installing encoders with 3.0 mm hub Bore= **MK M9 3.0**

Series E9 Miniature Encoder

- Ideal for position and speed sensing in small machines and actuators
- Low power standby mode is ideal for battery powered devices
- 200 kHz operating frequency
- Resolution to 512 lines/rev
- CE Qualified



MOTOR MOUNT

APPLICATION/INDUSTRY

The E9 series incremental optical encoder provides high performance feed-back for precision motion control in a very small package. Its small envelope makes it ideal for instrument axes for position and speed control in mechanisms too small to accept standard encoders.

DESCRIPTION

Its high performance, advanced features, and competitive pricing make it the encoder of choice for a broad range of applications.

The E9 optical encoders utilize a patent-pending ASIC that integrates all encoder electronics, including the optoelectronic sensors, which enhances reliability and accuracy.

Outputs are quadrature A and B channels with up to 512 lines per rev, an index pulse, unique up/down and rotation direction signals (version 2) or complementary CMOS-compatible (version 1). The E9 also has a low-power standby mode to conserve power in battery-operated applications.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental, Optical
Resolution: Incremental pulses per revolution; 100 to 512
Phasing: 90° ±18° electrical degrees
Symmetry: 180° ±18° electrical
Index Pulse Width: 90° ±36° electrical

ELECTRICAL

Supply Voltage: 5 VDC ±10%
Supply Current: 10 mA, typ.
Standby Current: 50 µA, max.
Output Signals: 2.5 V min. high (V_{OH}); 0.5 V max. low (V_{OL}). 3 mA sink/source (25°C), 2 mA (100°C)
Frequency Response: 200 kHz
Termination: 10 pin header (accessory connector/12" ribbon cable, part no. CA0040012)
Recommended Mating Connector: Thomas & Betts part number 622-1030

MECHANICAL

Weight: 0.18 oz (5.07 g)
Moment of Inertia: 0.28 x 10⁻⁵ oz-in-sec² (0.20 gm-cm²)
Hub Bore: 1.5, 2.0, 2.5, 3.0, 4.0 mm; 0.125, 0.156 inch
Hub Dia. Tolerance: +0.0004"/-0.0000" (+0.010 mm/-0.000 mm)
Mating Shaft Length: See table
Mating Shaft Runout: 0.001 TIR
Mating Shaft Endplay: >256 ppr: ±0.003" (±0.076mm); 250, 256 ppr: +0.005/-0.003" (+0.127/-0.076mm); <250 ppr: +0.007/-0.003" (+0.178/-0.076mm)

ENVIRONMENTAL

Operating Temperature: -40° to 100°C
Storage Temperature: -50° to 125°C
Relative Humidity: 90% non-condensing

Output Waveforms & Connections (Direction viewing encoder cover)

Code 4= 00

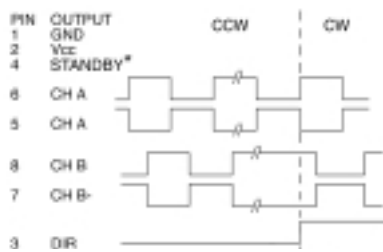


Figure 1

Code 4= 01

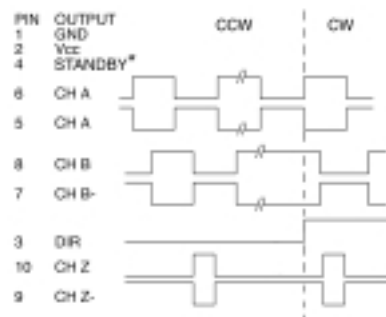


Figure 2

Code 4= 02

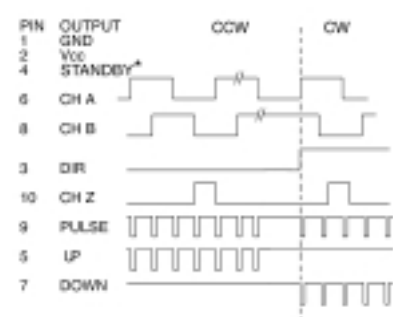
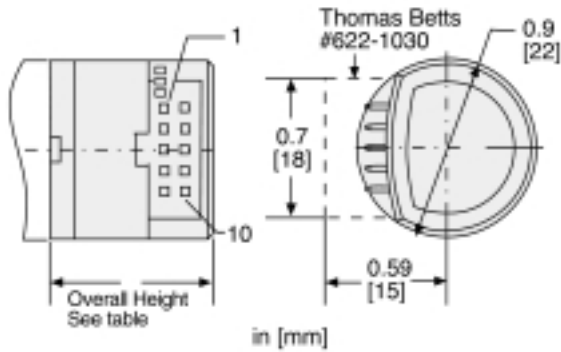


Figure 3

* For operation, connect **STANDBY (4)** to **Vcc (2)**

Series E9 Miniature Encoder

Dimensions/Installation



Base (Code 3)	Overall Height inch (MM)	Motor Shaft Length inch (MM)	
		Max.	Min
A	0.795 (20.20)	0.479 (12.16)	0.467 (11.86)
C, D, E	0.929 (23.60)	0.613 (15.56)	0.581 (14.76)

Bases C and D provide clearance for motor-bosses with maximum dimensions of 0.5 in. Dia. x 0.15 in. high. Base E provides clearance for motor-bosses with maximum dimensions of 1.0 in. x 0.15 in. high

MOTOR
MOUNT

Ordering Information

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

Code 1: Model	Code 2: PPR	Code 3: Hub Bore	Description	Code 4: Output	Description	Code 5: Mounting	Description
E9	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>	
Ordering Information							
E9 0.9" Diameter Incremental Modular Encoder	0100	1.5	1.5 mm	00	See Figure 1	0	No mounting base
	0144	2.0	2.0 mm	01	See Figure 2	A	4x M1.6 on 0.728" BC
	0200	2.5	2.5 mm	02	See Figure 3	C	2x #2-56 on 0.75" BC
	0256	3.0	3.0 mm			D	3x #0-80 on 0.823" BC
	0300	4.0	4.0 mm			E	2x #2-56 on 1.812" BC
	0360	125	0.125 in				
	0500	156	0.156 in				
0512							

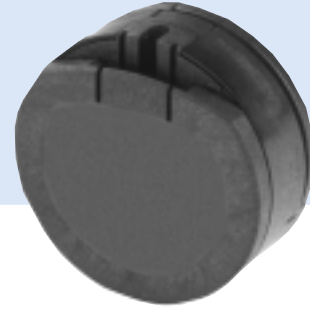
IMPORTANT: To properly install Series E9, a specialized mounting kit must be purchased. Only one kit is required to install any number of encoders with the same hub bore size.

Kit Part Number: MK E9 Code 3 (from Models Table, above) designating Hub Bore requirement.

Example: Kit for installing encoders with 3.0 mm hub Bore= **MK E9 3.0**

Series M14 Miniature Encoder

- Ideal economical feedback device for servo and stepper motors
- Short axial length and compact 1.5 inch diameter
- Easy “snap-on” installation
- High resolution to 1024 lines/rev and 200 kHz bandwidth
- Drop-in replacement for HP 5540
- CE Qualified



MOTOR MOUNT

APPLICATION/INDUSTRY

The M14 series of incremental optical encoders provides high performance feedback for precision motion control in a small, low cost package. Its high performance, advanced features, and competitive pricing make it the encoder of choice for a broad range of applications.

DESCRIPTION

The M14 optical encoder utilizes a patent-pending ASIC that integrates all encoder electronics, including the optoelectronic sensors, which enhances reliability and accuracy.

Quadrature A and B channels with up to 1024 lines per revolution and reference pulse are output as single-ended TTL/CMOS compatible signals.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental, Optical
Resolution: Incremental pulses per revolution; 200 to 1024
Phasing: 90° ±18° electrical
Symmetry: 180° ±18° electrical
Index Pulse Width: 90° ±36° electrical

ELECTRICAL

Supply Voltage: 5 VDC ±10%
Supply Current: 10 mA, typ.
Output Signals: 2.5 V min. high (V_{OH}); 0.5 V max. low (V_{OL}), 6 mA sink/source (25°C), 4 mA (100°C)
Frequency Response: 200 kHz
Termination: 5 pin connector (accessory connector w/12" wires, part no. CA0060012)
Recommended Mating Connector: Amp Part Number 103969-4

MECHANICAL

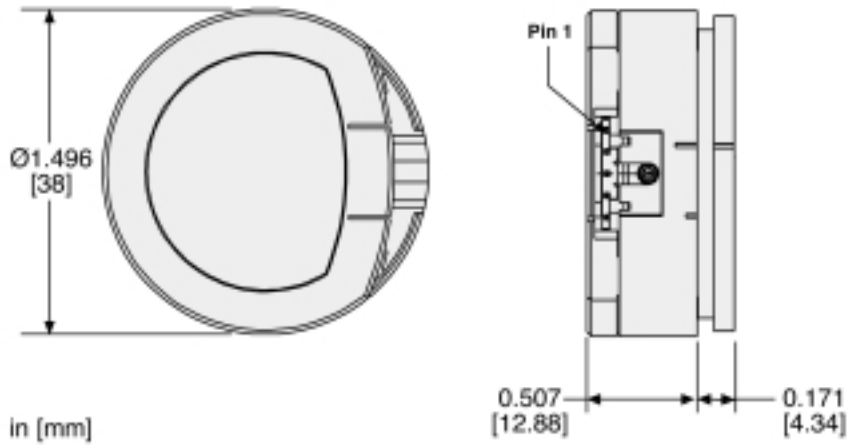
Weight: 0.22 oz (6.2 g)
Moment of Inertia: 0.16×10^{-5} oz-in-sec² (0.13 gm-cm²)
Hub Bore: 3.0, to 8.0 mm; 0.125, to 0.375 inch
Hub Dia. Tolerance: +0.0004"/-0.0000" (+0.010 mm/-0.000 mm)
Mating Shaft Length: 0.525" (13.3 mm) max.; 0.436" (11.07 mm) min.
Mating Shaft Runout: 0.001 TIR
Mating Shaft Endplay: >512 ppr: ±0.003" (±0.076mm); 500, 512 ppr: +0.005/-0.003" (+0.127/-0.076mm); <500 ppr: +0.007/-0.003" (+0.178/-0.076mm)

ENVIRONMENTAL

Operating Temperature: -40° to 100°C
Storage Temperature: -50° to 125°C
Relative Humidity: 90% non-condensing

Series M14 Miniature Encoder

Dimensions/Installation



Output Waveforms & Connections (Direction CCW viewing encoder cover)

PIN	FUNCTION		CABLE WIRE
5	GND		BLACK
4	CH Z		BLUE
3	CH A		WHITE
2	Vcc		RED
1	CH B		BROWN

MOTOR MOUNT

Ordering Information

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

Code 1: Model	Code 2: PPR	Code 3: Mounting	Description	Code 4: Hub Bore	Description
M14	□□□□/0	□		□ □ □	
Ordering Information					
M14	1.5" Diameter Incremental Modular Encoder	0200/0 0400/0 0500/0 0512/0 1000/0 1024/0	0 No mounting base A 2x #2-56 on 1.28" BC B 3x #0-80 on 0.823" BC C 2x #2-56 on 0.75" BC	3.0 4.0 5.0 6.0 8.0 125 187 249 250 312 374 375	3.0 mm 4.0 mm 5.0 mm 6.0 mm 8.0 mm 0.1248 in 0.1873 in 0.2498 in 0.2501 in 0.3123 in 0.3748 in 0.3750 in

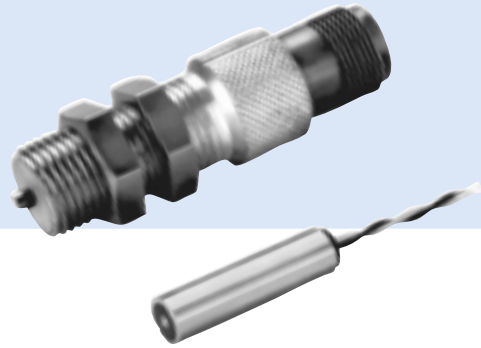
IMPORTANT: To properly install Series M14, a specialized mounting kit must be purchased. Only one kit is required to install any number of encoders with the same hub bore size.

Kit Part Number: MK M14 □ □ □ *Code 4 (from Models Table, above) designating Hub Bore requirement.*

Example: Kit for installing encoders with 0.1248" hub Bore= **MK M14 125**

Series 50 & 50BH Pickups

- **Speed Range:** typically 50 RPM min. to 4000 RPM max.
- **Sine wave output**
- **Passive, no external power source required**
- **Compact 3/8" & 5/8" diameter packages**
- **Rugged, mill-duty construction**



SENSORS AND PICKUPS

APPLICATION/INDUSTRY

Typically used in conjunction with a variety of instruments for indicating or controlling speed, flow rate, etc.

DESCRIPTION

These variable reluctance, magnetic sensors are the simplest, most economical form of speed sensing. Motion and speed are sensed without mechanical couplings, bearings, linkages or an external power source. A sinewave alternating voltage signal is generated synchronously in the presence of gear teeth made of carbon steel, magnetic stainless steel, or iron (ferrous metal). Output voltage and frequency start at zero with zero target speed, and both increase with the increasing speed of a passing target.

FEATURES AND BENEFITS

Advantages of magnetic pickups include

- Ability to generate a wide range of error-free speed signals
- Moderately priced
- Reliable operation with little protection required
- Good for wet, dirty, high temperature environments
- Many industrial, military, and commercial applications.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Operating Temperature: 0° to 170°F

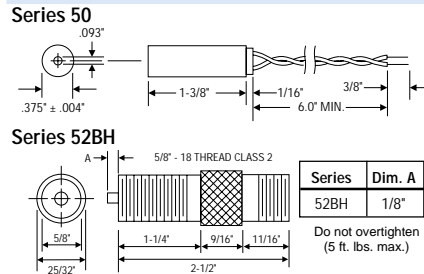
Recommended Gap: .005 inch

Output: Greater than .5 volt peak (2K ohm load) above 3 in./sec.

Cable Length: Maximum recommended cable length is 100 feet, but can be extended to 300 feet with minimum speeds above 300 RPM. Line amplifiers are available for longer line lengths. Consult factory.

DC Resistance: 500 to 650 ohms

APPROXIMATE DIMENSIONS (IN INCHES)



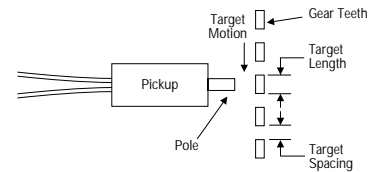
Recommended Dynapar brand Gears

Gear	Dia.	Bore	Pitch	PPR	50	52BH
16002070081	3-1/10"	3/8"	20	60	X	
16002070083	3-7/8"	1/2"	16	60	X	
16002070216	5-1/2"	1-1/8"	11	60	X	X
16002070217	5-1/2"	1-3/8"	11	60	X	X
16002070218	5-1/2"	1-5/8"	11	60	X	X
16002600314	5-1/2"	1-7/8"	11	60	X	X
16002600315	5-1/2"	2"	11	60	X	X
16002600316	5-1/2"	2-1/8"	11	60	X	X
16002600317	5-1/2"	2-1/4"	11	60	X	X
16002600318	5-1/2"	2-3/8"	11	60	X	X
16002600319	5-1/2"	2-1/2"	11	60	X	X
16002600320	5-1/2"	2-7/8"	11	60	X	X

Application Guidelines

Characteristics required for proper selection and application of variable reluctance sensors include:

1. Target speeds of interest must be greater than approximately 180 in./min. (60 tooth gear operation: 50 to 4000 RPM), and will generate operational voltage levels typically 0.5 to 2 volts peak-to-peak.
2. Minimum target length and width dimensions should be greater than and centered on the diameter of the pole tip.



3. Target spacing must be at least three times the length of the target.
4. The gap between the target and the tip of the pickups pole should be as small as possible (output voltage is optimized at a gap of 0.005").

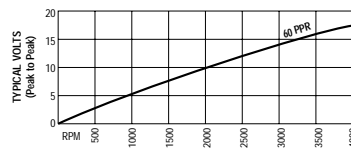
For more application information, refer to the "Fundamentals for Applying Magnetic Pickups" discussion in the Application Reference section of this catalog.

ELECTRICAL CONNECTIONS

Function	Series 50 Wire Color Code	Series 52BH Pin No.	Dyn.#14002030010* Cable Acc'y Color Code
Signal Out	WHT	A	RED
Common	BLK	B	BLK

Note: Wire with 2-conductor shielded cable, such as Belden 8737 should be insulated at sensor and grounded at the instrument.

*This is a cable assembly described in the Encoder Accessories section of this catalog. (A mating connector is also available.) Color-coding information is provided here for reference.



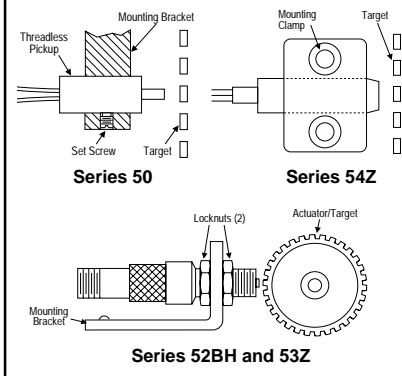
NOTE: ALL CURVES WERE GENERATED WITH A 20K LOAD
Typical Output Voltages vs. RPM

Ordering Information

Output Waveform	Termination	Tip Length	Model No
	6" leads Pin connector	— 1/8"	50 52BH

Note: For slower speed applications, refer to Series 53Z magneto-resistive pickups.

Typical Installation Methods (For All Dynapar Pickups)



Series 53Z & 53ZK Pickups

- Speed Range: zero speed to 20 kHz
- Squarewave digital outputs
- Rugged, mill-duty construction
- Compact 5/8" diameter package

Note: Series 53Z's and 53ZK's are not proximity detectors.



APPLICATION/INDUSTRY

Series 53Z and 53ZK pickups provide a squarewave digital output that is used as a feedback signal for many industrial speed-control applications.

DESCRIPTION

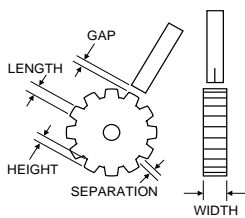
Series 53Z and 53ZK pickups provide a squarewave digital output that is generated by the alternating presence and absence of a ferrous metal target. The 53Z is used with gear teeth. The 53ZK's commonly used targets include gear teeth, slotted discs, shafts with keyways, etc. made of carbon steel, iron, or magnetic stainless steel. These sensors provide constant amplitude pulses down to zero speed. Reliable operation in wet, dirty, high temperature environments makes magnetic pickups a popular selection for many industrial and commercial applications.

FEATURES AND BENEFITS

Advantages of magnetic pickups include

- Speed sensing
- Ideal for inputs to PLC's, instruments, electronic counters, etc.

TYPICAL APPLICATION



Remember to rotate the pickup so that the line on the side is parallel to gear travel.

53Z (gear pickup) Target:

- Pitch: 20 to 32
- Gap: 0.005 to 0.015" (0.127 to 0.381 mm)
- Length: 0.049 to 0.081" (1.24 to 2.06 mm)
- Separation: 0.049 to 0.081" (1.24 to 2.06 mm)
- Width: 0.25" (6.35 mm) min.
- Height: 0.035" (.889 mm) min.

53ZK (keyway pickup) Target:

- Pitch: 20 max.
- Gap: 0.005 to 0.030" (0.127 to 0.762 mm)
- Length: 0.081" (2.057 mm) min.
- Separation: 0.081" (2.057 mm) min.
- Width: 0.375" (9.525 mm) min.
- Height: 0.081" (2.057 mm) min.

Note: The target can be a ferrous gear that falls within minimum dimensions.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Power Requirements: 5-15 VDC, 15 mA plus load
 Weight: 2 oz.
 Operating Temperature: -25° to +80°C
 Mating Connector: MS3106A-10SL-3S or Dynapar Part No. MCN-N2
 Recommended Cable: Belden #9770 or Dynapar Part No. 16002160022

ELECTRICAL CONNECTIONS

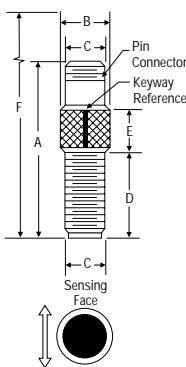
Function	Series 53Z & 53ZK Pin No.	Dyn.#14003340010* Cable Acc'y Color Code
5-15 VDC	A	RED
Signal	B	WHT
Common	C	BLK

*This is a mating connector/cable assembly described in the Encoder Accessories section of this catalog. Color-coding information is provided here for reference.

ELECTRICAL OUTPUT RATINGS

Outputs	Voltage Range	Sink (mA)	Source (mA)	Operating Speed
Current Sink (open collector w/2.0 kΩ pull-ups)	5-15 VDC	25	0.8 mA @ 3.5V output	20 kHz max.

APPROXIMATE DIMENSIONS (IN INCHES/MM)



53Z & 53ZK

- A. 2-9/16" (65.08mm)
 - B. 3/4" (19.05mm)
 - C. 5/8" (15.9mm)
 - D. 1-1/8" (28.6mm)
 - E. 9/16" (14.3mm)
 - F. 4-1/8" (104.8mm)
- Length with mating connector
 Mounting Thread 5/8-18
DO NOT OVERTIGHTEN
 (5 ft. lbs. max.)

Arrows indicate direction of metallic target or gear teeth movement relative to keyway position and mark on barrel.

Gears (For All Dynapar Pickups)



For use with series 50, 52BH, 53Z, and 53ZK pickups. Designed for customer boring and mounting.

Part No.	No. of Teeth	Pitch Dia.	Pitch	Rough Hole Bore	Largest Hole Bore Possible
16002070081	60	3.00"	20	3/8"	1.00"
16002070083	60	3.750"	16	1/2"	1.00"

Ordering Information

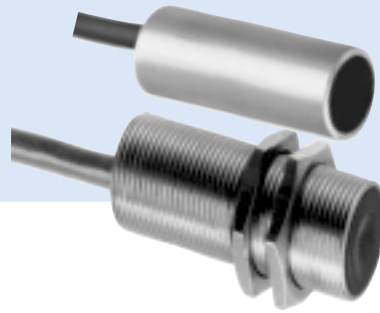
Output Waveform	Termination	Model No.
Unidirectional for gear A	MS Pin Connector	53Z
Unidirectional for keyway A	MS Pin Connector	53ZK

Recommended Dynapar brand Gears

Gear	Dia.	Bore	Pitch	PPR	53Z	53ZK
16002070081	3-1/10"	3/8"	20	60	X	X
16002070083	3-7/8"	1/2"	16	60		X
16002070216	5-1/2"	1-1/8"	11	60	X	X
16002070217	5-1/2"	1-3/8"	11	60	X	X
16002070218	5-1/2"	1-5/8"	11	60	X	X
16002600314	5-1/2"	1-7/8"	11	60	X	X
16002600315	5-1/2"	2"	11	60	X	X
16002600316	5-1/2"	2-1/8"	11	60	X	X
16002600317	5-1/2"	2-1/4"	11	60	X	X
16002600318	5-1/2"	2-3/8"	11	60	X	X
16002600319	5-1/2"	2-1/2"	11	60	X	X
16002600320	5-1/2"	2-7/8"	11	60	X	X
16002070219	5-1/2"	1-1/8"	22	120	X	X
16002070220	5-1/2"	1-3/8"	22	120	X	X
16002070221	5-1/2"	1-5/8"	22	120	X	X
16002600307	5-1/2"	1-7/8"	22	120	X	X
16002600308	5-1/2"	2"	22	120	X	X
16002600309	5-1/2"	2-1/8"	22	120	X	X
16002600310	5-1/2"	2-1/4"	22	120	X	X
16002600311	5-1/2"	2-3/8"	22	120	X	X
16002600312	5-1/2"	2-1/2"	22	120	X	X
16002600313	5-1/2"	2-7/8"	22	120	X	X
Key / Keyway			1			X

Series 54Z & 54ZT Pickups

- Low Cost Pickup
- Compact Design
- Simple Installation
- Wide Operating Range



SENSORS AND PICKUPS

APPLICATION/INDUSTRY

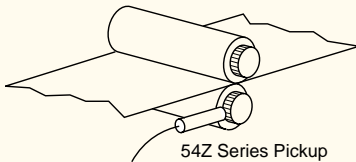
The Series 54 sensors operate over a wide range of air gaps, making them suitable for parts counting and speed sensing applications.

- Parts counting
- Speed sensing
- Sensor for PLC's and indicators

DESCRIPTION

The Series 54 pickups offer new levels of economy, performance and convenience to sensing devices. The wide operating voltage makes them compatible with most counters, indicators or controllers. The Series 54 does not require a minimum target speed, and can operate from zero up to 20,000 targets per second. Commonly used targets include gear teeth, slotted discs, shafts with keyways, etc. made of carbon steel, iron, or magnetic stainless steel. This low cost sensor offers reliable operation in wet, dirty and high temperature environments.

TYPICAL APPLICATION



54Z Series Pickup

Application Guidelines:

For ease of installation and optimum performance, a keyway is provided so that the sensor may be visually aligned with the target's direction of travel.

Target Requirements:

- Gap: 0.005 to 0.030 inch
- Length: 0.081 inch min.
- Separation: 0.081 inch min.
- Width: 0.375 inch min.
- Height: 0.081 inch min.
- Speed: 0 to 20,000 targets/sec. max.
- Pitch: 20 max

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Power Requirements: 5 to 18 VDC, 10 mA plus load

Weight: 2 oz.

Operating Temperature: -40 to +105 °C (-40 to +220 °F.)

Cable: 105 °C, PVC insulation, 10 foot length

Material: Stainless 303 Steel

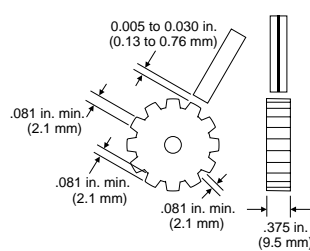
ELECTRICAL OUTPUT RATINGS

Outputs	Voltage Range	Sink (mA)	Source (mA)	Operating Speed
Current Sink (open collector w/2.2 kΩ pull-ups)	5 to 18 VDC	17	0.9 mA @Vcc-2V output	20 kHz max.

ELECTRICAL CONNECTIONS

Function	Series 54Z Wire Color Code
5 to 18 VDC	RED
Signal	WHT
Common	BLK

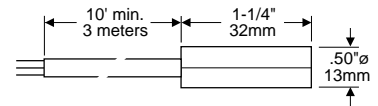
TARGET REQUIREMENTS



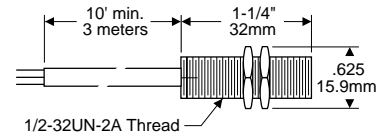
Remember to rotate the pickup so that the line on the side is parallel to gear travel.

APPROXIMATE DIMENSIONS

Model 54Z

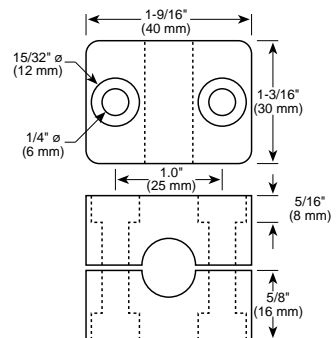


Model 54ZT



MOUNTING CLAMP

(not required for model 54ZT)



Recommended Dynapar brand Gears

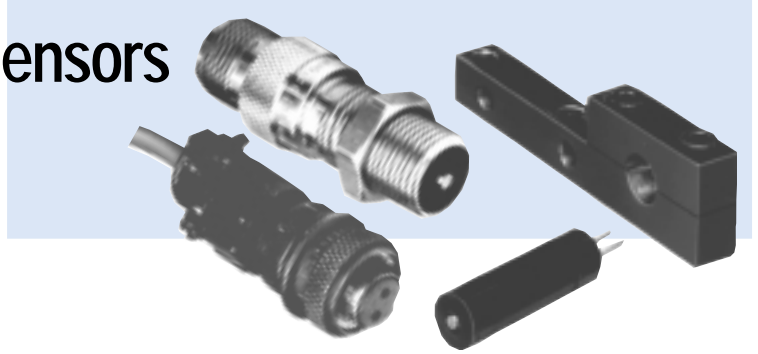
Gear	Dia.	Bore	Pitch	PPR	54Z/54ZT
16002070081	3-1/10"	3/8"	20	60	X
16002070083	3-7/8"	1/2"	16	60	X
16002070216	5-1/2"	1-1/8"	11	60	X
16002070217	5-1/2"	1-3/8"	11	60	X
16002070218	5-1/2"	1-5/8"	11	60	X
16002600314	5-1/2"	1-7/8"	11	60	X
16002600315	5-1/2"	2"	11	60	X
16002600316	5-1/2"	2-1/8"	11	60	X
16002600317	5-1/2"	2-1/4"	11	60	X
16002600318	5-1/2"	2-3/8"	11	60	X
16002600319	5-1/2"	2-1/2"	11	60	X
16002600320	5-1/2"	2-7/8"	11	60	X
Key or Keyway				1	X

Ordering Information

Output Waveform	Description	Model No.
	Pickup	54Z
	Threaded Pickup	54ZT
	Clamp for 54Z	605213

Series 7143 Magnetic Sensors

- High output gear tooth sensor
- Requires no power Supply
- For low RPM measurement



APPLICATION/INDUSTRY

For monitoring the speed of any shaft when mated with a magnetic-input tachometer and positioned in alignment with the teeth of a ferrous material gear.

DESCRIPTION

Typically, 60-tooth, 16-pitch gears provide the optimum characteristics for RPM measurement, but other gear types can serve special application needs. They are well suited for industrial machinery as well as test stand and laboratory installations. Series 7143 is available in a plastic tube model, supplied with mounting bracket, or in threaded stainless-steel model. Both include a 10-foot shielded cable with mating connector.

Series 7143 features an extra strength permanent magnet pole-piece and high inductance coil. Gear teeth supply the motion within the magnetic field, so that the sensor/gear combination acts as an AC generator. Voltage output is directly proportional to velocity and closeness of the air gap.

FEATURES AND BENEFITS

- High output design for superior low velocity performance
- Two-wire, self generating output requires no power connection
- Economy plastic, or heavy-duty noncorrosive stainless steel models
- Supplied with all necessary mounting hardware and cable

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Output Voltage: 25 VDC minimum peak to peak (into 100 kΩ load) with 16-pitch gear, 1000 RPM, 0.01" gap

DC Resistance: 1200Ω maximum

Inductance: 400 mH maximum

Temperature Range: -100° to +225°F (-73° to +107°C)

Materials: Model Number 714300-001: Plastic shell, stainless steel pole piece; Model Number 714300-002: Stainless steel shell and pole piece

Mounting: Model Number 714300-001: Aluminum bracket (supplied); Model Number 714300-002: Threaded body with locknuts (supplied)

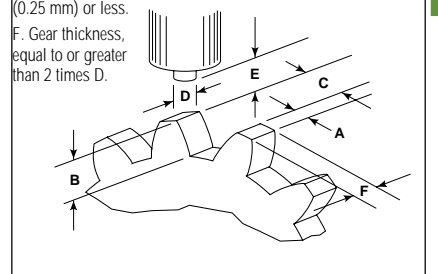
Connections: 10' cable assembly (supplied)

SELECTING THE PROPER GEAR

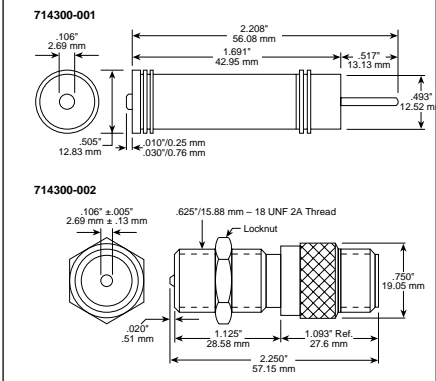
It is vital when using the Series 7143 for revolutions per minute applications that a 60-tooth, ferrous gear be properly selected. Optimum results relative to the sensing of low rpm, as well as high speeds will be achieved with gears having a pitch of 16 or less, and a gear-to-sensor gap of 0.01" or less. Sixty-tooth gears with up to 20 pitch and/or gear-to-sensor gaps of up to 0.05", will produce excellent results provided that operation below approximately 600 rpm is not required.

The following figure suggests typical requirements for gear configuration. Ideal dimensions may not be available in stock gears, but the figure serves as a guide for selection of the best stock gear available.

- A. Dimension of tooth top, equal to or greater than D.
- B. Height of tooth, equal to or greater than D.
- C. Space between teeth, equal to or greater than D.
- D. Diameter of pole piece, typically 0.106" (2.69 mm).
- E. Clearance, as close as possible, typically 0.01" (0.25 mm) or less.
- F. Gear thickness, equal to or greater than 2 times D.



Dimensions:



Recommended Gears

Gear	Dia.	Bore	Pitch	PPR	7143
16002070083	3-7/8"	1/2"	16	60	X
16002070216	5-1/2"	1-1/8"	11	60	X
16002070217	5-1/2"	1-3/8"	11	60	X
16002070218	5-1/2"	1-5/8"	11	60	X
16002600314	5-1/2"	1-7/8"	11	60	X
16002600315	5-1/2"	2"	11	60	X
16002600316	5-1/2"	2-1/8"	11	60	X
16002600317	5-1/2"	2-1/4"	11	60	X
16002600318	5-1/2"	2-3/8"	11	60	X
16002600319	5-1/2"	2-1/2"	11	60	X
16002600320	5-1/2"	2-7/8"	11	60	X

Model No.	Description
714300-001	1/2" diameter x 1-3/4" plastic probe, bracket, cable assembly
714300-002	5/8" diameter x 2-1/4" stainless steel probe, cable assembly

For zero speed sensors, see 51Z, 53Z Pickups

CPL Flexible Shaft Couplings

- **Maximum mechanical, thermal, and electrical protection for encoder shaft connections**
- **Three-beam helical design restricts torque "windup"**
- **Clamp attachment. No setscrews to score or pit shafts**
- **Full range of models designed to match specific encoders are supplied with shaft size adaptors**



APPLICATION/INDUSTRY

CPL Series couplings are carefully matched to the requirements of our encoders and are an excellent, low cost way to protect your investment and avoid equipment downtime.

DESCRIPTION

The method of coupling rotational input to an encoder is an important consideration.

Excessive shaft loading and poor environmental isolation are the leading causes of encoder failure and operational errors.

Even the most carefully designed machinery will produce shaft forces due to inherent thrusts, and eccentricities. Since encoder shafts and bearings must be engineered to have very restricted axial and radial play, using a Dynapar brand CPL Series coupling affords maximum protection against these common hazards.

A unique 3-beam design divides the coupling's helix into three segments. This feature maintains transfer accuracy by restricting windup during torque, yet retains full protective flexibility.

In addition to controlling mechanical shaft and bearing loads, the coupling further protects the encoder by providing a high degree of electrical and thermal isolation between coupled shafts. This is accomplished with a phenolic insulator-insert that blocks passage of potentially damaging heat, electrical currents and static charges.

Each CPL Series coupling is supplied with two insulator-inserts (three for metric models) that allow it to fit standard shaft diameters (see Models table, Secondary Bore).

Attachment at both ends is via integral 360° clamps that firmly grip the encoder shaft and input shaft, remaining slip-free to the rated torque of the coupling.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Predicted life: Tested in accordance with MIL-HDBK-5A for infinite life.

Material: 2024-T3.5 QQA225/6 aluminum with MIL A8625 Type II black anodize.

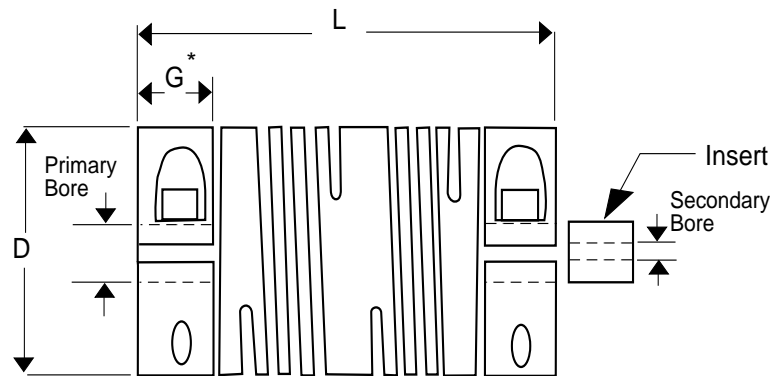
Insert/insulator: G10 glass filled phenolic. Sizes provided per *Models table, Secondary Bore*.

Clamps: Integral at each end, with black oxide finish hex socket cap screws. Grip is secure to peak torque rating of the coupling per *Models table, Peak Torque*.

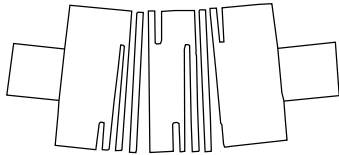
Peak Torque: Per *Models table, Peak Torque*. Safety factor should be determined considering acceleration and deceleration loads, etc.

APPROXIMATE DIMENSIONS

Refer to Models Table for dimensions of specific models.



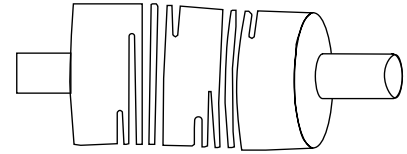
*Shafts may extend beyond the clamp-grip-area to within the flexure area, but must not butt.



Angular Misalignment

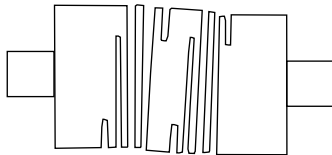
When the center lines of the shafts extend and form an obtuse angle. The intersection of this obtuse angle should be at the center of the flexible beam area.

Proper shaft coupling protects precision encoders from all of these common hazards. Use of a well engineered coupling can save many times its cost by eliminating failures due to excessive shaft loading, electrical leakage, and thermal stress.



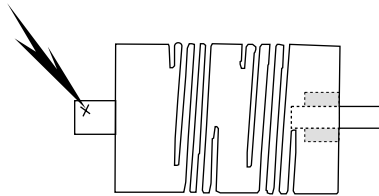
Skewed Misalignment

The shafts are not in the same plane. Center line extension is not parallel or intersecting. There can be two obtuse angles of varying degrees. These angles should be centered within the coupling.



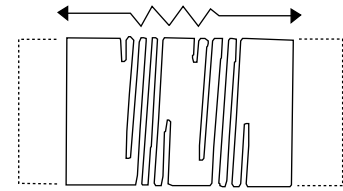
Parallel Misalignment

The shaft's center lines are parallel but offset. When the coupling is installed there should be two equal obtuse angles within the coupling.



Electrical and Thermal Stress

The supplied insulator insert blocks transfer of static charges, leakage currents, and heat to the encoder. These stresses have been proven to be contributory to bearing damage as well as electrical failures.



Axial Motion

Motion in the direction of the center lines of the shafts, such as motor shaft "thrust". Usually created by loose bearings or other elements that do not restrain the motion.

ORDERING INFORMATION

Coupling Model Numbers should be selected first by Encoder Application duty, then by specific encoder shaft size and drive shaft size. Most applications will use the Primary Bore as the encoder end, but it is permissible to reverse the coupling to accommodate specific shaft combinations. Each coupling is supplied with Secondary Bore insulator inserts as listed.

