INDUSTRIAL ENCODERS & ACCESSORIES CATALOG

ISSUE NO. 6

ENCODER PRODUCTS COMPANY

www.encoder.com

ENCODER PRODUCTS COMPANY

Company History

Encoder Products Company, Inc. is a leading designer and world-wide manufacturer of motion sensing devices. Founded in 1969 by William Watt, EPC began operations with a small line of custom encoders. Today, 45 years later, EPC's popular Accu-Coder™ brand is the most complete line of incremental and absolute shaft encoders in the industry. Our core philosophy is that each and every customer deserves quality products, superior customer service, and expert support.

Business Partnerships

Fostering long term business partnerships with satisfied customers is what we do best, and is at the heart of our mission. We take pride in providing superior customer service and supplying our customers with encoders that function precisely, dependably, and flawlessly. Listening to our customers needs, and designing products that provide solutions for them, is a key to our success.

Setting the Standard

At EPC, we concentrate on encoders. With that level of focus—and a 45 year history—we have a long list of "firsts" to our name. First to design the cube style encoder, now an industry standard. First to resolve mounting installation problems by providing a flexible-mounting system. First to include Opto-ASIC technology, which virtually eliminates miscounts by eliminating electrical noise and enhancing signal quality. First to provide an encoder that operates at 120° C. First to provide 6000 CPR in a 1.5" diameter encoder. First to provide a 3 year standard warranty because we stand proudly behind the reliability of each of our products. We will continue to do what we do best so that you can have the very best encoder for the job.

Solving Problems

Since 1969, we have been solving encoder problems. Custom designs, faster delivery, and reliable products set us apart from the competition. We believe that an encoder supplier should solve problems, not cause them.

Custom Encoders Our Specialty

Through years of experience, we understand that each industrial environment is different and that you need an encoder that fits your specific situation. Ultimately, this means not having to make due with someone else's specifications or configurations, but having your own custom designed unit. Many of our customers have come to depend on us for this special area of customization. Using state-of-the-art technology, we can design and deliver custom encoders faster than most suppliers' standard products—often shipping your unique encoder in 4 to 6 days or sooner.

ISO 9001 Quality Systems

At EPC, quality is designed into every product. Before it's offered for sale, each Accu-Coder™ model is developed using ultramodern design tools and is then fully tested against EPC's exacting quality standards. But quality does not stop at design. During the manufacturing process, each Accu-Coder™ is subjected to a series of stringent quality control tests to ensure you are receiving the best encoder available. Our quality system has successfully been audited to the requirements of ISO 9001:2008, an internationally recognized standard for comprehensive Quality Systems. By paying close attention to detail, our Accu-Coder™ brand has become known throughout the industry for quality and reliability.

EPC's world headquarters in Sagle, Idaho.

TABLE OF CONTENTS

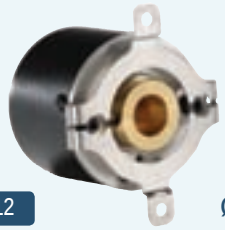
QUICK SELECTION GUIDE

INCREMENTAL THRU-BORE & MOTOR MOUNT ENCODERS

Pg 8 Ø1.5”

Models 15T & 15H

- Resolutions to 10,000 CPR
- Up to 12 Pole Commutation Available
- Bore Sizes to 0.375”, or 10 mm
- Operating Temps from -40° to +120° C
- Sealing Up to IP64



Pg 12 Ø1.5”

Model 755A

- Resolutions to 30,000 CPR
- Bore Sizes to 0.750”, or 14 mm
- A Variety of Flexible Mounting Brackets
- Operating Temps from -40° to +100° C
- Frequencies to 1 MHz

Pg 14 Ø2.0”

Model 121

- Patented Auto Aligning Modular Encoder
- Up to 12 Pole Commutation Available
- Bore Sizes to 0.625”, or 15 mm
- Ideal for higher speed motor applications
- Resolutions to 2540 CPR

Pg 16 Ø2.0”

Model 260

- Resolutions to 10,000 CPR
- Bore Sizes to 0.625”, or 15 mm
- A Variety of Flexible Mounting Brackets
- Operating Temps from -40° to +120° C
- Sealing Up to IP64

Pg 34 Ø2.0”

Model 702

- 2.0” Ultra-rugged, Compact Encoder
- Resolutions to 30,000 CPR
- Frequencies to 1 MHz
- Coupling Sizes to 0.500”
- Operating Temps from 0° to +100° C

Pg 20 Ø2.25”

Model 225

- Single Channel & Quadrature
- Economical Tachometer
- Motor Feedback
- Bore Sizes to 0.875”, or 22 mm

Pg 22 Ø2.5”

Model 25T

- Replaces 2.0” to 3.5” Encoders
- Resolutions to 10,000 CPR
- Bore Sizes to 1.125”, or 28 mm
- Versatile Flexible Mounting Options
- Operating Temps from -40° to +105° C

Pg 24 Ø4.3”

Model 775

- Slim Profile - to 1.36” Thru-Bores
- Resolutions to 4096 CPR
- Bore Sizes to 1.875”, or 43 mm
- Large Selection of Connector Options
- Operating Temps from 0° to +100° C

Pg 26 Ø4.3”

Model 776

- Slim Profile - to 1.36” Thru-Bores
- Resolutions to 4096 CPR
- Bore Sizes to 1.875”, or 43 mm
- Large Selection of Connector Options
- Operating Temps from 0° to +100° C

Pg 28 Ø6.5”

Model 770

- Fits NEMA Frame Size 56C Thru 184C
- Resolutions to 4096 CPR
- Bore Sizes to 1.00”, or 24 mm
- Large Selection of Connector Options
- Operating Temps from 0° to +100° C

Pg 30 Ø9.0”

Model 771

- Fits NEMA Frame Size 182TC Thru 256TC
- Standard Double C-Face
- Resolutions to 4096 CPR
- Bore Sizes to 1.875”, or 43 mm
- Optional protective cover affords IP65 Seal

Pg 32

Model 755A NEMA

- NEMA 23 or 34 Motor Mount with Coupling
- Resolutions to 30,000 CPR
- Frequencies to 1 MHz
- Coupling Sizes to 0.375”, or 6 mm
- Operating Temps from -40° to +100° C

INCREMENTAL SHAFT ENCODERS

Pg 46 Ø1.5”

Model 15S

- Resolutions to 10,000 CPR
- Up to 12 Pole Commutation Available
- Wide Variety of Mounting Options
- Operating Temps from -40° to +120° C
- Sealing Up to IP64

Pg 50 Ø1.5”

Model 755A

- Resolutions to 30,000 CPR
- Frequencies to 1 MHz
- A Variety of Servo and Flange Mounts
- Available with In-Line M12 Connectors
- Operating Temps from -40° to +100° C

Pg 38-43 Ø2.25”

Models 711, 715 & 716

- The Original Cube Encoders
- Single Channel, Quadrature and Timed Pulse
- Five Versatile Heavy Duty Housing Styles
- Resolutions to 10,000 CPR
- Single and Double Shaft Options

Pg 60 Ø58 mm

Model 758

- 80 lb. Max. Radial and Axial Load
- Resolutions to 30,000 CPR
- Clamping or Synchro Flange Options
- Operating Temps from -40° to +100° C
- Sealing Up to IP67

Pg 52 Ø2.5”

Model 702

- 80 lb. Max. Radial and Axial Load
- Resolutions to 30,000 CPR
- Shaft Sizes to 0.375”, or 10 mm
- Operating Temps from -40° to +100° C
- Sealing Up to IP67

Pg 56 Ø2.5”

Model 725

- Industrial Isolated Flex Housing Available
- Standard and Industrial Housing Available
- Resolutions to 30,000 CPR
- Operating Temps from -40° to +100° C
- Sealing Up to IP67

STAINLESS STEEL ENCODERS

Pg 74 Ø2.0”

Model 802S

- 2.0” Industrial 316 Stainless Steel Housing
- 80 lb. Max. Radial and Axial Load
- Resolutions to 30,000 CPR
- Shaft Sizes to 0.375”, or 10 mm
- Sealing Up to IP67

Pg 76 Ø58 mm

Model 858S

- 58 mm Industrial 316 Stainless Steel Housing
- 80 lb. Max. Radial and Axial Load
- Resolutions to 30,000 CPR
- Clamping or Synchro Flange Options
- Sealing Up to IP67

Ø6.5”

Pg 78

Model 865T

- Fits NEMA Frame Size 56C Thru 184C Motors
- Slim 1” Profile Housing in 316 Stainless Steel
- Resolutions to 4096 CPR
- Bore Sizes to 1.00”, or 24 mm
- Sealing Up to IP66 with Optional Cover

QUICK SELECTION GUIDE

ABSOLUTE ENCODERS

Pg 84 Ø2.0”

Model 960

- Low Profile - 1.55” Single Turn Absolute
- Opto-ASIC Circuitry in an All Metal Housing
- Resolutions to 11 Bits
- Bore Sizes to 0.375”, or 10 mm
- A Variety of Flexible Mounting Brackets

Pg 82 Ø58 mm

Model 958

- Industrial Housed European Size 58 mm
- Gray, Natural Binary, and Excess Gray Codes
- Shaft Sizes to 0.375”, or 10 mm
- Clamping or Synchro Flange Options
- Sealing Up to IP66

Pg 80 Ø2.5”

Model 925

- Industrial Housed 2.5” Single Turn Absolute
- Gray, Natural Binary, and Excess Gray Codes
- Shaft Sizes to 0.375”, or 10 mm
- Flange and Servo Mounts
- Sealing Up to IP67

Pg 88, 92

Model MA/SA36S

- Multiturn or Single Turn Absolute Encoder
- Durable Magnetic Technology
- Standard Size 36 mm Package (1.42”)
- SSI and CANopen Communications
- New Turns Counting Technology—
  No Gears or Batteries

Pg 86, 90

Model MA/SA36H

- Multiturn or Single Turn Absolute Encoder
- Durable Magnetic Technology
- Standard Size 36 mm Package (1.42”)
- SSI and CANopen Communications
- New Turns Counting Technology—
  No Gears or Batteries

Pg 94

Model MA63S

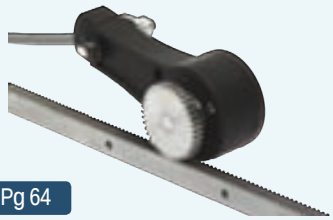
- Multiturn Absolute Encoder
- Durable Magnetic Technology
- Standard Size 25 Package (2.5” x 2.5”)
- SSI and CANopen Communications
- New Turns Counting Technology—
  No Gears or Batteries

LINEAR SOLUTION ENCODERS

Pg 62

Model TR1

- Integrated Encoder and Measuring Wheel
- Spring Loaded Torsion Arm Adjusts Wheel Pressure
  for Multiple Surfaces; Easy Installation
- Resolutions to 10,000 CPR
- Sealing Up to IP66



Pg 64

Model TR2

- Integrated Encoder and Rack and Pinion Gear
- Spring Loaded Torsion Arm Installs in Vertical,
  Horizontal, or Upside-Down Orientation
- Resolutions to 10,000 CPR
- Sealing Up to IP66

Pg 68

Model TR3

- Integrated Heavy Duty Encoder and
  Measuring Wheel
- Easily Installs in a Vertical, Horizontal,
  or Upside-Down Orientation
- Resolutions to 10,000 CPR
- Single or Dual Wheel

Pg 72

Model LCE

- Linear Cable Measurement Up to 50 Inches
- Resolutions From 2 to 500 Cycles Per Inch
- Low Cost Linear Solution
- Sealing Up to IP65
- Many Mounting/Cable Exit Configurations

Call Sales & Customer Service at 800-366-5412

EPC is open for business from
8:00 am to 7:30 pm EST/ 5:00 am to 4:30 pm PST.