Model Number	Primary Bore	Secondary Bore	Dimensions			Maximum Misalignment			Peak Torque (lb. - in.)	Encoder Application (Series)
			D= Dia.	L= Len.	G= Grip	Angular	Parallel	Axial		
CPL00750125	1/8	1/8, 3/16	0.750	0.875	0.230	3°	0.020	0.035	35	Very Light Duty E11, E15,
CPL00750187	3/16	3/16, 1/4								
CPL00750250	1/4	1/8, 1/4								
CPL01000187	3/16	3/16, 1/4	1.000	1.250	0.290	5°	0.025	0.060	45	Light Duty E20, EC80, 523, 42, 525, 21/22, 31/32
CPL01000250	1/4	1/4, 3/8								
CPL01000375	3/8	3/16, 3/8								
CPL01250250	1/4	1/4, 3/8	1.250	1.250	0.348	7°	0.038	0.060	75	Medium Duty 42, 525, 625, 21/22, 60
CPL01250375	3/8	3/8, 1/2								
CPL01250500	1/2	1/4, 1/2								
CPL01500375	3/8	3/8, 1/2	1.500	1.500	0.400	10°	0.035	0.060	100	Heavy Duty 625, EX625, 60, 60P
CPL01500500	1/2	1/2, 5/8								
CPL01500625	5/8	3/8, 5/8								
CPL02000875	7/8	3/8, 5/8	2.000	2.000	0.450	10°	0.040	0.060	300	Extra Heavy Duty 625, 60P
CPL02001000	1	3/8, 5/8								
CPL02001125	1 1/8	3/8, 5/8								
CPLM1000250	1/4	4, 5, 6 mm	1.000	1.250	0.290	5°	0.025	0.060	45	Light Duty E20, EC80, 523, 525, 21/22
CPLM1250375	3/8	6, 8, 10 mm	1.250	1.250	0.348	7°	0.038	0.060	75	Medium Duty 42, 525, 625, 21/22
CPLM1500500	1/2	6, 8, 10 mm	1.500	1.500	0.400	10°	0.035	0.060	100	Heavy Duty 60, 60P

- Note:**
1. For extremely high acceleration rates, consider using the next larger coupling size.
 2. When coupling an encoder to a shaft which is stepped down from a larger size, always use a heavy-duty or extra-heavy-duty coupling.
 3. For maximum life, encoders must be installed and aligned such that the encoder shaft to driving shaft alignment is within the 0.003" TIR NEMA standard despite the maximum misalignment specified.

FV2 Brushless Digital Feedback

- Bidirectional Frequency/Voltage or Frequency/Current Converter
- An FV2 and an encoder replace a DC Tachometer when precision feedback is required.



APPLICATION/INDUSTRY

Dynapar FV2 frequency-to-voltage converter measures a digital pulse input frequency and converts it to an analog ± 10 VDC or 4-20 mA output proportional to frequency/speed. When used with a Dynapar encoder it eliminates the need for a tachometer, and provides velocity feedback for closed loop speed control.

DESCRIPTION

A wide range of digital pulse transducers, application speed ranges, and converter response times can be configured via front panel switches. The FV2 also includes 12 VDC transducer supply power.

A factory- or field-installed option board can provide these features:

- Optical isolation for analog outputs
- An auxiliary set of unidirectional or bidirectional digital outputs
- Relay outputs for signaling transducer phase failure or loss; direction reversal; over/underspeed detection

FEATURES AND BENEFITS

- An FV2 and a Dynapar encoder is lower cost than a DC tachometer when precision feedback is required.
- No brushes to wear and replace.
- Because the FV2 is so versatile, it may eliminate the cost of additional transducers and their associated mounting expense.

Electrical Features

- ± 10 VDC or 4-20 mA analog output.
- Linearity is typically $\pm 0.01\%$ of full scale.
- Serves any variable speed drive application (single, double, or four quadrant drives).
- Switch selectable 115 or 230 VAC, 50/60 Hz power.
- Switch selectable response time (<10, <20, <36 or <46 msec.).
- Built-in transducer power supply.
- Plug-in terminal strips for field connections.

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Electrical

Input Power Requirements: 115/230 VAC $\pm 10\%$, 50/60 Hz; 120 mA @ 115 VAC, 60 mA @ 230 VAC

Available Power for the Transducer: 12 VDC $\pm 5\%$, 200 mA max.

Input Signal: (Field-Selectable) 4 to 15V differential; or 8 to 15V single-ended; or magnetic 1.5 to 15V peak-to-peak

Input Frequency Range: (Field-Selectable)
Bidirectional: 0-500 Hz to 0-100 kHz;
Unidirectional: 0-1 kHz to 0-100 kHz;

Analog Output: ± 10 V bidirectional; 0-10V unidirectional @ 25 mA

Output Linearity: $\pm 0.01\%$ of span

Temperature Stability: $\pm 0.02\%$ per $^{\circ}$ F

Current Range: 4-20 mA

Current Linearity: $\pm 0.2\%$ max.

Compliance: +16V min.

Response Time: <10 msec. switch selectable to <20, <36, or <46 msec.

Output Ripple: Volts RMS is generally less than brush generators and is predictable depending on input frequency from an encoder. For 240 PPR, open loop ripple is 0.080V at 25 RPM, 0.03V at 250 RPM and 0.015V at 2500 RPM

Output Overrange: 10% min. (volt. or current)

Output Offset: Adjustable

Environmental

Operating Temperature: 0 to 60 $^{\circ}$ C

Storage Temperature: -18 $^{\circ}$ to +85 $^{\circ}$ C

Relative Humidity: to 90% non-condensing

OPTIONAL FEATURES

The following features are available with the FV2 option board, which can be factory- or field-installed:

Auxiliary Isolated Digital Outputs

When supplied separately with 12 ± 3 VDC, an isolated digital differential line driver output is supplied corresponding to the A and B input phases. By connecting the analog power supply cable to the option board, the analog outputs can also be powered by the separate supply and optically isolated from the digital inputs.

Transducer Phase Reversal Detector

This feature monitors the A and B phases and detects reverse rotation. When reversal is detected, there is a user-selectable delay (2048 pulses max.) before the output relay drops out. The relay will not re-energize until: 1) the reset button is pressed, 2) an external reset signal is applied, or 3) power is removed and restored. An inhibit input is provided to override the reversal detection circuit.

Transducer Phase Failure Detector

This feature monitors the A and B phase inputs and detects a failure (i.e. one phase failed high or low). Its output is a normally-open relay contact which opens upon failure detection. This relay contact is shared with a Phase Loss Detection circuit.

Transducer Phase Loss Detector

This feature monitors current supplied to the encoder and reacts to a decrease in current required. Failure is indicated by opening the relay contact shared with the Phase Failure Detector. Current trip level is field-adjustable. Transducer supply must be provided by FV2.

Zero Speed Detector

This feature monitors transducer speed, and can be set by the user to trip at a specific level corresponding to desired speed. A relay with a single-pole-double-throw contact is used for the output.

SPECIFICATIONS FOR FV2 OPTIONS

Auxiliary Digital Outputs

Power Requirements: 12 ± 3 VDC

Current Requirements: 25 mA w/ digital outputs only; 250 mA w/ analog outputs only

Outputs	Voltage Range	Sink (mA)	Source (mA)	Standard IC
Differential Line Driver	12 ± 3 VDC	22	40	88C30

Transducer Reversal Detector

Forward Input Phasing: A leads B

Reversal Delay: 16, 32, 64, 128, 256, 512, 1024, or 2048 pulses, selectable.

Output: Relay contacts*, latched upon failure.

Latch Reset & Inhibit Input Requirements: TTL/CMOS, activates on high, 10K pull-down, 17V max.

Transducer Phase Failure Detector

Failure Type: A or B phase

Delay: 4 transitions

Output: N.O. contact* shared with Phase Loss Detector

Transducer Phase Loss Detector

Current Level: 30 to 200 mA, adjustable

Output: N.O. contact* shared with Phase Failure Detector

Zero Speed Detector

Adjustable Range: 10 Hz to 300 Hz

Response Time: Less than 0.1 sec.

Output: SPDT relay contact*

*Relay contacts are rated at (1) 1.0 amps, 24 VDC, or (2) 0.3 amps, 115 VDC resistive, or (3) 0.3 amps, 24 VDC, or (4) 0.2 amps, 115 VAC inductive.

ELECTRICAL CONNECTIONS

FV2-0 Functions		Terminal
Analog Outputs	4-20 mA	1
	Common	2
	±10V	3
Transducer Input & Supply	Signal B̄ (if used)	4
	Signal B (if used)	5
	Signal Ā (if used)	6
	Signal A or Magnetic	7
	Encoder Supply Common	8
	Encoder Supply V+	9
Power Input	115/230 VAC	L1
	115 Neutral/230 VAC	N/L2
	Case Ground	GND
FV2-1 Optional Functions		Terminal
Isolated Supply	Common	18
	Power	17
Transducer Auxiliary Outputs	A	16
	A	15
	B	14
	B	13
Transducer Phase Loss or Phase Failure	N.O.	12
		11
Zero Speed Detector	N.O.	10
		9
Reversal Detector Outputs	N.O.	8
	Common	7
	N.C.	6
	N.O. or N.C.*	5*
	Common	4
Reversal Detector Inputs	Reset	3
	Common	2
	Inhibit	1

*Circuit is field-selectable as N.O. or N.C. contact with internal jumper.

APPLICATION CONSIDERATIONS

Transducer Selection: The FV2 operates on the frequency content of a sinusoidal, triangular, or square waveform. Typical transducers include:

- 1) A magnetic pick-up detecting a passing keyway, gear teeth, etc.
- 2) A photo eye which scans alternating opaque and transparent slots.
- 3) A digital tachometer or encoder.

For fast response of FV2 outputs, it is important that the transducer be located toward the high speed end of the drive train. For slow shaft speeds, the transducer must be capable of delivering a high number of cycles or pulses per revolution. The transducer should also be capable of delivering a usable output for the entire speed range through maximum speed. The following formula is convenient for relating machine speeds and sensor frequency output:

$$FRQ \text{ (CPS or Hz)} = \frac{RPM}{60} \times PPR$$

Where:

RPM is the speed of the shaft where the sensor is located in revolutions per minute.

PPR is the number of pulses (or cycles) produced by the sensor for one shaft revolution.

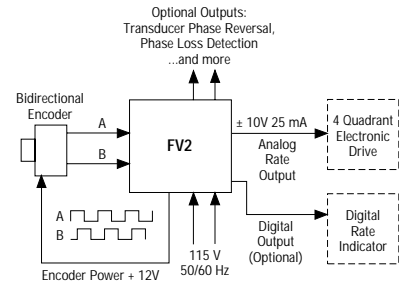
FV2 Performance: The FV2 range adjustment allows the unit to deliver full-scale output for any input frequency within the limits of each range rating. It will provide a better combination of fast response and low ripple when input frequencies for full scale output are at least 3 kHz and above. The FV2 is provided with the capability for field-installed capacitance to optimize response time vs. ripple if required (see the technical manual.)

Full-Scale Range Adjustment	Scaling Factor	
	Min.	Max.
50 – 100 kHz	÷ 4	
25 – 50 kHz	÷ 2	
12 – 25 kHz	x 1	
6 – 12 kHz	x 2	
1.5 – 6 kHz*	x 4	
3 – 6 kHz**	x 1	
1 – 3 kHz**	x 2	
0.5 – 1.5 kHz*	x 4	

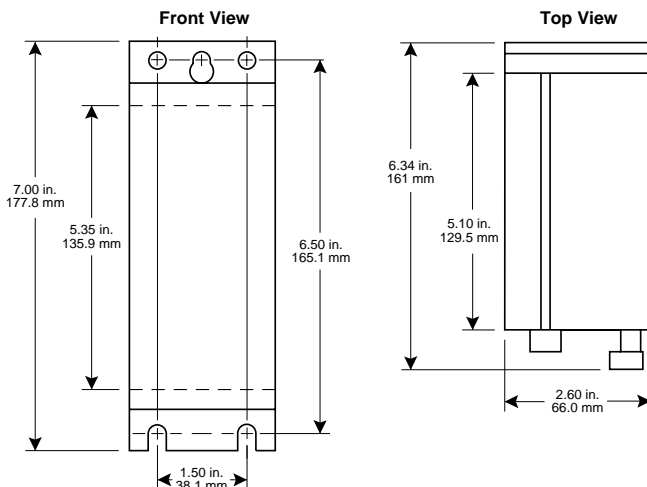
*Bidirectional inputs only
**Unidirectional inputs only

Typical Application

Bidirectional with 0 to ±10V Output



MOUNTING DIMENSIONS (INCHES/MM)



Ordering Information

Model No.	Description
FV2-0-S	Frequency-to-Voltage Converter
FV2-1-S	Same as FV2-0-S with Factory-Installed Option Board
FV2-N1	Option Board Only (Kit for Field Installation with FV2-0-S)
845-24*	Technical Manual

*A technical manual is automatically included with each FV2 unit shipped. Use this publication number for ordering extra copies.

INCREMENTALS

FV3 Frequency to Voltage Converter

- Delivers 0 to +10 VDC or 4-20 mA outputs proportional to input pulse rate (frequency).
- Accepts variable pulse rate inputs from a variety of sensors.
- Linearity ±0.2% maximum.
- An FV3 and an encoder replace a DC Tachometer when precision feedback is required.



APPLICATION/INDUSTRY

Dynapar FV3 frequency-to-voltage converter, when used with a Dynapar encoder, converts the frequency output of the encoder to an analog signal for operating chart recorders, or for supplying velocity feedback in closed loop speed control systems.

DESCRIPTION

Dynapar FV3 frequency-to-voltage converter measures a pulse input frequency and converts it to an analog 0 to +10 VDC or 4-20 mA output proportional to machine or process speed. When used with a Dynapar encoder, it converts the frequency content of the encoder to an analog signal for operating chart recorders, or for supplying velocity feedback in closed loop speed control systems.

A wide range of digital pulse transducers, application speed ranges, and converter response times can be configured via jumpers. The FV3 also includes 12 VDC transducer supply power.

FEATURES AND BENEFITS

Electrical Features

- 0 to +10 VDC or 4-20 mA analog output.
- Linearity is typically ±0.1% of full scale.
- Switch selectable 115 or 230 VAC, 50/60 Hz power.
- Jumper selectable input frequency range.
- Built-in transducer power supply.
- Front-mounted terminal strips for field connections.
- Potentiometer adjustments (gain, offset, 20 mA set and 4 mA set).
- Jumper-selectable input circuit to accept signals from a variety of sensors (i.e. sensor outputs with open collector PNP or NPN, line driver, magnetic sinewave, switch contact, etc.)

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Electrical

Input Power Requirements: 115/230 VAC ±10%, 50/60 Hz; 120 mA @ 115 VAC, 60 mA @ 230 VAC;

Externally fuse with Slo-Blo type 1/8 A for 115 VAC or 1/16 A for 230 VAC

Available Power for the Transducer: 12 VDC ±5%, 75 mA max.

Input Signal: (Field-Selectable) 2.5 to 15V single-ended; or magnetic 1.5 to 15V peak-to-peak

Input Frequency Range: (Adjustable) Unidirectional: 0.03 to 0.1 kHz; 0.1 to 0.3 kHz; 0.3 to 1 kHz; 1-3 kHz; 3-10 kHz; 10-30 kHz; 20-60 kHz

Analog Output: 0 to +10V unidirectional @ 25 mA

Voltage Output Linearity: ±0.1% of full scale
Current Range: 4-20 mA into load resistance range of 0-800 ohms

Current Linearity: ±0.2% max.

Output Overrange: 10% min. (volt. or current)

Output Offset: Adjustable

Speed Detector/Alarm Output (Optional)

This feature monitors transducer speed and can be adjusted—5% to 100%—from a front panel potentiometer to trip at a specific speed. The output is a relay contact, field selectable via an internal jumper as N.O. or N.C. Contact rating is 1.25 Amp AC/DC, 125 Volts.

Environmental

Operating Temperature: 0 to 60°C

Storage Temperature: -18° to +85°C

Relative Humidity: to 90% non-condensing

APPLICATION CONSIDERATIONS

Transducer Selection: The FV3 operates on the frequency content of a sinusoidal, triangular, or square waveform. Typical transducers include:

- 1) A magnetic pick-up detecting a passing keyway, gear teeth, etc.
- 2) A photo eye which scans alternating opaque and transparent slots.
- 3) A digital tachometer or encoder.

For fast response of FV3 outputs, it is important that the transducer be located toward the high speed end of the drive train. For slow shaft speeds, the transducer must be capable of delivering a high number of cycles or pulses per revolution. The transducer should also be capable of delivering a usable output for the entire speed range through maximum speed.

The following formula is convenient for relating machine speeds and sensor frequency output:

$$\text{FRQ (CPS or Hz)} = \frac{\text{RPM} \times \text{PPR}}{60}$$

Where:

RPM is the speed of the shaft where the sensor is located in revolutions per minute.

PPR is the number of pulses (or cycles) produced by the sensor for one shaft revolution.

FV3 Performance: The FV3 range adjustment allows the unit to deliver full-scale output for any input frequency within the limits of each range rating. It will provide a better combination of fast response and low ripple when input frequencies for full scale output are at least 3 kHz and above. The FV3 is provided with the capability for field-installed capacitance to optimize response time vs. ripple if required (see the technical manual).

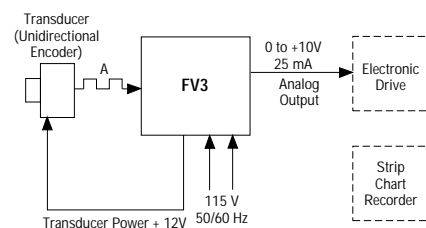
Full-Scale Range Adjustment ¹		Response Time ²
Min.	Max.	
30 Hz	100 hZ	5.1 sec.
100 Hz	300 hZ	1.7 sec.
300 Hz	1 kHz	0.52 sec.
1 kHz	3 kHz	13 msec.
3 kHz	10 kHz	10 msec.
10 kHz	30 kHz	6 msec.
20 kHz	60 kHz	6 msec.

¹Field-selectable range adjustment via jumpers (refer to technical manual).

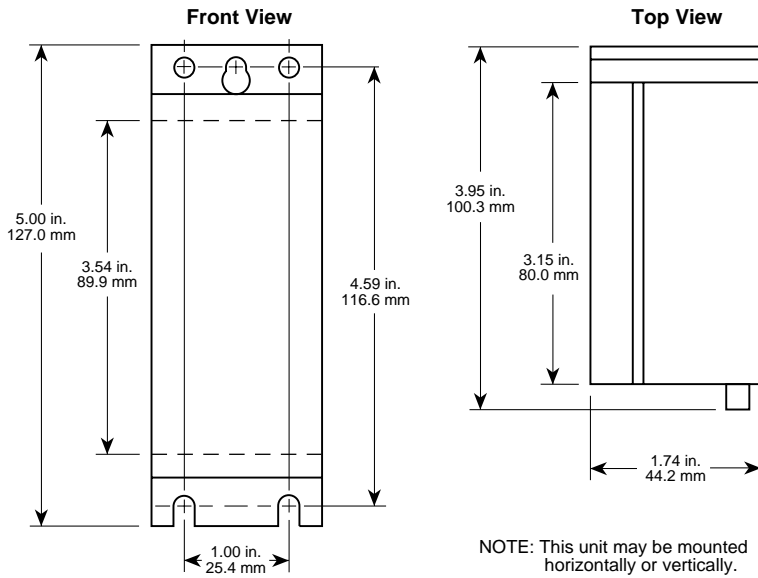
²Response time is time required for the output to reach 99% of final value when the input frequency instantly changes from 0 to full scale.

Typical Application

Unidirectional with 0 to +10V output






Mounting Dimensions (inches/mm)



NOTE: This unit may be mounted horizontally or vertically.

Electrical Connections

FV3-0 Functions		Terminal
Power Input	115/230 VAC	L1
	115 Neutral/230 VAC	N/L2
	Case Ground	GND
Transducer Input & Supply	Encoder Supply V+	1
	Encoder Supply Common	2
	Signal A or Magnetic	3
Speed Detector Output (Optional)	 *	4
	 or 	5
Analog Outputs	4-20 mA	6
	Common	7
	+10V	8

*Circuit is field selectable as normally open or normally closed output, via internal jumper selection.

Ordering Information

Model No.	Description
FV3-0-S-00	Frequency-to-Voltage Converter
FV3-1-S-00	Frequency-to-Voltage Converter with Speed Detection Option
845-26*	Technical Manual

*A technical manual is automatically shipped with each FV3. Use this publication number to order extra copies.

PM28S Dual Amplifier

Dual universal input amplifier . . .
provides 6 types of input functions



PM28S replaces PM21, PM25 and 101UA

APPLICATION/INDUSTRY

The model PM28S provides six types of input functions in one easy-to-use, two-channel isolated product.

DESCRIPTION

As an amplifier, it accepts differential line driver, single-ended, and magnetic signals, converting them to single-ended signals for use with counters and indicators. This unit is isolated from input to output, and allows input signals to travel long distances without degradation. The isolation provides higher noise immunity for the total system.

The input termination is programmable to match most encoders, pickups and other input devices, including many low level flow meters.

The PM28S also provides a power source for encoders, pickups and other input devices. Its special MOSFET output will typically drive up to six loads.

The two channels operate independently, so any combination of inputs can be used. All field connections are made through a terminal strip which accepts number 22 through 12 AWG.

FEATURES AND BENEFITS

- Two independent channels
- Selectable inputs – differential inputs, 12V inputs, 5V inputs, TTL inputs, magnetic inputs, 50 mv inputs for low level flowmeters
- Transducer supply
- Selectable line termination
- Hysteresis on inputs
- Noise filtering
- Isolated MOSFET line driver outputs
- Selectable 115/230 VAC operation

SPECIFICATIONS

SPECIFICATIONS

Input Power: 115/230 VAC, ±10%; 50/60 Hz; 6 VA
Input Transducer Power: +12 VDC ±5% @ 150 mA
Isolated Output Power: +12 VDC ±5% @ 150 mA
Transducer Inputs:
12V Inputs: Voltage Range: 12-30 VDC; High Trip Point: 9 VDC min.; Low Trip Point: 3 VDC max.
5V Inputs: Voltage Range: 5-12 VDC; High Trip Point: 3.5 VDC min.; Low Trip Point: 1.0 VDC max.; Input Frequency: 100 kHz max.
TTL Inputs: Voltage Range: 2.5-5 VDC; High Trip Point: 1.8 VDC min.; Low Trip Point: .8 VDC max.
Magnetic Inputs: Voltage Range: 2-30 VPP; High Trip Point: .8 VDC min.; Low Trip Point: .2 VDC max.
Flow Meter Inputs: Voltage Range: 50-500 mVP; High Trip Point: 50 mVDC min.; Low Trip Point: 15 mVDC max; Input Frequency: 100 kHz max.

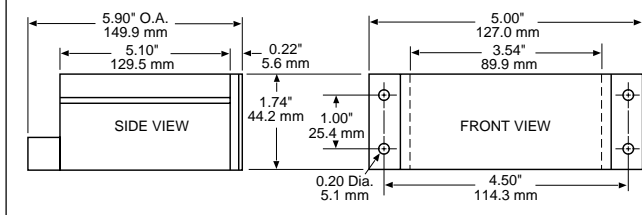
Outputs:

V_{OL}: 0.5 V typ. @ 70 mA sink
V_{OH}: 11.1 V typ. @ 70 mA source
Output Resistance: 15 ohm @ 10 mA typ.
Rise Time: 40 nS max.
Fall Time: 40 nS max.
Peak Output Current: 1.5 A max.
Output Current: 120 mA max.
Output Frequency: 100 kHz max.
Number of MAX or MAXjr loads: 6 per channel

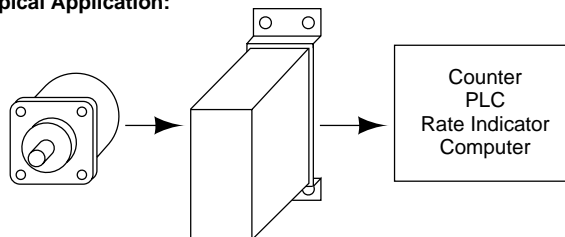
Environmental:

Operating Temperature: 32° to 122°F (0° to 50°C)
Storage Temperature: 0° to 186°F (-18° to 85°C)
Relative Humidity: 0% to 90% non-condensing

Dimensions:



Typical Application:

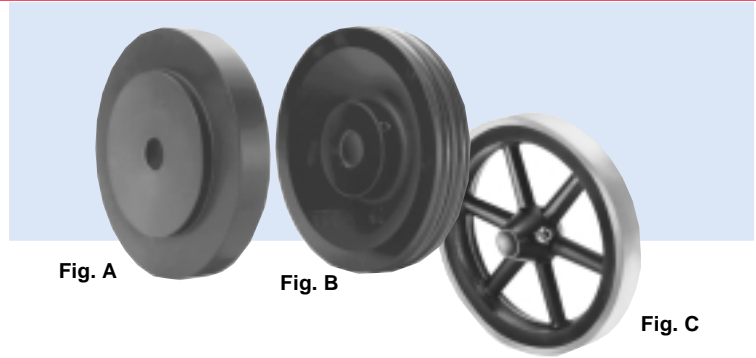


Model No.	Description
PM28S00	Dual Universal Input Amplifier

Note: For other application considerations see the Dynapar brand PM21S Differential Line Receiver and Supply in the **Digital Accessories** section.

Measuring Wheels

- Fit most Dynapar brand Encoders
- Rubber, Phenolic and O-Ring Surfaces
- Fast, Easy Attachment



SPECIFICATIONS

For materials with normal slip characteristics, precisely machined phenolic wheels provide maximum accuracy over the widest temperature range — better than aluminum or urethane. Where traction with reasonable accuracy and lower cost is required, the non-marking white rubber wheel is recommended.

Model No.	Fig.	Description/Shaft Bore	Measuring Circumference
16002070010	A	Phenolic; 1/2" bore Temperature Rating = -30 to +140°C	12"
16002070177	A	Phenolic; 3/8" bore Temperature Rating = -30 to +140°C	12"
16002070215	C	White rubber; 3/8" bore Temperature Rating = -30 to +70°C	12"

For materials with high slip characteristics. Dual "O" rings prevent slip but must be compressed to allow the phenolic surface to accurately measure. This requires 8 lbs. pressure per wheel and is best suited to the Series 60 encoders.

Model No.	Fig.	Description/Shaft Bore	Measuring Circumference
16002070011	B	for Series 60 Rotopulsers, 1/2" bore Temperature Rating: -30 to +70°C	12"
16002070284	B	for encoders with 3/8" shaft	12"
16002070046	B	Replacement O-ring	12"

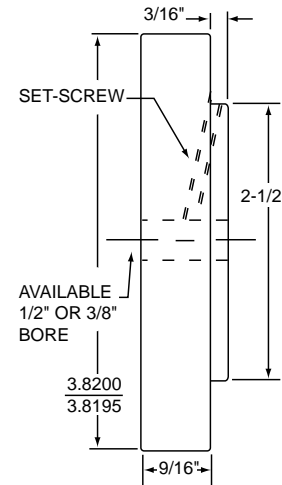


Fig. A

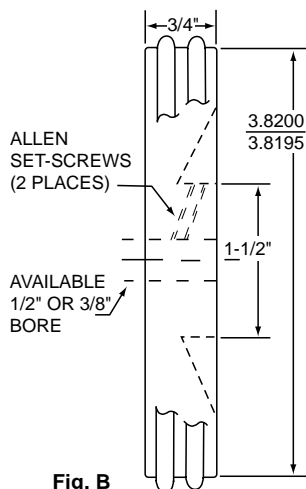


Fig. B

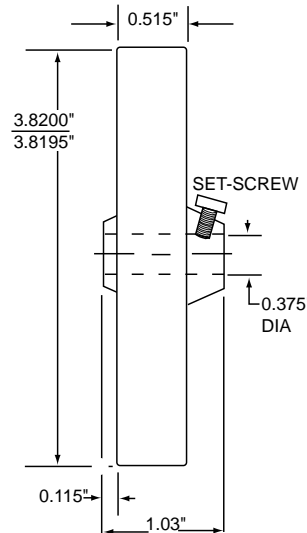


Fig. C

ACCESSORIES

Cables and Connectors

- Mating Connectors with Cable Clamps
- Shielded Cable without Connector
- Cable Assemblies



SPECIFICATIONS

MATING CONNECTORS WITH CABLE CLAMPS

Model No. (Description)	Use with Series	Pins
MCN-N1 (MS3106A-10SL-4S)	52BH	2
MCN-N2 (MS3106A-10SL-3S)	53Z, 53ZK, 71Z	3
MCN-N4 (MS3106A-14S-6S)	H20, 21/22, 60 Single-ended	6
MCN-N5 (MS3106A-16S-1S)	H20, H25, H26, 525, 526, 625 (H42, 21, 22 - Full Differential)	7
MCN-N6 (MS3106A-18-1S)	H20, H25, H26, 525, 526, 60, 60P, 625 - Full Differential	10
605560-0001	H58 (CW)	12
605560-0002	H58 (CCW)	12
600207 (MS3106A-20-29S)	AI25	17
606219-0001 (PT06E-14-195)	AI25	19

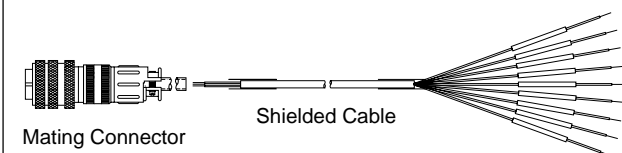
SHIELDED CABLE WITHOUT CONNECTOR

Use this bulk cable with the mating connectors (at left) to build custom length cables (sold in 10 ft. increments only). Your order must specify model # and length of cable desired.

Model No.	Description
16002160022	(Alpha 2403) 3 wire, 22 gage cable for Model 53Z Pickup
16002160024	(Alpha 2254/6) 6 wire, 22 gage cable for Series X25, HA25, HR25, HA26, HR26, HC25, HC526, 21/22, 60 and H56
107312 (special)	10 wire, special cable for Series X25, H20, HA25, HR25, HA26, HR26, HC25, HC526, H58, with Full Differential Outputs
16002160029	(Belden 9504) 4 Pair, 24 gage for 60/H56 DIF, H42

INCREMENTALS

Typical Incremental Encoder Cable



CABLE ASSEMBLIES FOR INCREMENTAL ENCODERS AND GEAR PICKUPS

Dynapar brand offers shielded cable with MS or M12 connector and cable clamps at one end and stripped and tinned leads at the other end. Cable assembly wire color codes are usually included in the Electrical Connections Table on the specific product catalog page.

USE WITH ENCODER SERIES	OUTPUT TYPE	ENCODER PINS	CABLE PART NO.	CABLE LENGTH
52 Pickup	Variable reluctance	2	14002030010 14002030020 1400203xxxx	10' 20' Note 1
53Z Pickup 71Z	Current Sink Open Collector	3	14003340010 1400334xxxx	10' Note 1
60, 60P, H56 Armoured Cable	Single Ended	6	14002090010 14002090025 1400209xxxx	10' 25' Note 1 & 2
60, 60P, H56 Full Differential	Differential	10	14004190010 14004190025 1400419xxxx	10' 25' Note 1
21/22 without marker	Single Ended Current Sink Open Collector	6	14006070010 1400607xxxx	10' Note 1
21/22, 525, 526, 625, HA25, HR25, HC526 H42, HC25, HA26, HR26 without marker	7 Pin Line Driver Differential	7	14004310010 1400431xxxx	10' Note 1
21/22	6 Pin Line Driver Differential	6	14006640010 1400664xxxx	10' Note 1
22 with marker	Single Ended Current Sink Open Collector	6	108241-0010 108241-xxxx	10' Note 1
525, 526, 625, HA25, HR25, H26, HC25, HA26, HA725, HR26, HC526, HS35	Differential	10	14006350010 1400635xxxx	10' Note 1 & 3
H20, HS35	Single Ended Current Sink Open Collector	6	108594-0010 108594-xxxx	10' Note 1
H20, H58, HS35, HA725	Open Collector Push-Pull Single Ended	7	108595-0010 108595-xxxx	10' Note 1
H20, HA25, HC25, HR25, HS35, 525, 625	Differential 7 Pin Dif Line Driver w/o Idx	7	108596-0010 108596-xxxx	10' Note 1
H58, HS35, (CCW)	Any output with 12 Pin CCW Connector	12	108615-0010 108615-xxxx	10' Note 1
H58 (CW)	Any output with 12 Pin CW Connector	12	108616-0010 108616-xxxx	10' Note 1
AI25	Parallel Push-Pull	19	110158-0010 110158-xxxx	10' Note 1
AI25	Parallel Push-Pull	17	107865-0010 107865-0020 107865-xxxx	10' 20' Note 1
HS20, HS35	Differential 6 pin differential line driver without index	6	112123-0010 112123-xxxx	10' Note 1
21/22, H20, H58, HA25, HR25, HC25, HA26, HR26, HC26, HS20, HS35	Single Ended	5 (M12)	112859-0015 112859-0030 112859-XXXX	15' 30' Note 4
21/22, H20, H58, HA25, HR25, HC25, HA26, HR26, HC26, HS20, HS35	Single Ended or Differential	8 (M12)	112860-0015 112860-0030 112860-XXXX	15' 30' Note 4

Note 1: Cable assemblies may be custom ordered in multiples of 5' lengths. Example: To order a #14002030010 cable assembly in 15', specify #14002030015.

Note 2: Non-armoured cable for lengths over 25 feet.

Note 3: For NEMA4 Watertight cable change base number to 109209xxxx.

Note 4: In lots of 50 pieces minimum, cable assemblies may be custom ordered in multiples of 5' lengths. Example: To order a #112860 cable assembly in 50', specify #112860-0050.

INCREMENTALS ACCESSORIES

"L" Mounting Bracket

- Precision machined aluminum (6061-T6)
- Drilled and tapped where required
- Mounting hardware included
- Encoder can be mounted from either side
- Allows servo ring mount for phasing adjust



Encoder and coupling not included

APPLICATION/INDUSTRY

Universal bracket allows base mounting of popular Dynapar brand encoders.

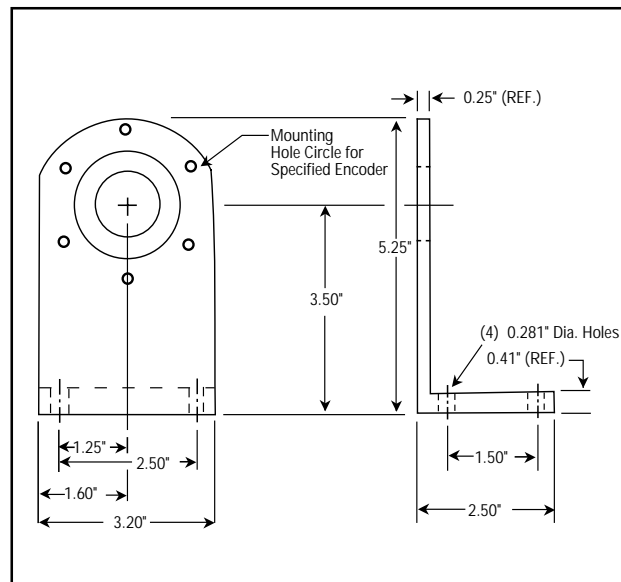
DESCRIPTION

Rugged and stable, the bracket is precision machined from 6061-T6 aluminum. Encoder is mounted using drilled and tapped holes which are positioned to accommodate the listed "Compatible Encoders".

Clearance holes are provided for base mounting to a suitable machine surface.

SPECIFICATIONS

DIMENSIONS



ACCESSORIES

Compatible Encoders

The mounting bracket may be used with the listed series encoders having the specified mounting configurations.

Encoder Series	Mounting Configuration	Figure
14005730000		
60A	All	1
60C	All	1
H42	2.5" Flange	2
H25	2.5" Flange	2
H25	2.5" Servo	3
AI25	2.5" Flange	2
HA725	2.5" Flange	2
108680-0001		
H20	Servo with 1.25" Male Pilot	3
H20	Flange	2
H20	2" BC Face	1
21/22	Except metric	1
108680-0002		
AI25	Face	1
H58	36 mm Pilot	1

Ordering Information

Model No.	Description
14005730000	Mounting Bracket for 60 Rotopulser, 2.5" Encoders
108680-0001	Mounting Bracket for QUBE Encoders
108680-0002	Mounting Bracket for 58mm Face Mount Encoders

INSTALLATION

If during installation, you encounter difficulty in matching the encoder's mount to the features of the bracket, refer to the table on the preceding page to choose the "L" Mounting Bracket part number for compatibility with a specific encoder series and mount configuration.

Figure 1

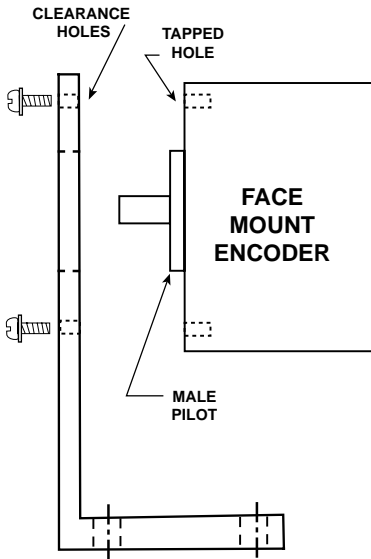


Figure 2

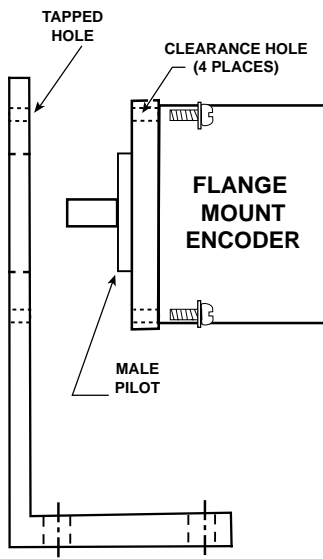
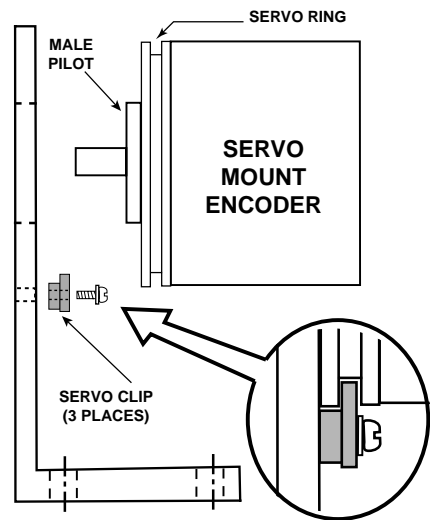


Figure 3



Procedure

- 1) Place encoder's pilot through center hole of bracket. Seat male pilot if provided.
- 2) Align tapped holes in face of encoder with clearance holes in bracket.
- 3) Install pan head machine screws with split lock washers (included) and tighten.

Procedure

- 1) Place encoder's pilot through center hole of bracket. Seat male pilot if provided.
- 2) Align clearance holes in flange of encoder with tapped holes in bracket.
- 3) Install (4) pan head machine screws with split lock washers (included) and tighten.

Procedure

- 1) Install (3) mounting cleats (servo clips) loosely to bracket using pan head machine screws and split lock washers (included).
- 2) Place encoder's pilot through center hole of bracket. Seat male pilot.
- 3) Rotate cleats until they fully engage servo ring groove.
- 4) If encoder has marker index pulse, rotate encoder housing to desired position. Tighten screws.

We strongly recommend use of a precision shaft-coupling to assure maximum performance and to avoid premature failure.

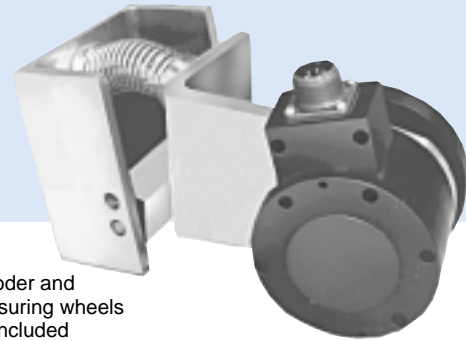


Our CPL Series of flexible shaft couplings ensures long encoder life by restricting transfer of mechanical, thermal, and electrical stress.

A full range of models is available. Each is designed to match specific encoders and is supplied with input-shaft size adaptors.

Pivot Mounting Bracket

- Complete pre-assembled mounting system with hardware included
- Single or dual wheel uses same mount
- Easy machine attachment
- Built-in spring tension for accurate tracking



Encoder and measuring wheels not included

APPLICATION/INDUSTRY

Provides adjustable, vertical, spring loading for the listed "Compatible Encoders" equipped with measuring wheels.

DESCRIPTION

Rugged and stable, the bracket is precision machined from heavy gauge aluminum. Encoder is mounted using holes which are positioned to accommodate the listed "Compatible Encoders". Dual shaft encoders may accommodate two wheels. Clearance holes are provided for base mounting to a suitable surface, or it may be mounted to 2" diameter tubing through use of "U" clamps.

SPECIFICATIONS

COMPATIBLE ENCODERS

The mounting bracket may be used with the listed series encoders having the specified mounting configurations.

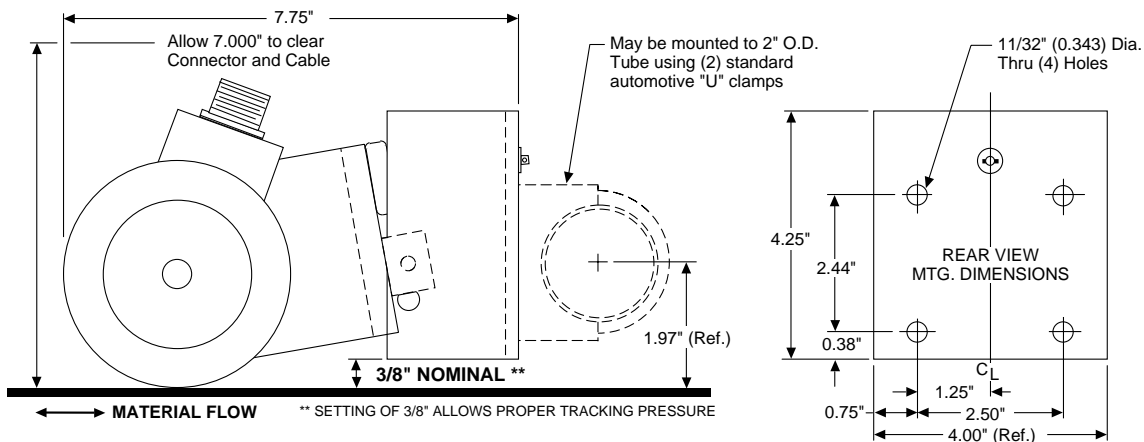
Encoder Series	Mounting Configuration	Figure
60A	All	2
60C	All	1
H42	2.5" Flange	3
H25	2.5" Flange	3
H25	2.5" Servo	4
HA725	2.5" Flange	3

Ordering Information

Model No.	Description
14005740000	Pivot Mounting Base

ACCESSORIES

Dimensions



INSTALLATION

Figure 1

**60C SERIES (DUAL WHEEL)
(Face Mount)**

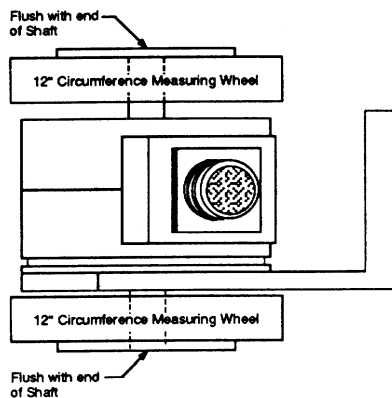


Figure 2

**60A SERIES (SINGLE WHEEL)
(Face Mount)**

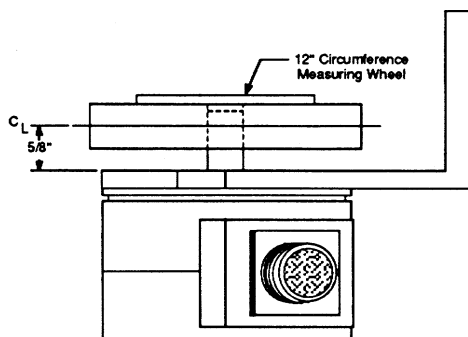
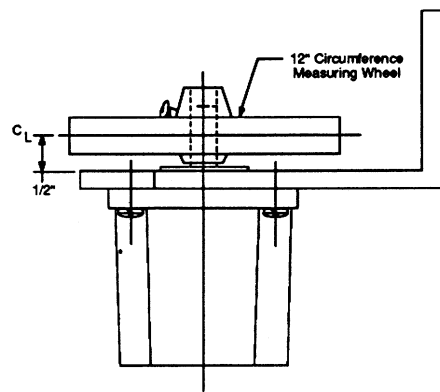


Figure 3

**2.5" & 42 SERIES
(Flange Mount)**



Procedure

**60C Series (Dual Wheel)
Face Mount Installation**

- 1) Mount encoder pilot in recess of "L" bracket.
- 2) Align (3) holes in face of encoder with counter-bored holes in bracket. Secure with #5-40 x 3/8" pan head machine screws with #6 split lock washers (included).
- 3) Install measuring wheels with hub side flush with shaft end and set screw over flat on shaft. Tighten set screws.

Procedure

**60A Series (single Wheel)
Face Mount Installation**

- 1) Mount encoder pilot in recess of "L" bracket.
- 2) Align (3) holes in face of encoder with counter-bored holes in bracket. Secure with #5-40 x 3/8" pan head machine screws with #6 split lock washers (included).
- 3) Install measuring wheel with hub side out and position center line at dimension shown above. Tighten set screws.

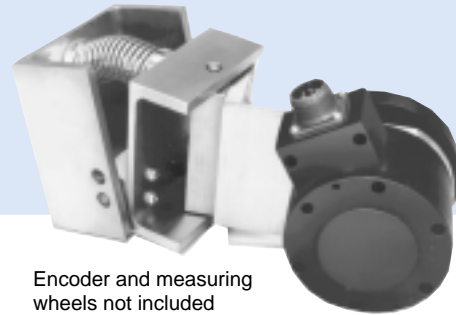
Procedure

**H25 & H42 Series (single Wheel)
Flange Mount Installation**

- 1) Mount encoder pilot in hole of "L" bracket.
- 2) Align (4) holes in face of encoder with counter-bored holes in bracket. Secure with #10-32 x 1/2" pan head machine screws with #10 split lock washers (included).
- 3) Install measuring wheel with hub side out and position center line at dimension shown above. Tighten set screws.

Universal Tracking Mount

- Complete, pre-assembled mounting system with hardware included
- Single or dual wheel uses same mount
- Easy machine attachment
- Built-in spring tension with two degrees of freedom for accurate tracking



Encoder and measuring wheels not included

APPLICATION/INDUSTRY

Provides adjustable spring loading and lateral self-tracking for compatible encoders.

DESCRIPTION

Provides adjustable spring loading and lateral self-tracking for Series 60 and Series H42, H25, & 625/525 encoders Series 60 may be equipped with two measuring wheels.

SPECIFICATIONS

COMPATIBLE ENCODERS

The mount may be used with the listed series encoders having the specified mounting configurations.

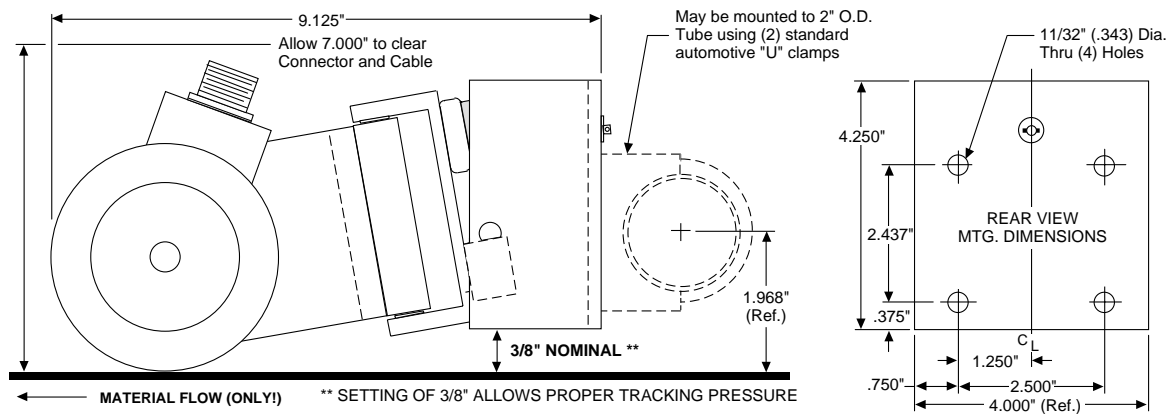
Encoder Series	Mounting Configuration	Figure
60A	All	2
60C	All	1
H42	2.5" Flange	3
H25	2.5" Flange	3
H25	2.5" Servo	4
HA725	2.5" Flange	3

Ordering Information

Model No.	Description
14005750000	Universal Tracking Mounting Base

ACCESSORIES

Dimensions



INSTALLATION

Figure 1

**60C SERIES (DUAL WHEEL)
(Face Mount)**

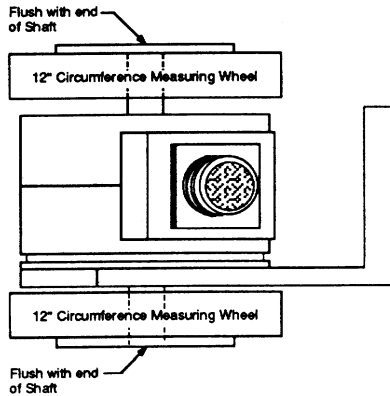


Figure 2

**60A SERIES (SINGLE WHEEL)
(Face Mount)**

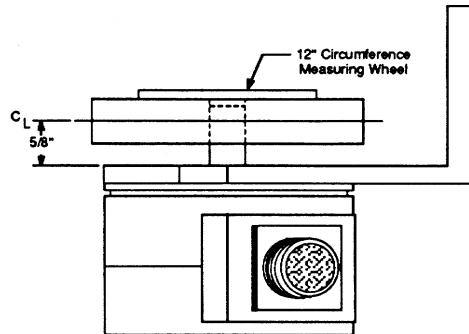
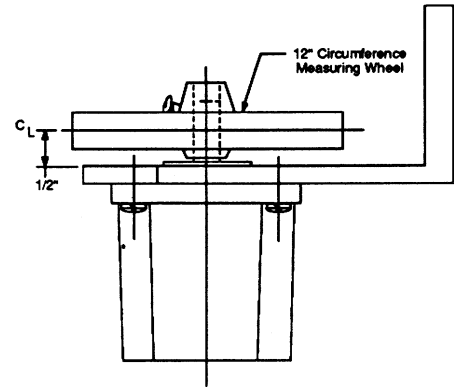


Figure 3

**2.5" & 42 SERIES
(Flange Mount)**



Procedure

**60C Series (Dual Wheel)
Face Mount Installation**

- 1) Mount encoder hub in recess of "L" bracket.
- 2) Align (3) holes in face of encoder with counter-bored holes in bracket. Secure with #5-40 x 3/8" pan head machine screws with #6 split lock washers (included).
- 3) Install measuring wheels with hub side flush with shaft end and set screw over flat on shaft. Tighten set screws.

Procedure

**60A Series (single Wheel)
Face Mount Installation**

- 1) Mount encoder hub in recess of "L" bracket.
- 2) Align (3) holes in face of encoder with counter-bored holes in bracket. Secure with #5-40 x 3/8" pan head machine screws with #6 split lock washers (included).
- 3) Install measuring wheel with hub side out and position center line at dimension shown above. Tighten set screws.

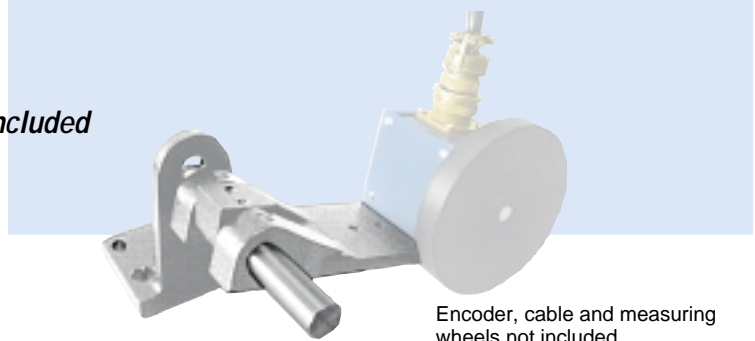
Procedure

H25 and H42 Series (single Wheel) Flange Mount Installation

- 1) Mount encoder hub in recess of "L" bracket.
- 2) Align (4) holes in face of encoder with counter-bored holes in bracket. Secure with #10-32 x 1/2" pan head machine screws with #10 split lock washers (included).
- 3) Install measuring wheel with hub side out and position center line at dimension shown above. Tighten set screws.

Qube Pivot Mount

- Complete mounting system with hardware included
- Single or dual wheel uses same mount
- Easy machine attachment
- Accepts Series 21/22 Qube Encoders



Encoder, cable and measuring wheels not included

APPLICATION/INDUSTRY

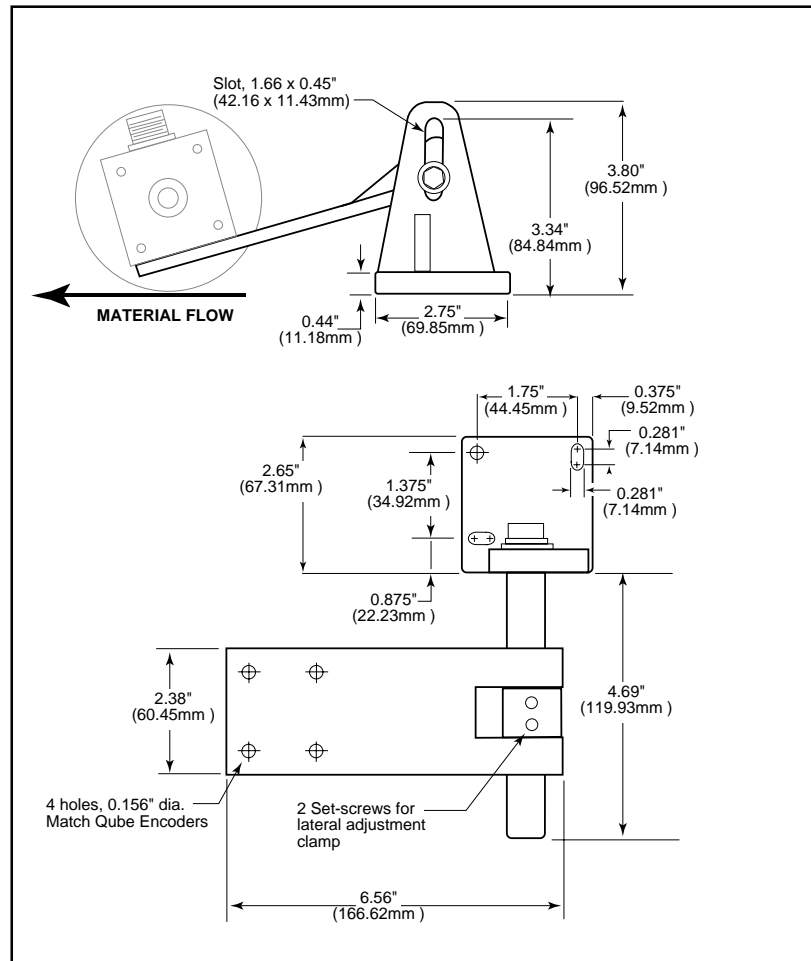
Provides adjustable mounting and self-tracking for compatible encoders.

DESCRIPTION

Provides mounting and self-tracking for Series 21, 22, QUBE encoders. Double ended shaft encoders may be equipped with two measuring wheels.

SPECIFICATIONS

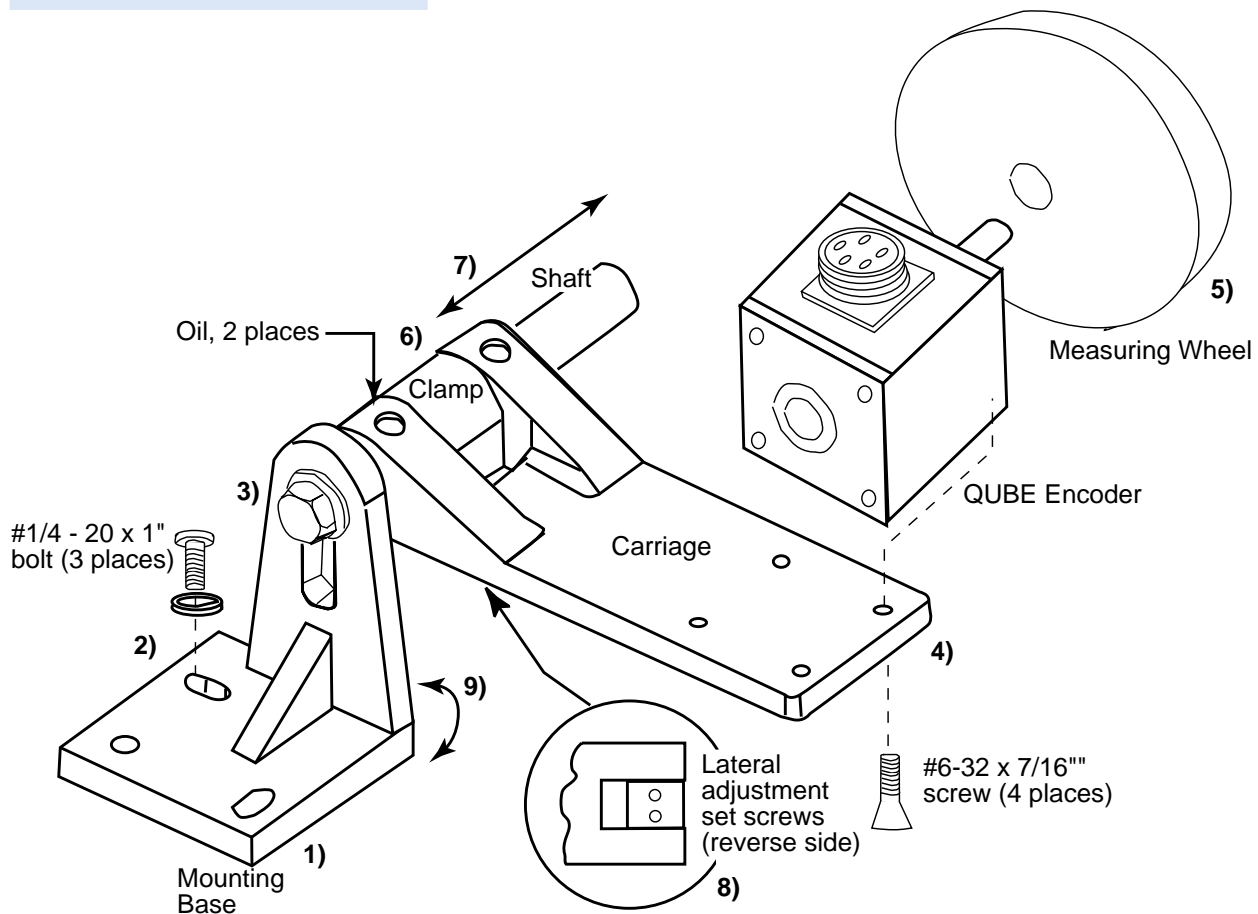
DIMENSIONS



Ordering Information

Model No.	Description
111328-0001	Qube Pivot Mounting Base

INSTALLATION



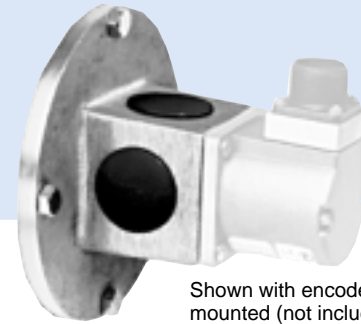
Procedure

Series 21/22 QUBE Encoders, single or dual measuring wheel

- 1) Prepare mounting surface by drilling and optionally tapping (3) holes matching clearance holes in bracket's mounting base.
- 2) Attach base to mounting surface using (3) #1/4-20 x 1" bolts, flat washers and lock washers (provided). If holes were not tapped, longer bolts and nuts (not provided) may be required. Leave bolts "finger" tight.
- 3) Assemble shaft to mounting base using provided #3/8-16 x 3/4" bolt, flat washer and lock washer. Tighten securely.
- 4) Align (4) holes in base of encoder with counter-bored holes in bracket carriage. Secure with (4) #6-32 x 7/16" flat-head machine screws (provided).
- 5) Attach measuring wheel to encoder's shaft. Tighten securely. Avoid wheel rubbing against encoder body. Dual shaft encoders may be fitted with two measuring wheels.
- 6) Place clamp in cavity provided in carriage. Slide carriage/clamp assembly on to shaft.
- 7) Adjust lateral extension of carriage to position measuring wheel at desired location on material.
- 8) Tighten clamp set screws to secure.
- 9) Swivel mounting base to adjust position of the measuring wheel to be parallel with measured material's direction of motion. Tighten bolts to secure base to mounting surface.

NEMA C Face Adapters

- "Flower pot" style adapter kit
- Provides spacer, coupling and all necessary hardware
- 5/8" I.D. coupling for 56C motor shafts with extensions from 1.1" to 1.8" long



Shown with encoder mounted (not included)

APPLICATION/INDUSTRY

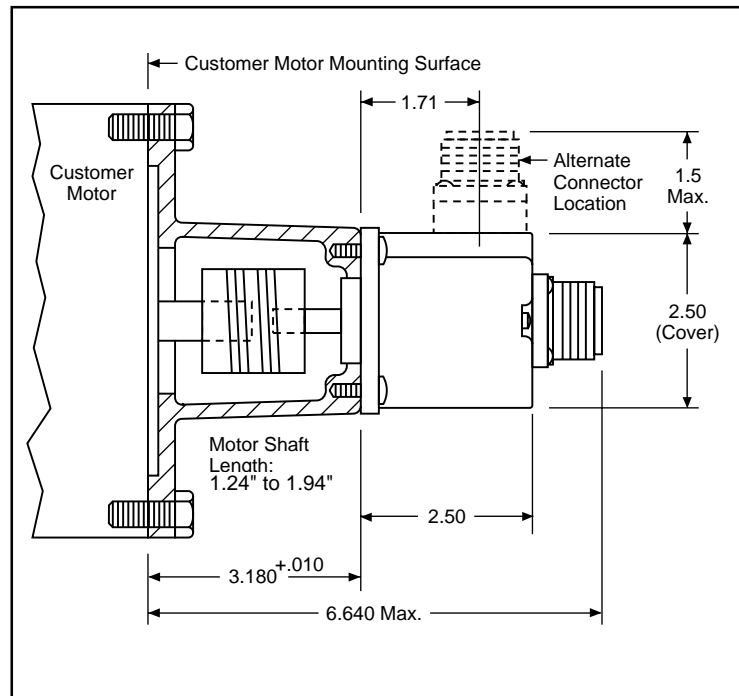
Mounts a Size 25 flange mount encoder to a 4-1/2" NEMA C motor or accessory flange

DESCRIPTION

Kits for 2.5" Encoders compatible with Series H42, H25 and HA725 encoders (flange mount, 3/8" shaft).

SPECIFICATIONS

DIMENSIONS



Compatible Encoders

The adapter may be used with the listed series encoders having the specified mounting configurations.

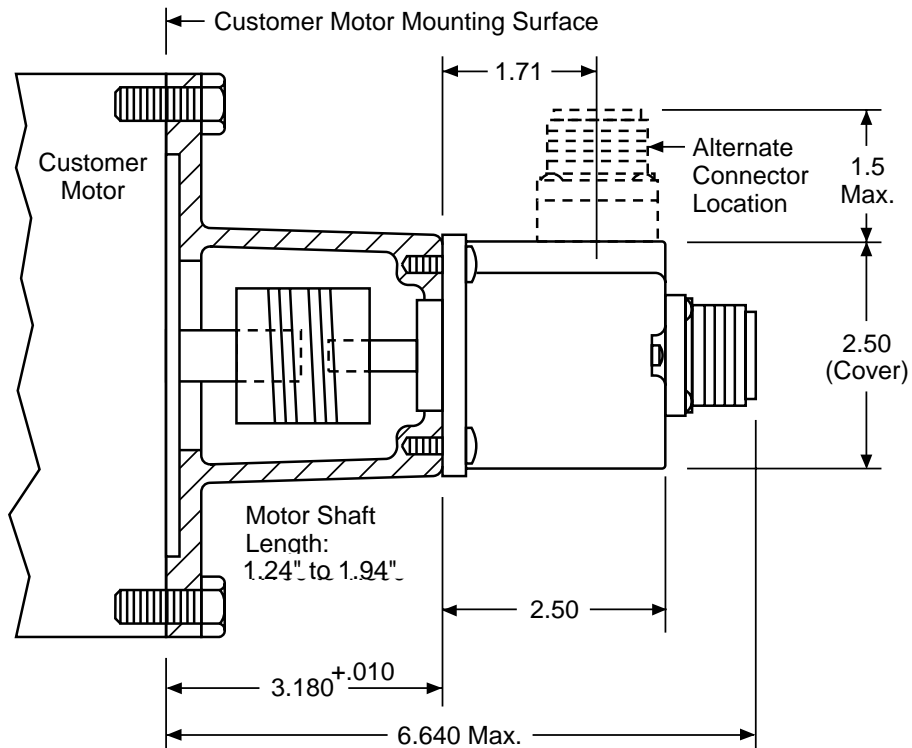
Encoder Series	Mounting Configuration
H42	2.5" Flange
H25	2.5" Flange
HA725	2.5" Flange

Ordering Information

Model No.	Description
FPA1	NEMA C Face Adapter, 5/8" Motor Shaft
FPA2	NEMA C Face Adapter, 7/8" Motor Shaft
FPA3	NEMA C Face Adapter, 1" Motor Shaft

INSTALLATION

- 1) Remove (4) black plugs from adaptor (if installed).
 - 2) Mount encoder to adaptor using (4) #10-32 x 1/2" screws and lock washers provided.
 - 3) Check motor shaft length and cut as required. Shaft should extend 1.240" to 1.940 from motor mounting surface.
 - 4) **A suitable flex coupling is provided.** Loosen setscrews or clamps at coupling ends. Slide coupling onto encoder shaft.
 - a) FPA1: Approximately 9/16" from end of shaft.
 - b) FPA2/FPA3: 3/8" from adapter mounting surface.
- Tighten coupling setscrew or clamp at encoder shaft.
- 5) Mount adapter/encoder assembly to motor using #3/8-16 x 1" bolts and lock washers provided. Tighten coupling setscrew or clamp at motor shaft.
 - 6) Reinstall (4) black plugs removed in step 1.



INSTALLATION

Figure 1

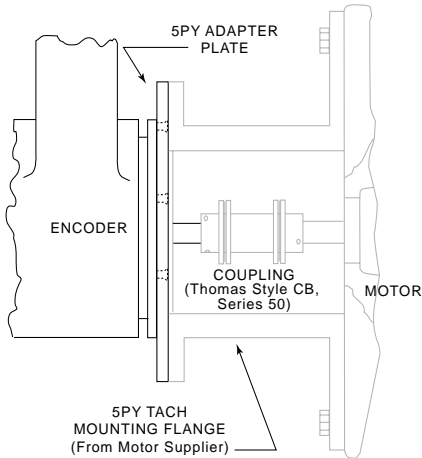


Figure 2

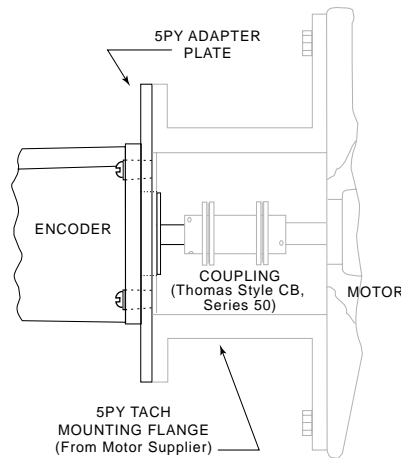
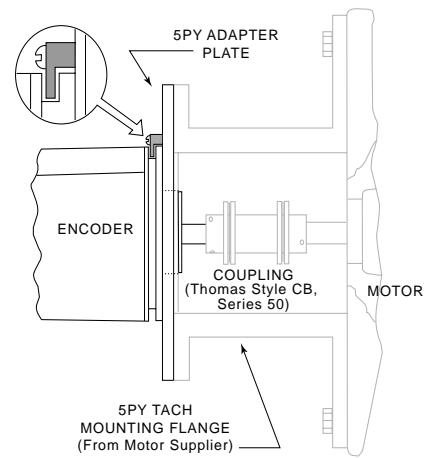


Figure 3



Procedure

60A Series Installation

- 1) Mount encoder pilot through hole in plate.
- 2) Align holes in face of encoder with counter-bored holes in plate. Secure with (6) #5-40 x 5/16" hex-socket-flat-head machine screws.
- 3) Loosen setscrews or clamps at coupling ends. Slide coupling onto motor shaft and tighten.
- 4) Mount assembly to motor tach mounting flange while inserting encoder shaft into coupling.
- 5) Tighten coupling to encoder shaft.

Procedure

Flange Mount Encoder Installation

- 1) Mount encoder pilot through hole in plate.
- 2) Align (4) holes in flange of encoder with holes in plate. Secure with (4) #10-32 x 1/2" pan-head-Philips machine screws with #10 split lock washers.
- 3) Loosen setscrews or clamps at coupling ends. Slide coupling onto motor shaft and tighten.
- 4) Mount assembly to motor tach mounting flange while inserting encoder shaft into coupling.
- 5) Tighten coupling to encoder shaft.

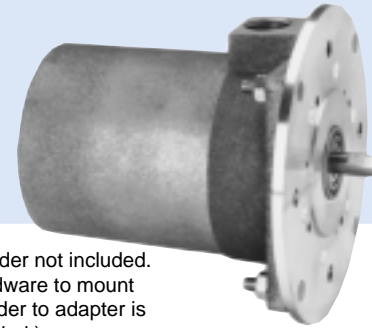
Procedure

2.5" Servo Mount Encoders

- 1) Loosen setscrews or clamps at coupling ends. Slide coupling onto motor shaft and tighten.
- 2) Install (3) mounting cleats (servo clips) loosely to bracket using pan head machine screws and split lock washers (included).
- 3) Place encoders pilot through center hole of bracket. Seat male pilot.
- 4) Rotate cleats until they fully engage servo ring groove and tighten.
- 5) Mount assembly to motor tach mounting flange while inserting encoder shaft into coupling.
- 6) Tighten coupling to encoder shaft.
- 7) Optional: If encoder has marker index pulse, loosen servo-clip screws, rotate encoder housing to desired position. Tighten screws.

5PY Adapter for X25 Encoders

- Kits include mounting plate and hardware
- Makes servo X25 encoders interchangeable with 5PY DC tach generators.



Encoder not included.
(Hardware to mount encoder to adapter is included.)

APPLICATION/INDUSTRY

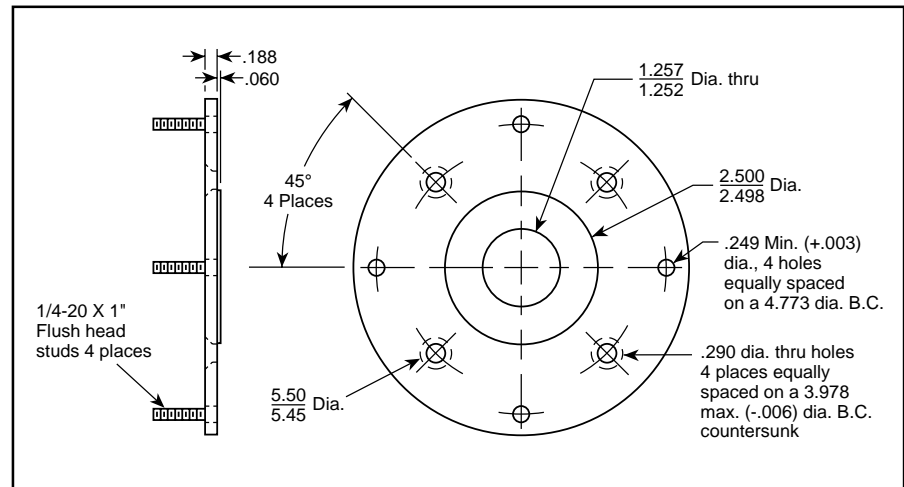
Makes X25 encoders interchangeable with 5PY DC tach generators.

DESCRIPTION

Kits include mounting plate and hardware for mounting to flange or servo mount encoders, making them interchangeable with 5PY DC tach generators. (Shaft sizes may require different couplings.) Use with bidirectional encoder and FV2, Frequency/Voltage Converter to replace DC tach generators with brushless technology.

SPECIFICATIONS

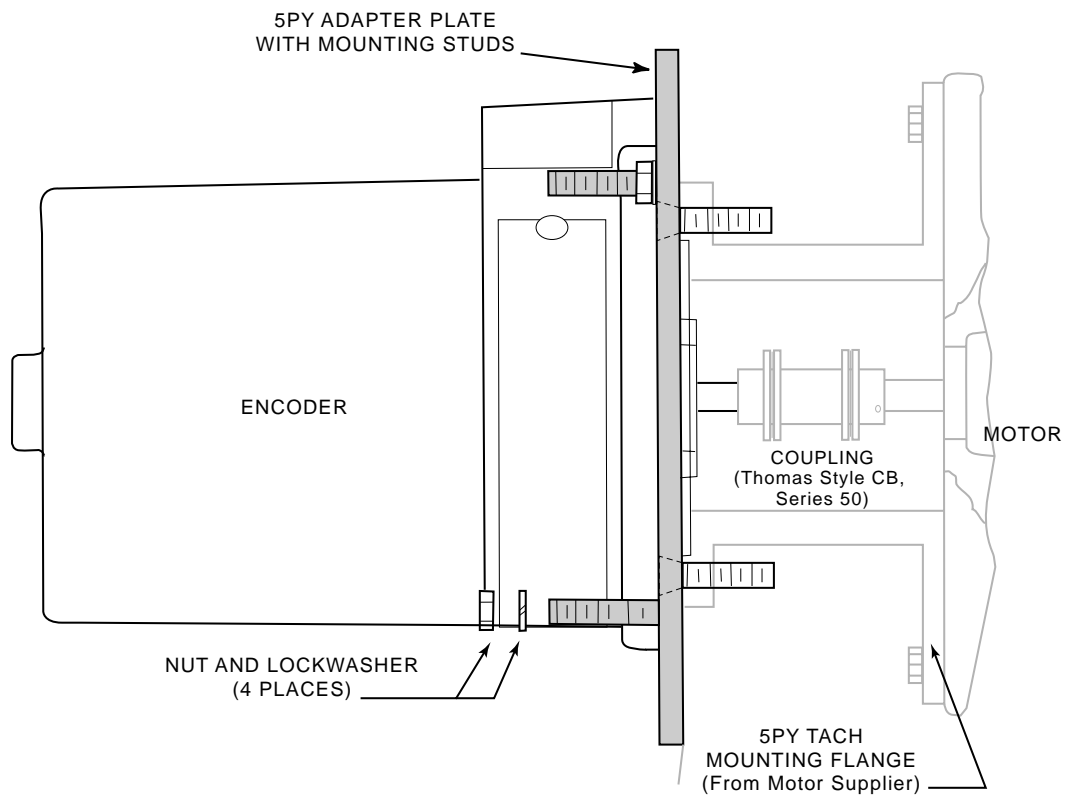
DIMENSIONS



Ordering Information

Model No.	Description
MPAEX5PY	5PY Adapter Kit for X25 encoder

INSTALLATION



Procedure

- 1) Loosen setscrews or clamps at coupling ends. Slide coupling onto motor shaft and tighten.
- 2) Install flat head bolts through adapter plate and into the motor housing adapter. Typically (4) #1/4-20 x 3/4" (provided). If housing is tapped, secure by tightening. If untapped, secure with nuts as required.
- 3) Assemble Adapter Plate to encoder housing by guiding studs on plate through holes in encoder flange and encoder shaft into coupling end. Secure to plate with 1/4" split lock washers and #1/4-20 nuts (provided).
- 4) Tighten encoder end of coupling.

Notes

A large grid of graph paper for taking notes, consisting of 20 columns and 30 rows of small squares.

Notes



Heavy Duty Encoder Introduction

THE HEAVY DUTY SOLUTION

NorthStar RIM Tach® and SLIM Tach digital tachometers use proven magnetoresistive (MR) technology to precisely track machine speed for better control.

The MR-based design is more rugged and robust than conventional, optical devices.

This state-of-the-art technology ensures precise, reliable, digital shaft velocity feedback every time.

For process industries, the choice of tachometers is an important decision that can directly impact a mill's profitability. NorthStar digital tachometers are performing reliably and delivering accurate results in tough, industrial applications throughout the world.

MILL DUTY ELECTRIC MOTORS WITH MUSCLE

- MagnetoResistive Sensing Technology
- Cast Iron and Stainless Steel Construction
- Mounts Directly on Standard Motor Flanges (modular type)
- Easy Service... Field Replaceable Sensor Modules
- PulseWheels, Housings, Covers, Connectors also are Replaceable

IDEAL FOR DIRTY APPLICATIONS

NorthStar RIM and SLIM Tachs feature a magnetic pulse wheel that is imprinted with numerous, small magnetic poles. This wheel, which works with an integrated MR sensor, creates magnetic fields which effectively penetrate any mill related contaminants such as dust, dirt or oil.

POWERFUL, PRECISE DIGITAL PULSE

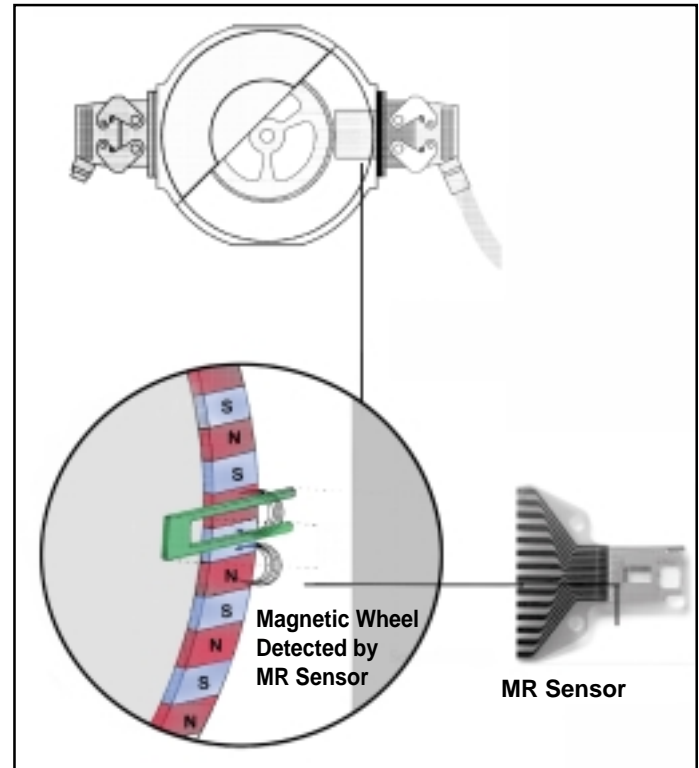
As the magnetic pulse wheel rotates with the machine shaft, an alternating pattern of north-south magnetic fields are created for the MR sensor to target.

The sensor responds by changing its resistance.

These changes are processed through an electrical circuit to provide a powerful digital pulse for precise motion measurement.

Accurate Permalloy MR Sensor The MR sensor consists of a combination of resistors, which change resistance with the application of a magnetic field.

Permalloy (NiFe) is used as the active magnetoresistive layer.



POPULAR MOUNTING STYLES

NorthStar brand specializes in a wide range of heavy duty encoders that are designed for direct motor mounting and other demanding industrial applications. Available in through-shaft and end-of-shaft mounting configurations.