ENCODER SELECTION CONSIDERATIONS

Modular vs. Bearing Encoders

When deciding whether or not a modular or bearing encoder is the best solution for your application, consider these factors:

1. First and foremost, shaft end float and TIR must be within the encoder's specifications. This is so important that if you don't have (or can't get) this information, or don't trust what you have, then an encoder with bearings is strongly recommended, since it will be a much safer choice.

2. Modular encoders can be a good choice for high-speed applications, those above 10,000 RPM, because there are no speed limitations dictated by encoder bearings. For example, EPC's Accu-Coder Model 121 Modular Encoder has been successfully operated at speeds in excess of 40,000 RPM. The speed limiting factor is the maximum frequency of the encoder, which is a function of disk resolution, RPM's and the signal processing circuitry. Most encoder manufacturers include maximum frequency in product specifications.

3. If the motor is to be used under considerable mechanical load, where the motor bearings could experience extra wear, then an encoder with bearings would be the better choice. Remember, the bearings of the host device, serve as the bearings of the modular encoder.

4. Modular encoders are difficult to seal. If your application requires wash-down, or if the operating environment is dirty, dusty or wet, then an encoder with bearings and seals should be your first consideration. Such environments effectively rule out modular encoders, unless external protection, such as an IP sealed motor cover, is used.

5. If your application requirements combine high maximum frequency (> 200kHz), high temperature (100C or higher), and higher resolution (>2048 CPR), then an encoder with bearings is recommended. For long term reliability, this combination of factors requires the air-gap between the disk and sensor to be very narrow and tightly controlled. An encoder with bearings simply provides a more stable optical platform.

6. Lower resolutions (up to 1024 CPR) are more forgiving of End Float and TIR, and are often well-suited for modular applications if the operating environment is appropriate.

7. If you plan to use numerous encoders, then the relatively lower price of a modular encoder could save you some money. On the other hand, the greater durability and easier installation of an encoder with bearings might be worth a slightly higher unit price. In any case, carefully weigh the factors of long term support costs versus lower acquisition costs before making your final decision.

Quick Selection Chart

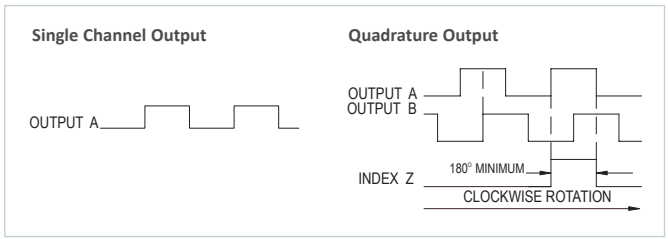
Parameter	Attribute	Use Modular	Use Encoder with Bearings
Motor shaft end float and TIR	Within the encoder manufacturer's specifications	Yes	Yes
Motor shaft end float and TIR	Outside the encoder manufacturer's specifications	No	Yes
Motor shaft end float and TIR	Don't have the information or don't trust	Not suggested	Suggested
High-speed applications	Above 10,000 RPM	Good possibility	Not suggested
Severe duty application	Motor bearings have extra load and wear	Not suggested	Suggested
Dirty environment	May need seals	Not suggested	Suggested
Combination of high frequency response, temperature, CPR	>200kHz, >100°C, >2048 CPR	Not suggested	Suggested
Lower resolution requirement	<1024 cycles per revolution	Good possibility	Good
Number of units needed	Acquisition cost vs. life cycle cost	Consider if large volume	Good

ENCODER BASICS

WHAT IS AN ENCODER?

An encoder is a sensing device that provides feedback from the physical world—it converts motion to an electrical signal which can be read by some type of control device, such as a counter or PLC. The control device can then use that signal to control a conditional event, such as activating a print head to create a mark at a specific location. Encoders use different types of technologies to create a signal. Some common encoder technologies are mechanical, magnetic, resistive and optical. Currently, the most common technology employed by encoders is optical. Encoders may produce either incremental or absolute signals. Incremental signals provide a series of high and low waves which indicate movement from one position to the next; there is no special indication provided by the encoder to show the specific position, only an indication that the position has changed. Absolute encoders, on the other hand, use a unique "word" for each position, meaning that an absolute encoder provides both the indication that the position has changed and an indication of the absolute position of the encoder. Each encoder type has its advantages, however, for the sake of this article, our discussion will be limited to the most common type of encoder used today—optical incremental encoders.

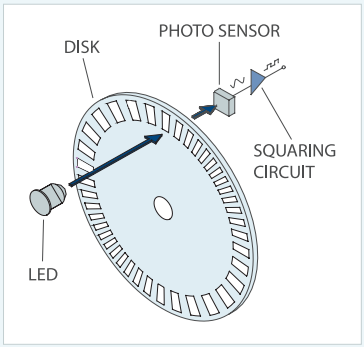
Incremental encoders are available in two basic output types, single channel and quadrature, shown below.



A single channel encoder, often called a tachometer, is normally used in systems that rotate in only one direction and require simple position and velocity information. Quadrature encoders have dual channels (A and B), phased 90 electrical degrees apart. These two output signals determine the direction or rotation by detecting the leading or lagging signal in their phase relationship. Quadrature encoders provide very high speed bi-directional information for very complex motion control applications.

HOW AN INCREMENTAL ENCODER SQUARE WAVE IS PRODUCED

The inset diagram outlines the basic construction of an incremental encoder. A beam of light emitted from an LED passes through a transparent disk patterned with opaque lines. The light beam is picked up by a photodiode array, also known as a photosensor. The photosensor responds to the light beam, producing a sinusoidal wave form, which is transformed into a square wave or pulse train. This pulse signal is then sent to the counter or controller which will then send the signal to produce the desired function. The diagram is for a typical rotary encoder. Incremental encoders can provide a once-per-revolution pulse (often called the index, marker, or reference) that occurs at the same mechanical point of the encoder shaft revolution. This pulse is on a separate output channel (Z) from the signal channel or quadrature outputs. The index pulse is often used to position motion control applications to a known mechanical reference.



Resolution is a term used to describe the Cycles Per Revolution (CPR) for incremental encoders. Each incremental encoder has a defined number of cycles that are generated for each 360 degree revolution of the shaft. These cycles are monitored by a counter or motion controller and converted to counts for position or velocity control. The diagram below is how the whole encoder comes together.

If you still have questions as to how an encoder works in your specific application, please feel free to call a Customer Service Representative for Technical Support.

TYPICAL USAGE

Motor Feedback is the most common use for rotary encoders. In this type of application, an encoder is either mounted directly to the motor, or indirectly using a measuring wheel or chain-and-sprocket arrangement. The parameter of interest is primarily the speed of the motor.

Web Tensioning is an application in which the encoder is not usually mounted to the drive motor, but to one of the tensioning arm rollers. Any unevenness in the speed of this roller indicates that proper web tension is not being maintained and must be adjusted. The rotating speed of the tensioning roller is fed back to the controller, which then adjusts the drive motor so that web material is kept at an even tension.

Cut-to-Length is a very practical application of an encoder combined with simple mathematics. If, for example, a system were to be designed with a roller that is exactly one foot in circumference, the roller would feed one foot of material for every revolution of the roller. An encoder mounted to the roller would reflect this situation and could tell a controller how much material had been fed through the roller. The resolution of the encoder would also directly reflect the accuracy of the cut. In the above example, 96 CPR would yield cuts to an 1/8" accuracy.

Elevators are just one example where encoders can perform a dual role. They can determine the position of the elevator through a mathematical calculation similar to the above, and they can determine the speed of travel of the elevator.

Registration Mark Timing uses encoders to determine the position of a unit relative to a known point, and then to determine the unit's speed relative to that mark. Radar antenna rotation is a good example of this type of application.

In **Backstop Gauging** the encoder is used to make sure that the unit, typically a machine tool, does not exceed a preset position or direction of travel. Very often, this is combined with a determination of the speed of travel of the table, tool head, or similar component. Filling applications is just one example where Table Positioning is critical since the item being filled must arrive at filling tube at the same time the fluid control is turned on.

Conveying is another common industry where encoders are widely used. They may be attached to the motor, to intermediate axle shafts, or to both. Encoders are an especially effective feedback device where the positioning and/or speed of multi-element conveying systems must be carefully coordinated.

Spooling (sometimes referred to as **Level Wind**) is another application where encoders can prove invaluable. Not only is it necessary that the speed of the supply and take-up reels be kept in proper relation to each other, but the amount of material being spooled must also often be tracked.

Electronics is just one industry that widely uses encoders in Pick and Place applications. Here many of the capabilities of encoders (rate, position, speed, velocity) can often be found combined in a single system.

MODEL 15T/H

Ø1.5"

FEATURES

Very High Performance Economical Encoder
Low Profile 1.0" (25.4 mm) Height and 1.5" (38 mm) Diameter
Thru-Bore with Sizes up to 0.375" (10 mm)
Simple, Innovative Flex Mounting System (Global Mounting Standards)
Up to 12 Pole Commutation Optional for Brushless Motor Control

The Model 15T or 15H offers a high performance feedback solution in a low profile package. Unlike modular or kit encoders, the Model 15 utilizes an integral bearing set and an innovative flexible mounting system which are much more tolerant to axial misalignment or radial shaft run-out. The slotted flex mounts provide 20 or 30 degrees of rotational adjustment for commutation or index pulse timing. Installation is quick and easy—for brushless servo motor applications, three 120° electrical phase tracks can provide up to 12 pole commutation feedback. The optional 100° C and 120° C temperature options allow servo motors to operate at higher power outputs and duty cycles. The Model 15 provides stable and reliable operation and is an excellent replacement for other manufacturers' modular encoders where a high performance solution is desired.

COMMON APPLICATIONS

Servo Motor Control, Robotics, Specialty Assembly Machines, Digital Plotters, High Power Motors

MODEL 15T/H ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical | Optional Features (Leave Blank For Standard Options: -20° to +85° C Std | IP50 Std | None Std)

15T – 01 SF – 0500 N 5 A OC – F00 – [ ] [ ] [ ] [ ]

MODEL
15T Thru-Bore
15H Hollow Bore

BORE SIZE[1]
15 3/16", 0.1875"
01 1/4", 0.250"
03 5/16", 0.3125"
02 3/8", 0.375"
08 4 mm
06 5 mm
04 6 mm
14 8 mm
05 10 mm

MOUNTING
SF 1.812" (46 mm) Slotted Flex-Mount
SA 1.812" (46 mm) Two Hole Flex Mount
SB 1.142" (29 mm) Slotted Flex Mount[2]
SC 1.2795" (32.5 mm) Slotted Flex Mount[2]
SD 1.575" (40 mm) Slotted Flex Mount[2]

CYCLES PER REVOLUTION
See CPR Options below
Price adder for CPR>1999

COMMUTATION[3]
N No Commutation
A 4 Pole
B 6 Pole
C 8 Pole
E 10 Pole
D 12 Pole

INPUT VOLTAGE
5 5 VDC
V1 5 to 28 VDC

NUMBER OF CHANNELS[4]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A[5]
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
OC Open Collector
PP Push-Pull
HV Line Driver
PU Pull-Up Resistor[6]
OD Open Collector with Differential Outputs
Available on special request.
Additional lead times may apply:
LO Line Driver on ABZ
Open Collector on UVW[6]

CONNECTOR TYPE[7]
F00 18" Cable[8] (Std)
F01 12" Cable
F02 24" Cable
F03 36" Cable
M00 2M Cable[9]
J00 18" Cable with 5-pin M12[10]
K00 18" Cable with 8-pin M12[10]
A00 15-pin Header with 18" Cable[11]

MAXIMUM FREQUENCY
Standard
F3 Extended
See Specifications

OPERATING TEMPERATURE
-20° to +85° C (Std)
T1 -40° to +85° C
T2 -20° to +100° C
T3 -20° to +120° C[12]

SEALING
IP50 (Std)
S1 IP64 for Thru-Bore & Blind Hollow Bore

CERTIFICATION
None (Std)
CE CE Marked[13]

MODEL 15T/H CPR OPTIONS

0001 thru 0189	0198	0200	0250	0256	0300	0315	0360	
0400	0500	0512	0580	0600	0750	0800	1000	1024
1125	1200	1250	1500	1800	2000	2048	2500	2540
3000	3600	4000	4096	5000	6000	7200	8192	10,000

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available values. Special disk resolutions are available upon request and may be subject to a one-time NRE fee.