RIM® TACH

Designed for harsh industrial (mill duty) applications

- Heaviest Construction
- Rugged cast iron and steel enclosure
- Equipped with double sealed, deep groove radial ball bearings
- Ultimate Reliability in its class
- Large Bore Hollow Shaft Model Available
- Many Options and Advanced Adaptability

SLIM® TACH

Designed for heavy duty industrial applications

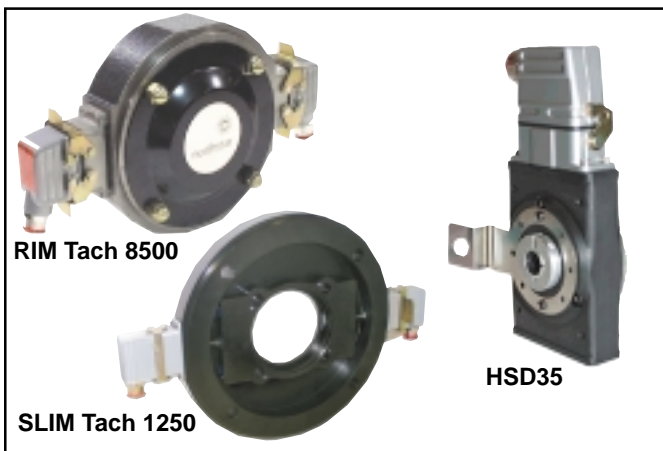
- Thin, bearingless construction ideal for space constraints
- Most Popular Model
- 1024 base Pulse Count
- Utter Simplicity for Excellent Reliability and Quick Installation
- Wide Range of Available Shaft Sizes
- Choice of Most Major Motor OEMs

SERIES HSD35

Designed for standard industrial duty applications





- Simple Mounting. Fits a wide variety of shaft types & sizes
- Hollow Shaft Design requires no shaft-coupling or bracketry
- Convenient Industrial Latching Connector requiring no soldering
- High Resolution Unbreakable Disk
- Bore is electrically and thermally insulated
- Resolutions of 1 to 2500 PPR available

HEAVY DUTY



Heavy Duty Encoder Selection Guide





Our NorthStar brand Heavy Duty Encoders wide range of heavy duty encoders are designed for direct motor mounting and other demanding industrial applications. Available in through-shaft and end-of-shaft mounting configurations. Complete information is available on the referenced page number that appears below each product's picture.

Type	RIM Tach 8500	RIM Tach HS85	RIM Tach 6200	RIM Tach 1250
				
PAGE NUMBER	3.04	3.06	3.08	3.10
DESCRIPTION AND FEATURES	<ul style="list-style-type: none"> High performance feedback for AC and DC drive control Thin design mounts without bearings or couplings Highly reliable speed signals for mill duty applications Stainless steel and cast iron construction Resolution to 1200 PPR - optional index 	<ul style="list-style-type: none"> Mounts easily to roller, sleeve, or ball bearing motors and can be used on non-motor applications, such as line shafts and conveyor shafts Accepts motor shafts sizes up to 4.500" (115mm) dia., including tapered shafts immune to grease, dust, and other conaminants 	<ul style="list-style-type: none"> Foot mounted or with accessory bracket it is ideal for close coupled, belt, or wheel driven setups Extra severe duty bearings for a longer encoder life Stainless steel and cast iron construction Resolutions up to 2048 PPR with optional index pulse 	<ul style="list-style-type: none"> Accepts shaft diameters up to 8". Ideal for crane & hoist applications Non-contact design mounts directly on motor frame Double C face can be sandwiched between motor and brake Resolutions to 2048 PPR - optional Index
ELECTRICAL SPECIFICATIONS				
Available Resolutions:	60 to 1200 PPR	60 to 2048 PPR	60 to 2048 PPR	60 to 2048 PPR
Output Frequency:	To 120kHz Data & Index	To 120kHz Data & Index	To 120kHz Data & Index	To 120kHz Data & Index
Input Power:	5-15 or 15-26 VDC, 45-65 mA per sensor module plus load	5-15 or 15-26 VDC, 45-65 mA per sensor module plus load	5-15 or 15-26 VDC, 45-65 mA per sensor module plus load	5-15 or 15-26 VDC, 45-65 mA per sensor module plus load
Available Output Types:	Line Driver	Line Driver	Line Driver	Line Driver
Terminations:	Latching Industrial Connector, MS Connector, 18" Pigtail	Latching Industrial Connector, MS Connector, 18" Pigtail	Latching Industrial Connector, MS Connector, 18" Pigtail	Latching Industrial Connector, MS Connector, 18" Pigtail
MECHANICAL SPECIFICATIONS				
Housing Material:	Cast Iron / Stainless Steel	Cast Iron / Stainless Steel	Cast Iron / Stainless Steel	Cast Iron / Stainless Steel
Bore/Shaft Size:	5/8" to 2-7/8" bore standard. Up to 3.75" available	1-1/8" to 2-7/8" bore standard. Up to 4.5" available	0.625"dia.; 1.87" long, single or double ended, standard	5/8" to 2-7/8" bore standard. Up to 8" available
Max. Shaft Speed:	Up to 5000 RPM	Up to 3600 RPM	Up to 7000 RPM	Up to 5000 RPM
Mounting:	8.5" 180C face mount for NEMA MG1 standards	8.5" 180C face mount for NEMA MG1 standards	4.5" dia., 56 C motor face; NEMA MG1-4; foot mount	12.5" face mount for NEMA MG1 standards
ENVIRONMENTAL SPECIFICATIONS				
Operating Temperature:	-40°C to +80°C	-20°C to +70°C	-40°C to +70°C	-40°C to +80°C
Sensing Technology:	Magnetic (MR)	Magnetic (MR)	Magnetic (MR)	Magnetic (MR)

HEAVY DUTY

Heavy Duty Encoder Selection Guide

Our NorthStar brand Heavy Duty Encoders wide range of heavy duty encoders are designed for direct motor mounting and other demanding industrial applications. Available in through-shaft and end-of-shaft mounting configurations Complete information is available on the referenced page number that appears below each product's picture.

Type	SLIM Tach SL56	SLIM Tach SL85	SLIM Tach RL67	SLIM Tach HS56
				
PAGE NUMBER	3.12	3.14	3.16	3.18
DESCRIPTION AND FEATURES	<ul style="list-style-type: none"> Thin, only 0.75 inch thick Mounts to 4.5 inch 56 C-Face motors Easy installation with no brackets or couplings Hard, anodized aluminum construction (Stainless Steel optional) Single or dual sensor outputs available 	<ul style="list-style-type: none"> Only 1.250" thick, mounts directly onto 8.5" (180 C) face motor Rugged, zero-speed, magnetoresistive sensing technology is unaffected by grease, salt water, dust, and other common contaminants Up to 90°C operation 	<ul style="list-style-type: none"> Unique mechanical design for Reliance RPM™ motors Low profile, adds only 1.5" to motor length Rugged, zero-speed, magnetoresistive sensing technology is unaffected by grease, salt water, dust, and other common contaminants Up to 120°C operational temperature 	<ul style="list-style-type: none"> For Fan Cooled and Non-Motor Applications Hollow shaft design allows for a variety of possible mountings; ideal to retrofit AC fan cooled motors. Rugged, immune to grease, salt water, dust, or other common contaminants. Up to 80° C operation
ELECTRICAL SPECIFICATIONS				
Available Resolutions:	64 to 2048 PPR	64 to 2048 PPR	64 to 2048 PPR	64 to 2048 PPR
Output Frequency:	To 120kHz Data & Index	To 120kHz Data & Index	To 120kHz Data & Index	To 120kHz Data & Index
Input Power:	5-15 or 5-26 VDC, 45-65 mA per sensor module plus load	5-15 or 5-26 VDC, 45-65 mA per sensor module plus load	5-15 or 5-26 VDC, 45-65 mA per sensor module plus load	5-15 or 5-26 VDC, 45-65 mA per sensor module plus load
Available Output Types:	Line Driver	Line Driver	Line Driver	Line Driver
Terminations:	Latching Industrial Connector, MS Connector, 18" Pigtail	Latching Industrial Connector, MS Connector, 18" Pigtail	Latching Industrial Connector, MS Connector, 18" Pigtail	Latching Industrial Connector, MS Connector, 18" Pigtail
MECHANICAL SPECIFICATIONS				
Housing Material:	Hard Anodized Aluminum Stainless Steel optional	Hard Anodized Aluminum	Hard Anodized Aluminum	Hard Anodized Aluminum w/ Stainless Steel Hub
Bore/Shaft Size:	5/8" to 2-7/8" bore standard. Up to 3.75" available	5/8" to 2-7/8" bore standard. Up to 3.75" available	5/8" to 2-7/8" bore standard. Up to 3.75" available	5/8" to 1-1/8" bore
Max. Shaft Speed:	Up to 5000 RPM	Up to 5000 RPM	Up to 5000 RPM	Up to 3600 RPM
Mounting:	4.5" 56C face mount for NEMA MG1 standards	8.5" 180C face mount for NEMA MG1 standards	4-1/2" 56 C motor face or directly to Reliance RPM™ motors	Hollow Shaft mount with Anti-Rotation Tether
ENVIRONMENTAL SPECIFICATIONS				
Operating Temperature:	-40°C to +90°C; extended to +120° available	-40°C to +90°C; extended to +120° available	-40°C to +90°C; extended to +120° available	-20°C to +80°C
Sensing Technology:	Magnetic (MR)	Magnetic (MR)	Magnetic (MR)	Magnetic (MR)

HEAVY DUTY

SLIM Tach SL1250	HSD35			
 <p>3.20</p>	<p>NEW</p>  <p>3.22</p>			
<ul style="list-style-type: none"> ■ Mounts to NEMA 12.5 inch C face motor ■ Thin, occupies only 1.4 inches of motor shaft ■ Easy installation with no brackets or couplings ■ Hard, anodized aluminum construction <p>64 to 1024 PPR</p> <p>To 120kHz Data & Index</p> <p>5-15 or 5-26 VDC, 45-65 mA per sensor module plus load</p> <p>Line Driver</p> <p>Latching Industrial Connector, MS Connector, 18" Pigtail</p>	<ul style="list-style-type: none"> ■ Fits a wide variety of shaft types and sizes ■ Fast, easy, flexible mounting ■ Unbreakable code disk ■ 1 - 2500 PPR available ■ Reverse polarity protected ■ Short-circuit protected <p>1 to 2500 PPR</p> <p>To 100kHz Data & Index</p> <p>5-26 VDC, 100 mA</p> <p>Open Collector, Push-Pull or Differential Line Driver</p> <p>Latching Industrial Connector, MS Connector, 18" Pigtail</p>			
<p>Hard Anodized Aluminum</p> <p>5/8" to 2-7/8" bore standard. Up to 3.75" available</p> <p>Up to 5000 RPM</p> <p>12.5" C face mount for NEMA MG1-4 standards</p>	<p>Cast Metal</p> <p>1/4" to 1-1/4" bore; 6mm to 28mm bore</p> <p>Up to 3600 RPM</p> <p>Stamped Metal or Swivel-Rod Tether</p>			
<p>-40°C to +90°C; extended to +120° available</p> <p>Magnetic (MR)</p>	<p>-40°C to +70°C 0°C to +100°C available</p> <p>Optical (unbreakable disk)</p>			

HEAVY DUTY

RIM Tach 8500



- High performance feedback for AC and DC drive control systems
- Thin, pancake style design mounts to motor without bearings or couplings
- Rugged, zero speed, magnetoresistive sensing technology is unaffected by grease, salt water, dust or other contaminants
- Highly reliable speed signals for mill duty applications
- Stainless steel and cast iron construction
- Resolution to 1200 pulses per revolution

APPLICATION/INDUSTRY

The ©NorthStar brand RIM Tach® 8500 is a mill duty digital tachometer which provides precise, reliable speed signals for even the most difficult mill processes.

DESCRIPTION

The 8500 is the most reliable magnetoresistive digital tachometer found on the market today. Available in either thru-shaft or end-of shaft models, it is specifically designed to provide feedback for AC and DC drive control systems.

Its ductile cast iron enclosure ensures rugged and reliable performance in the harshest environments. Its bearingless design greatly reduces failures and loading on the system. The 8500 features a magnetized drum that accommodates large (up to 4.5") thru-shaft or end-of-shaft mounting.

The 8500 accepts one or two stainless steel sensor modules with patented magnetoresistive technology. Each module generates A and B signals in quadrature, an optional index pulse Z, and each of their complements (A, B, Z). These reliable sensor modules can utilize DC power from +5 to +15 volts, provide transient and noise suppression, and reverse polarity protection. The 8500 high performance tachometer provides resolutions up to 1200 pulses per revolution, which is much higher than traditional encoders.

Its standard mill duty latching connectors are very easy to wire by simply inserting the stripped conductors into the plug and tightening the screw terminals. There is no need to field solder or to struggle with crimp pins. The unit easily mounts on a standard NEMA180 C face (8.5") and requires no gap adjustments. The sensor module is very simple to change, just remove four screws and slide the new sensor module in place. Finally, an optional shaft grounding brush can be added to the unit to reduce or eliminate motor shaft currents, thereby increasing motor bearing life.

FEATURES AND BENEFITS

- Rugged Mill Duty Construction
- Reliable Magnetoresistive Technology
- Easy Installation

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 60-1200
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge

ELECTRICAL

Input Power Requirements: 5-15 Volts DC, 45 mA typical per sensor module plus line driver load
 Output Signals: Line Driver, 150mA source/sink
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65

ELECTRICAL CONNECTIONS

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	A
B	2	Green	E
A	3	Blue	D
Z *	4	Violet	C
No Connection	5	—	—
Vcc (5-15 VDC)	6	Red	B
B̄	7	Yellow	H
Ā	8	Gray	G
Z̄ *	9	Orange	I
Shield	10	Braid	J

* Index (Z) optional. See Ordering Information

MECHANICAL

Max. Shaft Speed: 5,000 RPM
 Mounting Configuration: 8.5" 180C face mount for NEMA MG1 standards
 Housing Material: Cast Iron/Stainless Steel
 Acceleration Rate: 3600 rpm/sec max
 Shaft Length Required: 2.5" min
 Allowable Shaft End-Play: ± 0.050"
 Allowable Shaft Runout: 0.003" TIR

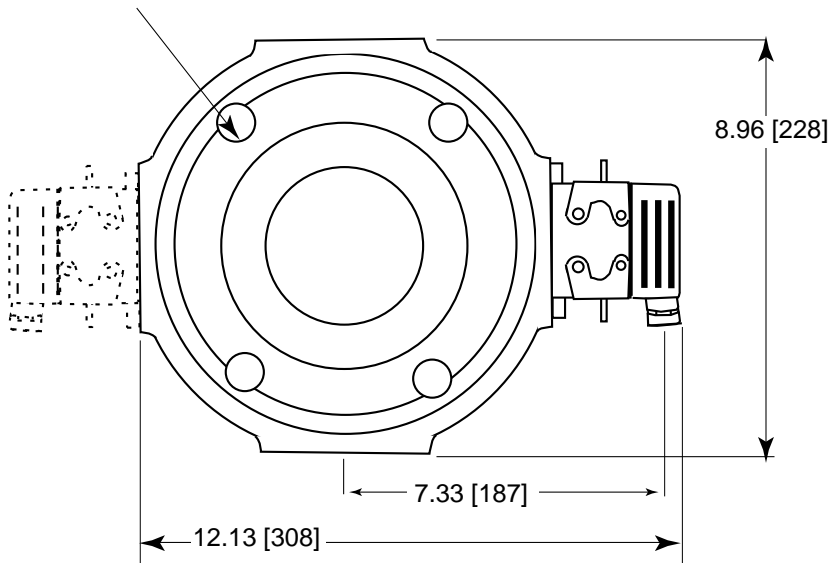
ENVIRONMENTAL

Operating Temperature Range: -40°C to +80°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

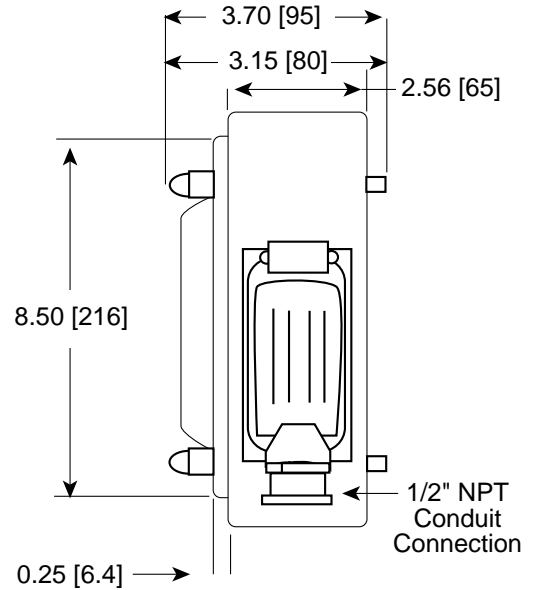
DIMENSIONS

inches [mm]

(4) 1/2"-13UNC
X 3.47 STUDS



RIM Tach 8500



ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Index	Code 4: Wheel Bore	Code 5: Output	Code 6: Electrical	Code 7: Termination
R8	□□□□	□	□□□	□	□	□
Ordering Information						
R8 Motor Mount Ring, for Nema 8 1/2" C-Face Motors (180C)	0060 0300 0064 0480 0075 0512 0120 0600 0128 0960 0150 1024 0240 1200 0256	L No Index Available when Code 2 is 0480, 0512, 0600, 0960 1024 or 1200 Z Differential Index (Z, Z̄)	J04 5/8" bore J05 7/8" bore J06 1.00" bore J07 1-1/8" bore K09 1-3/8" bore K10 1-1/2" bore K11 1-5/8" bore K12 1-3/4" bore K13 1-7/8" bore K14 2" bore K15 2-1/8" bore K16 2-1/4" bore K17 2-3/8" bore K18 2-1/2" bore K19 2-7/8" bore Additional Shaft Sizes Available Up to 3.75" Maximum End of Shaft Mounting E01 1.125" EOS E06 2.125" EOS E08 2.375" EOS E10 2.875" EOS	1 Single 2 Dual (Isolated) Differential, bidirectional signals (A, Ā, B, B̄)	L 5-15V in, 5-15V Line Driver (4428) out H Same as L with extended temp. to 120°C R 15-26V in, 15V Line Driver (4428) out 5 5-15V in, 5V Line Driver (4428) out	C Latching Industrial Connector with 1/2" NPT M 10 pin MS Connector P 18" Pigtail

Spare Sensor Module: Use "NS" followed by Code 1 (Model) & Code 2 (PPR) & Code 3 (Index) & Code 6 (Electrical) & Code 7 (Termination). Example: NSR80512ZLC
 Spare Pulse Wheel: Use "NS" followed by Code 2 (PPR) & Code 3 (Index) & Code 4 (Bore Size). Example: NS0512ZK11
 Spare Mating Connector: Use "NS" followed by Code 1 (Model) & Code 7 (Termination). Example: NSR8C
 5 foot Interface Cable: RIMCABLEDB10005. Other Length: final 4 digits is length in 5 ft increments. Example RIMCABLEDB10065 is 65 feet.

HEAVY DUTY

RIM Tach HS85



- Mounts easily to roller, sleeve, or ball bearing motors and can be used on non-motor applications, such as line shafts and conveyor shafts
- Accepts motor shafts sizes up to 4.500" (115mm) dia., including tapered shafts

APPLICATION/INDUSTRY

The © NorthStar brand RIM Tach HS85 is a mill duty, digital tachometer that accommodates large thru-shaft sizes (up to 4.5 inches or 115mm) and can easily mount to most AC or DC fan cooled motors. This digital tachometer offers the reliability, resolution, and flexibility characteristics for which NorthStar products are known.

DESCRIPTION

The HS85 digital tachometer incorporates state-of-the-art magnetoresistive sensing technology. The magnetically encoded signals provide pulse codes of A, B, and an optional index pulse Z, with complements (A, B, Z). These signals are solid for the life of the encoder. They do not exhibit the unreliable signal drift that requires a fault check on other digital tachometers. In addition, this technology is immune to common contaminants such as water, oil, grease, dirt, vibration, and overall harsh conditions of operation.

The HS85 was created as a solution to roller or sleeve bearing motors with excessive axial and radial play. This digital tachometer is ruggedly designed with steel flanges, heavy duty motor style bearings, and cast iron housing. The mill duty construction is ideal for motor and non-motor applications, or where the motor casting is otherwise unavailable. As an example, the HS85 is perfect for mounting as a line shaft reference encoder. By virtue of design, the HS85 is more forgiving of older motors which are unable to hold precise tolerances.

The HS85 is shipped pre-assembled. The installation is quick and easy; just slip the unit over the motor shaft, tighten the clamp, and add the anti-rotation arm. The sensor alignment of the HS85 is entirely independent of the motor frame. Wiring is simple due to the industrial duty connectors. No field soldering or crimp pins are required. Simply strip conductor ends, insert and tighten the connector screws. The interchangeable stainless steel sensor modules are available in a wide variety of pulse counts. There are no field gap checks, axial alignments, or radial run-out checks required.

FEATURES AND BENEFITS

- Easy Installation
- Rugged, cast-iron and steel enclosure and zero-speed, magnetoresistive sensing technology
- immune to grease, salt water, dust, and other contaminants
- Heavy duty, double sealed, deep groove, radial ball bearings to tolerate axial and radial runouts

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 60-2048
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge

ELECTRICAL

Input Voltage Requirement: 5-15 or 15-26 Volts DC
 Current Requirement:
 With Electrical Option L: 45mA typical per sensor module plus line driver load
 With Electrical Option R: 65mA typical per sensor module plus line driver load
 With Electrical Option 5: 65mA typical per sensor module plus line driver load
 Output Signals:
 With Elec Option L: 5-15 V Line Driver, 150mA
 With Elec Option R: 15 V Line Driver, 150mA
 With Elec Option 5: 5V Line Driver, 150mA
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65; MS connector or pig-tail

ELECTRICAL CONNECTIONS

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	A
B	2	Green	E
A	3	Blue	D
Z *	4	Violet	C
No Connection	5	—	—
Vcc	6	Red	B
B̄	7	Yellow	H
Ā	8	Gray	G
Z̄ *	9	Orange	I
Shield	10	Braid	J

* Index (Z) optional. See Ordering Information

MECHANICAL

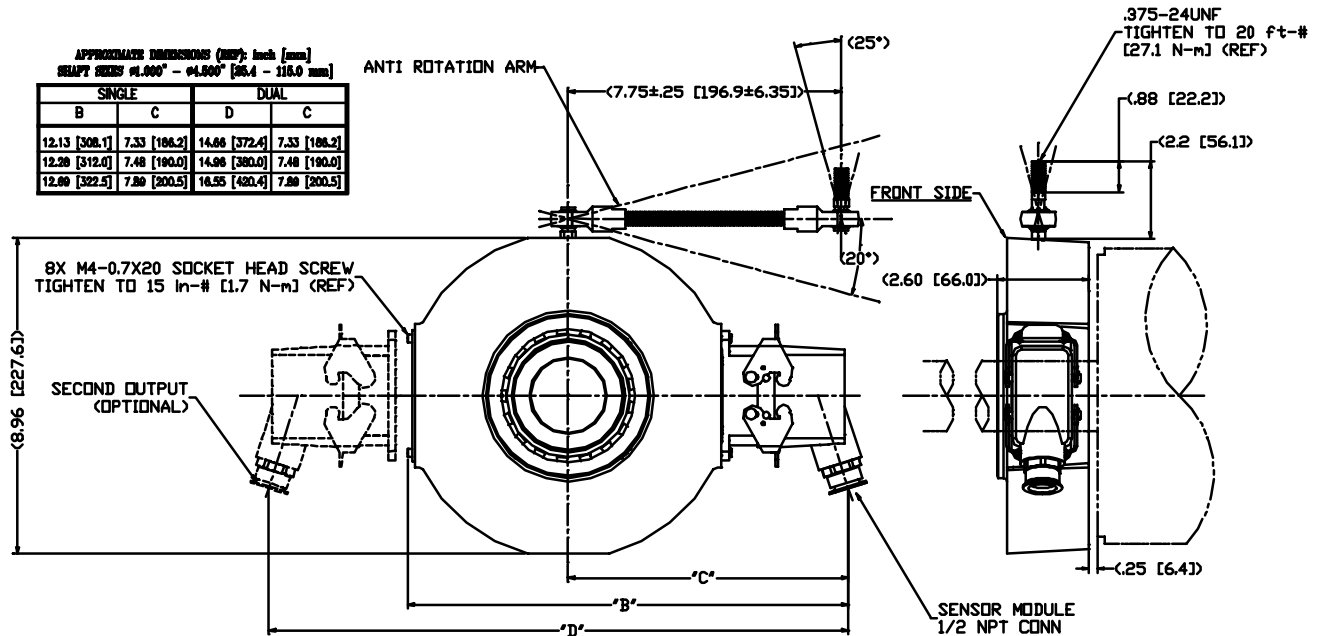
Max. Shaft Speed: 3,600 RPM
 Mounting Configuration: Hollow Shaft mount with Anti-Rotation Tether
 Housing Material: Cast Iron/Stainless Steel
 Acceleration Rate: 3,600 rpm/sec max
 Allowable Shaft End-Play: 0.25" (Subject to RPM Limitation)
 Allowable Shaft Runout: 0.010" TIR (Subject to RPM Limitation)

ENVIRONMENTAL

Operating Temperature Range: -20°C to +70°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

DIMENSIONS

inches [mm]



ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Index	Code 4: Wheel Bore	Code 5: Output	Code 6: Electrical	Code 7: Termination
H8	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information						
H8 Hollow Shaft	0060 0300 0064 0480 0075 0512 0120 0600 0128 0960 0150 1024 0240 1200 0256 2048	L No Index Available when Code 2 is 0480, 0512, 0600, 0960, 1024, 1200 or 2048 Z Differential Index (Z, \bar{Z})	Thru-bores T01 1-1/8" bore T02 1-3/8" bore T03 1-5/8" bore T04 1-7/8" bore T05 2.00" bore T06 2-1/8" bore T07 2-1/4" bore T08 2-3/8" bore T09 2-1/2" bore T10 2-7/8" bore Bores with 1.25" per foot taper P01 1-1/8" bore P02 1-3/8" bore P03 1-5/8" bore P04 1-7/8" bore P05 2.00" bore P06 2-1/8" bore P07 2-1/4" bore P08 2-3/8" bore P09 2-1/2" bore P10 2-7/8" bore Additional Shaft Sizes Up to 4.50" Maximum Available (thru and taper shaft) Call factory for details	1 Single 2 Dual (Isolated) Differential, bidirectional signals (A, \bar{A} , B, \bar{B})	L 5-15V in, 5-15V Line Driver (4428) out R 15-26V in, 15V Line Driver (4428) out 5 5-15V in, 5V Line Driver (4428) out	C Latching Industrial Connector with 1/2" NPT M 10 pin MS Connector P 18" Pigtail

Spare sensor module Use "NS" followed by Code 1 (Model) & Code 2 (PPR) & Code 3 (Index) & Code 6 (Electrical) & Code 7 (Termination). Example: NSH80512ZLC

Spare Mating Connector: Use "NS" followed by Code 1 (Model) & Code 7 (Termination). Example: NSH8C

5 foot Interface Cable: RIMCABLEDB10005. Other Length: final 4 digits is length in 5 ft increments. Example RIMCABLEDB10065 is 65 feet.

HEAVY DUTY

RIM Tach 6200

- Foot mounted or with accessory bracket it is ideal for close coupled, belt, or wheel driven setups
- Extra severe duty bearings for a longer encoder life
- Stainless steel and cast iron construction
- Resolutions up to 2048 PPR with optional index pulse



APPLICATION/INDUSTRY

The RIM Tach® 6200 is specifically designed to meet the needs of process industries, providing the most reliable, mechanical, electrical, and environmental features available in digital tachometers today.

DESCRIPTION

Featuring rugged, Mill Duty Construction, the durable RIM Tach® 6200 was designed for hostile environments. The mill duty, cast iron construction of the 6200 accepts stainless steel sensor modules with patented magnetoresistive technology. The outputs are available as either single or dual outputs and are completely isolated from one another. The modular design features extra severe duty bearings (1.875" OD) to ensure longer life under heavy loads.

The patented Magnetoresistive technology of the Rim Tach® 6200 is incorporated into a heavy duty, one piece sensor module, with encapsulated surface mount electronics. These advanced modules are immune to common mill contaminants (water, oil, grease, dirt, shock, and vibration) and overall harsh environments. This state-of-the-art technology allows for much higher resolutions providing resolutions up to 2048 pulses per revolution. With the addition of a RIM Tach® Shaft Grounding Brush, induced shaft currents "drain" away, preventing premature material weakening of large AC and DC motor bearings, and their consequent failure.

Standard mill duty latching connectors provide ease of installation. These sealed connectors are simple to wire by inserting the stripped conductor in the plug and tightening the screw terminals. There is no need to field solder or to struggle with a crimp pin. The unit easily mounts on a standard NEMA 56 C face (4.5") and requires no gap adjustments. The sensor module is very easy to change, just remove four screws and slide the new sensor module in place.

FEATURES AND BENEFITS

- Rugged Mill Duty Construction
- Easy Installation
- Reliable Magnetoresistive sensor unaffected by common contaminants
- Sensor modules for fast and easy field service

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 60-2048
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge

ELECTRICAL

Input Voltage Requirement: 5-15 or 15-26 Volts DC
 Current Requirement:
 With Electrical Option L: 45 mA typical per sensor module plus line driver load
 With Electrical Option R: 65 mA typical per sensor module plus line driver load
 With Electrical Option 5: 65 mA typical per sensor module plus line driver load
 Output Signals:
 With Elec Option L: 5-15 V Line Driver, 150mA
 With Elec Option R: 15 V Line Driver, 150mA
 With Elec Option 5: 5V Line Driver, 150mA
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65

ELECTRICAL CONNECTIONS

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	A
B	2	Green	E
A	3	Blue	D
Z *	4	Violet	C
No Connection	5	—	—
Vcc	6	Red	B
B	7	Yellow	H
A̅	8	Gray	G
Z̅ *	9	Orange	I
Shield	10	Braid	J

* Index (Z) optional. See Ordering Information

MECHANICAL

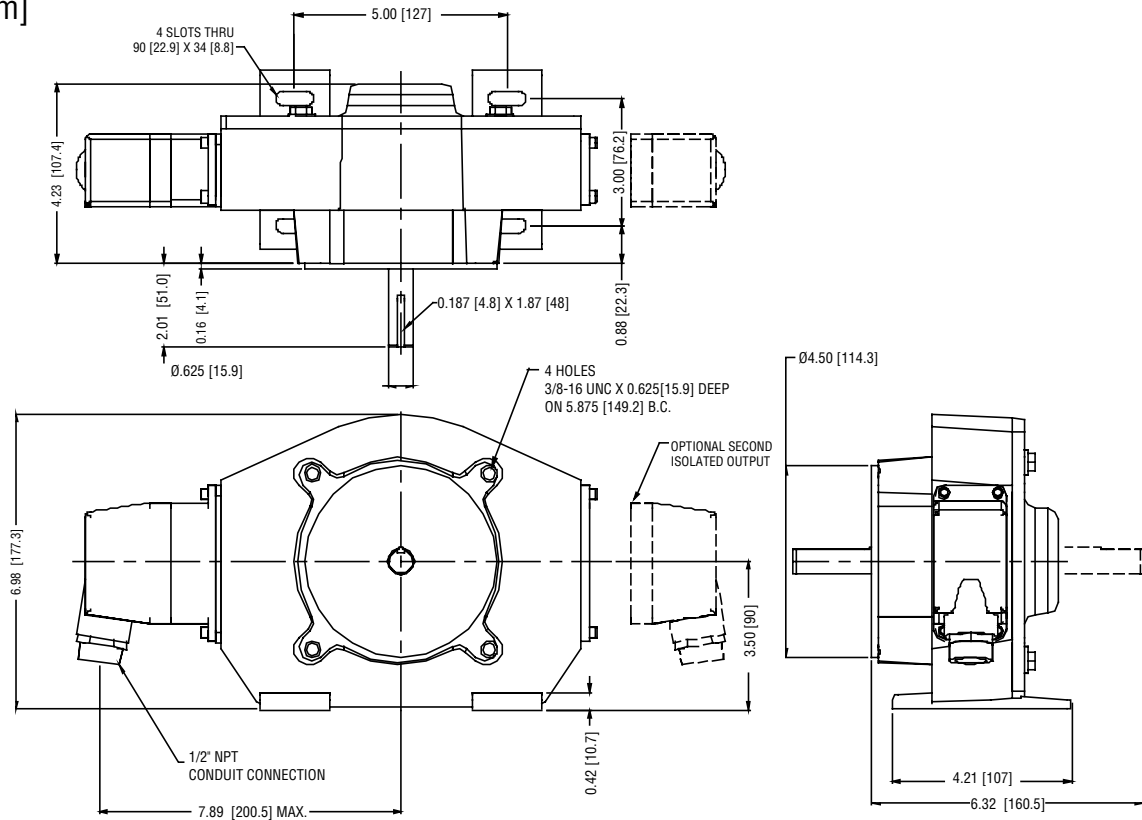
Max. Shaft Speed: 7,000 RPM
 Mounting Configuration: 4.5" [115mm] diameter, 56 C motor face or accessory flange to meet NEMA MG1-4 standards; foot mount with 4 slotted bolt holes
 Housing Material: Cast Iron/Stainless Steel
 Acceleration Rate: 3600 rpm/sec max
 Shaft : 0.625" [16mm] diameter with 1.87" [48mm] long, 3/16" [5mm] square-parallel key. Optional double ended shaft and optional 14 mm shaft with metric key
 Axial/Radial Loading: 50 lbf axial, 50 lbf radial

ENVIRONMENTAL

Operating Temperature Range: -40°C to +70°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

DIMENSIONS

inches [mm]



ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Index	Code 4: Shaft	Code 5: Output	Code 6: Electrical	Code 7: Termination
R6	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information						
R6 Foot Mount or Close Coupled	0060 0064 0075 0120 0128 0150 0240 0256 0300 0480 0512 0600 0960 1024 1200 2048	L No Index Available when Code 2 is 0480, 0512, 0600, 0960 1024, 1200 or 2048 Z Differential Index (Z, Z̄)	S Single D Double	1 Single 2 Dual (Isolated) Differential, bidirectional signals (A, Ā, B, B̄)	L 5-15V in, 5-15V Line Driver (4428) out R 15-26V in, 15V Line Driver (4428) out 5 5-15V in, 5V Line Driver (4428) out	C Latching Industrial Connector with 1/2" NPT M 10 pin MS Connector P 18" Pigtail

HEAVY DUTY

Spare sensor module Use "NS" followed by Code 1 (Model) & Code 2 (PPR) & Code 3 (Index) & Code 6 (Electrical) & Code 7 (Termination). Example: NSR60512ZLC
 Spare Mating Connector: Use "NS" followed by Code 1 (Model) & Code 7 (Termination). Example: NSR6C
 5 foot Interface Cable: RIMCABLEDB10005. Other Length: final 4 digits is length in 5 ft increments. Example RIMCABLEDB10065 is 65 feet.

RIM Tach 1250

- Accepts shaft diameters up to 8" - ideal for crane & hoist applications
- Non-contact design mounts directly on motor frame
- Double C face can be sandwiched between motor and brake
- Zero speed sensors are unaffected by grease, salt water, dirt or other common contaminants.



APPLICATION/INDUSTRY

NorthStar's RIM Tach® 1250 digital tachometer provides position and velocity feedback from both AC & DC electric motors, providing precise, reliable speed signals for many monitoring and control applications

DESCRIPTION

The Model 1250 is designed for 12.5 inch diameter type C face motor frames and accessory mounts. This tachometer provides precise, reliable speed signals for many monitoring and control applications and is a standard feedback device for AC & DC variable speed drives. The RIM Tach® 1250 is the process industry's answer to a large thru-shaft option for precise speed control.

Constructed of ductile cast iron, it ensures maximum strength and endurance for possible exposure to acid wash down in pulp and paper applications. The enclosure accommodates both end-of-shaft and thru-shaft mountings and is universally machined to accommodate all sensor modules, regardless of the desired pulse count.

The RIM Tach® 1250 sensor module is engineered to provide a non-contact sensor and electronics in one interchangeable hermetically sealed package. Encapsulated surface mount electronics provide resistance to water, oil, dirt, high temperatures, shock and vibrations and overall harsh environments. The Model 1250 can accommodate up to 2048 pulses per revolution and is bidirectional providing square wave outputs. The sensor module is very simple to change, just remove four screws and slide the new module in place.

There are no bearings to fail or requirements for flexible couplings because its magnetized drum assembly is attached directly to the shaft. The mill duty latching connectors are are easy to wire with no need to field solder or to struggle with a crimp pin.

FEATURES AND BENEFITS

- Rugged Mill Duty Construction
- Reliable Magnetoresistive Technology
- Easy Installation
- Modular design for fast, easy field service.
- Resolutions to 2048 PPR - optional Index

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 60-2048
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge

ELECTRICAL

Input Power Requirements: 5-15 Volts DC, 45 mA typical per sensor module plus line driver load
 Output Signals: Line Driver, 150mA source/sink
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65

MECHANICAL

Max. Shaft Speed: 5,000 RPM (J or K wheels); 3600 RPM (L wheels)
 Mounting Configuration: 12.5" face mount for NEMA MG1 standards
 Housing Material: Cast Iron/Stainless Steel
 Acceleration Rate: 3600 rpm/sec max
 Shaft Length Required: 3.0" min
 Allowable Shaft End-Play: ± 0.050"
 Allowable Shaft Runout: 0.003" TIR

ENVIRONMENTAL

Operating Temperature Range: -40°C to +80°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

ELECTRICAL CONNECTIONS

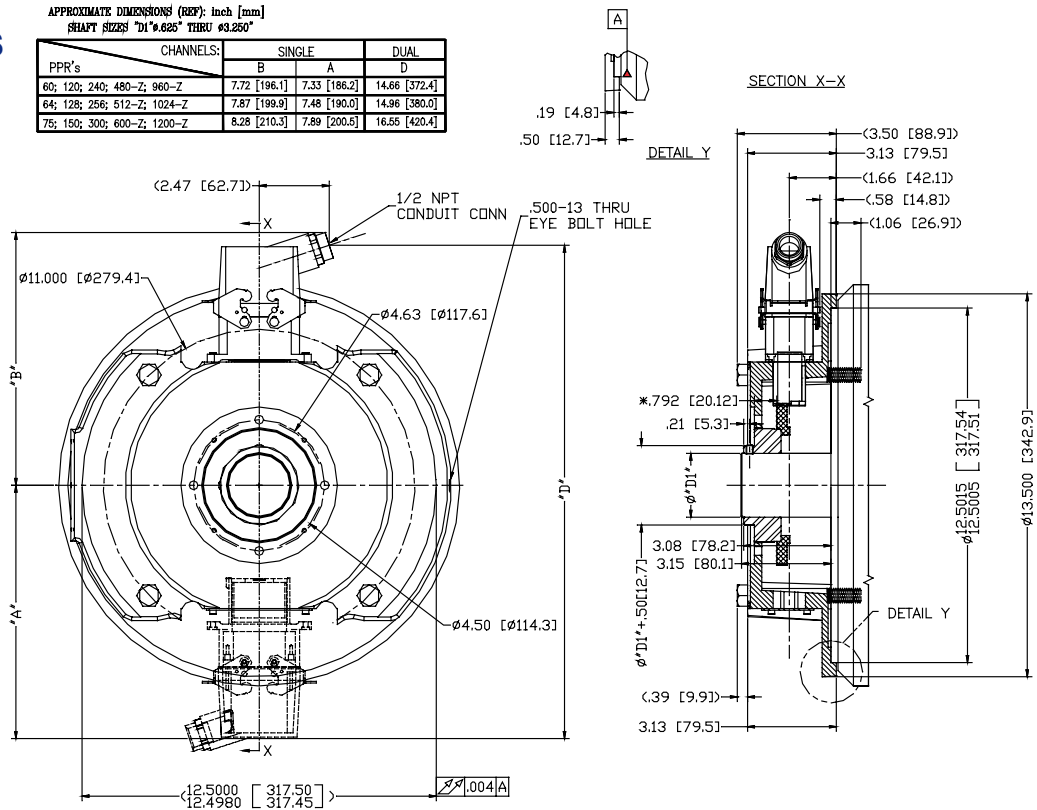
Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	A
B	2	Green	E
A	3	Blue	D
Z *	4	Violet	C
No Connection	5	—	—
Vcc	6	Red	B
B̄	7	Yellow	H
Ā	8	Gray	G
Z̄ *	9	Orange	I
Shield	10	Braid	J

* Index (Z) optional. See Ordering Information

DIMENSIONS

APPROXIMATE DIMENSIONS (REF): Inch [mm]
SHAFT SIZES "D1" \pm 0.005" THRU \pm 0.250"

PPR's	CHANNELS:		
	B	A	D
60; 120; 240; 480-Z; 960-Z	7.72 [196.1]	7.33 [186.2]	14.66 [372.4]
64; 128; 256; 512-Z; 1024-Z	7.87 [199.9]	7.48 [190.0]	14.96 [380.0]
75; 150; 300; 600-Z; 1200-Z	8.28 [210.3]	7.89 [200.5]	16.55 [420.4]



ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Index	Code 4: Wheel Bore	Code 5: Output	Code 6: Electrical	Code 7: Termination
R1	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information						
R1 Motor Mount Ring, for 12-1/2" C-Face Motors	0060 0064 0075 0120 0128 0150 0240 0256	0300 0480 0512 0600 0960 1024 1200 2048	L No Index Available when Code 2 is 0480, 0512, 0600, 0960, 1024, 1200 or 2048 Z Differential Index (Z, Z̄)	J04 5/8" bore J05 7/8" bore J06 1.00" bore J07 1-1/8" bore K09 1-3/8" bore K10 1-1/2" bore K11 1-5/8" bore K12 1-3/4" bore K13 1-7/8" bore K14 2" bore K15 2-1/8" bore K16 2-1/4" bore K17 2-3/8" bore K18 2-1/2" bore K19 2-7/8" bore Additional Shaft Sizes Available Up to 8.00" Maximum	1 Single 2 Dual (Isolated) Differential, bidirectional signals (A, Ā, B, B̄)	L 5-15V in, 5-15V Line Driver (4428) out R 15-26V in, 15V Line Driver (4428) out 5 5-15V in, 5V Line Driver (4428) out C Latching Industrial Connector with 1/2" NPT M 10 pin MS Connector P 18" Pigtail

HEAVY DUTY

Spare sensor module: Use "NS" followed by Code 1 (Model) & Code 2 (PPR) & Code 3 (Index) & Code 6 (Electrical) & Code 7 (Termination). Example: NSR10512ZLC
 Spare Pulse Wheel: Use "NS" followed by Code 2 (PPR) & Code 3 (Index) & Code 4 (Bore Size). Example: NS0512ZK11
 Spare Mating Connector: Use "NS" followed by Code 1 (Model) & Code 7 (Termination). Example: NSR1C
 5 foot Interface Cable: RIMCABLEDB10005. Other Length: final 4 digits is length in 5 ft increments. Example RIMCABLEDB10065 is 65 feet.