NOTES:
1 Contact Customer Service for additional options not shown.
2 This mount requires button head screws and a modified Hex wrench. Order appropriate Installation Kit listed under Specifications.
3 Not available in all configurations, and not available with V1 Input Voltage. Contact Customer Service for availability.
4 Contact Customer Service for non-standard index gating or phase relationship options.
5 Reverse Quadrature not available with PU output type.
6 With Input Voltage above 16 VDC, operating temperature is limited to 85° C.
7 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
8 For non-standard English cable lengths enter 'F' plus cable length expressed in feet. Example: F06 = 6 feet of cable. Frequency above 300 kHz standard cable lengths only.
9 For non-standard metric cable lengths enter 'M' plus cable length expressed in meters. Example: M06 = 6 meters of cable.
10 Not available with commutation. 5-pin not available with Line Driver (HV, OD, LO) outputs. Additional cable lengths available. Please consult Customer Service.
11 Pin Header available with 5 VDC Input Voltage, HV Line Driver and standard quadrature phasing only. Not available with CE Certification. IP50 sealing option only.
12 Only available with 5 VDC Input Voltage.
13 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 15T/H SPECIFICATIONS

Electrical

Input Voltage..... 5 VDC +10% Fixed Voltage
4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° to 100° C

Input Current ..... 100 mA max (65 mA typical) with no output load

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face. See *Waveform Diagrams*.

Output Types..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Pull-Up- Open collector with 2.2K ohm Pull-Up 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution
1 to 189 CPR: Ungated
190 to 10,000 CPR: Gated to output A
See *Waveform Diagrams.*

Max. Frequency ..... Standard Frequency Response is 200 kHz for CPR 1 to 2540
500 kHz for CPR 2541 to 5000
1 MHz for CPR 5001 to 10,000
Extended Frequency Response (optional) is 300 kHz for CPR 2000, 2048, 2500, and 2540

Noise Immunity..... Tested to BS EN61000-6-2; BS EN50081-2; BS EN61000-4-2; BS EN61000-4-3; BS EN61000-4-6; BS EN500811

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Waveform Symmetry... 180°(±18°) electrical (single channel encoder)

Accuracy..... Within 0.017° mechanical or 1 arc-minute from true position (for CPR>189)

Commutation..... Up to 12 pole. Contact Customer Service for availability.

Comm. Accuracy ..... 1° mechanical

Mechanical

Max Shaft Speed..... 8000 RPM. Higher speeds may be achievable, contact Customer Service.

Bore Tolerance ..... -0.0000" / +0.0006"

User Shaft Tolerances
Radial Runout ..... 0.008" max
Axial Endplay..... ±0.030" max

Starting Torque ..... IP50 Hollow Bore: 0.2 oz-in
IP50 Thru-Bore: 0.3 oz-in
IP64: 0.6 oz-in

Moment of Inertia ... 6.7 x 10^{-5} oz-in-sec^2 (4.8 gm-cm^2)

Max Acceleration ..... 1 x 10^5 rad/sec^2

Weight..... 3 oz typical

Environmental

Storage Temp ..... -25° to +85° C

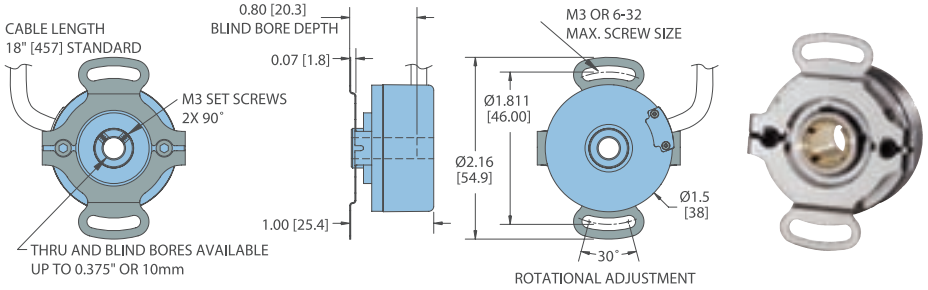
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

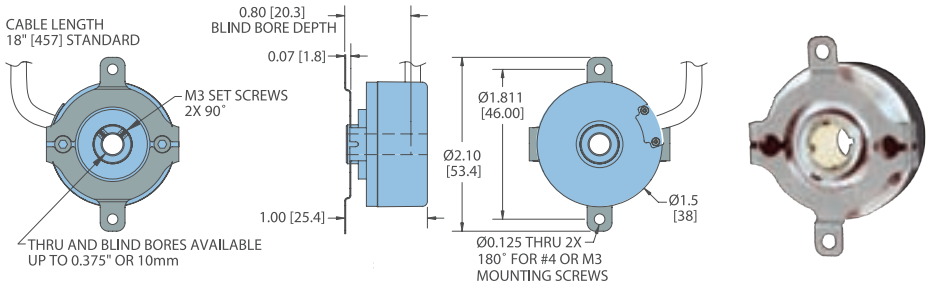
Shock..... 80 g @ 11 ms duration

Sealing..... IP50 standard; IP64 available

MODEL 15T/H 1.811" (46 MM) SLOTTED FLEX MOUNT (SF)

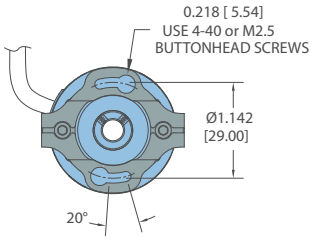


MODEL 15T/H 1.811" (46 MM) TWO HOLE FLEX MOUNT (SA)

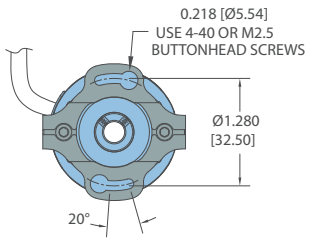


MODEL 15T/H SMALL DIAMETER SLOTTED FLEX MOUNTS

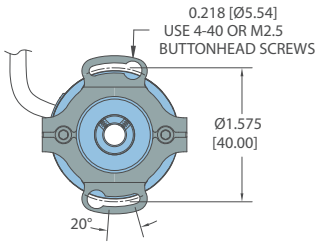
1.142" (29 mm) SB*



1.2795" (32.5 mm) SC*



1.575" (40 mm) SD*



*Order Appropriate No Charge Mounting and Installation Kit for SB, SC, or SD Option. Each kit contains 10 screws for mounting 5 encoders.

176150-01 Installation Kit, 4-40 Buttonhead Screws with 0.062" Shortened Hex Wrench

176149-01 Installation Kit, M2.5 Buttonhead Screws with 1.5 mm Shortened Hex Wrench

Encoder length and diameter are the same as SF and SA mounts detailed above. All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified. Metric dimensions are given in brackets [mm].

SB Slotted Flex Mount

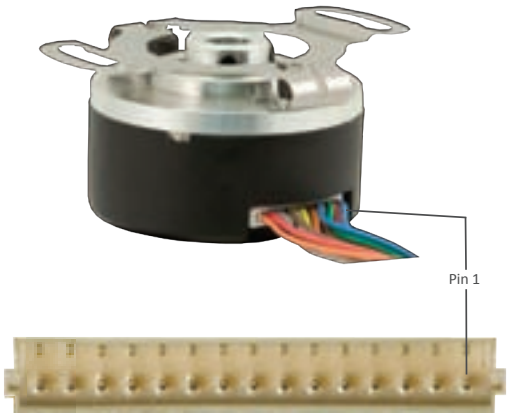
MODEL 15T/H

WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**	15-pin Header
Com	Black	3	7	1
+VDC	White	1	2	2
A	Brown	4	1	4
A'	Yellow	--	3	3
B	Red	2	4	6
B'	Green	--	5	5
Z	Orange	5	6	7
Z'	Blue	--	8	8
U	Violet	--	--	10
U'	Gray	--	--	9
V	Pink	--	--	14
V'	Tan	--	--	13
W	Red/Green	--	--	12
W'	Red/Yellow	--	--	11
Shield	Bare*	--	--	--

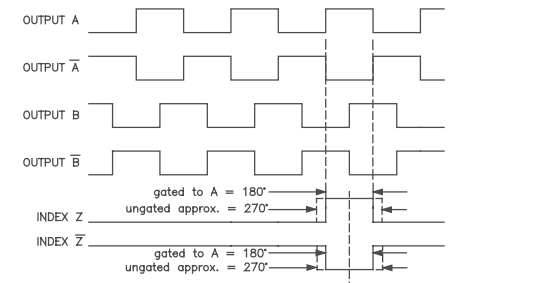
*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body
CE Option: Cable shield and M12 connector body is connected to internal case.
†Standard cable for non-commutated models is 24 AWG For commutated units, conductors are 28 AWG.

15-pin Header

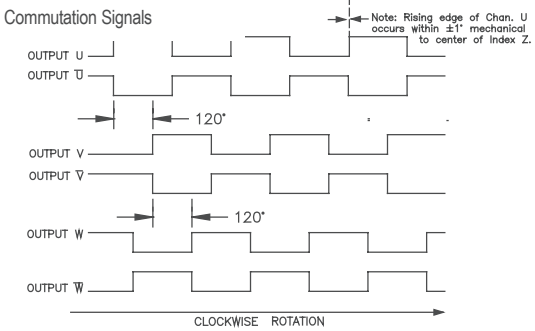


WAVEFORM DIAGRAMS

Incremental Signals



Commutation Signals



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV AND OD OUTPUTS ONLY.

EPC HAS THE SOLUTION

Replacing Your Foreign Encoder Has Never Been Easier

MODEL 15S

M1 - 3x120°
M3 on 1.102" BC
0.787" Dia. Boss
- Automation Dir TRDS
- Nemicon OEW
- Sumtak IRS3
- Tamagawa OIS38

M3 - 2.093" Sq. Flange
0.688" Dia. Boss
- DRC M2

M4 - 2.093" Dia.
0.688" Dia. Boss
- DRC 23
- DRC 77L
- DRC M2

M5 - 0.8745" Dia. Boss
- Dynapar E14

M6 - 0.6875" Dia. Boss
M3x0.5-6H 0.187" Deep
4x1.000" BC
- Dynapar E23
- Tekel TK-15

M7 - 0.7870" Dia. Boss
M3 0.18" Deep
4x1.181" BC
- Nemicon OEW

MODEL 15T

SA - 1.811" Bolt
Circle Mounting
- DRC 730
- DRC 731
- DRC T23
- Sumtak LBK/LDA

SB - 1.142" (29mm)
Bolt Circle Mounting
- Dynapar F14

SC - 1.2795" (32.5mm
Bolt Circle Mounting
- Dynapar M14
- Renco RCM15

SD - 1.575" (40 mm
Bolt Circle Mounting
- Sumtak IRH3
- Sumtak IRT3

SF - 1.811" Bolt
Circle Mounting
- DRC H15
- Dynapar M15
- Dynapar M21
- Dynapar F14
- Renco RCM15
- Sumtak LBK/LDA
- Turck 8.3720

Cross References

Contact EPC with your cross reference request and you will receive a prompt, informative response that will help you serve your customers better, while reducing your overhead.

EPC also has a complete line of motor friendly encoders that easily fit motor sizes from small to large.

The Model 15 can be crossed to many encoders. This is not a comprehensive list. Please contact Customer Service for additional offerings and to ensure complete and accurate cross-referencing.

Model 15T

15T and 15H are the superior choice for your servo or stepper motor applications. Endurance under high temperature conditions, high resolution performance, commutation, and flexible mounting options make the 15T/H an unbeatable encoder.

For help selecting the correct motor kit for your motor, please contact our encoder experts today.

Model 15S

15S has more mounting face options than any other 1.5" shaft encoder. A variety of bosses and bolt hole patterns will provide cross-reference adaptability like no other encoder.

Visit www.encoder.com for a product datasheet and to view our full line of replacement encoders.

ENCODER PRODUCTS COMPANY

MODEL 755A HOLLOW BORE

FEATURES

Miniature Size (1.5" Diameter)
Up to 30,000 Cycles Per Revolution
Flex Mounting & Large Hollow Bore Option (up to 0.750")
High Temperature Option

The Model 755A Size 15 Accu-Coder™ is ideal for applications requiring a small, high-precision, high-performance encoder. Approximately 1.5" in diameter and 1.5" long, it will fit where many encoders cannot. All metal construction and shielded ball bearings provide years of trouble-free use. A variety of blind hollow bore sizes are available with large bores allowing for shafts up to 0.750" or 14 mm. Attaching directly to a motor is quick and simple with the innovative flex mount, first developed by EPC. This industry standard mount eliminates couplings and increases reliability, while reducing overall length and cost. Where critical alignment is required, a Slotted Flex (SF) is available. A perfect replacement encoder where high reliability is required.

COMMON APPLICATIONS

Robotics, Assembly Machines, Motor-Mounted Feedback, Phototypesetters, Printers & Digital Plotters, Elevator Controls, Medical Diagnostic Equipment

MODEL 755A ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

755A – 01 – S – 1000 – R – HV – 1 – S – S – CE

MODEL
755A Model 755A

BORE SIZES[1]

15	3/16", 0.1875"	16	4 mm
01	1/4", 0.250"	18	5 mm
03	5/16", 0.3125"	04	6 mm
02	3/8", 0.375"	14	8 mm
10	1/2", 0.500"	05	10 mm
11	5/8", 0.625"	12	12 mm
17	3/4", 0.750"	13	14 mm

OPERATING TEMPERATURE
L -40° to 70° C
S 0° to 70° C
H 0° to 100° C[2]

CYCLES PER REVOLUTION 1-30,000
See *CPR Options* below for available resolutions.
Price adder for CPR >1270

NUMBER OF CHANNELS[3]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[4]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver
V In/5V Out[5,6]
H5 Line Driver
P5 Push-Pull

MAXIMUM FREQUENCY
1 Standard 100 kHz
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[7]
4 1 MHz, >10,000 CPR[7]

MOUNTING
S Standard Flex Mount
SF Slotted Flex Mount

CONNECTOR TYPE[8]
S Standard 18" Cable[9]
C01 8-pin Molex
C02 Terminal Block
J00 18" Cable with 5-pin M12[10]
K00 18" Cable with 8-pin M12[10]

CERTIFICATION
N None
CE CE Marked[11]

MODEL 755A CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*	0011*
0012*	0014*	0020	0021*	0024*	0025*	0028*	0030*	0032*
0033*	0034*	0035*	0038*	0040*	0042*	0045*	0050*	0060
0064*	0100	0120	0125	0128*	0144*	0150*	0160*	0192*
0200	0240*	0250	0254*	0256*	0300	0333*	0360	0400
0500	0512	0600	0625*	0635	0665*	0720	0768*	0800
0889	0900*	1000	1024	1200	1201*[a]	1203*[a]	1204*[a]	1250[a]
1270[a]	1440	1500	1800	2000	2048	2400[a]	2500	2540[a]
2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]	7500[a]
9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	15,000[a]	18,000[a]	
20,000[a]	20,480[a]	25,000[a]	30,000[a]					

*Contact Customer Service for High Temperature Option.
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 Contact Customer Service for additional options.
2 0° to 85° C for certain resolutions, see CPR Options.
3 Contact Customer Service for index gating options.
4 24 VDC max for high temperature option.
5 Standard temperature, 60 to 3000 CPR only.
6 H5 and P5 outputs are not available with CE option.
7 Standard cable lengths only. For details, please refer to Technical Bulletin TB116: *Noise and Signal Considerations* at www.encoder.com.
8 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
9 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: S/6 = 6 feet of cable.
10 5-pin not available with Line Driver (HV, H5) outputs. Additional cable lengths available. Please consult Customer Service.
11 Please refer to Technical Bulletin TB100: *When to Choose the CE Option.*

MODEL 755A SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face. See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.

Max Frequency ..... Up to 1 MHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Symmetry..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 20,480 CPR: 180° (±36°) electrical

Quad Phasing..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 20,480 CPR: 90° (±36°)

Min Edge Sep..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical

Rise Time..... Less than 1 microsecond

Accuracy..... Instrument and Quadrature Error: For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

Mechanical

Max Shaft Speed..... 7500 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Bore Tolerance ..... -0.0000" / +0.0006"

User Shaft Tolerances
- Radial Runout ..... 0.007" max
- Axial End Play..... ±0.030" max

Starting Torque ..... 0.14 oz-in typical
4.0 oz-in typical for -40° C operation

Moment of Inertia ... 2.8×10^{-4} oz-in-sec^2

Max Acceleration ..... 1×10^5 rad/sec^2

Housing ..... Black non-corrosive finish

Bearings..... Precision ABEC ball bearings

Weight..... 3.50 oz typical

Environmental

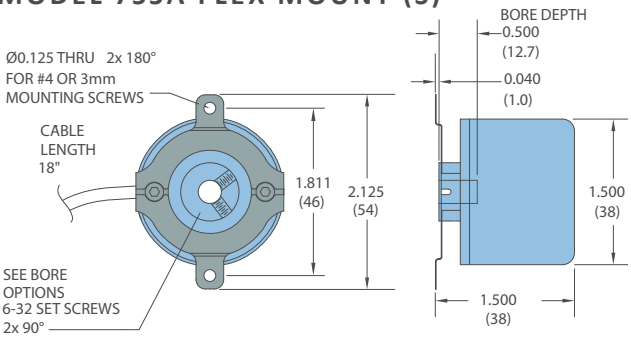
Storage Temp ..... -25° to +85° C

Humidity..... 98% RH non-condensing

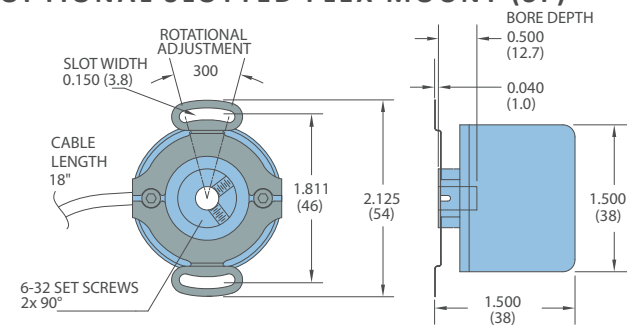
Vibration..... 10 g @ 58 to 500 Hz

Shock..... 50 g @ 11 ms duration

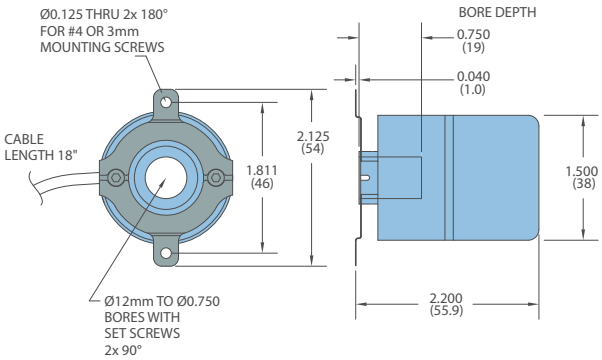
MODEL 755A FLEX MOUNT (S)



OPTIONAL SLOTTED FLEX MOUNT (SF)



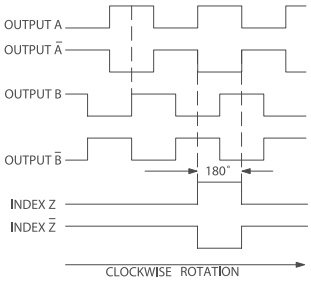
MODEL 755A LARGE BORE FLEX MOUNT (S)



All dimensions are in inches with a tolerance of +0.005" or +0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

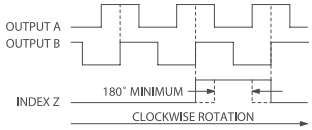
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
INDEX IS POSITIVE GOING.

WIRING TABLE

Function	Cable† Wire Color	Terminal Block	8-pin Molex	5-pin M12**	8-pin M12**
Com	Black	7	2	3	7
+VDC	White	8	1	1	2
A	Brown	1	8	4	1
A'	Yellow	2	7	--	3
B	Red	3	4	2	4
B'	Green	4	3	--	5
Z	Orange	6	6	5	6
Z'	Blue	5	5	--	8
Shield	Bare*	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**CE Option: Read Technical Bulletin TB111. Available at encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 121

Ø2.1"
Patent #6,608,300B2

FEATURES

Simple, Hassle Free Mounting
Accepts Larger Shafts up to 5/8" (or 15 mm)
Up to 12 Pole Commutation Available
0° to 100° C Operating Temperature Available
Patented Design
Includes New IP50 Dust Seal Kit

EPC has taken the performance of modular encoders to a new level with the Model 121 Auto-Aligning Modular Encoder. This new and innovative design requires no calibration, gapping or special tools for hassle-free installation. The Model 121 incorporates the latest Optical ASIC technology for enhanced performance. Common problems with other modular encoder designs are warping and deflection, caused by their extensive use of plastic, both of which are virtually eliminated by the Model 121's all metal construction. For brushless servo motor applications, the Model 121 can be specified with three commutation tracks to provide motor feedback. The optional 100°C temperature capability allows servo motors to operate at higher power outputs and duty cycles.

COMMON APPLICATIONS

Servo Motor Control, Robotics, Specialty Assembly Machines, Digital Plotters, High Power Motors

MODEL 121 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

121 – N – A – 5 – 01 – S – 0256 – Q – OC – 1 – S – N

MODEL
121 Auto-Aligning Modular Thru-Bore

COMMUTATION[1]
N No Commutation
C4 4 Pole
C6 6 Pole
C8 8 Pole
C12 12 Pole

MOUNTING & HOUSING STYLE
A Mounting Style A

INPUT VOLTAGE
5 5 VDC
12 12 VDC

BORE SIZE[2]
01 1/4", 0.250"
03 5/16", 0.3125"
02 3/8", 0.375"
10 1/2", 0.500"
11 5/8", 0.625"
06 5 mm
04 6 mm
14 8 mm
05 10 mm
12 12 mm
13 14 mm
15 15 mm

OPERATING TEMPERATURE
S 0° to 70° C
H 0° to 100° C

CYCLES PER REVOLUTION
See *CPR Options* below
Price adder >1999

NUMBER OF CHANNELS[3]
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index
See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.