SLIM Tach SL56



- Thin, compact, and only 0.75 inch thick
- Mounts to 4.5 inch 56 C-Face motors
- Rugged, reliable magnetoresistive sensor technology
- Easy installation with no brackets or couplings
- Anodized aluminum construction - Stainless Steel optional
- Single or dual sensor outputs available

APPLICATION/INDUSTRY

The bearingless, heavy duty, ©NorthStar SLIM Tach SL56 mounts directly to 4.5 inch 56 C face motors. With resolutions up to 2048 PPR, it is only 0.75 inch thick and ideal for tight machine configurations.

DESCRIPTION

This reliable encoder may be configured with one or two electrically independent and totally isolated outputs. A high temperature version is available to meet operational needs up to 120°C. It also comes in a wide variety of shaft sizes, cover choices, and connector options.

The durable SL56 operates with unequalled resistance to grease, oil, salt water, dirt, fibers, and dust. Its hardened, encapsulated electronics make it immune to contamination, heavy machine vibration, and accidental impact, decreasing downtime. Hard, anodized aluminum of aircraft quality makes the SL56 the toughest, yet lightest, C-Face encoder available. For corrosive environments, a stainless steel version is available.

A high power line driver comes standard and guarantees clean, crisp signals over long cable lengths, minimizing the need for signal repeaters.

Each version of the SL56 is easy to mount, requiring no bearings, adapter plates, or flexible couplings. Because the SL56 occupies only 0.75 inch of the motor shaft length, a brake, pulley, gear box, or coupling can also be placed on the shaft. The sandwich version provides double C-Face mounting for applications which need the encoder between the motor and another device.

FEATURES AND BENEFITS

- Thru-shaft-shaft versions are standard; double C face sandwich version is also available
- 64, 128, 256, 512, 1024, or 2048 pulses per revolution (PPR) with optional index pulse
- 5-24VDC operation, bi-directional quadrature signals with high power, differential line driver outputs

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 64-2048
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge
 Number of Output Modules: Single or Dual Redundant

ELECTRICAL

Input Voltage Requirement: 5-15 or 5-26 Volts DC
 Current Requirement:
 With Electrical Option L or H: 45 mA typical per sensor module plus line driver load
 With Electrical Option V or 5: 65 mA typical per sensor module plus line driver load
 Output Signals:
 With Elec Option L or H: 5-15 V Line Driver, 150mA
 With Elec Option V: 5-26 V Line Driver, 100mA
 With Elec Option 5: 5V Line Driver, 150mA
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65; MS connector or pig-tail

ELECTRICAL CONNECTIONS

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	F
B	2	Green	B
A	3	Blue	A
Z*	4	Violet	C
No Connection	5	—	E
Vcc (5-15 VDC)	6	Red	D
B̄	7	Yellow	I
Ā	8	Gray	H
Z*	9	Orange	J
Shield	10	Braid	G

* Index (Z) optional. See Ordering Information

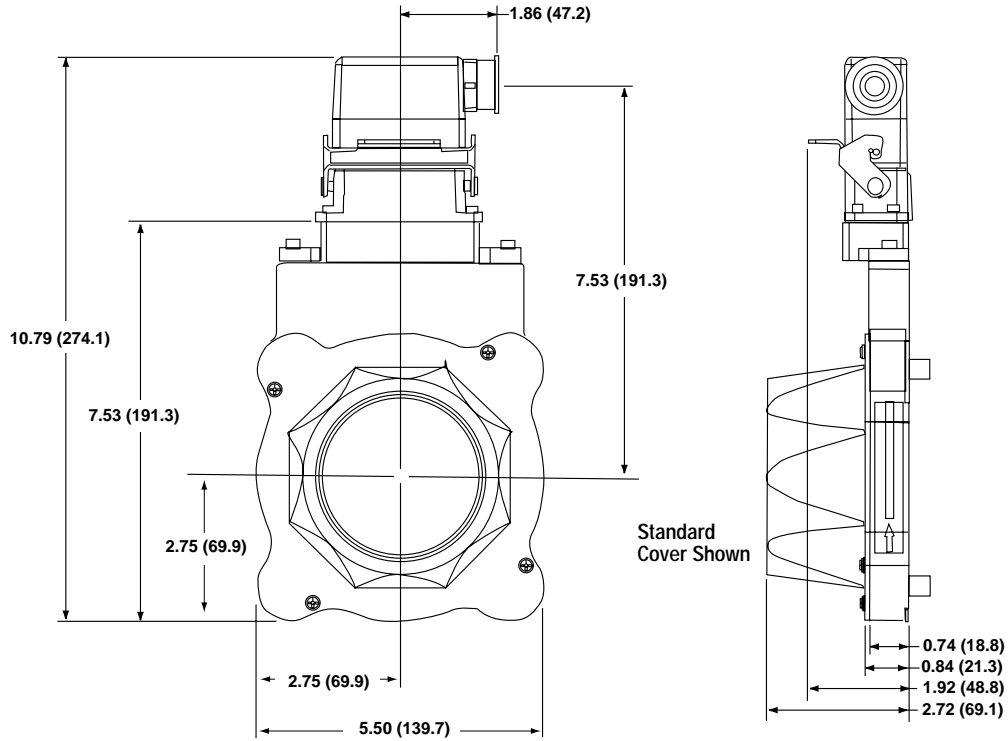
MECHANICAL

Max. Shaft Speed: 5,000 RPM
 Mounting Configuration: 4.5" 56C face mount for NEMA MG1 standards
 Housing Material: Cast Aluminum (Stainless Steel optional)
 Acceleration Rate: 12,000 rpm/sec max
 Shaft Length Required: 0.7" min
 Allowable Shaft End-Play: ± 0.045"
 Allowable Shaft Runout: 0.002" TIR
 Weight: Aluminum: 1.7 lbs (0.77 kg);
 Stainless: 3 lbs (1.36 kg)

ENVIRONMENTAL

Operating Temperature Range:
 Standard: -40°C to +90°C
 Extended: -40°C to +120°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

DIMENSIONS
inches [mm]



ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Index	Code 4: Wheel Bore	Code 5: Termination	Code 6: Electrical	Code 7: Cover/Adapter
<input type="checkbox"/> 5	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information						
S5 Motor Mount Ring, for 4 1/2" C-Face Motors (56C) Single Output	0064	L No Index Available when Code 2 is 0512, 1024 or 2048 Z Differential Index (Z, Z̄)	J04 5/8" bore	C Latching Industrial Connector with 1/2" NPT E 3" extended height Latching Industrial Connector with 1/2" NPT M 10 pin MS Connector P 18" pigtail cable	L 5-15V in, 5-15V Line Driver (4428) out H Same as L with extended temp. to 120°C V 5-26V in, 5-26V Line Driver (IC-WE) out 5 5-15V in, 5V Line Driver (4428) out	C Standard Cover E Extra heavy duty steel cover F Flat Thru-hole cover S Double 56 C-Face Sandwich Adapter T Flat No Hole Cover
	0128		J05 7/8" bore			
D5 Motor Mount Ring, for 4 1/2" C-Face Motors (56C) Dual Output	0256		J06 1.00" bore	Available when Code 1 is S5 and Code 4 is J04 thru J07: S 18" pigtail cable with stainless steel housing	Differential, bidirectional signals (A, Ā, B, B̄)	
	0512		J07 1-1/8" bore			
	1024		K09 1-3/8" bore			
	2048		K10 1-1/2" bore			
			K11 1-5/8" bore			
			K12 1-3/4" bore			
			K13 1-7/8" bore			
			K14 2.00" bore			
			K15 2-1/8" bore			
			K16 2-1/4" bore			
			K17 2-3/8" bore			
			K18 2-1/2" bore			
			K19 2-7/8" bore			
			Additional Shaft Sizes Available Up to 3.75" Maximum			

HEAVY DUTY

Spare Pulse Wheel: Use "NS" followed by Code 2 (PPR) & Code 3 (Index) & Code 4 (Bore Size). Example: NS0512ZK11
 Spare Mating Connector: Use "NS" followed by Code 1 (Model) & Code 5 (Termination). Example: NSS5C
 Spare Cover: Use "NS" followed by Code 1 (Model) & Code 4 (Bore Size) & Code 7 (Cover). Example: NSS5K11C
 5 foot Interface Cable: RIMCABLEDB10005. Other Length: final 4 digits is length in 5 ft increments. Example RIMCABLEDB10065 is 65 feet.

SLIM Tach SL85

- Only 1.250" thick, mounts directly onto 8.5" (180 C) face motor
- Rugged, zero-speed, magnetoresistive sensing technology is unaffected by grease, salt water, dust, and other common contaminants
- Up to 90°C operation



APPLICATION/INDUSTRY

The ©NorthStar brand SLIM Tach® SL85 is a mill duty digital tachometer with high immunity to grease, oil, salt water, dirt, fibers, and dust is optimized for AC vector motor applications.

DESCRIPTION

The magnetoresistive sensor of the SLIM Tach SL85 operates with an unparalleled immunity to grease, oil, salt water, dirt, fibers, and dust, thereby eliminating the need for sealing. It occupies only 1.250" of the motor shaft length, enabling the encoder and a flexible coupling or pulley to be mounted on the motor. The simple and sturdy design can be mounted in any attitude quickly and easily.

The sensor generates A and B phase quadrature signals and their complements (\bar{A} & \bar{B}). The module provides transient and noise suppression, reverse polarity protection, and operates with DC power from +5 to +15 volts. A high power, complementary, line driver output assures clean, crisp signals over long cable lengths. The hardened encapsulated electronics of the SL85 make it especially resistant to heavy machine vibration and accidental impacts.

Mounting the SL85 onto the 8.5" (180 C) face of a motor is quick and easy with no adapter plates, bearings, or flexible coupling. Installation can be completed in seconds with no gap adjustments or special tools. The encoder can be removed then reinstalled just as easily. The latching industrial connector requires only a simple screw driver to install. To replace a module, simply remove four screws and replace with a new module. No electrical adjustment or alignment is required.

The SL85 pulse wheel assembly is imprinted with magnetic poles that provide higher pulse counts than traditional gear tooth wheels. The higher resolution provides greater accuracy and more precise speed control in your applications. For flexible usage, wheel assemblies are available in a variety of mounting configurations.

FEATURES AND BENEFITS

- Thru-shaft and end-of-shaft versions are standard; double C face sandwich version is also available
- 64, 128, 256, 512, 1024, or 2048 pulses per revolution (PPR) with optional index pulse
- 5-15VDC operation, bi-directional quadrature signals with high power, differential line driver outputs

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 64-2048
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: $90^\circ \pm 22^\circ$
 Symmetry: $180^\circ \pm 54^\circ$
 Index: 270° gated to falling B edge
 Number of Output Modules: Single or Dual Redundant

ELECTRICAL

Input Power Requirements: 5-15 Volts DC, 45 mA typical per sensor module plus line driver load
 Output Signals: Line Driver, 150mA source/sink
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65

ELECTRICAL CONNECTIONS

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	F
B	2	Green	B
A	3	Blue	A
Z *	4	Violet	C
No Connection	5	—	E
Vcc (5-15 VDC)	6	Red	D
\bar{B}	7	Yellow	I
\bar{A}	8	Gray	H
\bar{Z} *	9	Orange	J
Shield	10	Braid	G

* Index (Z) optional. See Ordering Information

MECHANICAL

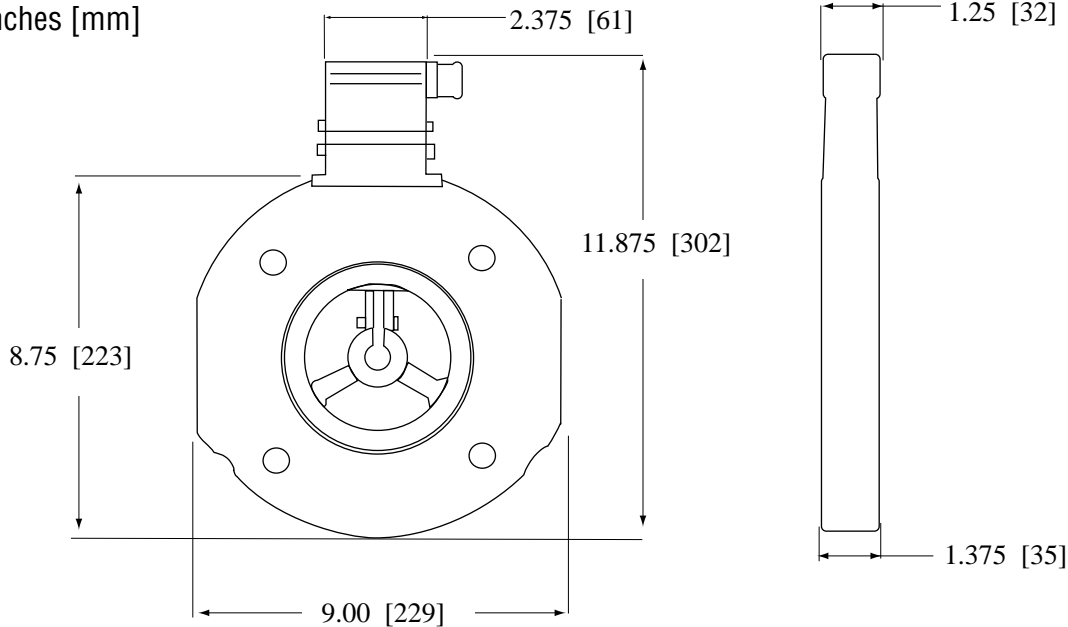
Max. Shaft Speed: 5,000 RPM
 Mounting Configuration: 8.5" 180C face mount for NEMA MG1 standards
 Housing Material: Cast Aluminum
 Acceleration Rate: 3600 rpm/sec max
 Shaft Length Required: 2.5" min
 Allowable Shaft End-Play: $\pm 0.050"$
 Allowable Shaft Runout: 0.003" TIR

ENVIRONMENTAL

Operating Temperature Range:
 Standard: -40°C to $+90^\circ\text{C}$
 Extended: -40°C to $+120^\circ\text{C}$
 Storage Temperature Range: -40°C to $+120^\circ\text{C}$
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

DIMENSIONS

inches [mm]



ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Index	Code 4: Wheel Bore	Code 5: Termination	Code 6: Electrical	Code 7: Cover/Adapter
<input type="checkbox"/> 8	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information						
S8 Motor Mount Ring, for 8 1/2" C-Face Motors (180C) Single Output	0064 0128 0256 0512 1024 2048	L No Index Available when Code 2 is 0512, 1024 or 2048 Z Differential Index (Z, Z̄)	J04 5/8" bore J05 7/8" bore J06 1.00" bore J07 1-1/8" bore K09 1-3/8" bore K10 1-1/2" bore K11 1-5/8" bore K12 1-3/4" bore K13 1-7/8" bore K14 2.00" bore K15 2-1/8" bore K16 2-1/4" bore K17 2-3/8" bore K18 2-1/2" bore K19 2-7/8" bore Additional Shaft Sizes Available Up to 3.75" Maximum End of Shaft Mounting N01 1.125" EOS N06 2.125" EOS N08 2.375" EOS N10 2.875" EOS	C Latching Industrial Connector with 1/2" NPT E Double C-Face Sandwich Version with 3" extended height Industrial Connector M 10 pin MS Connector P 18" pigtail cable Q Latching Industrial Connector on 18" pigtail cable	L 5-15V in, 5-15V Line Driver (4428) out H Same as L with extended temp. to 120°C V 5-26V in, 5-26V Line Driver (IC-WE) out 5 5-15V in, 5V Line Driver (4428) out Differential, bidirectional signals (A, Ā, B, B)	C Standard Cover F Flat Thru-hole cover
D8 Motor Mount Ring, for 8 1/2" C-Face Motors (180C) Dual Output						

HEAVY DUTY

Spare Pulse Wheel: Use "NS" followed by Code 2 (PPR) & Code 3 (Index) & Code 4 (Bore Size). Example: NS0512ZK11
 Spare Mating Connector: Use "NS" followed by Code 1 (Model) and Code 5 (Termination). Example: NSS8C
 Spare Cover: Use "NS" followed by Code 1 (Model) & Code 4 (Bore Size) & Code 7 (Cover). Example: NSS8K11C
 5 foot Interface Cable: RIMCABLEDB10005. Other Length: final 4 digits is length in 5 ft increments. Example RIMCABLEDB10065 is 65 feet.

SLIM Tach RL67



- *Unique mechanical design for Reliance RPM™ motors*
- *Rugged, zero-speed, magnetoresistive sensing technology is unaffected by grease, salt water, dust, and other common contaminants*

APPLICATION/INDUSTRY

The SLIM Tach® RL67 heavy duty encoder is a breakthrough innovation in feedback technology. Incorporating dual mounting features, the RL67 was designed especially for Reliance Electric, Inc. RPM® AC or DC motors.

DESCRIPTION

The hard anodized aluminum alloy frame provides strength, ruggedness, and corrosion resistance. The hardened encapsulated electronics offer outstanding reliability under heavy machine vibration and accidental impacts. The electronics range from +5 to +15 volts DC and include the latest in short circuit proof design on all output pins. High power, complementary, line driver outputs assure clean, crisp signals over long cable lengths. These outputs are compatible with most drives or other input devices. The advanced magnetoresistive sensing technology operates with an unparalleled immunity to grease, oil, salt water, dirt, fibers, and other contaminants. This eliminates the need to seal the encoder.

The compact RL67 adds only 1.5" to the motor length. Designed to maximize the ease of field installation, the RL67 retrofits onto older existing motors as well as new motors. In some cases, it may be necessary to change the accessory stub shaft in the motor. This stub shaft is also available from us.

The RL67 will mount directly in the 6.75" machined accessory recess of the 4.5" accessory flange found on the motor. This unique modular design mounts quickly and easily with no adapter plates, bearings, or flexible couplings. Installation can be completed in minutes, without gap adjustments or special tools. The encoder can be removed then reinstalled just as easily.

FEATURES AND BENEFITS

- Modular, bearingless, low profile "pancake" design adds only 1.5" to motor length
- 5-15 VDC operation with bi-directional quadrature and signals, with high power differential line driver outputs
- 64, 128, 256, 512, 1024 & 2048 pulses per revolution (PPR) with optional Index pulse
- Up to 120°C operational temperature

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 64-2048
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge

ELECTRICAL

Input Voltage Requirement: 5-15 or 5-26 Volts DC
 Current Requirement:
 With Electrical Option L or H: 45 mA typical per sensor module plus line driver load
 With Electrical Option V or 5: 65 mA typical per sensor module plus line driver load
 Output Signals:
 With Elec Option L or H: 5-15 V Line Driver, 150mA
 With Elec Option V: 5-26 V Line Driver, 100mA
 With Elec Option 5: 5V Line Driver, 150mA
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65

MECHANICAL

Max. Shaft Speed: 5,000 RPM
 Mounting Configuration: 4.5" diameter, 56 C motor face or accessory flange to meet NEMA MG1-4 standards or mounts directly in the 6.75" machined accessory recess of the 4.5" accessory flange found on Reliance RPM™ motors
 Housing Material: Cast Aluminum
 Acceleration Rate: 12,000 rpm/sec max
 Shaft Length Required: 2.5" min
 Allowable Shaft End-Play: ± 0.045"
 Allowable Shaft Runout: 0.003" TIR

ENVIRONMENTAL

Operating Temperature Range:
 Standard: -40°C to +90°C
 Extended: -40°C to +120°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

ELECTRICAL CONNECTIONS

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	F
B	2	Green	B
A	3	Blue	A
Z *	4	Violet	C
No Connection	5	—	E
Vcc (+ VDC)	6	Red	D
B	7	Yellow	I
A	8	Gray	H
Z *	9	Orange	J
Shield	10	Braid	G

* Index (Z) optional. See Ordering Information

SLIM Tach HS56 *For Fan Cooled and Non-Motor Applications*



- *Hollow shaft design allows for a variety of possible mountings; ideal to retrofit AC fan cooled motors.*
- *Rugged, zero-speed, magnetoresistive sensing technology is immune to grease, salt water, dust, or other common contaminants.*
- *Up to 80° C operation*

APPLICATION/INDUSTRY

The NorthStar brand HS56 has been designed especially for maintenance, motor repair, and field personnel. It offers an unparalleled means of applying a leading edge digital encoder to motors and other devices that require an innovative method of installation.

DESCRIPTION

The HS56's magnetoresistive sensor technology is virtually immune to common contaminants such as grease, oil, water, and dirt. Hardened encapsulated electronics make it especially resistant to heavy machine vibration and accidental impacts. Advanced electronic design offers many features such as operation from 5-26 volts DC power, short circuit protected outputs, and EMI noise resistance. High power complimentary line driver outputs assure clean, crisp signals over long cable lengths.

A stainless steel and hard anodized aluminum alloy frame provides exceptional strength, ruggedness, and superior corrosion resistance. Its extra heavy duty bearings are designed to maximize its operational life. Since the entire encoder rides on large motor style bearings, the unit can tolerate considerable shaft movement. A strong, insulated, stainless steel anti-rotation arm with multiple mounting holes allows the encoder to move axially, radially, and at a tangent. The simple prealigned design of the HS56 does not require user adjustments.

Easily mounted on fan-cooled motor shafts, conveyor equipment, assembly machines, material feeders, pumps, hydraulic equipment, and gear boxes, the HS56 does not require mounting flanges or accessory brackets. If a suitable shaft is not available, a stub shaft installed through the fan shroud into the motor shaft provides a means of easy mounting.

The HS56 is also available in with electrically isolated dual outputs. Each output can be operated at different voltages and/or sent to different locations. The dual outputs can be used for security with encoder redundancy. A failed output can be quickly switched to the second output, thereby reducing downtime. Our accessory Intellitach™, can continuously monitor the encoder feedback, and automatically switch outputs in the case of signal failure.

FEATURES AND BENEFITS

- Combines rugged reliable feedback with a flexible mounting design. Fits 0.625 - 1.125 inch shaft sizes
- 64, 128, 256, 512, 1024, or 2048 pulses per revolution (PPR) with optional index pulse
- 5-26VDC operation, bi-directional quadrature signals. Short circuit protected, high power line drivers are available

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 64-2048
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge
 Number of Output Modules: Single or Dual Redundant

ELECTRICAL

Input Voltage Requirement: 5-15 or 5-26 Volts DC
 Current Requirement:
 With Electrical Option L: 45 mA typical per sensor module plus line driver load
 With Electrical Option V or 5: 65 mA typical per sensor module plus line driver load
 Output Signals:
 With Elec Option L: 5-15 V Line Driver, 150mA
 With Elec Option V: 5-26 V Line Driver, 100mA
 With Elec Option 5: 5V Line Driver, 150mA
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit
 Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65; MS connector or pig-tail

MECHANICAL

Max. Shaft Speed: 3,600 RPM
 Mounting Configuration: Hollow Shaft mount with Anti-Rotation Tether
 Housing Material: Hard Anodized Aluminum W/Stainless Steel Hub
 Acceleration Rate: 3,600 rpm/sec max
 Shaft Length Required: 2.0" min
 Allowable Shaft End-Play: ± 0.150" (tether limit)
 Allowable Shaft Runout: 0.015" TIR typical (rpm dependent)

ENVIRONMENTAL

Operating Temperature Range: -20°C to +80°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

ELECTRICAL CONNECTIONS

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	F
B	2	Green	B
A	3	Blue	A
Z *	4	Violet	C
No Connection	5	—	E
Vcc +	6	Red	D
B̄	7	Yellow	I
Ā	8	Gray	H
Z *	9	Orange	J
Shield	10	Braid	G

* Index (Z) optional. See Ordering Information

SLIM Tach SL1250



- Mounts to NEMA 12.5 inch C face motor
- Thin, compact, and occupies only 1.4 inches of motor shaft
- Rugged, reliable, magnetoresistive technology
- Easy installation with no brackets or couplings
- Hard, anodized aluminum construction

APPLICATION/INDUSTRY

NorthStar's SLIM Tach 1250 is an economical, bearingless, heavy duty encoder designed for 12.5 inch C face motors. Available with resolutions to 1024 PPR.

DESCRIPTION

Employing NorthStar's innovative magnetoresistive technology, this dependable product combines high accuracy with reliable service. Made of anodized aluminum and with a net thickness of only 1.4 inches, the SL1250 comes with one or two electrically independent and totally isolated output modules and a high temperature version for operation needs up to 120° C.

The SLIM Tach 1250 assembly is imprinted with magnetic poles, providing higher pulse counts than traditional encoders. Its totally encapsulated electronics make it immune to machine vibration and contaminants. It is resistant to dirt, grease, water, oil, fibers, and dust, making it reliable in hot, wet environments. A high power line driver comes standard. Clean, crisp signals are ensured over long cable lengths, decreasing the need for signal repeaters and saving on total installation costs.

The SLIM Tach 1250's pulse wheels are available in thru-shaft sizes from 0.625 inch to 3.75 inches. The pulse wheels are keyless and very easy to align. The SL1250's thin profile leaves plenty of room on the motor shaft for a brake or pulley and it mounts without bearings, adapter plates, or couplings, eliminating a common source of mechanical problems.

FEATURES AND BENEFITS

- Thru-shaft sizes from 0.625 to 3.75 inches
- 64, 128, 256, 512, or 1024 pulses per revolution (PPR) with optional index pulse
- 5-15VDC operation, bi-directional quadrature signals with high power, differential line driver outputs

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
 Pulses per Revolution: 64-1024
 Phasing Sense: A leads B for Counter-Clockwise rotation (CCW) viewing encoder-mounted end
 Quadrature Phasing: 90° ± 22°
 Symmetry: 180° ± 54°
 Index: 270° gated to falling B edge

ELECTRICAL

Input Voltage Requirement: 5-15 or 5-26 Volts DC
 Current Requirement:
 With Elec Option L or H: 45 mA typical per sensor module plus line driver load
 With Elec Option V or 5: 65 mA typical per sensor module plus line driver load
 Output Signals:
 With Elec Option L or H: 5-15 V Line Driver, 150mA
 With Elec Option V: 5-26 V Line Driver, 100mA
 With Elec Option 5: 5V Line Driver, 150mA
 Frequency Response: 0 - 120kHz Data & Index
 Electrical Immunity: 2kV ESD, Reverse Polarity, Short Circuit

ELECTRICAL CONNECTIONS

Connector: 10 pin industrial duty latching, sealed NEMA 4 & 12, IP65; MS connector or pig-tail

Signal	Connector Pin	Pigtail Cable	MS 3102E18-IT#
Common	1	Black	F
B	2	Green	B
A	3	Blue	A
Z *	4	Violet	C
No Connection	5	—	E
Vcc (5-15 VDC)	6	Red	D
B̄	7	Yellow	I
Ā	8	Gray	H
Z *	9	Orange	J
Shield	10	Braid	G

* Index (Z) optional. See Ordering Information

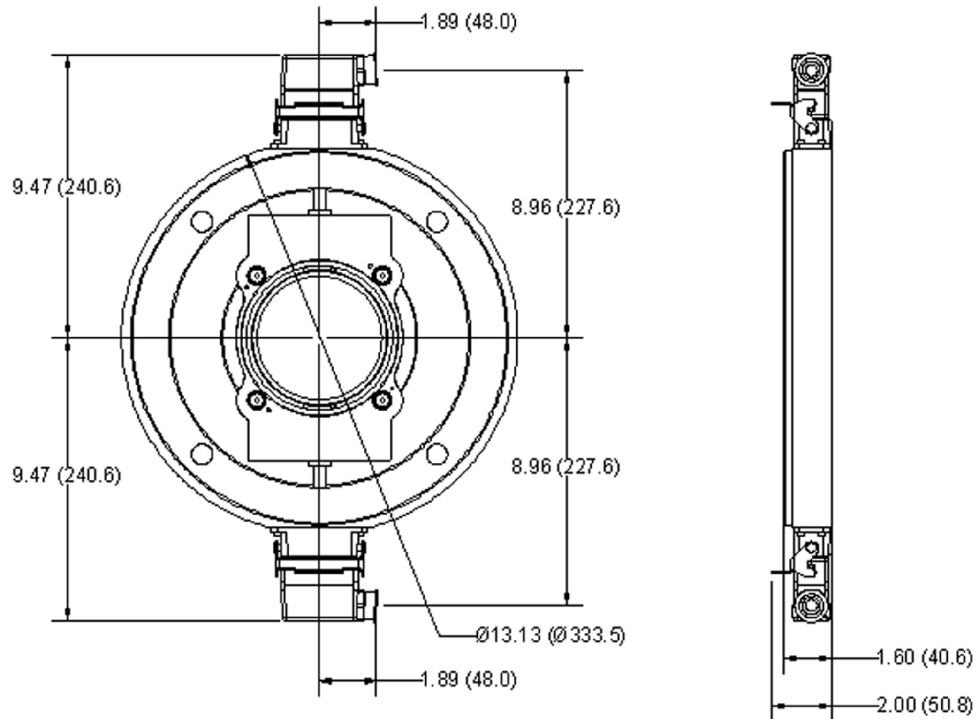
MECHANICAL

Max. Shaft Speed: 5,000 RPM
 Mounting Configuration: 12.5" C face mount for NEMA MG1-4 standards (excluding C-Face runout)
 Housing Material: Cast Aluminum
 Acceleration Rate: 12,000 rpm/sec max
 Shaft Length Required: 1.1" min
 Allowable Shaft End-Play: ± 0.045"
 Allowable Shaft Runout: 0.003" TIR
 Weight: 11 lbs.

ENVIRONMENTAL

Operating Temperature Range:
 Standard: -40°C to +90°C
 Extended: -40°C to +120°C
 Storage Temperature Range: -40°C to +120°C
 Humidity: to 98% RH (non-condensing)
 Shock (Sensor Module): 1 meter drop test, 30 G's Min
 Vibration: 18 G's @ 5-2000 Hz spectrum

DIMENSIONS
inches [mm]



ORDERING INFORMATION

Code 1: Model	Code 2: PPR	Code 3: Index	Code 4: Wheel Bore	Code 5: Termination	Code 6: Electrical	Code 7: Cover/Adapter
<input type="checkbox"/> 1	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering Information						
S1 Motor Mount Ring, for 12 1/2" NEMA C-Face Motors Single Output	0064 0128 0256 0512 1024	L No Index Available when Code 2 is 0512 or 1024 Z Differential Index (Z, Z)	J04 5/8" bore J05 7/8" bore J06 1.00" bore J07 1-1/8" bore K09 1-3/8" bore K10 1-1/2" bore K11 1-5/8" bore K12 1-3/4" bore K13 1-7/8" bore K14 2.00" bore K15 2-1/8" bore K16 2-1/4" bore K17 2-3/8" bore K18 2-1/2" bore K19 2-7/8" bore Additional Shaft Sizes Available Up to 3.75" Maximum	C Latching Industrial Connector with 1/2" NPT M 10 pin MS Connector P 18" pigtail cable Q Latching Industrial Connector on 18" pigtail cable	L 5-15V in, 5-15V Line Driver (4428) out H Same as L with extended temp. to 120°C V 5-26V in, 5-26V Line Driver (IC-WE) out 5 5-15V in, 5V Line Driver (4428) out Differential, bidirectional signals (A, \bar{A} , B, \bar{B})	C No Cover F Flat Thru-hole cover
D1 Motor Mount Ring, for 12 1/2" NEMA C-Face Motors Dual Output						

HEAVY DUTY

Spare Pulse Wheel: Use "NS" followed by Code 2 (PPR) & Code 3 (Index) & Code 4 (Bore Size). Example: NS0512ZK11

Spare Mating Connector: Use "NS" followed by Code 1 (Model) & Code 5 (Termination). Example: NSS1C

Spare Cover: Use "NS" followed by Code 1 (Model) & Code 4 (Bore Size) & Code 7 (Cover). Example: NSS1K11C

5 foot Interface Cable: RIMCABLEDB10005. Other Length: final 4 digits is length in 5 ft increments. Example RIMCABLEDB10065 is 65 feet.

HSD35

- Fits a wide variety of shaft types and sizes
- Fast, easy, flexible mounting
- High Resolution Unbreakable Code Disk
- 1 - 2500 PPR available
- Reverse polarity protected
- Short-circuit protected

NEW



Dual Isolated Outputs Model with Swivel Rod Tether

Single Output Model with Stamped Metal Tether



APPLICATION/INDUSTRY

The HSD35 hollow shaft digital encoder is ideal for motor and machine applications at resolutions to 2500 PPR. Flexible mounting and adjustable tether, provide high tolerance to shaft vibration.

DESCRIPTION

The NorthStar brand Series HSD35 Sealed Hollowshaft encoder is designed for easy installation on motor or machine shafts. Its hollowshaft design eliminates the need for a flexible shaft coupling, mounting bracket, flower pot, or flange adapter. This not only reduces the installation depth, but also lowers total cost.

The Series HSD35 Sealed Hollowshaft is equipped with an unbreakable disk that resists contamination and meets the demands of the most severe shock and vibration generating processes. Its floating shaft mount and spring tether eliminate bearing loads and flexible shaft couplings to eliminate wear and maintenance.

Series HSD35 has complete electrical protection from overvoltage, reverse voltage, and output short circuits. In addition, the Series HSD35 is not only electrically & thermally isolated, but also environmentally sealed with shaft seals at both ends.