OUTPUT TYPE
OC Open Collector
PP Push-Pull
HV Line Driver

MAXIMUM FREQUENCY
1 100 kHz
2 200 kHz
3 300 kHz[4]

CONNECTOR TYPE
S 18" Cable[5]

CERTIFICATION
N None
CE CE Marked[6]

MODEL 121 CPR OPTIONS

0200	0250	0254	0256	0300	0360	0500
0512	0600	0720	0800	0840	1000	1024
1200	1250	1800*	2000*	2048*	2500*	2540*

*Contact Customer service for application analysis.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available values. Special disk resolutions are available upon request and may be subject to a one-time NRE fee.

NOTES:
1 Not available in all configurations. Contact Customer Service for availability.
2 Contact Customer Service for additional options not shown.
3 Contact Customer Service for non-standard index gating options.
4 Standard 0° to 70° C operating temperature only.
5 For Non-Standard Cable Lengths add a forward slash (/) plus cable length expressed in feet. Example: S/6 = 6 feet of cable.
6 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 121 SPECIFICATIONS

Electrical

Input Voltage..... 5 VDC +10% Fixed Voltage
12 VDC +10% Fixed Voltage
Input Current..... 100 mA maximum with no output load
Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face. Index optional
Output Types..... Open Collector- 20 mA per channel max
Push-Pull- 20 mA per channel max
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)
Index..... Once per revolution gated to channel A. Contact Customer Service for additional gating options.
Max Frequency ..... 100 kHz standard, 200 kHz, and 300 kHz optional
Quadrature Edge Separation..... 67.5° electrical or better is typical, 54° electrical minimum at temperatures > 99° C
Accuracy..... Within 0.1° mechanical from one cycle to any other cycle, or 6 arc minutes
Commutation..... Optional- three 120° electrical phase tracks for commutation feedback. (4, 6, 8, or 12 poles. Others available upon request)
Comm. Accuracy..... 1° mechanical

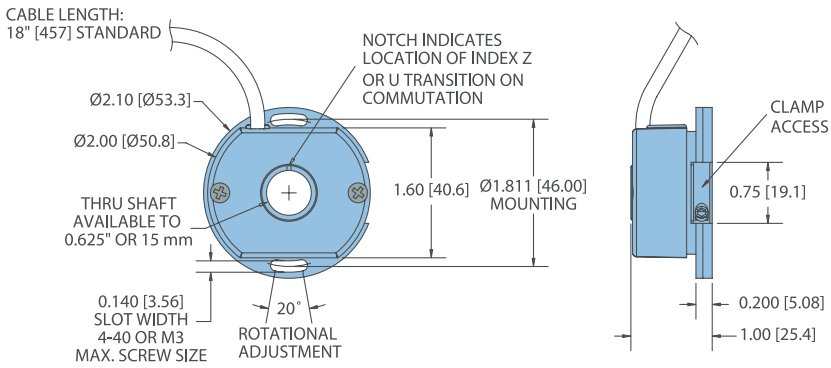
Mechanical

Max. Shaft Speed..... Determined by maximum frequency response
Bore Tolerance..... +0.0007" (max) -0.0000" (Based on H7 bore fit for g6 shaft Class LC5 per ANSI B-4.1 standard)
User Shaft Tolerance
Radial Runout..... 0.002" max
Axial End Play..... ±0.015" for CPR <= 512
±0.010" for CPR 513 to 1250
±0.005" for CPR > 1250
Moment of Inertia... 2.5 x 10^{-4} oz-in-sec^2
Max. Acceleration... 5 x 10^5 rad/sec^2
Housing..... All Metal Aluminum and Zinc Alloy
Weight..... 4 oz typical

Environmental

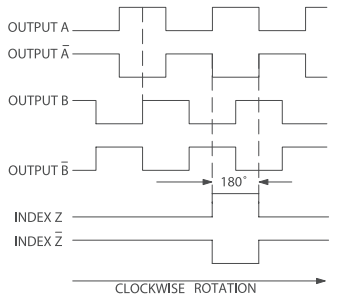
Storage Temp..... -25° to +100° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 50 g @ 11 ms duration

MODEL 121 AUTO-ALIGNING MODULAR (A)

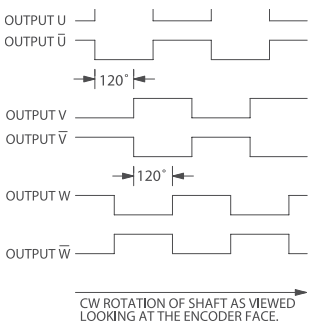


All dimensions are in inches with a tolerance of +0.005" or +0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

WAVEFORM DIAGRAMS



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

WIRING TABLE

Function	Cable† Wire Color
Com	Black
+VDC	White
A	Brown
A'	Yellow
B	Red
B'	Green
Z	Orange
Z'	Blue
U	Violet
U'	Gray
V	Pink
V'	Tan
W	Red/Green
W'	Red/Yellow
Shield	Bare*

*CE Option: Cable shield (bare wire) is connected to internal case.
†Standard cable for non-commutated models is 24 AWG For commutated units, conductors are 28 AWG.

MODEL 260

Ø2.0"

FEATURES

Low Profile 1.19"
Up to 12 Pole Commutation
Thru-Bore and Hollow Bore (Blind) Styles
Simple, Innovative Flexible Mounting System
Incorporates Opto-ASIC Technology
CE Marking Available

The Model 260's larger bore (up to 0.625") and low profile make it the perfect solution for many machine and motor applications. Available in two distinct formats—a Hollow Bore and a complete Thru-Bore—the Model 260 uses EPC's pioneering Opto-ASIC design. The Model 260 uses EPC's innovative anti-backlash mounting system, allowing simple, reliable, and precise encoder attachment. Unlike traditional kit or modular encoder designs, its integral bearing set provides stable and consistent operation without concerns for axial or radial shaft runout. For brushless servo motor applications, the Model 260 can be specified with three 120° electrical phase tracks to provide up to 12 pole commutation feedback. The optional extended temperature capability allows servo motors to operate at higher power outputs and duty cycles.

COMMON APPLICATIONS

Brushless Servo Motor Commutation, Robotics, Motor-Mounted Feedback, Assembly Machines, Digital Plotters, High Power Motors

MODEL 260 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

260 – N – T – 01 – S – 0256 – Q – OC – 1 – S – SF – 1 – N

MODEL
260 Ultra Versatile Commutated Thru-Bore

COMMUTATION[1]
N No Commutation
C4 4 Pole
C6 6 Pole
C8 8 Pole
C10 10 Pole
C12 12 Pole

HOUSING STYLE
B Hollow Bore (Blind)
T Front Clamp Thru-Bore
R Rear Clamp Thru-Bore

BORE SIZE[2]
01 1/4", 0.250"
02 3/8", 0.375"
76 7/16", 0.4375"
10 1/2", 0.500"
11 5/8", 0.625"
06 5 mm
04 6 mm
14 8 mm
05 10 mm
09 11 mm
12 12 mm
13 14 mm
15 15 mm

OPERATING TEMPERATURE[3]
L -40° to 70° C
S 0° to 70° C
H 0° to 100° C
V 0° to 120° C

CYCLES PER REVOLUTION
1-10,000
See *CPR Options* below
Price adder >1999

NUMBER OF CHANNELS[4]
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index
See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.

OUTPUT TYPE
OC Open Collector
PP Push-Pull
HV Line Driver
OD Open Collector with Differential Outputs

MAXIMUM FREQUENCY
1 Standard
2 Extended
See specifications for explanation.

CONNECTOR[5] **TYPE**
S 18" Cable[6]
J00 18" Cable with 5-pin M12[7]
K00 18" Cable with 8-pin M12[7]
SMJ 5-pin Body Mount M12[7]
SMK 8-pin Body Mount M12[7]
SMH 10-pin Body[8] Mount Bayonet

MOUNTING
SD 1.575" (40 mm) BC Flex Mount
SF 1.811" (46 mm) BC Flex Mount
SL 2.36" (60 mm) BC Flex Mount
XF 2.250" BC 3-point Flex Mount
NF 2.375" BC 3-point Flex Mount
FA 1.06" to 1.81" BC Flex Arm
FB 1.50" to 3.13" BC Flex Arm

SEALING
1 IP50 for Thru-Bore
2 IP64 for Thru-Bore
3 IP64 for Hollow Bore
4 IP50 for Hollow Bore

CERTIFICATION
N None
CE CE Marked[9]

MODEL 260 CPR OPTIONS

0001 thru 0189*		0200	0250	0254	0256
0300	0360	0400*	0500	0512	0600
0720	0800	0840	1000	1024	1200
1220	1250	1270	1500	1800	2000
2048	2500	2540	3000	3600	4000
4096	5000	6000	8192	7200	10,000

*Contact Customer Service for availability.

Contact Customer Service for other disk resolutions. Not all disk resolutions available with every commutation option.

NOTES:
1 Not available in all configurations. Contact Customer Service for availability.
2 Contact Customer Service for additional options not shown.
3 5 to16 VDC supply only for H option; 5 VDC supply only for V option. Contact Customer Service for availability and additional information.
4 Contact Customer Service for non-standard index gating options.
5 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
6 For non-standard cable lengths add a forward slash (/) plus cable length expressed in feet. Example: S/6 = 6 feet of cable. Frequency above 300 kHz standard cable lengths only.
7 Not available with commutation or extreme temperature (V) option. 5-pin not available with Line Driver (HV) output. Additional cable lengths available. Please consult Customer Service.
8 Not available with commutation.
9 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 260 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC for temperatures up to 70° C
5 to 16 VDC for 0° to 100° C operating temperature
5 VDC for 0° to 120° C operating temperature

Input Current ..... 100 mA max with no output load

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face.
See *Waveform Diagrams.*

Output Types..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution gated to channel A.
See *Waveform Diagrams.*

Max. Frequency ..... Standard Frequency Response is 200 kHz for CPR 1 to 2540
500 kHz for CPR 2541 to 5000
1 MHz for CPR 5001 to 10,000
Extended Frequency Response (optional) is 300 kHz for CPR 2000, 2048, 2500, and 2540

Noise Immunity..... Tested to BS EN61000-6-2; BS EN50081-2; BS EN61000-4-2; BS EN61000-4-3;
BS EN61000-4-6, BS EN55011

Quadrature..... 67.5° electrical or better is typical,

Edge Separation..... 54° electrical minimum at temperatures > 99° C

Accuracy..... Within 0.01° mechanical from one cycle to any other cycle, or 0.6 arc minutes.

Commutation..... Up to 12-pole. Contact Customer Service for availability.