FEATURES AND BENEFITS

- Short circuit protection and reverse polarity protection
- 5-26 VDC operation with bi-directional quadrature and with high power differential line driver outputs
- Resolutions from 1 to 1024 pulses per revolution (PPR) with optional Index pulse
- Operating temperature of -40 to +70°C. Optional 0 to +100°C

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental
Resolution: 1 to 2500 PPR (pulses/revolution)
Accuracy: (worst case any edge to any other edge) ± 7.5 arc-min.
Format: Two channel quadrature (AB) with optional Index (Z) and complementary outputs
Phase Sense: A leads B for CW shaft rotation viewing the shaft clamp end of the encoder
Quadrature Phasing: $90^\circ \pm 22.5^\circ$ electrical
Symmetry: $180^\circ \pm 18^\circ$ electrical
Index: $180^\circ \pm 18^\circ$ electrical (gated with B low)
Waveforms: Squarewave with rise and fall times less than 1 microsecond into a load capacitance of 1000 pf

ELECTRICAL

Input Power: (each output)
 4.5 min. to 26 VDC max. at 100 mA max., not including output loads
Outputs:
 7273 Open Collector: 30 VDC max., 40 mA sink max.
 7272 Push-Pull and Differential Line Driver: 40 mA sink or source
 4469 Differential Line Driver: 100 mA sink or source
Frequency Response: 100 kHz min.
Electrical Protection: Overvoltage, reverse voltage and output short circuit protected
Noise Immunity: Tested to EN50082-2 (Heavy Industrial) for Electro Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted and Magnetic Interference
Mating Connector:
 10 pin-style HA-10

ELECTRICAL CONNECTIONS

Signal	Connector Pin
Common	1
B	2
A	3
Z *	4
Case (optional)	5
Vcc 5-26 VDC	6
\bar{B}	7
\bar{A}	8
Z *	9
No Connection	10

* Index (Z) optional. See Ordering Information

MECHANICAL

Bearing Life: 80,000 hours at 3600 RPM; 128,000 hours at 1800 RPM
Shaft Loading: 40 lbs. radial, 30 lbs. axial
Shaft Speed: 3600 RPM max. (Important: see Operating Temperature derating for >1800 RPM)
Shaft Bore Tolerance: Nominal $+0.0003^*/+0.0005^*$ ($+0.008/+0.013$ mm)
Mating Shaft Requirements:
 Runout: $\pm 0.025^*$ (± 063 mm) radial typical
 Endplay: $\pm 0.050^*$ (± 1.27 mm) axial typical
 Minimum Length: 1.25" (32 mm) recommended
 Maximum Length: 2.0" (51 mm) to fit inside cover
 Solid shaft recommended; keyway allowed; flatted shaft should not be used
Starting Torque: 5.0 oz-in max.
Running Torque: 4.5 oz.-in max.
Moment of Inertia:
 $\leq 5/8"$ bore: 7.9×10^{-4} oz-in-sec²
 $> 5/8"$ bore: 25.6×10^{-4} oz-in-sec²
Weight: 28 oz. max.Environmental

ENVIRONMENTAL

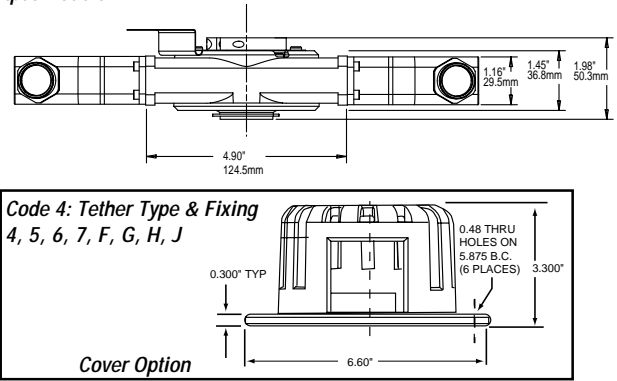
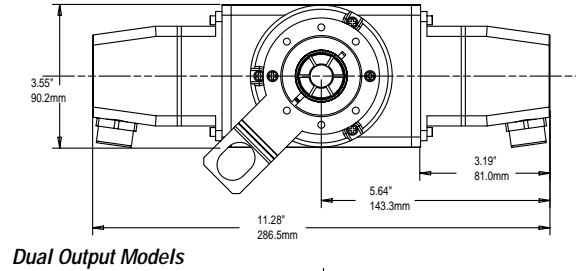
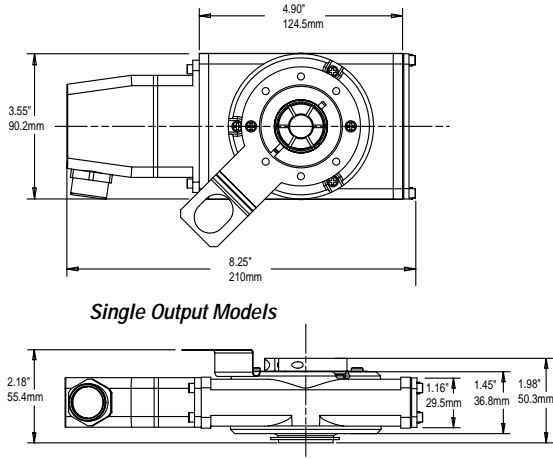
Operating Temperature:
 Standard: -40 to +70 °C
 Extended: 0 to +100 °C
 $\leq 5/8"$ bore: Derate 5 °C per 1000 RPM above 1800 RPM
 $> 5/8"$ bore: Derate 10 °C per 1000 RPM above 1800 RPM.
Storage Temperature: -40 to +90 °C
Shock: 50 G's for 11 milliseconds duration
Vibration: 5 to 2000 Hz at 20 G's
Humidity: to 98% without condensation
Enclosure Rating: NEMA4/IP65

Replaces the Magcoder HS35M (shown below)



Contact Customer Service for appropriate replacement model. +1.800.873.8731

DIMENSIONS



ORDERING INFORMATION

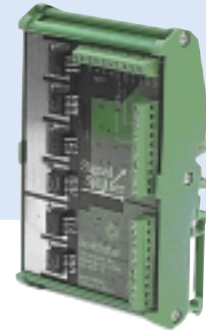
Code 1: Model	Code 2: PPR	Code 3: Bore	Code 4: Tether Type & Fixing	Code 5: Format	Code 6: Output	Code 7: Seal	Code 8: Options
HSD35	□□□□	□	□	□	□	□	□

Ordering Information									
HSD35 Size 35 heavy-duty, sealed hollowshaft encoder with industrial latching connector (1/2" NPT)	0001	0300	0 6 mm	Stamped Metal	Swivel Rod	0 single ended, unidirectional (A)	0 5-26V in, 5-26V open collector out	0 Standard Shaft Seals	Blank None
	0002	0360	1 1/4"	0 None - customer supplied	A Standard Tether	1 single ended, bidirectional (AB)	1 5-26V in, 5-26V open collector out w/ 2.2kΩ pullups	1 Rugged Shaft Seals	D LED Output Indicator
	0003	0400	2 5/16"	1 Clearance hole for 3/8" bolt on 5.88" dia. bolt circle (to fit 4-1/ 2" NEMA C face)	B 56C Tether	2 single ended, bidirectional with index (ABZ)	2 5-26V in, 5-26V push-pull out		
	0005	0500	3 8 mm	2 Clearance hole for 1/2" bolt on 7.25" dia. bolt circle (to fit 8-1/ 2" NEMA C-face)	C 180C Tether	available when Code 6 is 3, 4, 5, 6, A or B:	available when Code 5 is 3, 4 or 5:		
	0006	0512	4 3/8"	3 Slotted hole for bolt on 2.5" to 4.0" radius (to fit standard AC motor fan cover slots)	D 56C Tether with protective guard	3 differential, bidirectional (AĀ BĀ)	3 5-26V in, 5V line driver out (7272)		
	0007	0600	5 10 mm	4 Same as '1', w/ cover kit	E 180C Tether with protective guard	4 differential, bidirectional with index (AĀ BB ZZ)	4 5-26V in, 5-26V line driver out (7272)		
	0010	0720	6 12 mm	5 Same as '3', w/ cover kit	Available when Code 5 is 0-4:	5 Dual isolated differential, bi- directional w/index (AABBZZ)	5 5-26V in, 5 V Differential Line Driver out (4469)		
	0012	0800	7 1/2"	6 Same as '1' w/ dual cover kit	F Same as 'A', w/ cover kit	available when Code 6 is 3, 4, 5, 6, A or B:	6 5-15V in, 5-15 V Differential Line Driver out (4469)		
	0025	0900	8 5/8"	7 Same as '3' w/ dual cover kit	G Same as 'B', w/ cover kit		A same as '3' with high temp. to 100°C		
	0050	1000	9 15 mm	Available when Code 5 is 5	H Same as 'A' w/ dual cover kit		B same as '4' with high temp. to 100°C		
	0060	1024	A 16 mm		J Same as 'B' w/ dual cover kit				
	0064	1200	B 19 mm						
	0100	1270	C 3/4"						
0120	1500	D 20 mm							
0128	1800	E 7/8"							
0180	2000	F 24 mm							
0200	2048	G 1"							
0240	2400	H 1-1/8"							
0250	2500	J 14 mm							
		K 18 mm							
		M 25 mm							
		N 28 mm							
		P 1-1/4"							

109473-0001	Stamped Tether kit (clearance hole for 3/8" bolt on 5.88" dia. bolt circle)	110533-0001	Cover Kit, 56C face
109473-0002	Stamped Tether kit (clearance hole for 1/2" bolt on 7.25" dia. bolt circle)	110533-0002	Cover Kit, fan cover
109473-0003	Stamped Tether kit (slotted hole for bolt on 2.5" to 4.0" radius)	110533-0003	Dual Cover Kit, 56C face
112121-0001	Spare Hub Clamp (Bore size Code 3: 0 - 9)	110533-0004	Dual Cover Kit, fan cover
112121-0002	Spare Hub Clamp (Bore size Code 3: A - H)	106-764	Spare Mating Connector
756-042-01	Rod tether kit , standard		
756-043-01	Rod tether kit , 56C		
756-044-01	Rod tether kit , 180C		

HEAVY DUTY

RIM SS2 Signal Splitter



- Eliminates the need for two encoders
- Routes signals to multiple locations, repeats and amplifies
- Provides two independent, isolated 5-26 VDC line driver outputs
- Compatible with virtually all incremental encoders

APPLICATION/INDUSTRY

The NorthStar brand Signal Splitter isolates and duplicates encoder outputs. It is designed to route one encoder's signals to multiple, isolated locations.

DESCRIPTION

The Signal Splitter will accept 4-26 VDC signals and provide two independent and completely isolated line driver outputs of 5-26 VDC based on user defined voltage levels. Its optically isolated inputs accept quadrature or single channel inputs, with or without their complements, from differential line drivers, open collector, and even from proximity probes. The Signal Splitter also has the ability to repeat and amplify signals.

Each output of the Signal Splitter is user definable from 5 to 26 VDC. In addition to short circuit protection, outputs are ESD protected according to MIL-STD-883. Each connector of the Signal Splitter is equipped with two positions for +VCC and common, as well as two extra field accessible tie points, making power supply connections simple and quick. Capable of driving the output signal up to 26 VDC, the Signal Splitter will also function with either output disconnected.

FEATURES AND BENEFITS

- Eliminates the expense and maintenance of two separate encoders
- Optically isolated outputs can be sent to a motor drive and a display at the same time
- Compatible with virtually every incremental digital encoder
- Combats long distance and electrical interference problems

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Input Signal: 2 or 3 channel quadrature signal, sine or square wave, open collector, differential, or single ended line driver

ELECTRICAL

Input Signal Voltage: 4 - 26 VDC

Input Signal Current: 2.2 mA minimum, 3.5 mA typical

Input Impedance: Optically isolated, 1 kOhm at 4V, 6.8 kOhms at 24V typical. Current limited.

Frequency Range: 0 - 120 kHz

Output Signal: Two independent, isolated line driver output sets (A/A, B/B)

Supply Voltage: 5 - 26 VDC

Output Current: 150 mA (maximum per channel)

Wire Gauge Accepted: 26 -16 AWG

Output Protection: ESD to MIL-STD-883 and short circuit protected

MECHANICAL

Enclosure Material: PVC

Mounting Options: DIN 32 or 35

ENVIRONMENTAL

Operating Temperature: 0°C to 50°C

Storage Temperature: -20°C to 70°C

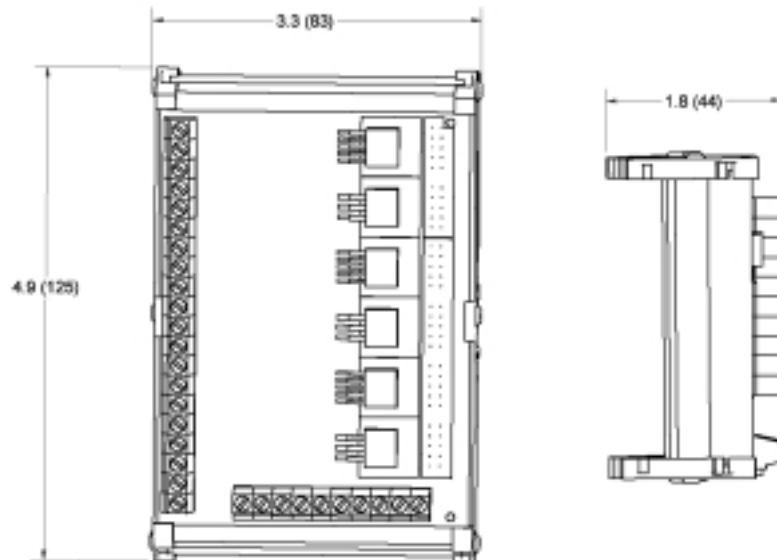
Operational Humidity: 98% non-condensing

ORDERING INFORMATION

Part Number: RIM SS2

DIMENSIONS

inches [mm]



RIM Signal Switcher

- Accepts A, B, and Z inputs from two separate encoders
- Eliminates the need for two input devices
- Status indicators for normal operation and encoder selection
- Thermal, under voltage, reverse polarity, and overload protection
- Input voltage range from 4 to 26 VDC
- Provides redundancy and backup



APPLICATION/INDUSTRY

The Signal Switcher enables the use of one drive with two separate encoders, switching between encoder inputs as needed.

DESCRIPTION

The Signal Switcher enables the use of one drive with two separate encoders, switching between encoder inputs as needed. Its optically isolated inputs accept signals from two different voltage levels, including signals from differential line drivers, open collector, and even proximity probes. It has a wide input voltage range of 4-26 VDC and high power differential adaptive line driver outputs. It can switch seamlessly from one encoder to another in just microseconds and can also convert signals between high and low voltage levels.

The Switcher can also perform signal level conversions from low to high or high to low voltages. It has thermal, under voltage, reverse polarity, and overload protection and a fail-safe mode which directly connects input terminals through dry contacts during power losses and faults. Its front panel has a status indicator showing normal operation and encoder selection. The Signal Switcher is approximately three by five inches in size and mounts with DIN 32 or 35 mounting hooks.

FEATURES AND BENEFITS

- Eliminating need for two PLCs or input devices
- May switch two encoders of different resolutions coarse and fine position control
- Can select spare encoder that acts as backup of first

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Input Signal: 2 or 3 channel quadrature signal, sine or square wave, open collector, differential, or single ended line driver

ELECTRICAL

Input Signal Voltage: 4 - 26 VDC

Input Signal Current: 2.2 mA minimum, 3.5 mA typical

Input Signal Impedance: Optically isolated, 1 k Ohm at 4V, 6.8 k Ohms at 24V typical. Current limited.

Operating Frequency Range: 0 - 100 kHz

Output Signal: Differential driven square wave, signal level approximately equivalent to input supply voltage.

Error Output Signal: Sinking normally open, closes on error. 5V, 20 mA maximum load

Supply Voltage: 5 - 26 VDC

Current Consumption: Less than 150 mA at 100 kHz and 26 VDC typical with no output driver load

Output Current: 150 mA (maximum)

Power Up Time: Less than 10 ms

Encoder Switching Time: Less than 8 μs

Connector Wire Gauge: 26 -16 AWG

Electrical Protection: Reverse polarity protected

Output Protection: Under voltage, short circuit, and thermally protected

Fail Safe Feature: Fail safe mode connects device's ENCODER 1 INPUT directly to device's OUTPUT terminals

MECHANICAL

Enclosure Material: PVC

Side Element Material: Polyamide PA non-reinforced

Mounting Options: DIN 35 or 32

ENVIRONMENTAL

Operating Temperature: 0°C to 50°C

Storage Temperature: -20°C to 70°C

Operational Humidity: 98% non-condensing

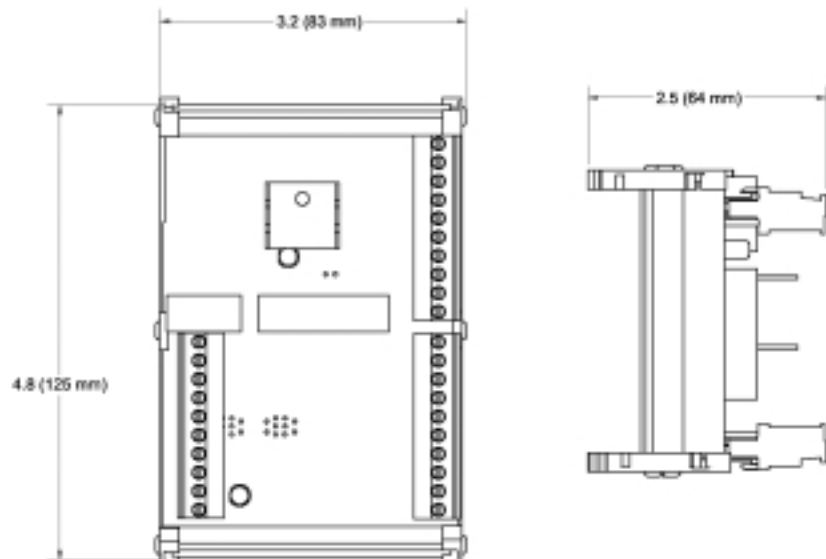
*Specifications subject to change without notice

ORDERING INFORMATION

Part Number: RIMSSW

DIMENSIONS

inches [mm]



RIM M100 Encoder Tester

- Performs up to 18 tests of signal output quality; simple one keystroke access to tests
- Interfaces with most major brands of digital tachometers and encoders
- Fast encoder checkout with numeric value display



APPLICATION/INDUSTRY

The NorthStar brand RIM Tach® M100 Encoder Tester is an easy to use instrument developed especially to evaluate the signal presence and quality produced by a digital tachometer or encoder.

DESCRIPTION

Utilizing 68HC11 microcomputer electronics, the M100 can accurately interpret the signal phase and duty cycle from the encoder in a variety of applications, including those of motor manufacturers and mill applications.

It can perform up to 18 distinctly different tests on encoders with the push of a single key. The results of each test is displayed on an LCD display in different numeric values. The tester will continually update the results, while retaining the minimum and maximum readings until larger values are received. This is helpful in identifying transient problems. The M100 can test all popular incremental encoder configurations. Nonvolatile memory retains all of the setup information through power downs. This eases operator work load when checking a repetitive number of identical encoders such as on a production line or in a mill environment.

Additional features of the M100 include an RPM count, total turns display, rolling pulse counter, and pulse per second (PPS). All can be used to identify and monitor motor speeds or determine pulse counts of encoders. Included with the M100 system is a standard RIM Tach® or SLIM Tach® digital tachometer connector hood. Simply snap the hood into place and the M100 is ready to begin testing. An internal compartment stores a 9V battery for operation where a 110VAC outlet is not convenient. The encoder tester is able to power the encoder as well as itself during parameter testing.

The M100 encoder tester can be easily used by operators with little experience in encoder testing parameters.

FEATURES AND BENEFITS

- 68HC11 microcomputer controlled for accurate, intelligent operation
- 110 VAC line or 9V battery powered
- Accepts encoders ranging in resolutions from 1 to 8,192 pulses per revolution (PPR)

SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Controller: 68HC11 microcomputer
Frequency Response: 10Hz - 10kHz
Signal Input: 5-15 VDC digital line driver signal
Power: 110 VDC power pack or 9 VDC battery
Keyboard power on/off

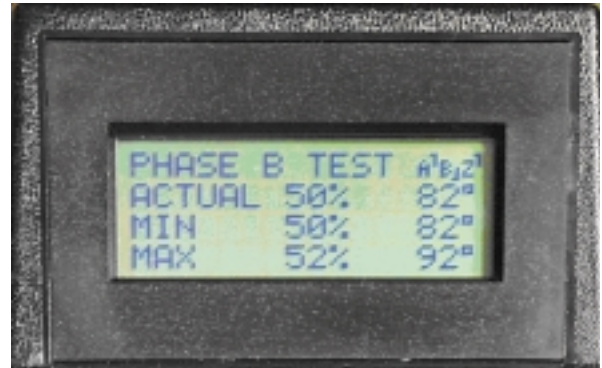
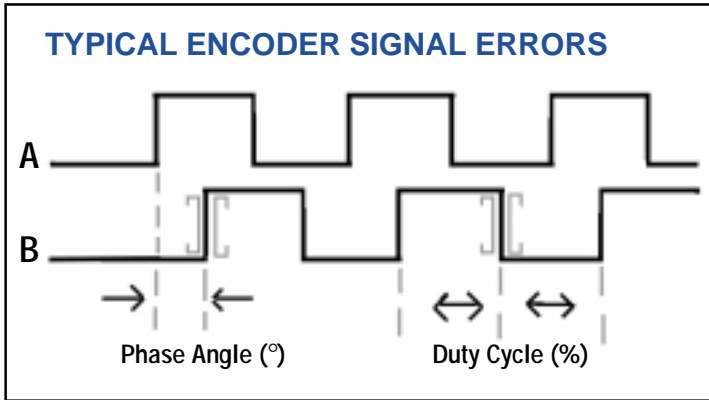
MECHANICAL SPECIFICATIONS

Size: 7.50"(191mm) x 4.00"(102mm) x 3.00"(77mm)
Weight: 0.94 lbs. (0.43 kg)
Display: 4 line x 16 character LCD
Keyboard: 24 key membrane sealed, contamination resistant

*Specifications subject to change without notice.

TESTS PERFORMED

	Test	Function
Function	Signal Pulse State	Continuous display of high/low signal state (A,B,Z)
	Complementary	Display high/low state of complementary signals
	Pulses Per Second	Count number of pulses detected each sec-ond (100 kHz maximum)
	Pulse Counter	Display a continuous bidirectional count of detected pulses (10 digits)
Phase	Quadrature Phase	Display actual phase angle (±1% accuracy, derated at higher speeds)
	Min & Max Phase	Detects and holds the extreme quadrature phase angles
	Pulse Duty Cycle	Continuous update display (±1% accuracy, derated at higher speeds)
	Min & Max Duty	Detects and holds the extreme duty cycles
RPM	RPM	Calculates RPM (100 kHz maximum)
	Min & Max RPM	Detects and holds the extreme RPM (100 kHz maximum)
	Direction of Rotation	Displays + or - to indicate direction of signal input
Marker	Number of Pulses	Display number of pulses detected between markers (10,000 PPR max)
	Marker Pulse Presence	Display signal when marker is received
	Count Error	Detects and displays the number of pulse counts different from input count
	Revolution Counter	Display a continuous bidirectional count of revolution (10,000 revolutions)



ORDERING INFORMATION

Part Number:	Description
RIMM100RC	M100 system with RIM Tach® connector
RIMM100SC	M100 system with SLIM Tach® connector
Options	
RIMTEUROCON	Spare Eurostyle connector with strain relief
RIMETCABLE-RIM	Cable harness, RIM Tach® connector
RIMETCABLE-SL	Cable harness, SLIM Tach® connector
RIMETCERT	Recalibration and certification service

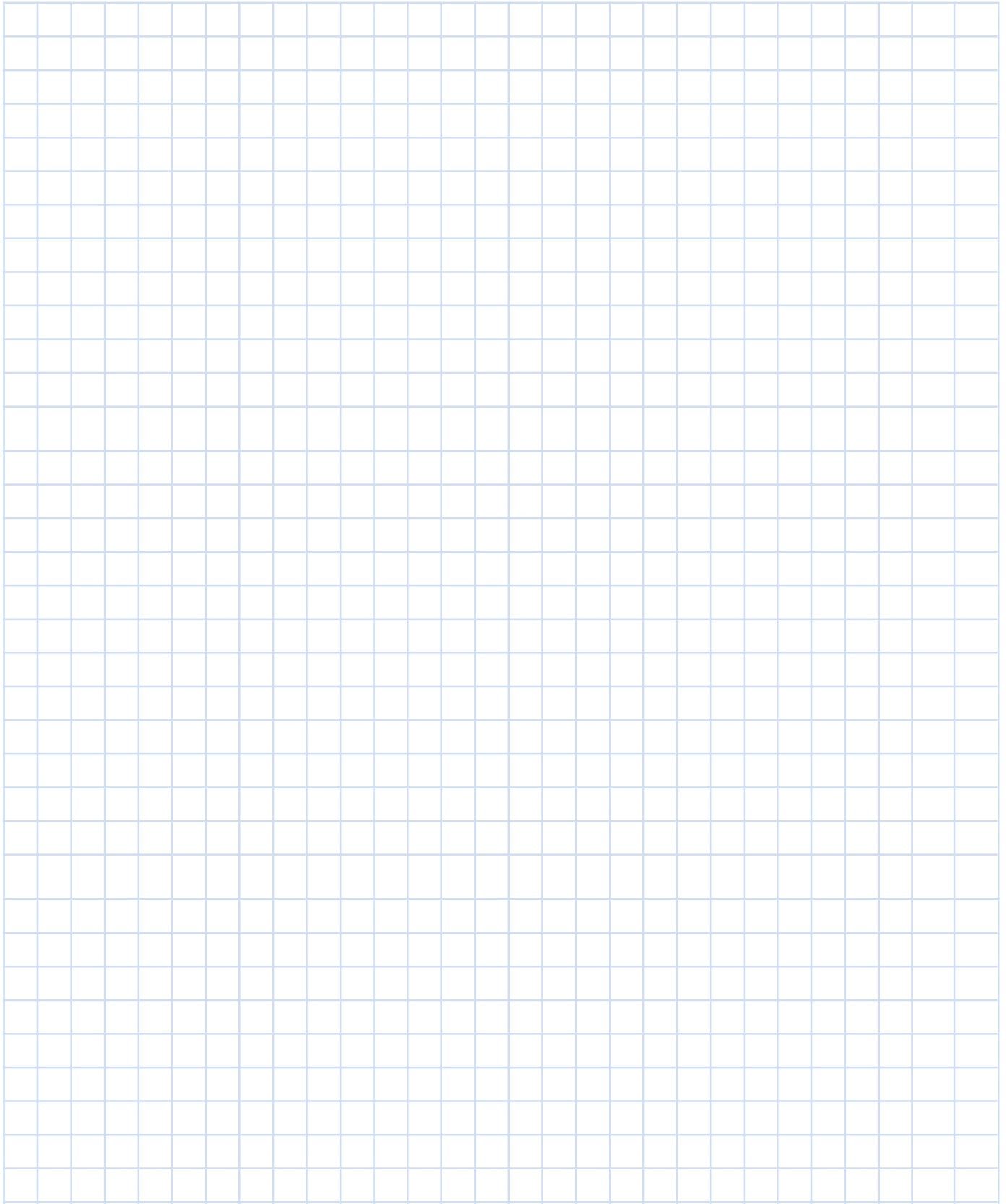
Items Included in Package

- Hard sided carrying case (15" x 12" x 3")
- Connector Hood
- Cable for standard NorthStar RIM Tach® encoders
- 110 V power pack
- 9 V high energy alkaline battery

Notes

A large grid of graph paper for taking notes, consisting of 20 columns and 30 rows of small squares.

Notes



ACURO Absolute Encoder Introduction

ABSOLUTE CODING

Absolute and incremental encoders share the same optical principle – a coded disk interrupts a beam of light between a photo-emitter and receiver. However, incremental encoders use the disk's track to produce a specific number of on/off pulses per revolution. To relate the pulses to physical position, they must be accumulated by a counter. The count is subject to loss during a power interruption or corruption by electrical transients.

The difference between incremental and absolute encoders is analogous to the difference between a stop watch and a clock.

A stop watch measures the incremental time that elapses between its start and stop, much as an incremental encoder will provide a known number of pulses relative to an amount of movement. If you knew the actual time when you started movement, you can tell what time it is later by adding the elapsed time value from the stop watch. For position control, adding incremental pulses to a known starting position will measure the current position.



When an absolute encoder is used, the actual position will constantly be transmitted, just as a clock will tell you the current time.

An absolute encoder's disk features multiple tracks and multiple emitters and receivers. Position is transmitted as a distinct digital value for each position in the rotation. If power is lost, it's output will be absolutely correct whenever power is restored. And electrical transients can only produce transient data-errors, usually too brief to effect the dynamics of a control system.

The encoder's output is a multi-bit digital "word" based on the exact rotational position of the its shaft. A counting circuit is not required to track position since the encoder will provide the correct information upon returning from a power-down event. After power is restored, the position can be immediately read out. It is not necessary to move to a reference position as with incremental type encoders.

Absolute shaft encoders, also known as shaft-angle encoders, are by no means used only to detect angular positions. They are also suitable for linear movements that can be converted into rotary movements by a toothed belt, drive pinion, or wire winch.

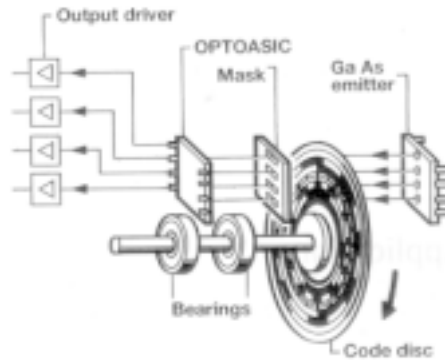
In this catalog, you'll find absolute encoders that offer anywhere from .5° output (720 Counts Per Revolution) to extremely high precision units featuring 16,384 CPR.

SINGLE VS. MULTI-TURN

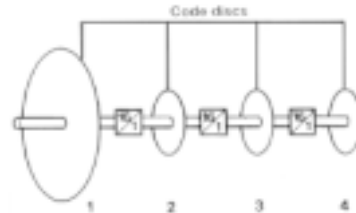
The basis of any absolute encoder is to provide a unique output based on shaft position. However, for a single-turn device, the output codes are repeated for every revolution of the encoder's shaft. There is no data provided to indicate if the encoder had made one revolution - or 1000 revolutions.

With multi-turn absolute encoders, the output is unique for each shaft position, through every rotation, up to 4096 revolutions.

Absolute shaft encoders using an optical scanning principle to resolve several tracks of line markings on a code disc. Scanned in parallel, these tracks provide data transmitted as a distinct digital value or "word" for each angular position of its shaft's rotation. The tracks utilize "Gray Code", which has the advantage that only one output bit changes for each increment. This prevents reading errors. Optical absolute shaft encoders with a mechanical multiturn capability have additional discs, besides the disc for measuring 360°, for resolving multiple revolutions.



Multiple code disks are used to distinguish position for each revolution of the shaft



Benefits of Using an Absolute Encoder

No need to physically move a machine to a "home position" to reestablish a reference point: This can provide significant time savings during machine change over, and lets positioning be based on a point to point method without the necessity of passing through the home position.

Will not lose position during loss of power. In addition to the time savings and convenience gained through the elimination of referencing at power-up, added safety is achieved for applications where loss of position can be hazardous.

Decreased susceptibility to EMI: All signal wiring can be subject to the influence of electrical interference or "noise". If a stray noise induced pulse is transmitted by an incremental encoder, positioning will always be inaccurate by that amount. Subsequent stray pulses will cause the error to accumulate. Systems using an absolute encoder may produce a fleeting inaccurate reading due to a noise transient, but the correct absolute position will be regained at the next reading.

Increased Flexibility: Some of our absolute encoders offer field programmable features. Typical features are:

offset-value – allows the encoder's output data to be shifted in relation to machine mechanical position

output-scaling – calibrates resolution by reducing counts-per-revolution to a value that might provide a simplified interface with your position control system.

INDUSTRIAL BUS INTERFACE

Absolute encoders are available with parallel outputs which require a cable connection with many conductors (one for each bit). New technology has simplified wiring by incorporating serial data that complies with popular industrial networks.

Dynapar brand encoders are offered with interfaces for the three most common buses worldwide. While each bus provides the same basic benefits, there are important differences between the three. Listed below is a brief overview to assist you with choosing the bus that best fits your application.

DeviceNet Based on the Controller Area Network (CAN) which was developed by Bosch for use in automobiles as a communication system with Anti-lock brakes. Commercialized for industrial use by Allen-Bradley/Rockwell, this bus is now administered by the Open Device Vendor Association. The basic trunkline-dropline topology provides separate twisted pair wires for both signal and power distribution, enabling 24 VDC devices to be powered directly from the bus. End to end network distance varies with data rate and cable size (thick vs. thin). The 0-8 byte data packet is ideal for low end devices with small amounts of I/O that must be exchanged frequently.

Profibus An open communication standard developed by the European Community (European Common Standard EC50170), Profibus was adopted by Siemens for use as their remote I/O network. There are 2 variations of Profibus: FMS which is used for upper level cell to cell communication, and Profibus DP which is optimized for data transfer with local field devices like valves, drives and encoders. DP is very well suited for applications that require high speed transmission of fairly large amounts of information (512 bits of input data and 512 bits of output data over 32 nodes in 1 msec).

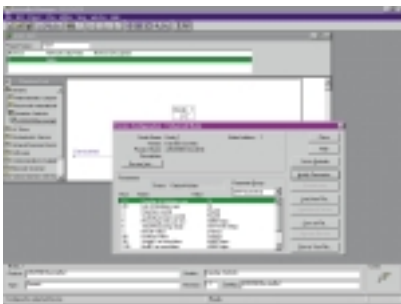
Interbus Designed by Phoenix contact in the mid '80s, Interbus is the longest standing open industrial network. A true token ring topology, Interbus is actually divided into 2 buses. The remote bus is an RS-485 transmission medium with length capabilities up to 13 km. The local or peripheral bus enables connection of up to 8 devices within a 10 m range. Although transmitted at a moderate baud rate of 500 Kbps, the low overhead structure makes this an ideal choice for high speed, deterministic transmission of small amounts of data over long distances.

BiSS BiSS is a new, fully-digital and bi-directional sensor interface. It defines communication between one master and several slaves (sensors) in industrial control systems. BiSS manifests a new standard in technology and is available license-free. Due to its high performance, it constitutes an efficient alternative to the standard combination of data interface and analog sine/cosine incremental output. Requiring only 6 wires BiSS does not require any hardware for analog signals - and therefore, helps to reduce system costs. Self-configuration allows "plug-and-play" and keeps the system in an operable condition even after a power failure. *For detailed information on BiSS and support, please visit www.biss-ic.de*

SSI The SSI bus is the Synchronous Serial Interface bus. This bus was originally developed for transmitting absolute encoder information over a synchronous serial interface. In Europe, this bus design as been adopted as a standard for information transfer. The interface uses a signal clock originating at the SSI of the MPU or PLC or other processor to transfer the serial data bits so that the client processor has control of the bus speed and rate of arrival of new readings.

BUS NETWORK COMPARISON

	DeviceNet	Profibus	Interbus	BiSS	SSI
Topology	Linear (trunkline/dropline)	Linear (trunkline/dropline)	Closed Loop	Point to Point	Point to Point
Comm. System	Master/Slave	Multimaster (Producer/Consumer)	Master/Slave	Master/Slave	Master/Slave
Data Exchange	Polled, Change of State, Cyclic	Polled	Polled	Synchronous	Synchronous
Max. Length	500 m	1200 m (w/repeaters)	13 km	400 m	400 m
Max. Nodes	64	126	512	8 Slaves	1
Data Packet	0 - 8 bytes	244 bytes	flexible	N/A	N/A
Trans. Speed	125 Kbps @ 500 m 250 Kbps @ 250 m 500 Kbps @ 100 m	9.6 Kbps to 12 Mbps	500 Kbps	10 Mbps	400 kHz @ 50 m 300 kHz @ 100 m 200 kHz @ 200 m 100 kHz @ 400 m 70 kHz to 1.5 mHz
Trans. Media	2 wire twisted pair with 2 wire bus power cable w/drain wire	2 wire twisted pair w/shield	Twisted w/drain Local: 3 pair Remote: 5 pair	2 Twisted Pair	2 Twisted Pair







Bus networks are considered the perfect vehicle for two way communication with an encoder, providing a variety of programmable features including resetting the encoder's position to match your machine. Most of these features are easily accessible via bus management software with the Danaher Controls data file.

In addition conformation of proper encoder operation can be acquired along with potential areas of corrective action should a malfunction occur.



ACURO Absolute Encoder Selection Guide

Our Absolute encoders offer a wide range of single- or multi- turn resolutions and all popular output options. This Selector Guide can assist you in determining the type of encoder that best fits your application requirements. Condensed description and specification information is provided. Complete information is available on the referenced page number that appears below each product's picture.

Type	AI25 - DeviceNet Output	AI25 - Profibus Output	AI25 - Interbus Output	AI25 - BiSS Output
PAGE NUMBER	 4.04	 4.06	 4.08	 4.10
DESCRIPTION AND FEATURES	<ul style="list-style-type: none"> ■ Single- or Multi- Turn ■ Resolution to 14 Bits ■ 4096 multi-turn revs ■ Short installation depth ■ Solid shaft and hollow shaft versions ■ DeviceNet Interface 	<ul style="list-style-type: none"> ■ Single- or Multi- Turn ■ Resolution to 14 Bits ■ 4096 multi-turn revs ■ Short installation depth ■ Solid shaft and hollow shaft versions ■ Profibus Interface 	<ul style="list-style-type: none"> ■ Single- or Multi- Turn ■ Resolution to 12 Bits ■ 4096 multi-turn revs ■ Short installation depth ■ Solid shaft and hollow shaft versions ■ Interbus Interface 	<ul style="list-style-type: none"> ■ Single- or Multi- Turn ■ Resolution to 17 Bits ■ 4096 multi-turn revs ■ Short installation depth ■ Solid shaft and hollow shaft versions ■ BiSS Interface
ELECTRICAL SPECIFICATIONS				
Single-Turn Resolution:	10, 12, 13, 14 bits	10, 12, 13, 14 bits	10, 12 bits	10, 12, 13, 14, 17 bits
Multi-Turn Resolution:	12 bits	12 bits	12 bits	12 bits
Input Power:	10 to 30 VDC; 220 mA, Max. (plus output load)	10 to 30 VDC; 220 mA, Max. (plus output load)	10 to 30 VDC; 250 mA, Max. (plus output load)	5 VDC -5%/+10% or 10-30 VDC 100 mA, Max. (plus output load)
Available Output Types:	DeviceNet	Profibus	Interbus	BiSS
Terminations:	Bus Cover with connector options*	Bus Cover with connector options*	Bus Cover with connector options*	Bus Cover with connector options*
MECHANICAL SPECIFICATIONS				
Overall Size:	2.28" (58mm) body diameter See dimensional drawings*	2.28" (58mm) body diameter See dimensional drawings*	2.28" (58mm) body diameter See dimensional drawings*	2.28" (58mm) body diameter See dimensional drawings*
Shaft Size:	6mm to 3/8" dia. See models*; 10mm, 12 mm, 3/8", 1/2" hubshaft	6mm to 3/8" dia. See models*; 10mm, 12 mm, 3/8", 1/2" hubshaft	6mm to 3/8" dia. See models*; 10mm, 12 mm, 3/8", 1/2" hubshaft	6mm to 3/8" dia. See models*; 10mm, 12 mm, 3/8", 1/2" hubshaft
Max. Shaft Speed:	10,000 RPM (continuous), 12,000 RPM (peak)	10,000 RPM (continuous), 12,000 RPM (peak)	10,000 RPM (continuous), 12,000 RPM (peak)	10,000 RPM (continuous), 12,000 RPM (peak)
Max. Shaft Load:	6mm shaft: 13lb axial, 24lb radial 10mm shaft: 24lb axial, 35lb radial	6mm shaft: 13lb axial, 24lb radial 10mm shaft: 24lb axial, 35lb radial	6mm shaft: 13lb axial, 24lb radial 10mm shaft: 24lb axial, 35lb radial	6mm shaft: 13lb axial, 24lb radial 10mm shaft: 24lb axial, 35lb radial
Mounting:	Square, Clamp, Servo, Hubshaft with flexible tether	Square, Clamp, Servo, Hubshaft with flexible tether	Square, Clamp, Servo, Hubshaft with flexible tether	Square, Clamp, Servo, Hubshaft with flexible tether
ENVIRONMENTAL SPECIFICATIONS				
Operating Temperature:	-40° to +85°C	-40° to +85°C	-40° to +85°C	-40° to +100°C
Enclosure Rating:	IP64 or IP67	IP64 or IP67	IP64 or IP67	IP64 or IP67

*Information on product pages

AI25 - SSI Output	AI25 - Parallel Output	AD25 - Drive		
				
4.12	4.16	4.20		
<ul style="list-style-type: none"> ■ Single- or Multi- Turn ■ Resolution to 17 Bits ■ 4096 multi-turn revs ■ Short installation depth ■ Solid shaft and hollow shaft versions ■ SSI Interface 	<ul style="list-style-type: none"> ■ Single- or Multi- Turn ■ Resolution to 17 Bits ■ 4096 multi-turn revs ■ Short installation depth ■ Solid shaft and hollow shaft versions ■ Parallel Interface 	<ul style="list-style-type: none"> ■ For high performance BLDC Motors ■ Resolution to 17 Bits ■ 4096 multi-turn revs ■ Safety through self-diagnostics ■ -15°C to +120°C Operation ■ BiSS or SSI Interface 		
10, 12, 13, 14, 17 bits	10, 12, 13, 14 bits, 360 PPR, 720 PPR	BiSS: 22 bits, SSI: 13 bits		
12 bits	12 bits	12 bits		
5 VDC -5%/+10% or 10-30 VDC 100 mA, Max. (plus output load)	5 VDC -5%/+10% or 10-30 VDC 300 mA, Max. (plus output load)	5 VDC -5%/+10% 85 mA, Max. (plus output load)		
SSI	Parallel	BiSS or SSI		
Bus Cover with connector options*	1.5m Cable; Connector: Conin, MS, sub-D*	1 ft. Cable (30 cm)		
2.28" (58mm) body diameter See dimensional drawings*	2.28" (58mm) body diameter See dimensional drawings*	2.28" (58mm) body diameter See dimensional drawings*		
6mm to 3/8" dia. See models*; 10mm, 12 mm, 3/8", 1/2" hubshaft	6mm to 3/8" dia. See models*; 10mm, 12 mm, 3/8", 1/2" hubshaft	10 mm Tapered solid shaft or Tapered hub shaft		
10,000 RPM (continuous), 12,000 RPM (peak)	10,000 RPM (continuous), 12,000 RPM (peak)	12,000 RPM (continuous), 15,000 RPM (peak, ST only)		
6mm shaft: 13lb axial, 24lb radial 10mm shaft: 24lb axial, 35lb radial	6mm shaft: 13lb axial, 24lb radial 10mm shaft: 24lb axial, 35lb radial	5 lb axial, 20 lb radial		
Square, Clamp, Servo, Hubshaft with flexible tether	Square, Clamp, Servo, Hubshaft with flexible tether	Designed for integration into BLDC servomotors		
-40° to +100°C	-40° to +100°C	-15°C to +120°C Operation		
IP64 or IP67	IP64 or IP67	IP40		

*Information on product pages

Series AI25 DeviceNet Interface



ACURO

- Up to 14 Bit single-turn resolution
- 4096 revolutions of multi-turn resolution
- Short installation depth
- Safety through self-diagnostics
- Solid shaft and hollow shaft versions
- -40°C to +85°C Operating temperature

APPLICATION/INDUSTRY

The Dynapar brand ACURO Absolute Encoder offers a modern full-feature design equipped with DeviceNet interface.

DESCRIPTION

The *Acuro AI25* optical absolute industrial encoder is available in a single-turn or multi-turn version. The multi-turn design is based on a reliable high-speed gear with optical scanning and the latest generation of OptoASIC technology.