Comm. Accuracy..... 1° mechanical

Mechanical

Max Shaft Speed..... 7500 RPM. Higher shaft speeds may be achievable, contact Customer Service.
Note: For extreme temperature operation, de-rate temperature by 5° C for every 1000 RPM above 3000 RPM

Bore Tolerance ..... -0.0000" / +0.0006"

User Shaft Tolerances

Radial Runout ..... 0.007" max

Axial Endplay..... ±0.030" max

Starting Torque ..... IP50 Thru-Bore: 0.50 oz-in
IP50 Hollow Bore: 0.30 oz-in
IP64 Thru-Bore: 2.50 oz-in
IP64 Hollow Bore: 2.0 oz-in
Note: Add 3.0 oz-in for -40° C operation

Moment of Inertia ... 3.9×10^{-4} oz-in-sec^2

Max Acceleration ..... 1×10^5 rad/sec^2

Housing ..... Non-corrosive material

Weight..... 3.5 oz typical

Environmental

Storage Temp ..... -40° to +100° C

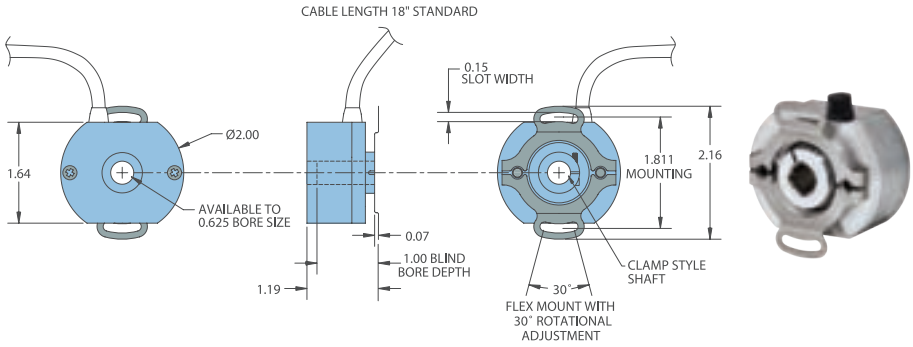
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

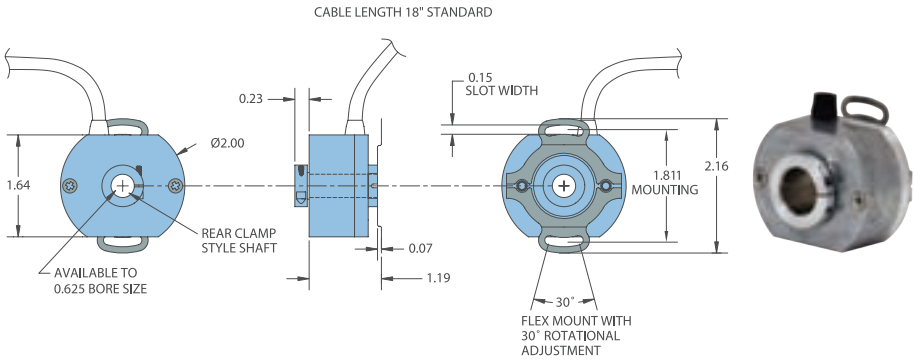
Shock..... 50 g @ 11 ms duration

Sealing..... IP50; IP64 available

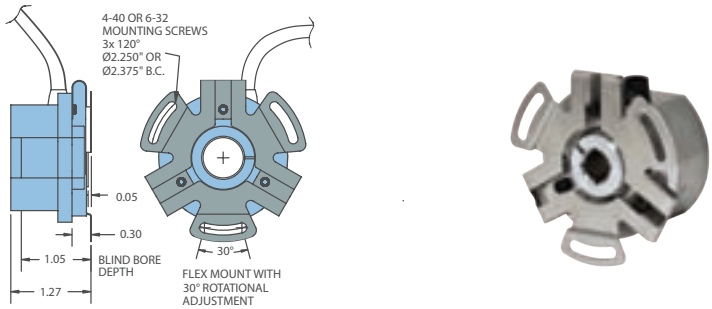
MODEL 260 WITH FRONT SHAFT CLAMP (T)
WITH 1.811" (46 MM) BC SLOTTED FLEX (SF)



MODEL 260 REAR CLAMP (R)
WITH 1.811" (46 MM) BC SLOTTED FLEX (SF)



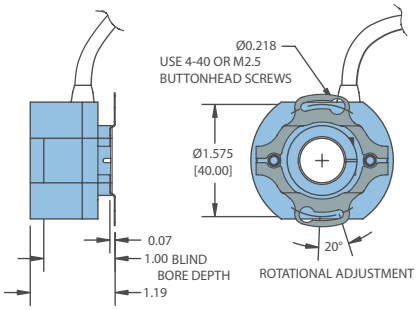
THREE POINT FLEX MOUNT (XF, NF)



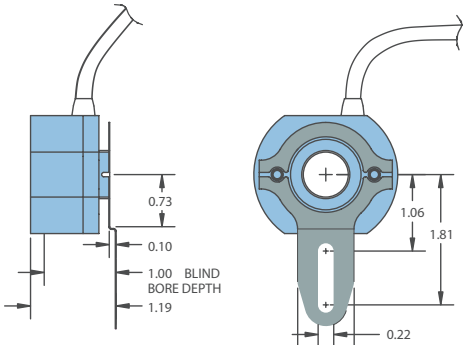
All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

MODEL 260

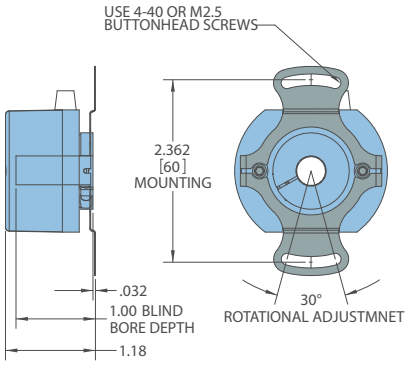
1.575" (40 MM) BC FLEX MOUNT (SD)



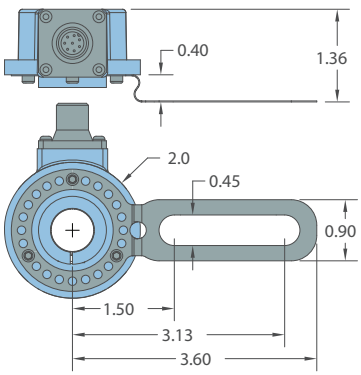
1.06" TO 1.81" FLEX ARM (FA)



2.36" (60 MM) BC FLEX MOUNT (SL)



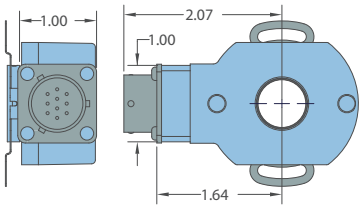
1.50" TO 3.13" FLEX ARM (FB)



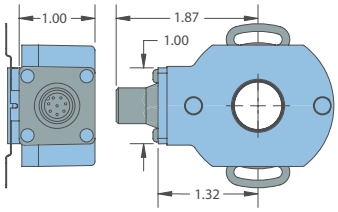
All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

MODEL 260 CONNECTOR OPTIONS

BODY MOUNT 10-PIN BAYONET (SMH)

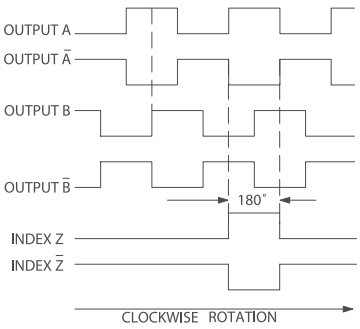


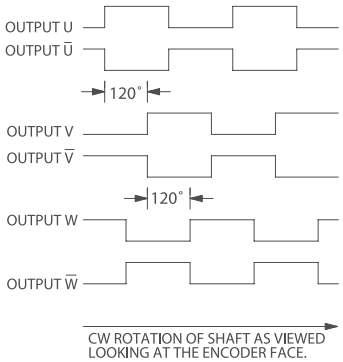
BODY MOUNT M12 (SMJ, SMK)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

WAVEFORM DIAGRAMS





NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV AND OD OUTPUTS ONLY.

WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**	10-pin Bayonet+
Com	Black	3	7	F
+VDC	White	1	2	D
A	Brown	4	1	A
A'	Yellow	--	3	H
B	Red	2	4	B
B'	Green	--	5	J
Z	Orange	5	6	C
Z'	Blue	--	8	K
U	Violet	--	--	--
U'	Gray	--	--	--
V	Pink	--	--	--
V'	Tan	--	--	--
W	Red/Green	--	--	--
W'	Red/Yellow	--	--	--
Shield	Bare*	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body.
CE Option: Cable shield and M12 connector body is connected to internal case.
+CE Option: Pin G is connected to internal case.
†Standard cable for non-commutated models is 24 AWG For commutated units, conductors are 28 AWG.

MODEL 225A/Q

FEATURES

Single Channel & Quadrature Models
Easy to Mount Economical Thru-Bore Design
Metal Construction
Bore Sizes To 0.875" or 22 mm

Controlling motor speed is essential for many production assembly machines or robotic equipment. For tachometer feedback, or motor speed control applications, the Model 225 Accu-Coder™ is the ideal encoder choice. The Model 225 Accu-Coder™ is a Thru-Bore encoder available in both single channel (225A) and quadrature (225Q) models. Providing a cost effective solution for simple measurement. Features including an all metal housing, a variety of connector options, and easy installation due to the Thru-Bore design, make the Model 225 Accu-Coder™ ideal for many motion control and manufacturing applications.

COMMON APPLICATIONS

Brushless Servo Motor Commutation, Robotics, Motor-Mounted Feedback, Assembly Machines, Digital Plotters, High Power Motors

MODEL 225A/Q ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

225Q – 10 – 100 – OC – N – N – K

MODEL
225A Single Channel
225Q Quadrature

OUTPUT TYPE
OC Open Collector
PU Pull-Up Resistor

CYCLES PER REVOLUTION
See *CPR Options* below
225A 1 - 600 CPR
225Q 1 - 100 CPR

BORE SIZES

01	1/4", 0.250"	07	7 mm
03	5/16", 0.3125"	05	10 mm
02	3/8", 0.375"	06	11 mm
10	1/2", 0.500"	12	12 mm
56	9/16", 0.562"	14	14 mm
11	5/8", 0.625"	15	15 mm
68	11/16", 0.6875"	16	16 mm
34	3/4", 0.750"	17	17 mm
18	7/8", 0.875"	19	19 mm
		20	20 mm
		22	22 mm

MOUNTING
N No Additional Mounting
F Flex Arm Kit

SEAL
N No Seal (Standard)
Y Bearing Seals[1]

CONNECTOR TYPE[2]
S 6 ft Cable[3]
T Terminal Block
9D 9-pin D-subminiature
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)

MODEL 225A/Q CPR OPTIONS

225A
1-600 CPR, all resolutions

225Q

001	002	003	004	005	006	010	011
015	016	020	022	025	030	032	040
048	050	060	062	080	083	090	099
100							

Contact Customer Service for other disk resolutions.

NOTES:
1 Shaft speed limited to 400 RPM.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 For Non-Standard Cable Lengths add a forward slash (/) plus cable length expressed in feet. Example: S/12 = 12 feet of cable.