The mechanical concept is based on a double ball bearing design, which is available as a solid-shaft or hollow-shaft version in common shaft diameters.

FEATURES AND BENEFITS

- Compact design to save valuable space
- Low power consumption
- Fast delivery of any model variant
- Additional field-bus and point-to-point interfaces available

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Single-turn Resolution: 10, 12, 13, 14 Bit
Multi-turn Resolution: 12 bit
Linearity: +/- 1/2 LSB
Absolute Accuracy: ± 0.01° mechanical (36 arc-sec.)
Repeatability: ± 0.002° mechanical (7.2 arc-sec.)
Code format: Binary

ELECTRICAL

Connection: Bus Cover with spring terminal clamps
Supply voltage: 10-30 VDC
Intrinsic current consumption: 200 mA (ST), 220 mA (MT)
Baud Rate: 125, 250, 500 kBAud
Interface: CAN Highspeed according to ISO/DIS 11898, CAN Specification 2.0 B (11 and 29 bit identifier)
Protocol: According to DeviceNet V2.0
Transfer mode:
 Poll mode
 Bit strobe (time-synchronous for all devices)
 Change of State (automatic after change of values)
 Cyclic, with adjustable cycle timer

MECHANICAL

Shaft diameter:
 Shaft: 6 mm (Servo Mount), 10 mm (Clamping Mount), 3/8" (Square Flange Mount)
 Hubshaft: 10mm, 12 mm, 3/8", 1/2"
Maximum shaft load:
 6 mm shaft: 13 lb axial, 24 lb radial
 10 mm shaft: 24 lb axial, 35 lb radial
Maximum shaft speed: 10,000 RPM (continuous), 12,000 RPM (peak)
Starting torque: < 1.4 in-oz
Body Diameter: 58 mm, nominal
Weight (approx.): 350 g ST, 400 g MT
Shaft tolerance (hubshaft only): +/- 1.5 mm axial, +/- 0.2 mm radial
Flange configurations: Square, Clamp, Servo, Hubshaft with flexible tether
Bearing life:
 1 x 10¹⁰ revolutions at 35% full rated shaft load
 1 x 10⁹ revolutions at 75% full rated shaft load
 1 x 10⁹ revolutions at 100% full rated shaft load

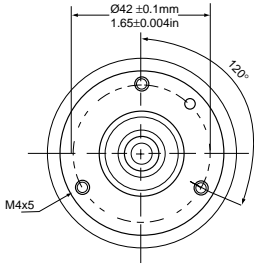
ENVIRONMENTAL

Operating Temperature: -40 to 85° C
Storage Temperature: -40 to 100° C
Enclosure Rating: IP64 or IP67
Shock: 1,000 m/s² (6 ms)
Vibration: 100 m/s² (10 to 2,000 Hz)

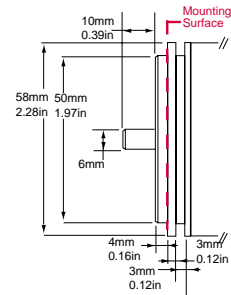
Code 1: Model	Code 2: Bits	Code 3 :Mounting	Code 4: Shaft Size	Code 5: Protocol	Code 6: Electrical	Code 7: Connector
AI25	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AI25 Size25 Acuro Absolute Encoder	Single-Turn 0010 10 Bit 0012 12 Bit 0013 13 Bit 0014 14 Bit Multi-Turn 1212 12 Bit Multi-Turn, 12 Bit Single-Turn 1213 12 Bit Multi-Turn, 13 Bit Single-Turn 1214 12 Bit Multi-Turn, 14 Bit Single-Turn	Available when Code 4 is 0 or A 0 Servo* Available when Code 4 is 2 or C 1 Clamping* Available when Code 4 is 1 or B 2 Square flange** Available when Code 4 is 3, 4, 5 or 6 3 Hubshaft w/tether† * 58mm Dia. ** 2.5" Square † 63mm BC	w/o shaft seal (IP64) 0 6 mm 1 3/8" 2 10 mm 3 3/8" Hub Shaft 4 12 mm Hubshaft 5 1/2" Hubshaft 6 10 mm Hub Shaft w/ shaft seal (IP67) A 6 mm B 3/8" C 10 mm	9 Devicenet	2 10-30 VDC	F Bus Cover 1 M12, 5-Pole Connector G Bus Cover 2 Strain Relief Exits and 1 M12, 5-Pole Connector (for Tico display). Internal T-coupler included L Bus Cover 2 Strain Relief Exits. Internal T-coupler included

Series AI25 DeviceNet Interface

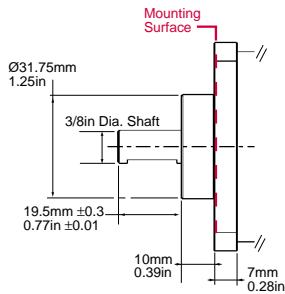
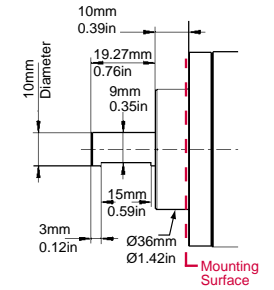
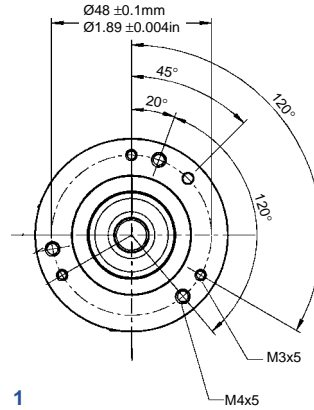
Code 3: Mounting



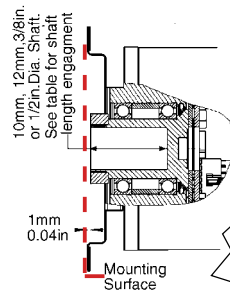
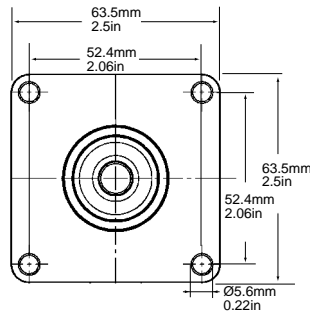
0
Servo



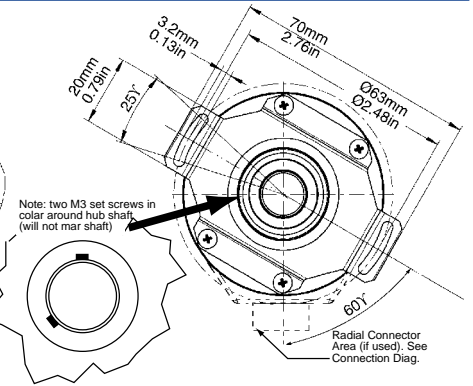
1
Clamping



2
Square Flange



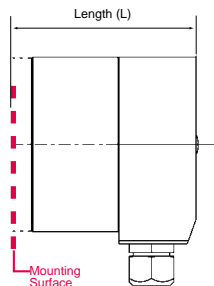
3
Hubshaft w/Tether



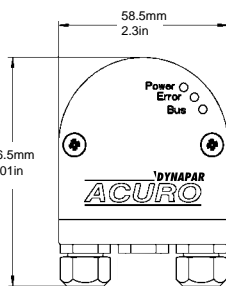
Hubshaft Shaft Engagement

HubShaft Diameter	Min. Shaft Length	Max. Shaft Length
10mm, 3/8"	15mm (0.59")	20mm (0.79")
12mm, 1/2"	18mm (0.71")	20mm (0.79")

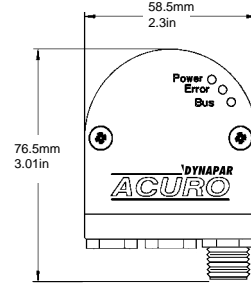
Code 7: Connector



L
2 Strain Relief Exits



F
1 M12, 5-Pole Connector



G
2 Strain Relief Exits
1 M12, 5-Pole Connector*

Length (L) Mounting Surface to Rear
For connector types L, F and G

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	63.3/2.49	72.3/2.85
(1) Clamping	62.3/2.45	71.3/2.81
(2) Square Flange	64.8/2.55	73.8/2.91
(3) Hubshaft	72.2/2.84	81.2/3.2

*M12, 5-Pole Connector used to interface Hengstler Tico 731 LCD display

Series AI25 Profibus Interface

- Up to 14 Bit single-turn resolution
- 4096 revolutions of multi-turn resolution
- Short installation depth
- Safety through self-diagnostics
- Solid shaft and hollow shaft versions
- -40°C to +85°C Operating temperature



ACURO



APPLICATION/INDUSTRY

The Dynapar brand ACURO Absolute Encoder offers a modern full-feature design equipped with Profibus interface.

DESCRIPTION

The **Acuro AI25** optical absolute industrial encoder is available in a single-turn or multi-turn version. The multi-turn design is based on a reliable high-speed gear with optical scanning and the latest generation of OptoASIC technology.

The mechanical concept is based on a double ball bearing design, which is available as a solid-shaft or hollow-shaft version in common shaft diameters.

FEATURES AND BENEFITS

- Compact design to save valuable space
- Low power consumption
- Fast delivery of any model variant
- Additional field-bus and point-to-point interfaces available

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Single-turn Resolution: 10, 12, 13, 14 Bit
Multi-turn Resolution: 12 bit
Linearity: +/- 1/2 LSB
Absolute Accuracy: ±0.01° mechanical (36 arc-sec.)
Repeatability: ±0.002° mechanical (7.2 arc-sec.)
Code format: Binary

ELECTRICAL

Connection: Bus Cover with spring terminal clamps
Supply voltage: 10-30 VDC
Intrinsic current consumption: 200 mA (ST), 220 mA (MT)
Baud Rate: 12 Mbaud
Interface: Profibus-DP, Encoder Profile
Programmable: According to Class 2
Special Functions: Speed, Acceleration

MECHANICAL

Shaft diameter:
 Shaft: 6 mm (Servo Mount), 10 mm (Clamping Mount), 3/8" (Square Flange Mount)
 Hubshaft: 10mm, 12 mm, 3/8", 1/2"
Maximum shaft load:
 6 mm shaft: 13 lb axial, 24 lb radial
 10 mm shaft: 24 lb axial, 35 lb radial
Maximum shaft speed: 10,000 RPM (continuous), 12,000 RPM (peak)
Starting torque: < 1.4 in-oz
Weight (approx.): 350 g ST, 400 g MT
Shaft tolerance (hubshaft only): +/- 1.5 mm axial, +/- 0.2 mm radial
Flange configurations: Square, Clamp, Servo, Hubshaft with flexible tether
Bearing life:
 1 x 10¹⁰ revolutions at 35% full rated shaft load
 1 x 10⁹ revolutions at 75% full rated shaft load
 1 x 10⁸ revolutions at 100% full rated shaft load

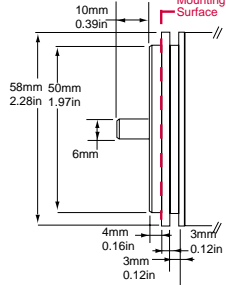
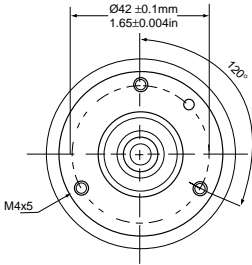
ENVIRONMENTAL

Operating Temperature: -40 to 85° C
Storage Temperature: -40 to 100° C
Enclosure Rating: IP64 or IP67
Shock: 1,000 m/s² (6 ms)
Vibration: 100 m/s² (10 to 2,000 Hz)

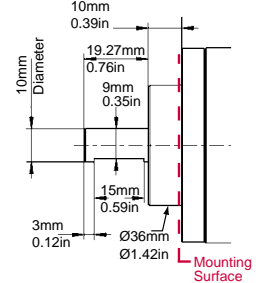
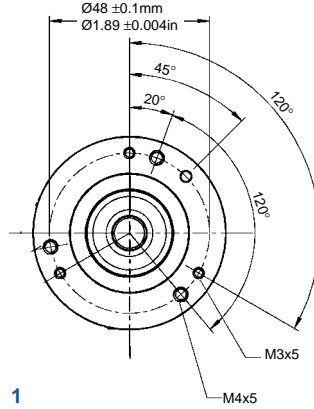
Code 1: Model	Code 2: Bits	Code 3 :Mounting	Code 4: Shaft Size	Code 5: Protocol	Code 6: Electrical	Code 7: Connector
AI25	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AI25 Size25 Acuro Absolute Encoder	Single-Turn	Available when Code 4 is 0 or A	w/o shaft seal (IP64) 0 6 mm 1 3/8" 2 10 mm 3 3/8" Hub Shaft 4 12 mm Hubshaft 5 1/2" Hubshaft 6 10 mm Hub Shaft	6 Profibus	2 10-30 VDC	E Bus Cover 3 Strain Relief Exits. Internal T-coupler included
	0010 10 Bit	0 Servo*				
	0012 12 Bit	Available when Code 4 is 2 or C				
	0013 13 Bit	1 Clamping*				
	0014 14 Bit	Available when Code 4 is 1 or B				
	Multi-Turn	2 Square flange**				
	1212 12 Bit Multi-Turn, 12 Bit Single-Turn	Available when Code 4 is 3, 4, 5 or 6	w/ shaft seal (IP67) A 6 mm B 3/8" C 10 mm			
	1213 12 Bit Multi-Turn, 13 Bit Single-Turn	3 Hubshaft w/tether†				
	1214 12 Bit Multi-Turn, 14 Bit Single-Turn	* 58mm Dia. ** 2.5" Square † 63mm BC				

Series AI25 Profibus Interface

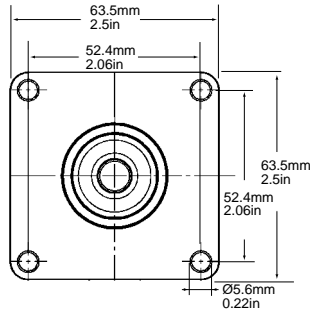
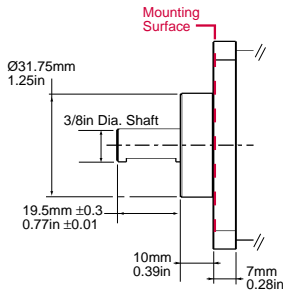
Code 3: Mounting



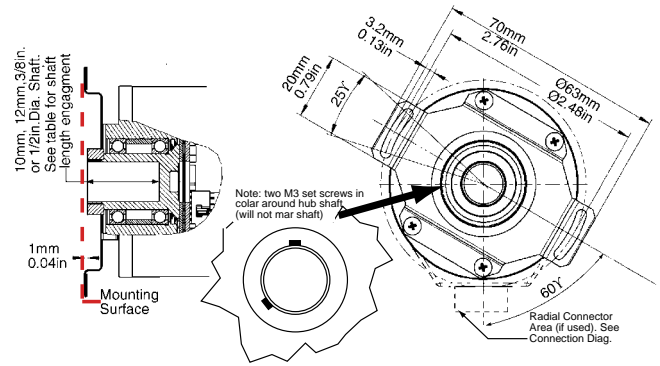
0
Servo



1
Clamping



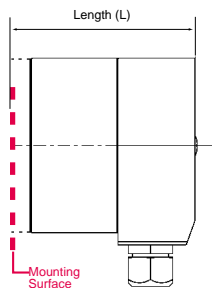
2
Square Flange



HubShaft Diameter	Min. Shaft Length	Max. Shaft Length
10mm, 3/8"	15mm (0.59")	20mm (0.79")
12mm, 1/2"	18mm (0.71")	20mm (0.79")

3
Hubshaft w/Tether

Code 7: Connector

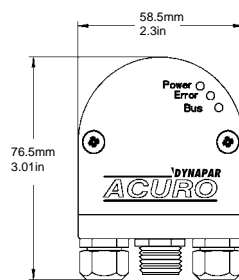


E

3 Strain Relief Exits

Length (L) Mounting Surface to Rear
For connector types E, G, H & L

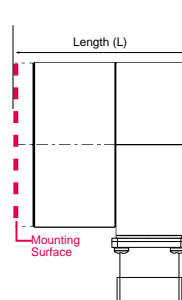
Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	63.3/2.49	72.3/2.85
(1) Clamping	62.3/2.45	71.3/2.81
(2) Square Flng	64.8/2.55	73.8/2.91
(3) Hubshaft	72.2/2.84	81.2/3.2



G

2 Strain Relief Exits
1 M12, 5-pole Connector*

*M12, 5-pole Connector used to interface Hengstler Tico 731 LCD display



H

Double Conin

Series AI25 Interbus Interface

- Up to 12 Bit single-turn resolution
- 4096 revolutions of multi-turn resolution
- Short installation depth
- Safety through self-diagnostics
- Solid shaft and hollow shaft versions
- -40°C to +85°C Operating temperature



ACURO



APPLICATION/INDUSTRY

The Dynapar brand ACURO Absolute Encoder offers a modern full-feature design equipped with Interbus interface.

DESCRIPTION

The **Acuro AI25** optical absolute industrial encoder is available in a single-turn or multi-turn version. The multi-turn design is based on a reliable high-speed gear with optical scanning and the latest generation of OptoASIC technology.

The mechanical concept is based on a double ball bearing design, which is available as a solid-shaft or hollow-shaft version in common shaft diameters.

FEATURES AND BENEFITS

- Compact design to save valuable space
- Low power consumption
- Fast delivery of any model variant
- Additional field-bus and point-to-point interfaces available

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Single-turn Resolution: 10, 12 Bit
Multi-turn Resolution: 12 bit (only available with 12 bit ST resolution)
Linearity: +/- 1/2 LSB
Absolute Accuracy: ±0.01° mechanical (36 arc-sec.)
Repeatability: ±0.002° mechanical (7.2 arc-sec.)
Code format: 32 Bit Binary

ELECTRICAL

Connection: Bus Cover with spring terminal clamps; cable with connector
Supply voltage: 10-30 VDC
Intrinsic current consumption: 220 mA (ST), 250 mA (MT)
Baud Rate: 500 kbaud according to ENCOM
Interface: Interbus, ENCOM Profile K3 (parameterizable)
Programmable: Direction, scaling factor, preset, offset

MECHANICAL

Shaft diameter:
 Shaft: 6 mm (Servo Mount), 10 mm (Clamping Mount), 3/8" (Square Flange Mount)
 Hubshaft: 10mm, 12 mm, 3/8", 1/2"
Maximum shaft load:
 6 mm shaft: 13 lb axial, 24 lb radial
 10 mm shaft: 24 lb axial, 35 lb radial
Maximum shaft speed: 10,000 RPM (continuous), 12,000 RPM (peak)
Starting torque: < 1.4 in-oz
Weight (approx.): 350 g ST, 400 g MT
Shaft tolerance (hubshaft only): +/- 1.5 mm axial, +/- 0.2 mm radial
Flange configurations: Square, Clamp, Servo, Hubshaft with flexible tether
Bearing life:
 1 x 10¹⁰ revolutions at 35% full rated shaft load
 1 x 10⁹ revolutions at 75% full rated shaft load
 1 x 10⁸ revolutions at 100% full rated shaft load

ENVIRONMENTAL

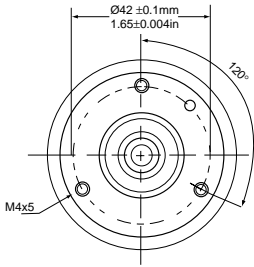
Operating Temperature: -40 to 85° C
Storage Temperature: -40 to 100° C
Enclosure Rating: IP64 or IP67
Shock: 1,000 m/s² (6 ms)
Vibration: 100 m/s² (10 to 2,000 Hz)

Code 1: Model	Code 2: Bits	Code 3 :Mounting	Code 4: Shaft Size	Code 5: Protocol	Code 6: Electrical	Code 7: Connector
AI25	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AI25 Size25 Acuro Absolute Encoder	Single-Turn	Available when Code 4 is 0 or A	w/o shaft seal (IP64)	5 Interbus K3	2 10-30 VDC	E Bus Cover 3 Strain Relief Exits. Internal T-coupler included
	0010 10 Bit	0 Servo*	0 6 mm			
	0012 12 Bit	Available when Code 4 is 2 or C	1 3/8"			
	Multi-Turn	1 Clamping*	2 10 mm			
1212 12 Bit Multi-Turn, 12 Bit Single-Turn	Available when Code 4 is 1 or B	3 3/8" Hub Shaft	w/ shaft seal (IP67)	4 12 mm Hubshaft	5 1/2" Hubshaft	G Bus Cover 2 Strain Relief Exits and 1 M12, 5-Pole Connector (for Tico display). Internal T-coupler included
2 Square flange**	5 10 mm Hub Shaft	A 6 mm				
Available when Code 4 is 3, 4, 5 or 6	6 10 mm Hub Shaft	B 3/8"				
3 Hubshaft w/tether†		C 10 mm				H Double Conin. Internal T-coupler included

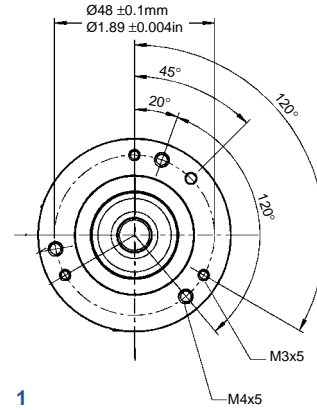
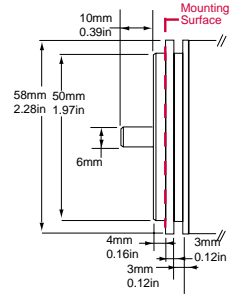
ABSOLUTE
ACURO

Series AI25 Interbus Interface

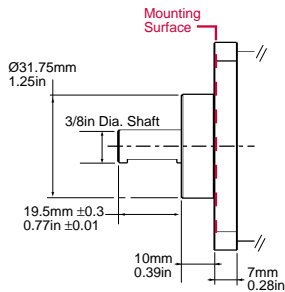
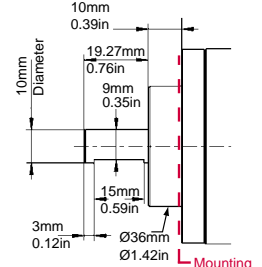
Code 3: Mounting



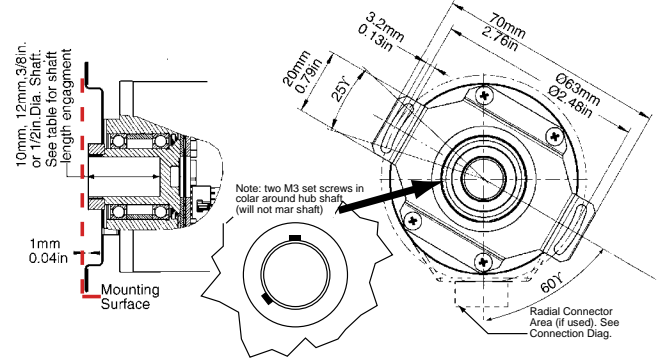
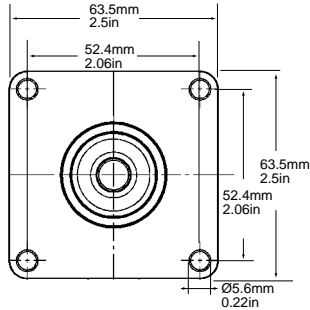
0
Servo



1
Clamping



2
Square Flange

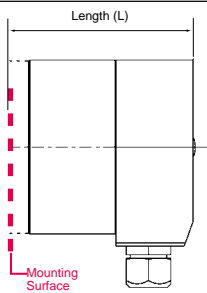


3
Hubshaft w/Tether

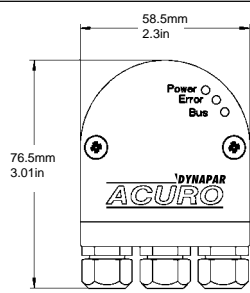
Hubshaft Shaft Engagement

HubShaft Diameter	Min. Shaft Length	Max. Shaft Length
10mm, 3/8"	15mm (0.59")	20mm (0.79")
12mm, 1/2"	18mm (0.71")	20mm (0.79")

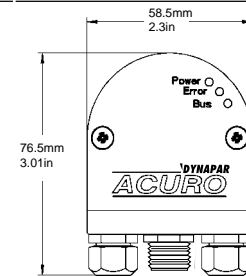
Code 7: Connector



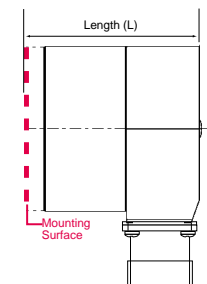
E
3 Strain Relief Exits



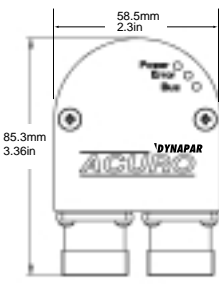
G
2 Strain Relief Exits
1 M12, 5-pole Connector*



*M12, 5-pole Connector used to interface Hengstler Tico 731 LCD display



H
Double Conin



Length (L) Mounting Surface to Rear
For connector types E, and H

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	63.3/2.49	72.3/2.85
(1) Clamping	62.3/2.45	71.3/2.81
(2) Square Flng	64.8/2.55	73.8/2.91
(3) Hubshaft	72.2/2.84	81.2/3.2

Series AI25 BiSS Interface

- Up to 17 Bit single-turn resolution
- 4096 revolutions of multi-turn resolution
- Short installation depth
- Safety through self-diagnostics
- Solid shaft and hollow shaft versions
- -40° C to +100° C Operating temperature



APPLICATION/INDUSTRY

The Dynapar brand ACURO Absolute Encoder offers a modern full-feature design equipped with BiSS interface.

DESCRIPTION

The **Acuro AI25** is available in a single-turn or multi-turn versions. Its multi-turn design is based on a reliable high-speed gear with optical scanning and the latest generation of OptoASIC technology.

Mechanical concept is based on a double ball bearing design, and is available as a solid-shaft or hollow-shaft version in common shaft diameters.

BiSS is a new, fully-digital and bi-directional sensor interface. It defines communication between one master and several slaves (sensors) in industrial control systems. BiSS manifests a new standard in technology and is available license-free. Due to its high performance, it constitutes an efficient alternative to the standard combination of data interface and analog sine/cosine incremental output.

BiSS needs only 6 wires and does not require any hardware for analog signals - and therefore, helps to reduce system costs.

Self-configuration allows "plug+play" and keeps the system in an operable condition even after a power failure. For detailed information on BiSS and support, please visit www.biss-ic.de

FEATURES AND BENEFITS

- Compact design to save valuable space
- Low power consumption
- Fast delivery of any model variant
- Additional field-bus and point-to-point interfaces available

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Single-turn Resolution: 10, 12, 13, 14, 17 Bit
Multi-turn Resolution: 12 bit (only available with 12, 13, 14 or 17 bit ST resolution)
Linearity: +/- 1/2 LSB
Absolute Accuracy: ± 0.01° mechanical (36 arc-sec.)
Repeatability: ± 0.002° mechanical (7.2 arc-sec.)
Code format: Binary, Gray, Gray Excess, parameterization through *AcuroSoft*
Parameterization: Resolution code type, sense of rotation, warning, alarm

ELECTRICAL

Connection: Cable, M23 - 12 pole Conin connector, M12 - 8-pole connector
Supply voltage: 5 VDC -5%/+10% or 10-30 VDC
Intrinsic current consumption: 50 mA (ST), 100 mA (MT) not including output current
Output current: 60 mA per bit, short circuit protected
Frequency response: 500 kHz
Maximum cable length: 400 m
Control Inputs: Direction
Alarm output: Warning and Alarm bits
Status LED: Green = OK, Red = Alarm (IP64 only)
Preset Switch: Sets encoder to zero output at present mechanical position (IP64 only)

BiSS Benefits

- All digital interface eliminates the costs of interpolation electronics
- Offers transmission reliability through a 4-bit cyclic redundancy check (CRC)
- Represents the only fully digital, open motor feedback interface for real-time applications

MECHANICAL

Shaft diameter:
 Shaft: 6 mm (Servo Mount), 10 mm (Clamping Mount), 3/8" (Square Flange Mount)
Hubshaft: 10mm, 12 mm, 3/8", 1/2"
Maximum shaft load:
 6 mm shaft: 13 lb axial, 24 lb radial
 10 mm shaft: 24 lb axial, 35 lb radial
Maximum shaft speed: 10,000 RPM (continuous), 12,000 RPM (peak)
Starting torque: < 1.4 in-oz
Weight (approx.): 350 g ST, 400 g MT
Shaft tolerance (hubshaft only): +/- 1.5 mm axial, +/- 0.2 mm radial
Flange configurations: Square, Clamp, Servo, Hubshaft with flexible tether
Bearing life:
 1 x 10¹⁰ revolutions at 35% full rated shaft load
 1 x 10⁹ revolutions at 75% full rated shaft load
 1 x 10⁸ revolutions at 100% full rated shaft load

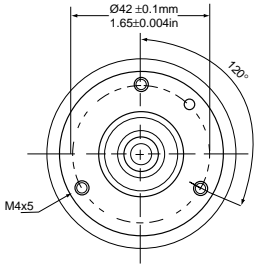
ENVIRONMENTAL

Operating Temperature: -40 to 100° C
Storage Temperature: -40 to 100° C
Enclosure Rating: IP64 or IP67
Shock: 1,000 m/s² (6 ms)
Vibration: 100 m/s² (10 to 2,000 Hz)

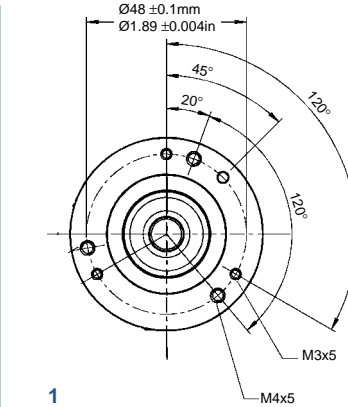
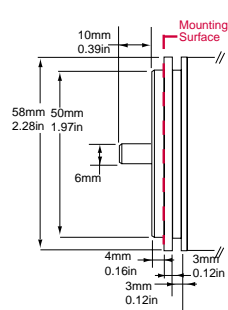
Code 1: Model	Code 2: Bits	Code 3 :Mounting	Code 4: Shaft Size	Code 5: Protocol	Code 6: Electrical	Code 7: Connector
AI25	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AI25 Size25 Acuro Absolute Encoder	Single-Turn 0010 10 Bit 0012 12 Bit 0013 13 Bit 0014 14 Bit 0017 17 Bit Multi-Turn 1212 12 Bit Multi-Turn, 12 Bit Single-Turn 1213 12 Bit Multi-Turn, 13 Bit Single-Turn 1214 12 Bit Multi-Turn, 14 Bit Single-Turn 1217 12 Bit Multi-Turn, 17 Bit Single-Turn	Available when Code 4 is 0 or A 0 Servo* Available when Code 4 is 2 or C 1 Clamping* Available when Code 4 is 1 or B 2 Square flange** Available when Code 4 is 3, 4, 5 or 6 3 Hubshaft w/tether† * 58mm Dia. ** 2.5" Square † 63mm BC	w/o shaft seal (IP64) 0 6 mm 1 3/8" 2 10 mm 3 3/8" Hub Shaft 4 12 mm Hubshaft 5 1/2" Hubshaft 6 10 mm Hub Shaft w/ shaft seal (IP67) A 6 mm B 3/8" C 10 mm	A BiSS	0 5 VDC 2 10-30 VDC	0 1.5m axial cable 1 1.5m radial cable 2 M23 Conin 12 pin axial CW 3 M23 Conin 12 pin radial CW C M12 , 8-pole connector axial D M12 , 8-pole connector radial

Series AI25 BiSS Interface

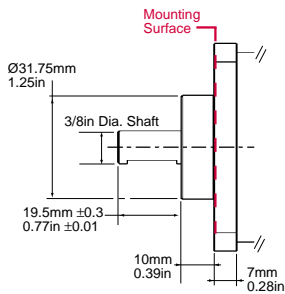
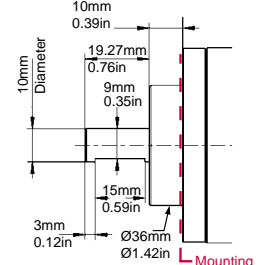
Code 3: Mounting



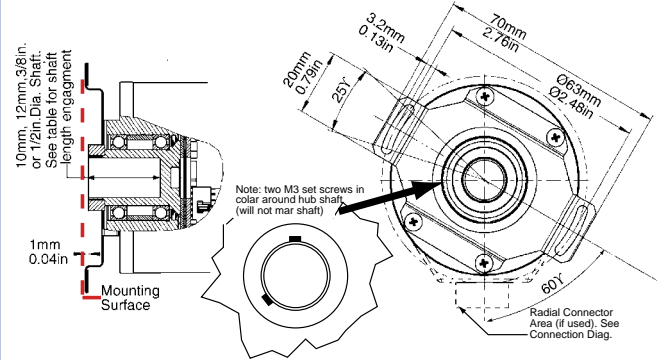
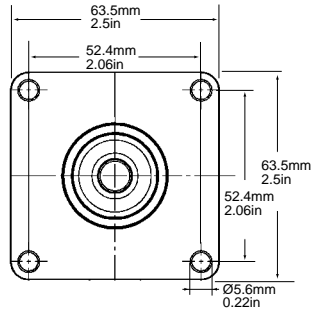
0
Servo



1
Clamping



2
Square Flange

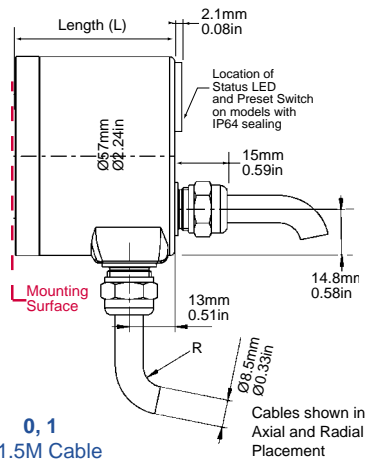


3
Hubshaft w/Tether

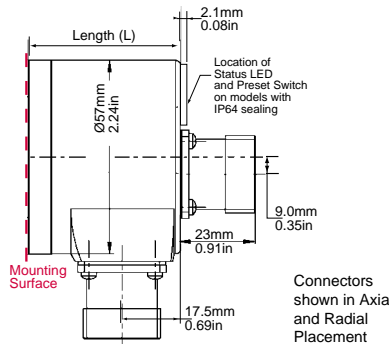
Hubshaft Shaft Engagement

HubShaft Diameter	Min. Shaft Length	Max. Shaft Length
10mm, 3/8"	15mm (0.59")	20mm (0.79")
12mm, 1/2"	18mm (0.71")	20mm (0.79")

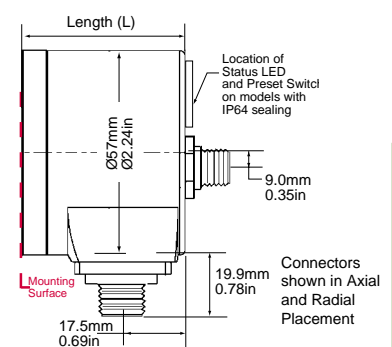
Code 7: Connector



0, 1
2.1.5M Cable



2, 3
Conin 12 Pin Connector



C, D
M12, 8-pole Connector

Length (L) Mounting Surface to Rear

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	46.5/1.83	46.5/1.83
(1) Clamping	45.5/1.79	45.5/1.79
(2) Square Flng	45.5/1.79	45.5/1.79
(3) Hubshaft	53.4/2.1	53.4/2.1

Length (L) Mounting Surface to Rear

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	46.5/1.83	46.5/1.83
(1) Clamping	45.5/1.79	45.5/1.79
(2) Square Flng	45.5/1.79	45.5/1.79
(3) Hubshaft	53.4/2.1	53.4/2.1

Length (L) Mounting Surface to Rear

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	46.5/1.83	46.5/1.83
(1) Clamping	45.5/1.79	45.5/1.79
(2) Square Flng	45.5/1.79	45.5/1.79
(3) Hubshaft	53.4/2.1	53.4/2.1

ABSOLUTE

Series AI25 SSI Interface

- Up to 17 Bit single-turn resolution
- 4096 revolutions of multi-turn resolution
- Short installation depth
- Safety through self-diagnostics
- Solid shaft and hollow shaft versions
- -40°C to +100°C Operating temperature



ACURO



APPLICATION/INDUSTRY

The Dynapar brand ACURO Absolute Encoder offers a modern full-feature design equipped with SSI interface.

DESCRIPTION

The **Acuro AI25** optical absolute industrial encoder is available in a single-turn or multi-turn version. The multi-turn design is based on a reliable high-speed gear with optical scanning and the latest generation of OptoASIC technology.

The mechanical concept is based on a double ball bearing design, which is available as a solid-shaft or hollow-shaft version in common shaft diameters.