MODEL 225A SPECIFICATIONS
SINGLE CHANNEL

Electrical

Input Voltage..... 4.75 to 24 VDC
Input Current ..... 32 mA max with Pull-Up option
Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz
Output Format..... Square wave 50% duty cycle
Output Types..... Open Collector- 100 mA max
Pull-Up- 20 mA max (1.5K)
Max Frequency ..... 0 to 6 kHz
Rise Time..... Less than 1 microsecond
Cycles per Rev..... 1 to 600

Mechanical

Max. Shaft Speed..... 4000 RPM
Bore Tolerance..... Bore H7 fit for g6 shaft Class LC5 per ANSI B-4.I Standard
Running Torque..... 10 oz-in typical
Housing ..... Black non-corrosive finish
Bearings..... Precision ABEC ball bearings
Weight..... 8 oz typical

Environmental

Storage Temp ..... -25° to +85° C
Humidity..... 95% RH non-condensing
Vibration..... 3 g @ 5 to 1000 Hz
Shock..... 20 g @ 10 ms duration

MODEL 225Q SPECIFICATIONS
QUADRATURE

Electrical

Input Voltage..... 4.75 to 24 VDC
Input Current ..... 64 mA max with Pull-Up option
Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz
Output Format..... Square wave 50% duty cycle in quadrature
Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 20 mA max per channel (1.5K)
Max Frequency ..... 0 to 6 kHz
Rise Time..... Less than 1 microsecond
Cycles Per Rev..... 1 to 100

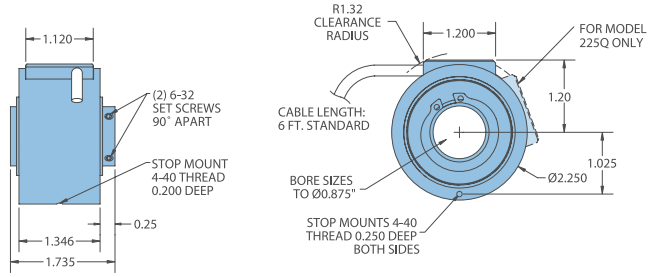
Mechanical

Max. Shaft Speed..... 4000 RPM
Bore Tolerance..... Bore H7 fit for g6 shaft Class LC5 per ANSI B-4.I Standard
Running Torque..... 10 oz-in typical
Housing ..... Black non-corrosive finish
Bearings..... Precision ABEC ball bearings
Weight..... 10 oz typical

Environmental

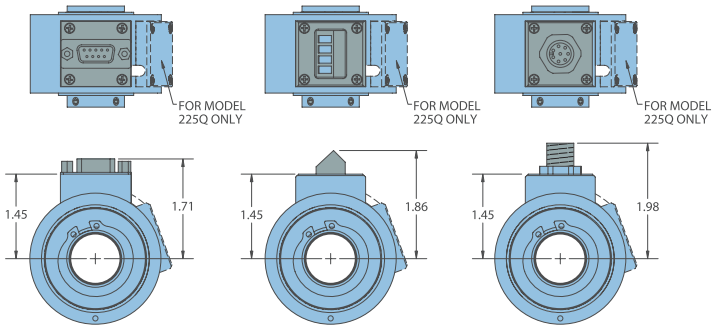
Storage Temp ..... -25° to +85° C
Humidity..... 95% RH non-condensing
Vibration..... 3 g @ 5 to 1000 Hz
Shock..... 20 g @ 10 ms duration

MODEL 225



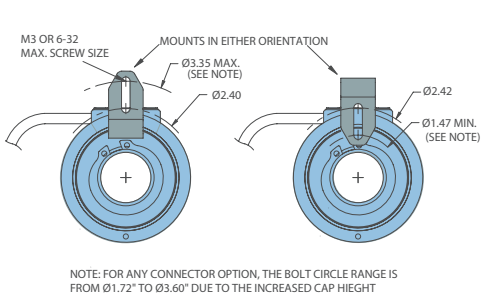
MODEL 225 CONNECTOR OPTIONS

9D 9-pin D-Subminiature
T Terminal Block
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)



MODEL 225 MOUNTING OPTION (F) FLEX ARM KIT

To order Model 225 Flexible Mounting Arm Kit as an accessory, order part #140106-01.
Kit may be mounted in either an up or down orientation.



NOTE: FOR ANY CONNECTOR OPTION, THE BOLT CIRCLE RANGE IS FROM Ø1.72" TO Ø3.60" DUE TO THE INCREASED CAP HIEGHT

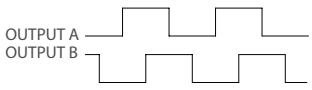
All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

WIRING TABLE

Function	Cable† Wire Color	5-pin M12	8-pin M12	Term Block	9-pin D-Sub
Com	Black	3	7	1	9
+VDC	Red	1	2	2	1
A	White	4	1	3	2
B	Green	2	4	4	4
Shield	Bare	--	--	--	--

†Standard cable is 24 AWG conductors with foil and braid shield.

WAVEFORM DIAGRAM
MODELS 225A/Q



NOTE: MODEL 225A INCLUDES OUTPUT A ONLY

MODEL 25T/H

FEATURES

2.5" Opto-ASIC Encoder with a Low Profile (2.0")
Standard Bore Sizes Ranging from 0.625" to 1.125"
Metric Bore Sizes Ranging from 6 mm to 28 mm
Single Replacement Solution For 2.0" to 3.5" Encoders
Resolutions to 10,000 CPR; Frequencies to 1 MHz
Versatile Flexible Mounting Options
RoHS Compliant

Representing the next generation of high performance encoders, the Model 25T features the largest thru-bore available in a 2.5" encoder, mounting directly on shafts as large as 1.125" or 28 mm. With resolutions of up to 10,000 CPR, and Frequencies of up to 1MHz this industrial strength encoder is perfect for fast revving motors. The 25T features the next generation of EPC's proprietary Opto-ASIC sensor which provides superior accuracy and precision counts. The injection molded housing, made from EPC's custom blend of nylon composites, is grooved with "cooling fins" and can take the extreme heat of the motion control industry. With sealing available of up to IP66 and many new rugged flexible mounting options, the Model 25T can perform in demanding industrial environments. This revolutionary new 2.5" encoder truly is unlike any other.

COMMON APPLICATIONS

Motor-Mounted Feedback and Vector Control, Specialty Machines, Robotics, Web Process Control, Paper and Printing, High Power Motors

MODEL 25T/H ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical | Optional Features (Leave Blank for Standard Options)

25T		–	42	SE	–	0500	N	V1	R	OC	–	SMW	–			
MODEL 25T Thru-Bore 25H Hollow Bore	HOUSING OPTION (Leave Blank for Standard) Standard C Corrosion Resistant		BORE SIZE[1] 01 1/4", 0.250" 14 8 mm 03 5/16", 0.3125" 10 10 mm 02 3/8", 0.375" 09 11 mm 05 1/2", 0.500" 12 12 mm 11 5/8", 0.625" 13 14 mm 34 3/4", 0.750" 15 15 mm 40 1", 1.000" 16 16 mm 42 1-1/8", 1.125" 17 17 mm 19 19 mm 24 24 mm 25 25 mm 28 28 mm	MOUNTING SE 2.25" to 2.75" B.C. 3-point Flex Mount SG 3.50" to 5.90" B.C. (4.5" C-face) Tether Arm Kit SJ 3.50" to 8.10" B.C. (8.5" C-face) Tether Arm Kit SH 2.72" to 3.42" B.C. (Block & Pin) Tether Arm Kit		CYCLES PER REVOLUTION See *CPR Options* below Price Adder for Resolutions Over 2000	COMMUTATION N None	INPUT VOLTAGE V1 5 to 28 VDC	NUMBER OF CHANNELS[1] *Channel A Leads B* Q Quadrature A & B R Quadrature A & B with Index *Channel B Leads A*[2] K Reverse Quadrature A & B D Reverse Quadrature A & B with Index See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.	OUTPUT TYPE *5 - 28V In/Out*[3] OC Open Collector PP Push-Pull HV Line Driver[4] PU Pull-Up Resistor[5] *5 - 28V In/5V Out*[6] H5 Line Driver[4] P5 Push-Pull		CONNECTOR TYPE[7] SMW 6-pin MS[8] SMY 7-pin MS SMX 10-pin MS SMJ 5-pin M12 (12 mm) SMK 8-pin M12 (12 mm) SMH 10-pin Bayonet[9] F00 Gland, 24" Cable[10] 9D 9-pin D-Sub[9]	OPERATING TEMPERATURE -20° to 85° C (Std) T1 -40° to +85° C T4 -20° to +105° C[2]	SEALING IP50 (Standard) S3 IP66	CERTIFICATION None (Std) CE CE Marked[12]

MODEL 25T/H CPR OPTIONS

0001	0002	0003	0005	0008	0010	0011	0012
0024	0025	0030	0032	0050	0060	0064	0070
0080	0100	0105	0115	0120	0125	0150	0180
0192	0200	0240	0250	0256	0300	0336	0360
0500	0512	0600	0625	1000	1024	1200	1250
1800	2000	2048	2500	3600	4096	5000	7200
8192	10,000						

Contact Customer Service for other disk resolutions.

NOTES:
1 Contact Customer Service for additional options.
2 Reverse Quadrature not available with PU output type.
3 24 VDC max for T4 temperature option.
4 Not available with 5-pin M12 or 6-pin MS style connectors. Available with 7-pin MS style connector without index Z.
5 With Input Voltage above 16 VDC, operating temperature is limited to 85° C max.
6 Standard operating temperature only.
7 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
8 Not available with CE option.
9 Not available with corrosion resistant option.
10 For non-standard English cable lengths enter 'F' plus cable length expressed in feet. Example: F06 = 6 feet of cable.
11 Contact Customer Service for availability on resolutions < 360 CPR.
12 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com. Contact Customer Service for availability.

MODEL 25T/H SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC max for temperatures between 85° and 105° C
Input Currentt..... 100 mA max with no output load
Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face.
See *Waveform Diagram*.
Output Types..... Open Collector- 20 mA max per channel
Pull Up - Open Collector with 2.2K ohm resistor, 20 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)
Index..... Once per revolution.
1 to 360 CPR: Ungated
361 to 10,000 CPR: Gated to output A
See *Waveform Diagram*.
Max Frequency ..... 250 kHz for 1 to 2500 CPR
500 kHz for 2501 to 5000 CPR
1 MHz for 5001 to 10,000 CPR
CE Testing..... Emissions tested per EN61000-6-3:2001 as applicable. Immunity tested per EN6100-6-2: 2005 as applicable
Min. Edge Sep ..... 45° electrical min, 63° electrical or better typical
Rise Time..... Less than 1 microsecond
Accuracy..... Within 0.1° mechanical from one cycle to any other cycle, or 6 arc minutes.