FEATURES AND BENEFITS

- Compact design to save valuable space
- Low power consumption
- Fast delivery of any model variant
- Additional field-bus and point-to-point interfaces available

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Single-turn Resolution: 10, 12, 13, 14, 17 Bit
Multi-turn Resolution: 12 bit (only available with 12 or 13 bit ST resolution)
Linearity: +/- 1/2 LSB
Absolute Accuracy: ±0.01° mechanical (36 arc-sec.)
Repeatability: ±0.002° mechanical (7.2 arc-sec.)
Code format: Binary, Gray, Gray Excess, parameterization through *AcuroSoft*
Parameterization: Resolution code type, sense of rotation, warning, alarm

ELECTRICAL

Connection: Cable, M23 - 12 pole Conin connector, M12- 8-pole connector
Supply voltage: 5 VDC -5%/+10% or 10-30 VDC
Intrinsic current consumption: 50 mA (ST), 100 mA (MT) not including output current
Output current: 60 mA per bit, short circuit protected
Frequency response: 500 kHz
Maximum cable length: 400 m
Control Inputs: Direction
Alarm output: Alarm bit
Status LED: Green = OK, Red = Alarm (IP64 only)
Preset Switch: Sets encoder to zero output at present mechanical position (IP64 only)

MECHANICAL

Shaft diameter:
 Shaft: 6 mm (Servo Mount), 10 mm (Clamping Mount), 3/8" (Square Flange Mount)
 Hubshaft: 10mm, 12 mm, 3/8", 1/2"
Maximum shaft load:
 6 mm shaft: 13 lb axial, 24 lb radial
 10 mm shaft: 24 lb axial, 35 lb radial
Maximum shaft speed: 10,000 RPM (continuous), 12,000 RPM (peak)
Starting torque: < 1.4 in-oz
Weight (approx.): 350 g ST, 400 g MT
Shaft tolerance (hubshaft only): +/- 1.5 mm axial, +/- 0.2 mm radial
Flange configurations: Square, Clamp, Servo, Hubshaft with flexible tether
Bearing life:
 1 x 10¹⁰ revolutions at 35% full rated shaft load
 1 x 10⁹ revolutions at 75% full rated shaft load
 1 x 10⁸ revolutions at 100% full rated shaft load

ENVIRONMENTAL

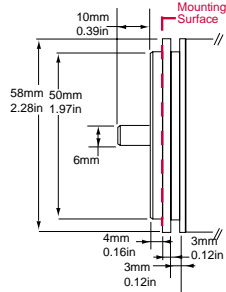
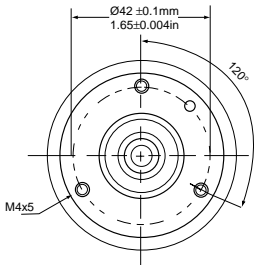
Operating Temperature: -40 to 100° C
Storage Temperature: -40 to 100° C
Enclosure Rating: IP64 or IP67
Shock: 1,000 m/s² (6 ms)
Vibration: 100 m/s² (10 to 2,000 Hz)

ABSOLUTE

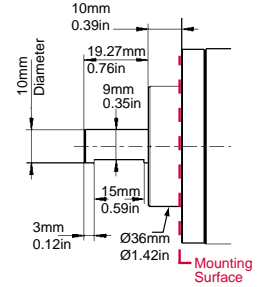
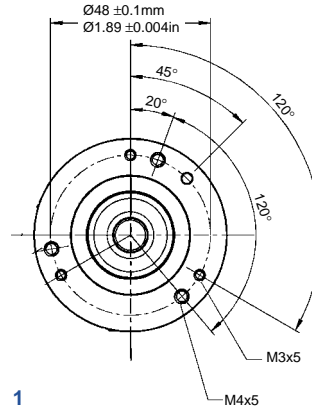
Code 1: Model	Code 2: Bits	Code 3 :Mounting	Code 4: Shaft Size	Code 5: Protocol	Code 6: Electrical	Code 7: Connector
AI25	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AI25 Size25 Acuro Absolute Encoder	Single-Turn 0010 10 Bit 0012 12 Bit 0013 13 Bit 0014 14 Bit 0017 17 Bit Multi-Turn 1212 12 Bit Multi-Turn, 12 Bit Single-Turn 1213 12 Bit Multi-Turn, 13 Bit Single-Turn	Available when Code 4 is 0 or A 0 Servo* Available when Code 4 is 2 or C 1 Clamping* Available when Code 4 is 1 or B 2 Square flange** Available when Code 4 is 3, 4, 5 or 6 3 Hubshaft w/tether† * 58mm Dia. ** 2.5" Square † 63mm BC	w/o shaft seal (IP64) 0 6 mm 1 3/8" 2 10 mm 3 3/8" Hub Shaft 4 12 mm Hubshaft 5 1/2" Hubshaft 6 10 mm Hub Shaft w/ shaft seal (IP67) A 6 mm B 3/8" C 10 mm	2 SSI Gray 3 SSI Binary	0 5 VDC 2 10-30 VDC	0 1.5m axial cable 1 1.5m radial cable 2 M23 Conin 12 pin axial CW 3 M23 Conin 12 pin radial CW C M12 , 8-pole connector axial D M12 , 8-pole connector radial

Series AI25 SSI Interface

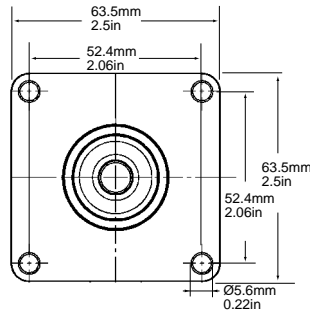
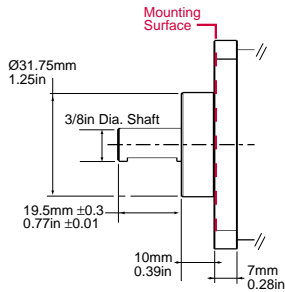
Code 3: Mounting



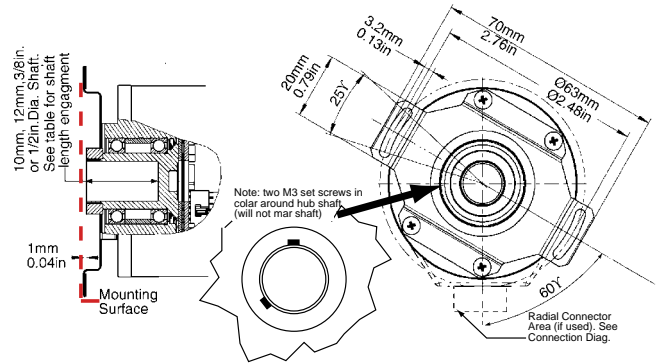
0
Servo



1
Clamping



2
Square Flange

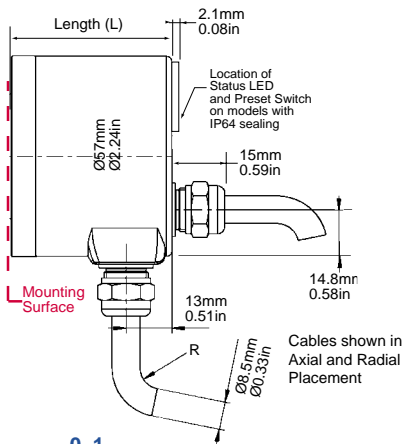


3
Hubshaft w/Tether

Hubshaft Shaft Engagement

HubShaft Diameter	Min. Shaft Length	Max. Shaft Length
10mm, 3/8"	15mm (0.59")	20mm (0.79")
12mm, 1/2"	18mm (0.71")	20mm (0.79")

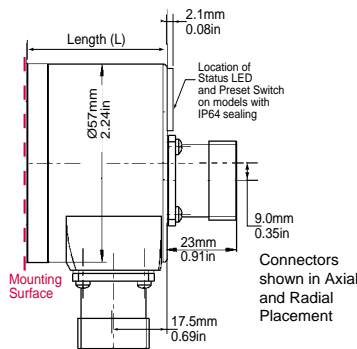
Code 7: Connector



0, 1
2.15M Cable

Length (L) Mounting Surface to Rear

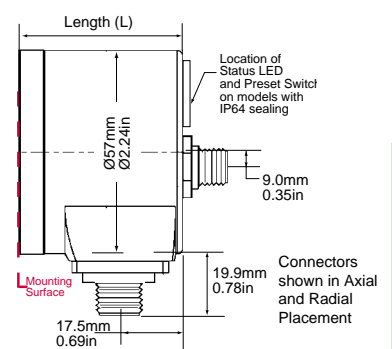
Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	46.5/1.83	46.5/1.83
(1) Clamping	45.5/1.79	45.5/1.79
(2) Square Flng	45.5/1.79	45.5/1.79
(3) Hubshaft	53.4/2.1	53.4/2.1



2, 3
Conin 12 Pin Connector

Length (L) Mounting Surface to Rear

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	46.5/1.83	46.5/1.83
(1) Clamping	45.5/1.79	45.5/1.79
(2) Square Flng	45.5/1.79	45.5/1.79
(3) Hubshaft	53.4/2.1	53.4/2.1



C, D
M12, 8-pole Connector

Length (L) Mounting Surface to Rear

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	46.5/1.83	46.5/1.83
(1) Clamping	45.5/1.79	45.5/1.79
(2) Square Flng	45.5/1.79	45.5/1.79
(3) Hubshaft	53.4/2.1	53.4/2.1

Series AI25 SSI Interface

SSI Data Format

Bits	T1 - T10	T11	T12	T13	T14	T15	T16	T17	T18	T19
10	S9 - S0	0	0	0	0	S9	S8	S7	S6	S5
12	S11 - S2	S1	S0	0	0	S11	S10	S9	S8	S7
13	S12 - S3	S2	S1	S0	0	S12	S11	S10	S9	S8
14	S13 - S4	S3	S2	S1	S0	0	S13	S12	S11	S10
17	S16 - S7	S6	S5	S4	S3	S2	S1	S0	0	S16

Bits	T1 - T12	T13 - T21	T22	T23	T24	T25	T26	T27	T28	T29
1212	M11 - M0	S11 - S3	S2	S1	S0	0	0	M11	M10	M9
1213	M11 - M0	S12 - S4	S3	S2	S1	S0	0	M11	M10	M9

S9, S8 Data Bits for resolution per turn.

S9 - S0 Data Bits S9, S8, S7, S6, S5, S4, S3 Etc.

M11, M10 Data Bits for number of turns.

M11- M0 Turn Data Bits M11, M10, M9, M8, Etc.

T1, T2 SSI Clock number

Electrical Connections 12 pin CONIN

Wire Color	Pin	Function
Brown	1	0V
Pink	2	Data
Yellow	3	Clock
—	4	N.C.
Blue	5	Direction
Red	6	N.C.
Violet	7	N.C.
White	8	5V/10-30V
—	9	N.C.
Gray	10	Data
Green	11	Clock
Black	12	0 V Data

12 pin CONIN Connector **Part Number: G3 539 202**

Bulk Cable (sold by the meter) **Part Number: G3 280 220**

Cable Assembly (with Connector)

3 meters **Part Number: G1 542 003**

5 meters **Part Number: G1 542 004**

10 meters **Part Number: G1 542 005**

Electrical Connections 8 pin M12

Wire Color	Pin	Function
White	1	5/10-30 Volt
Brown	2	0 Volt
—	3	N.C.
Green	4	Clock
Pink	5	Data
Yellow	6	Clock
Blue	7	Direction
Gray	8	Data

8 pin M12 Connector **Part Number: G3 539 597**

Bulk Cable (sold by the meter) **Part Number: G3 280 251**

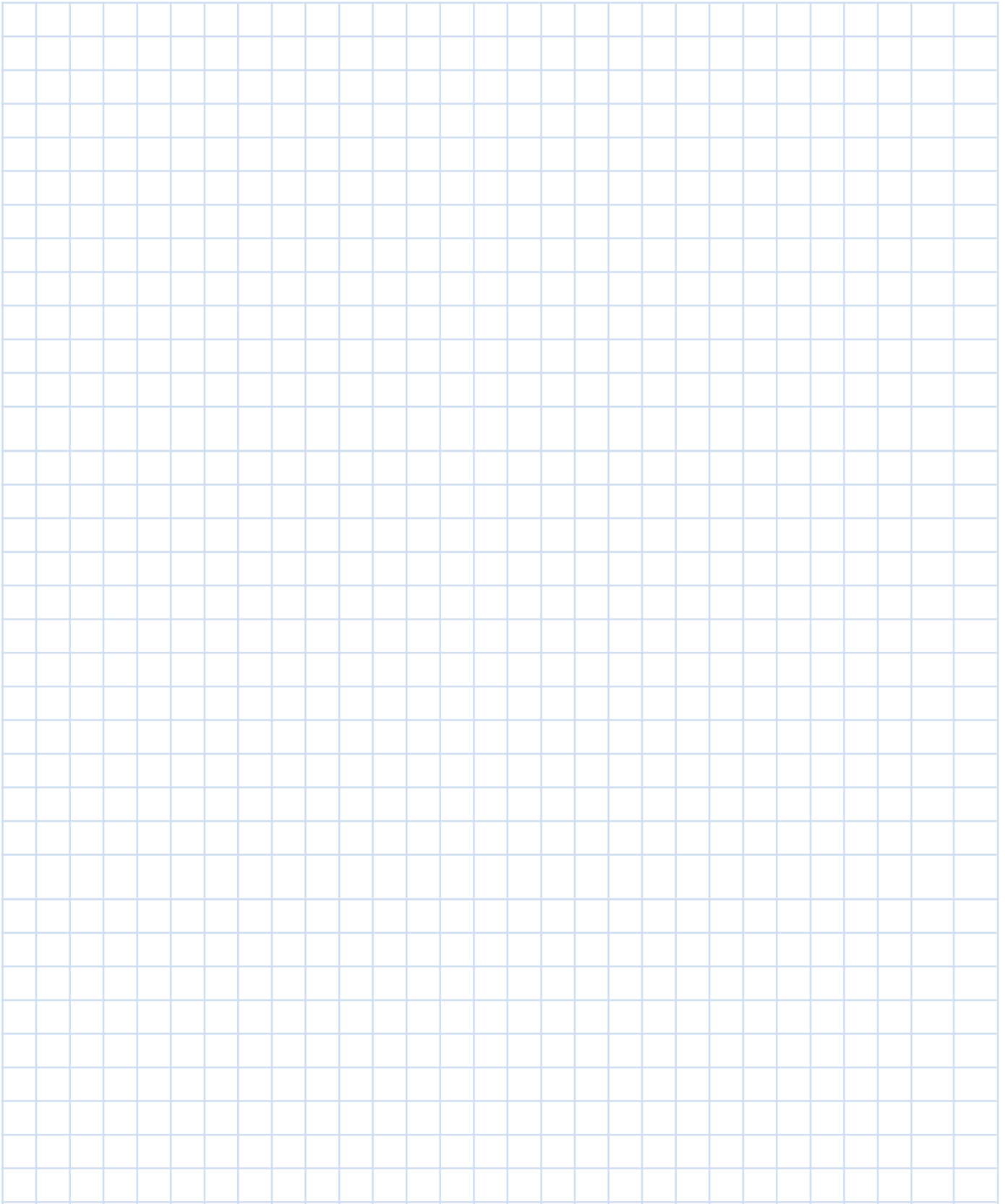
Cable Assembly (with Connector)

3 meters **Part Number: G1 565 329**

5 meters **Part Number: G1 565 330**

10 meters **Part Number: G1 565 331**

Notes



Series AI25 Parallel Interface

- Up to 14 Bit single-turn resolution
- 4096 revolution multi-turn resolution
- Short installation depth
- Safety through self-diagnostics
- Solid shaft and hollow shaft versions
- -40°C to +100°C Operating temperature



ACURO



APPLICATION/INDUSTRY

The Dynapar brand ACURO Absolute Encoder offers a modern full-feature design equipped with Parallel interface.

DESCRIPTION

The Acuro AI25 optical absolute industrial encoder is available in a single-turn or multi-turn version. The multi-turn design is based on a reliable high-speed gear with optical scanning and the latest generation of OptoASIC technology.

The mechanical concept is based on a double ball bearing design, which is available as a solid-shaft or hollow-shaft version in common shaft diameters.

FEATURES AND BENEFITS

- Compact design to save valuable space
- Low power consumption
- Fast delivery of any model variant
- Additional field-bus and point-to-point interfaces available

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Single-turn Resolution: 10, 12, 13, 14 Bit, 360 PPR, 720 PPR
Multi-turn Resolution: 12 bit (only available with 12 bit ST resolution)
Absolute Accuracy: ±0.01° mechanical (36 arc-sec.)
Repeatability: ±0.002° mechanical (7.2 arc-sec.)
Code format: Binary, Gray, Gray Excess

ELECTRICAL

Connection: Cable, Conin Connector, MS Connector, Cable with Sub-D Connector (MT only)
Supply voltage: 5 VDC -5%/+10%, or 10-30 VDC
Intrinsic current consumption: 200 mA (ST), 300 mA (MT)
Output current: 30 mA per bit, short circuit protected
Frequency response: 500 kHz on single-turn, 1.5m cable*
Alarm output: NPN open collector max 5 mA
Maximum cable length: 100 m

*Data refresh rate: 70µsec is for multi-turn and single-turn with preset

Control Inputs		
Input	Logic Level	Function
Direction	1	Ascending code values when turning clockwise
	0	Descending code values when turning clockwise
Latch	1	Encoder data continuously changing at output
	0	Encoder data stored and constant at output
Tristate (ST)	1	Outputs active
	0	Outputs at high impedance (Tristate mode)
Tristate (MT)	1	Outputs at high impedance (Tristate mode)
	0	Outputs active

Status LED: Green = OK, Red = Alarm (IP64 only, not available on connector type J)
Preset Switch: Sets encoder to zero output at present mechanical position (Multi-turn IP64 only, not available on connector type J)
Control Inputs: Latch, Direction, Tri-state (see table below)

MECHANICAL

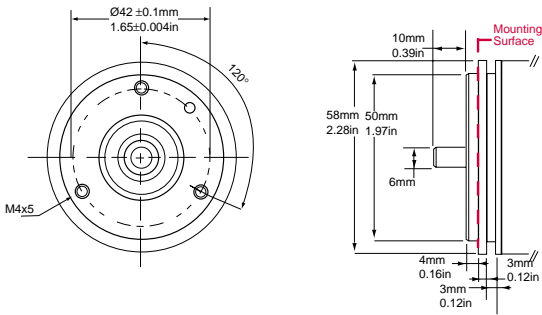
Shaft diameter:
 Shaft: 6 mm (Servo Mount), 10 mm (Clamping Mount), 3/8" (Square Flange Mount)
 Hubshaft: 10mm, 12 mm, 3/8", 1/2"
Maximum shaft load:
 6 mm shaft: 13 lb axial, 24 lb radial
 10 mm shaft: 24 lb axial, 35 lb radial
Maximum shaft speed: 10,000 RPM (continuous), 12,000 RPM (peak)
Starting torque: < 1.4 in-oz
Weight (approx.): 350 g ST, 400 g MT
Shaft tolerance (hubshaft only): +/- 1.5 mm axial, +/- 0.2 mm radial
Flange configurations: Square, Clamp, Servo, Hubshaft with flexible tether
Bearing life:
 1 x 10¹⁰ revolutions at 35% full rated shaft load
 1 x 10⁹ revolutions at 75% full rated shaft load
 1 x 10⁸ revolutions at 100% full rated shaft load

ENVIRONMENTAL

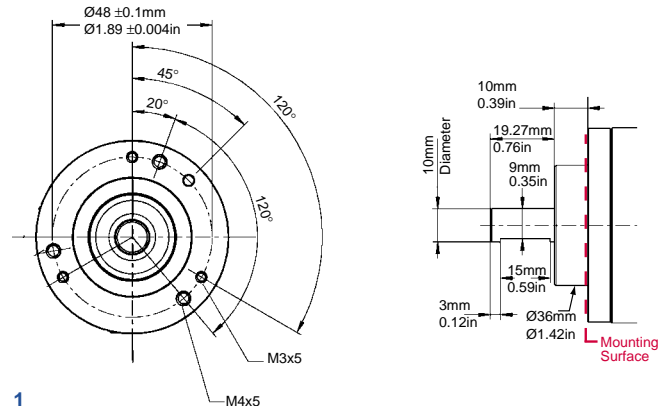
Operating Temperature: -40 to 100° C
Storage Temperature: -40 to 100° C
Enclosure Rating: IP64 or IP67
Shock: 1,000 m/s² (6 ms)
Vibration: 100 m/s² (10 to 2,000 Hz)

Code 1: Model	Code 2: Bits	Code 3 :Mounting	Code 4: Shaft Size	Code 5: Protocol	Code 6: Electrical	Code 7: Connector
AI25	□ □ □ □	□	□	□	□	□
AI25 Size25 Acuro Absolute Encoder	Single-Turn 0010 10 Bit 0012 12 Bit 0013 13 Bit 0014 14 Bit 0360 360 PPR (Gray excess) 0720 720 PPR (Gray excess) Available when Code 6 is 2 Multi-Turn 1212 12 Bit Multi-Turn, 12 Bit Single-Turn	Available when Code 4 is 0 or A 0 Servo* Available when Code 4 is 2 or C 1 Clamping* Available when Code 4 is 1 or B 2 Square flange** Available when Code 4 is 3, 4, 5 or 6 3 Hubshaft w/tether† * 58mm Dia. ** 2.5" Square † 63mm BC	w/o shaft seal (IP64) 0 6 mm 1 3/8" 2 10 mm 3 3/8" Hub Shaft 4 12 mm Hubshaft 5 1/2" Hubshaft 6 10 mm Hub Shaft w/ shaft seal (IP67) A 6 mm B 3/8" C 10 mm	0 Parallel Binary 1 Parallel Gray	0 5 VDC 2 10-30 VDC	0 1.5m axial cable 1 1.5m radial cable Available when Code 2 is 00XX, 0360 or 0720 6 M23 Conin 17 pin axial CW 7 M23 Conin 17 pin radial CW J 17 pin MS axial * K 19 pin Bayonet radial Available when Code 2 is 1212 A Cable 1.5m radial w/ 37 pin sub-D B Cable 1.5m axial w/37 pin sub-D * Status LED and Preset Switch features not available with 'J'

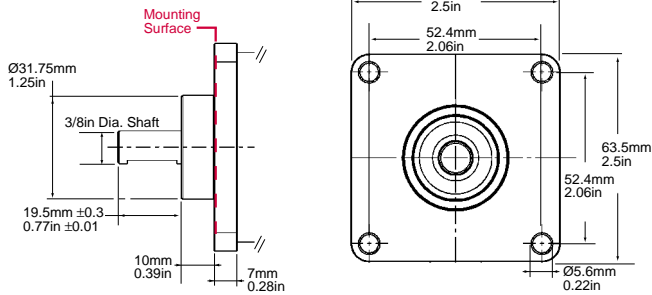
Code 3: Mounting



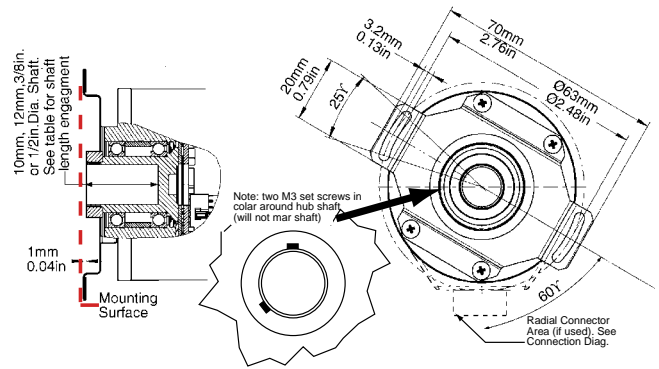
0
Servo



1
Clamping



2
Square Flange

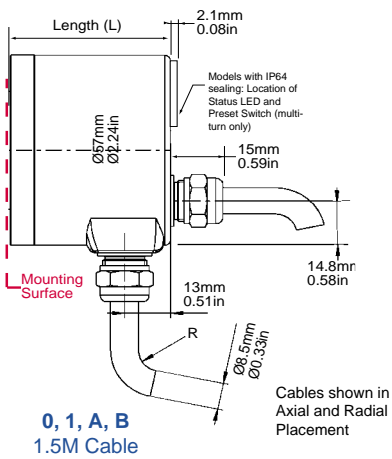


3
Hubshaft w/Tether

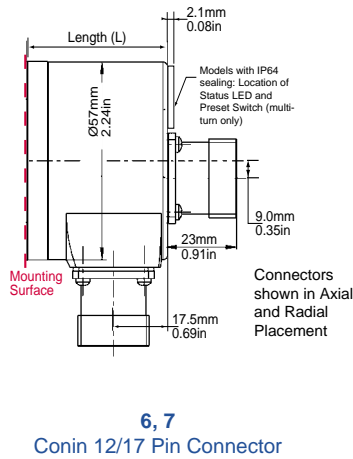
Hubshaft Shaft Engagement

HubShaft Diameter	Min. Shaft Length	Max. Shaft Length
10mm, 3/8"	15mm (0.59")	20mm (0.79")
12mm, 1/2"	18mm (0.71")	20mm (0.79")

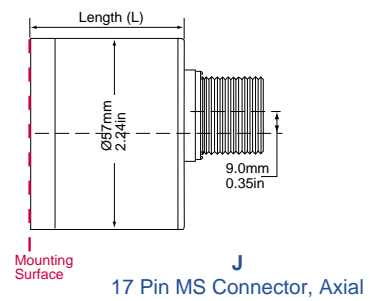
Code 7: Connector



0, 1, A, B
1.5M Cable



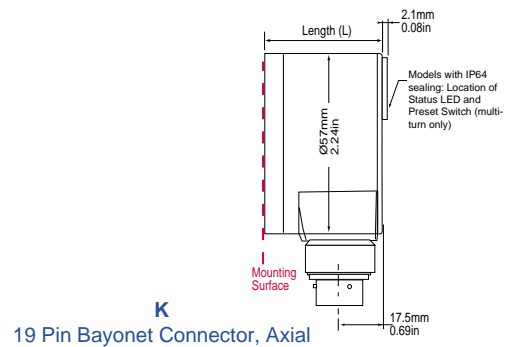
6, 7
Conin 12/17 Pin Connector



J
17 Pin MS Connector, Axial

Length (L) Mounting Surface to Rear

Mount (Code 3)	Single-Turn	Multi-Turn
(0) Servo	46.5/1.83	60.2/2.37
(1) Clamping	45.5/1.79	59.2/2.33
(2) Square Flng	45.5/1.79	59.2/2.33
(3) Hubshaft	49.9/1.96	67.1/2.64



K
19 Pin Bayonet Connector, Axial

CONNECTOR WIRING

Series AI25 Parallel Interface

Explanation of Terms		
Tristate	+UB = Outputs at high impedance (Tristate mode) 0 V ²⁾ = Outputs active	
Tristate	+UB ²⁾ = Outputs active 0 V = Outputs at high impedance (Tristate-Mode)	
Latch	+UB ²⁾ = Encoder data continuously changing at output 0 V = Encoder data stored and constant at output	
Direction	+UB ²⁾ = Ascending code value when turning cw 0 V = Descending code value when turning cw	
N.C.	= Not Connected	
LSB	= Least Significant Bit	
MSB	= Most Significant Bit	
S0, S1, ...	= Data bits for resolution per turn	
M0, M1, ... (Multiturn)	= Data bits for number of turns	

2) Or unattached (floating)

PVC-cable (Singleturn) 9-12 Bit			
Color	9 Bit / 360 ³⁾	10 Bit/720 ³⁾	12 Bit
brn/gry	N.C.	N.C.	S0 (LSB)
red/blu	N.C.	N.C.	S1
vio	N.C.	S0 (LSB)	S2
wht/brn	S0 (LSB)	S1	S3
wht/grn	S1	S2	S4
wht/yel	S2	S3	S5
wht/gry	S3	S4	S6
wht/pnk	S4	S5	S7
wht/blu	S5	S6	S8
wht/red	S6	S7	S9
wht/blk	S7	S8	S10
brn/grn	S8 (MSB)	S9 (MSB)	S11 (MSB)
yel	Tristate D0...D8	Tristate D0...D9	Tristate D0.. D11
pnk	Latch ⁴⁾	Latch ⁴⁾	Latch ⁴⁾
grn	Direction	Direction	Direction
blk	0 V	0 V	0 V
red	5/10...30VDC	5/10...30VDC	5/10...30VDC
brn	Alarm	Alarm	Alarm

3) Increments 4) Binary Only

Connector 17pol. (CONIN) 9-12 Bit			
Pin	9 Bit / 360 ³⁾	10 Bit / 720 ³⁾	12 Bit
1	S0 (LSB)	S0 (LSB)	S0 (LSB)
2	S1	S1	S1
3	S2	S2	S2
4	S3	S3	S3
5	S4	S4	S4
6	S5	S5	S5
7	S6	S6	S6
8	S7	S7	S7
9	S8 (MSB)	S8	S8
10	N.C.	S9 (MSB)	S9
11	N.C.	N.C.	S10
12	Tristate S0...S8	Tristate S0...S9	S11 (MSB)
13	Latch ⁴⁾	Latch ⁴⁾	Latch ⁴⁾
14	Direction	Direction	Direction
15	0 V	0 V	0 V
16	5/10...30VDC	5/10...30VDC	5/10...30VDC
17	Alarm	Alarm	Alarm

3) Increments 4) Binary Only

Connector 17pol. (CONIN) 13-14 Bit		
Pin	13 Bit	14 Bit
1	S12 (MSB)	S13 (MSB)
2	S11	S12
3	S10	S11
4	S9	S10
5	S8	S9
6	S7	S8
7	S6	S7
8	S5	S6
9	S4	S5
10	S3	S4
11	S2	S3
12	S1	S2
13	S0 (LSB)	S1
14	Direction	S0 (LSB)
15	0 V	0 V
16	5/10...30VDC	5/10...30VDC
17	Latch (Binarycode) Alarm (Graycode)	Latch (Binarycode) Alarm (Graycode)

TPE-cable (Multiturn 13-14 Bit) 37 pol. Sub-D		
Color	Pin	
brn	2	S0
grn	21	S1
yel	3	S2
gry	22	S3
pnk	4	S4
vio	23	S5
gry/pnk	5	S6
red/blu	24	S7
wht/grn	6	S8
brn/grn	25	S9
wht/yel	7	S10
yel/brn	26	S11
wht/gry	8	M0
gry/brn	27	M1
wht/pnk	9	M2
pnk/brn	28	M3
wht/blu	14	M4
brn/blu	33	M5
wht/red	15	M6
brn/red	34	M7
wht/blk	16	M8
brn/blk	35	M9
gry/grn	17	M10
yel/gry	36	M11
pnk/grn	18	Alarm
yel/pnk	10	Direction
grn/blu	30	Latch
yel/blu	12	Tristate
red	13	10...30 VDC
wht	31	10...30 VDC
blu	1	0 V
blk	20	0 V

MS style 17 pin connectors					
Pin	Function		107865 Cable Accessory* Color Code	14 BIT	13 BIT
	12 Bit 4096 CPR	10 Bit 1024 CPR			
A	Vin		Red	D13 (MSB)	D12 (MSB)
B	N.C.		Violet	D12	D11
C	Latch (binary only)		Green	D11	D10
D	Direction		Orange	D10	D9
E	S1	N.C.	White	D9	D8
F	S3	S1	White/Brown	D8	D7
G	S5	S3	White/Orange	D7	D6
H	S7	S5	White/Green	D6	D5
J	S8	S6	White/Blue	D5	D4
K	S9	S7	White/Violet	D4	D3
L	S11 (MSB)	S9 (MSB)	White/Black/Brown	D3	D2
M	GND		Black	D2	D1
N	S4	S2	White/Red	D1	D0 (LSB)
P	S0 (LSB)	N.C.	Gray	D0 (LSB)	Direction
R	S2	S0 (LSB)	White/Black	GND	GND
S	S6	S4	White/Yellow	Latch	Latch
T	S10	S8	White/Grey	Vin	Vin
10ft Cable # 107865-0010				NA	
Mating Connector: MS 17 pin style MS3106A-20-29S part # MCN-N8					
*This is a mating connector/cable assembly. Color coding information is provided here for reference					

PVC-cable (Singleturn 13-14 Bit)		
Color	13 Bit	14 Bit
gry/pnk	N.C	S0 (LSB)
brn/yel	S0 (LSB)	S1
brn/gry	S1	S2
red/blu	S2	S3
vio	S3	S4
wht/brn	S4	S5
wht/grn	S5	S6
wht/yel	S6	S7
wht/gry	S7	S8
wht/pnk	S8	S9
wht/blu	S9	S10
wht/red	S10	S11
wht/blk	S11	S12
brn/grn	S12 (MSB)	S13 (MSB)
yel	Tristate S0...S12	Tristate S0...S13
pnk	Latch ⁴⁾	Latch ⁴⁾
grn	Direction	Direction
blk	0 V	0 V
red	5/10...30VDC	5/10...30VDC
brn	Alarm	Alarm

4) Binary Only

Bayonet style 19 pin connectors							
Pin	Function 14 Bit 16384 CPR	112077 Cable Accessory* Color Code	Function 13 bit 8192 CPR	112076 Cable Accessory* Color Code	Function		110158 Cable Accessory* Color Code
					12 Bit 4096 CPR	10 Bit 1024 CPR	
A	S13 (MSB)	White/Black/Brown	S12	White/Black/Brown	S11 (MSB)	S9 (MSB)	White/Black/Brown
B	S12	White/Grey	S11	White/Grey	S10	S8	White/Grey
C	S11	White/Violet	S10	White/Violet	S9	S7	White/Violet
D	S10	White/Blue	S9	White/Blue	S8	S6	White/Blue
E	S9	White/Green	S8	White/Green	S7	S5	White/Green
F	S8	White/Orange	S7	White/Orange	S6	S4	White/Orange
G	S7	White/Yellow	S6	White/Yellow	S5	S3	White/Yellow
H	S6	White/Red	S5	White/Red	S4	S2	White/Red
J	S5	White/Brown	S4	White/Brown	S3	S1	White/Brown
K	S4	White/Black	S3	White/Black	S2	S0 (LSB)	White/Black
L	S3	Brown	S2	Blue	S1	N.C.	White
M	S2	Blue	S1	White	S0 (LSB)	N.C.	Grey
N	S1	White	S0 (LSB)	Grey	N.C.	N.C.	
P	S0 (LSB)	Grey	GND	Black	GND		Black
R	Direction	Orange	Direction	Orange	Direction		Orange
S	Case	Violet	Case	Violet	Case		Violet
T	GND	Black	GND	Yellow	GND		Yellow
U	Latch	Green	Latch	Green	Latch (binary only)		Green
V	Vin	Red	Vin	Red	Vin		Red
10ft Cable # 112077-0010			10ft Cable # 112076-0010		10ft Cable # 110158-0010		
Mating Connector: 19 pin Bayonet style PT06E-14-19S part # 606219-0001							

*This is a mating connector/cable assembly. Color coding information is provided here for reference

Series AD25 Drive

- For high performance BLDC Motors
- Up to 22 Bit Single-turn Resolution
- 4096 Revolutions of Multi-turn Resolution
- Safety through self-diagnostics
- Data storage on the encoder
- Tapered Shaft
- -15°C to +120°C Operation



APPLICATION/INDUSTRY

Fully digital position information with up to 22 Bit Single-turn + 12 Bit Multi-turn resolution for speed and position applications.

DESCRIPTION

The **Acuro AD25** is an optical absolute encoder with an optical multi-turn gearbox (non magnetic). Double ball bearing design with flexible spring tether as a torque support. Designed for integration into BLDC servomotors for demanding applications such as CNC, precision positioning and high quality printing. Low current consumption of 85 mA contributes to lowering the drive cost.

The **AD25** features new, fully digital technology ... Conventional top of the range absolute encoders for motor feedback still provide analog sinusoidal signals to feedback the speed and position of the motor. This information is transmitted over a bidirectional synchronous interface with a variable clock rate up to 10 MHz, resulting in over 4 million measuring steps.

BiSS Interface

BiSS is a new, fully-digital and bi-directional sensor interface. It defines communication between one master and several slaves (sensors) in industrial control systems. **BiSS** manifests a new standard in technology and is available license-free. Due to its high performance, it constitutes an efficient alternative to the standard combination of data interface and analog sine/cosine incremental output.

BiSS needs only 6 wire, does not require any hardware for analog signals (cables and drive interpolation electronics) - and therefore, helps to reduce system costs.

Self-configuration capabilities allow "plug+play" and keep the system in an operable condition even after a power failure. For more detailed information on **BiSS** and implementation support please visit www.biss-ic.de

FEATURES AND BENEFITS

- Compact design to save valuable space
- Low power consumption
- Fast delivery of any model variant
- High Speed digital interface **BiSS**
- Downward compatible (SSI + sincos)
- PCB connector

SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Supply Voltage: 5 VDC, +10% / -5%
Current Consumption (w/o output current):
Single-turn: ≤ 45 mA (at 5V)
Multi-turn: ≤ 85 mA (at 5V)
Absolute Accuracy: ± 0.01° mechanical (36 arc-sec.)
Repeatability: ± 0.002° mechanical (7.2 arc-sec.)
Connection: 1 ft. Cable (30 cm)
Incremental Signals (SSI models only)
Resolution: 2048
Format: A, B Quadrature, 1 Vpp Sine wave
SSI Interface
Resolution:
Single-turn: 13 Bits
Multi-turn resolution: 12 Bits
Interface:
Number of lines: 4 unidirectional (2 for clock; 2 for data)
Electrical Interface: RS 422
Transmission speed: 70 kHz to 2 MHz per SSI definition
BiSS Interface
Resolution:
Single-turn resolution: 22 Bits
Multi-turn resolution: 12 Bits
Interface:
Signals: Clock unidirectional (from master to encoder); Data unidirectional (from encoder to master)
Electrical Interface: RS 422
Number of lines: 4 unidirectional (2 for clock and 2 for data)
Transmission speed: 70 kHz – 10 MHz

Transmission security: 1 start bit, 1 stop bit, 4 Bit CRC

Diagnostic functions: possible failure modes are constantly checked with the following functions

LED current sensing: Pollution, condensation, over-temperature

Single-step check: Disk pollution or damage, condensation, mechanical overload

Temperature monitoring: Warning message if the user-defined limits have been reached/exceeded

For further information on the **BiSS** interface please consult: <http://www.biss-ic.de/>

MECHANICAL

Shaft Size:

Tapered solid shaft: 10 mm diameter; Cone 1:10

Tapered hub shaft: 10 mm diameter; Cone 1:10

Shaft Loading: 5 lb axial, 20 lb radial

Shaft Speed: 12,000 RPM (continuous), 15,000 RPM (peak-ST only)

Starting Torque: < 1.4 in-oz

Weight: 6.2 oz.

Diameter: 2.28"

Length: 1.85"

ENVIRONMENTAL

Operating Temperature: -15 to +120° C

Storage Temperature: -25 to +85° C (due to packaging)

Enclosure Rating: IP40

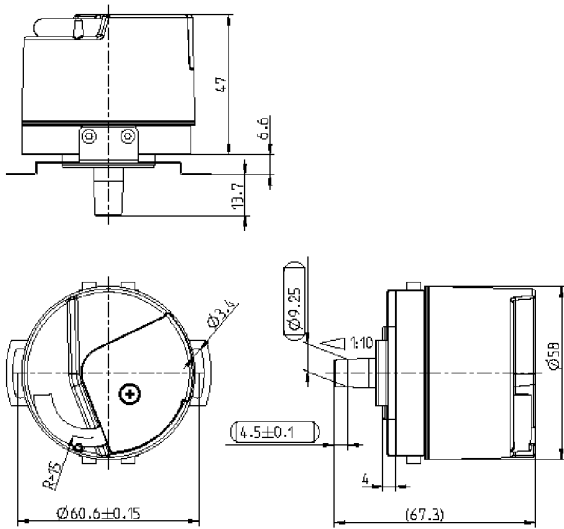
Shock: 100 g's for 6 msec duration

Vibration: 10 g's (10 to 2000 Hz)

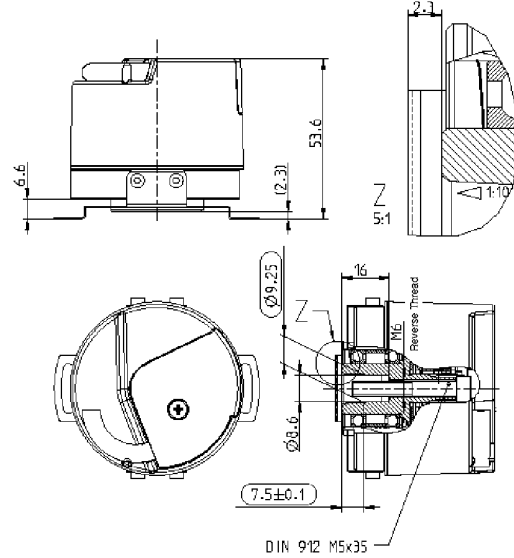
Code 1: Model	Code 2: Bits	Code 3 :Mounting	Code 4: Shaft Size	Code 5: Protocol	Code 6: Electrical	Code 7: Connector
AD25	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AD25 Size25 Acuro Absolute Encoder	Single-Turn 0013 13 Bit 0022 22 Bit	4 Spring Tether	Y 10mm Shaft (10:1 Taper) Z 10mm Hub Shaft (10:1 Taper)	Available when Code 2 is 0022 or 1222 A BiSS	0 5 VDC	M Drive cable, 1 foot (30 cm)
	Multi-Turn 1213 12 Bit Multi- Turn, 13 Bit Single-Turn 1222 12 Bit Multi- Turn, 22 Bit Single-Turn			Available when Code 2 is 0013 or 1213 F SSI-Gray Code, + 1Vpp		

Series AD25 Drive

Code 4: Shaft Size



Y
10mm (10:1 taper) Shaft



Z
10mm Hub Shaft

Electrical Connections

Row b	U_p	Clock	B -	0V (U_n)*	A -	Data
Row a	$\overline{\text{Data}}$	A +	0V Sensor	B +	$\overline{\text{Clock}}$	Up - Sensor
PIN	1	2	3	4	5	6

PIN	1b	2b	3b	4b	5b	6b
Name	Power Supply	Clock	B -	0 V (U_n)	A -	Data
Signal	Up	Clk	B -	0 V	A -	Dat
Color	Gray/Pink	White	Red	White/Green	Yellow	Black

PIN	1a	2a	3a	4a	5a	6a
Name	$\overline{\text{Data}}$	A +	0 V - Sen	B +	$\overline{\text{Clock}}$	U_p Sensor
Signal	$\overline{\text{Dat}}$	A +	0V - Sen	B +	$\overline{\text{Clk}}$	Up-Sen
Color	Violet	Green	Brown/Green	Blue	Brown	Blue/Red

U_p = power Supply
Sensor is connected to Power Supply and 0 V (U_n)
Shield connected to case

Notes

A large grid of graph paper for taking notes, consisting of 20 columns and 30 rows of small squares.

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