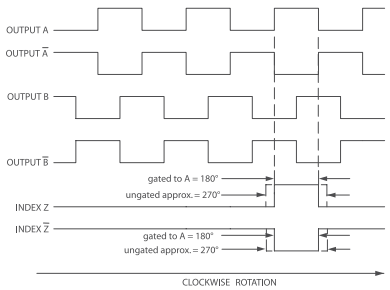
Mechanical

Max Shaft Speed..... 6000 RPM, 8000 RPM intermittent
4000 RPM for IP66 seal option
Bore Tolerance ..... -0.0000"/+0.0008"
User Shaft Tolerances
Radial Runout ..... 0.005" max
Axial Endplay..... ±0.050" max
Starting Torque ..... IP50 sealing: 1.0 oz-in typical
IP66 sealing: 4.0 oz-in typical
Note: Add 1.0 oz-in typical for -20° C operation
Moment of Inertia ... 7.6×10^{-4} oz-in-sec^2
Max Acceleration ..... 1×10^5 rad/sec^2
Housing ..... Proprietary nylon composite
Weight..... 8 oz typical

Environmental

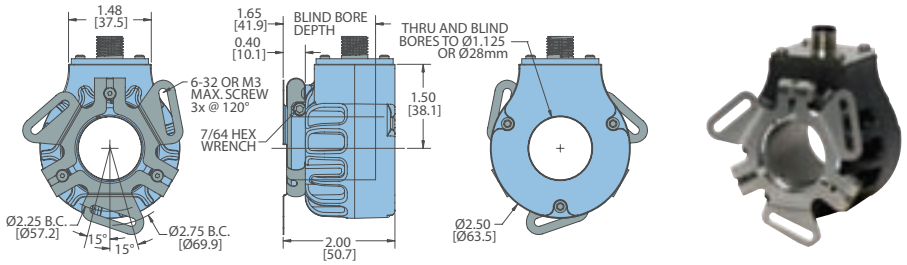
Storage Temp..... -20° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 20 g @ 5 to 2000 Hz
Shock..... 80 g @ 11 ms duration
Sealing..... IP50, IP66 with shaft seals at both ends

WAVEFORM DIAGRAM

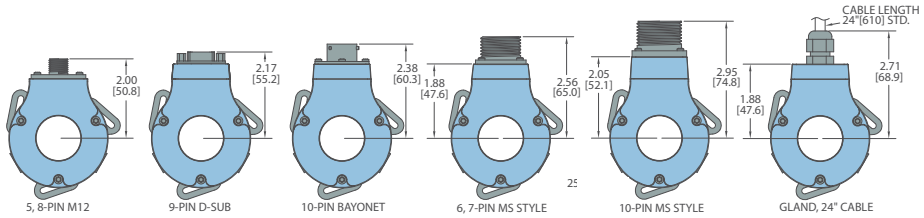


NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

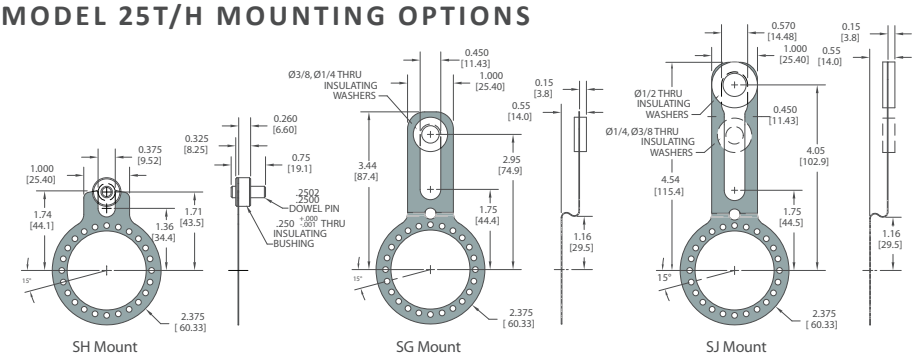
MODEL 25T/H



MODEL 25T/H CONNECTOR OPTIONS



MODEL 25T/H MOUNTING OPTIONS



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12**	8-pin M12**	10-pin MS	7-pin MS HV, H5	7-pin MS PU, PP, OC, P5	6-pin MS PU, PP, OC, P5	9-pin D-sub	10-pin Bayonet HV, H5, OD, PU, PP, OC, P5
Com	Black	3	7	F	F	F	A, F	9	F
+VDC	White	1	2	D	D	D	B	1	D
A	Brown	4	1	A	A	A	D	2	A
A'	Yellow	--	3	H	C	--	--	3	H
B	Red	2	4	B	B	B	E	4	B
B'	Green	--	5	I	E	--	--	5	J
Z	Orange	5	6	C	--	C	C	6	C
Z'	Blue	--	8	J	--	--	--	J	K
Case	--	--	--	G	G	G	--	8	G
Shield	Bare*	--	--	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**CE Option: Read Technical Bulletin TB111. Available at encoder.com
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 775

FEATURES

Thru-Bore Design For Easy Mounting
Bore Options to 1.375"
Incorporates Opto-ASIC Technology
Resolutions to 4096 CPR
100° C Operating Temperature Available
CE Marking Available

The sleek design of the Model 775 Thru-Bore Series Accu-Coder™ makes form and function a successful reality. The slim profile and Thru-Bore design, makes installation easy by simply slipping the bore over motor shafts up to 1.375" in diameter. The advanced Opto-ASIC based electronics provide the superior noise immunity necessary in many industrial applications. With a variety of bore sizes, resolutions, and connector types, application possibilities are endless.

COMMON APPLICATIONS

Motor Feedback, Velocity & Position Control, Food Processing, Robotics, Material Handling

MODEL 775 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

775 – A – H – 1024 – Q – OC – C – Y – N – N – CE

MODEL
775 Slim Thru-Bore

OPERATING TEMPERATURE
S 0° to 70° C
H 0° to 100° C

HOUSING STYLE
A Completely encloses motor shaft, and eliminates access to motor shaft. For physical protection only.
B Thru-Bore housing version. Allows access to motor shaft.

CYCLES PER REVOLUTION
1 - 4096
See *CPR Options* below for available resolutions.
Price adder for CPR >1024

NUMBER OF CHANNELS[1]
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index
See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.

OUTPUT TYPE
5 - 28V In/Out[2]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[3]

BORE SIZE

A	5/8", 0.625" collet style	H	14 mm collet style
B	3/4", 0.750" collet style	I	19 mm collet style
C	7/8", 0.875" collet style	K	24 mm collet style
D	1", 1.000" collet style	M	25 mm clamp style
O	1-1/8", 1.125" clamp style	L	28 mm clamp style
T	1-1/4", 1.250" clamp style	Q	30 mm clamp style
V	1-3/8", 1.375" clamp style	R	32 mm clamp style

CONNECTOR TYPE[4]
P Gland Nut with 24" Cable[5]
W 6-pin MS
Y 7-pin MS
X 10-pin MS
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)
9D 9-pin D-subminiature

ANTI-ROTATION FLEX MOUNT
N None
A Style A

MATING CONNECTOR
N No Connector
Y Yes

CERTIFICATION
N None
CE CE Marked[6]

MODEL 775 CPR OPTIONS

0060	0100	0120	0240	0250	0256
0500	0512	0600	1000	1024	2048
2500	4096				

Contact Customer Service for other disk resolutions; not all disk resolutions available with all output types

NOTES:
1 Contact Customer Service for index gating options.
2 5 to 24 VDC max for high temperature option.
3 Not available with 5-pin M12 or 6-pin MS connector. Available with 7-pin MS connector only without Index Z.
4 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
5 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: P/6 = 6 feet of cable.
6 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 775 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face.
See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0001 to 0474 CPR: Ungated
0475 to 4096 CPR: Gated to output A
See *Waveform Diagrams*.

Max Frequency ..... 200 kHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Rise Time..... Less than 1 microsecond

Mechanical

Max Shaft Speed..... 6000 RPM. Higher shaft speeds may be achievable, contact Customer Service.

User Shaft Tolerances
Radial Runout ..... 0.005"
Axial Endplay..... ±0.030" with appropriate flex mount

Moment of Inertia ... 3.3 X 10^{-3} oz-in-sec^2 typical

Housing ..... All metal construction

Weight..... 1.0 lb with gland nut or D-sub connector option 1.5 lb with MS connector option
Note: All weights typical

Environmental

Storage Temp ..... -25° to 100° C

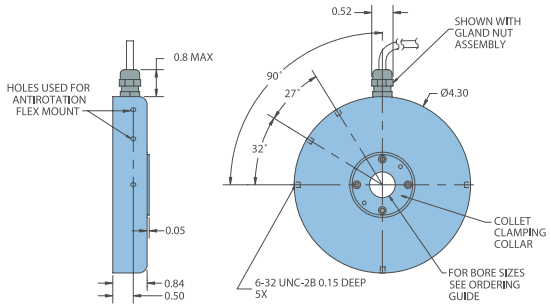
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

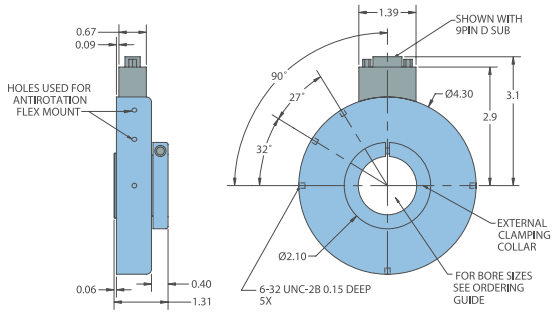
Shock..... 50 g @ 11 ms duration

Sealing..... IP50

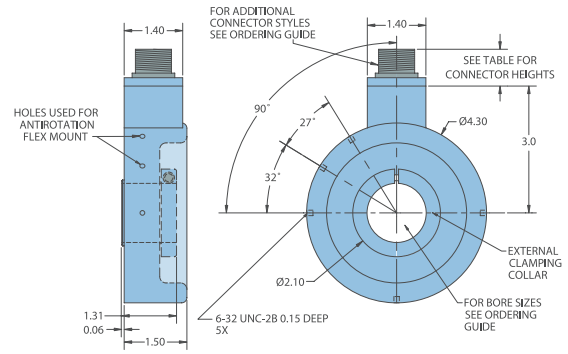
MODEL 775 COLLET CLAMP (A, B, C, D, H, I, K)



MODEL 775 CLAMP STYLE (O, T, V, M, L, Q)



MODEL 775 EXTENDED HOUSING (W, X, Y, J, K)

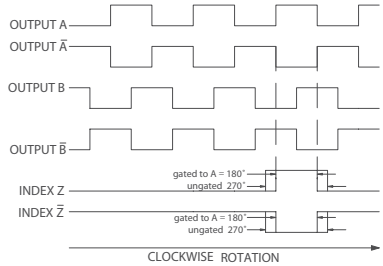


CONNECTOR TYPE	HEIGHT
6- OR 7-PIN MS	0.67"
10-PIN MS	0.90"
5- OR 8-PIN M12	0.50"

All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

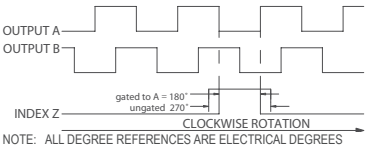
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES
INDEX IS POSITIVE GOING

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12++ PU, PP, OC	8-pin M12++	10-pin MS	7-pin MS HV	7-pin MS PU, PP, OC	6-pin MS PU, PP, OC	9-pin D-sub
Com	Black	3	7	F	F	F	A, F	9
+VDC	Red	1	2	D	D	D	B	1
A	White	4	1	A	A	A	D	2
A'	Brown	--	3	H	C	--	--	3
B	Blue	2	4	B	B	B	E	4
B'	Violet	--	5	I	E	--	--	5
Z	Orange	5	6	C	--	C	C	6
Z'	Yellow	--	8	J	--	--	--	7
Case	--	--	--	G**	G**	G**	--	8*
Shield	Bare*	--	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal Case.
**CE Option: Pin G is connected to Case. Non-CE Option: Pin G has No Connection.
*CE Option: Pin G is connected to Case. Non CE Option: Pin 8 has No Connection.
++CE Option: Read Technical Bulletin TB111 at www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 776

FEATURES

Slim Profile—Only 1.36" In Depth
Thru-Bore Design For Easy Mounting
Incorporates Opto-ASIC Technology
Resolutions to 4096
Bore Options to 1.875"
CE Marking Available

The Thru-Bore Series Accu-Coder™ Model 776 encoder is designed to fit directly on either a motor or other shaft where position, direction, or velocity information is needed. The advanced Opto-ASIC based electronics provide the superior noise immunity necessary in many industrial applications. The Model 776 conveniently features a clamp type mount for fast and easy mounting over a large range of shaft sizes. An optional anti-rotation flex mount maintains housing stability.

COMMON APPLICATIONS

Motor Feedback, Velocity & Position Control, Robotics, Conveyors, Material Handling

MODEL 776 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

776 – A – H – 1024 – Q – OC – C – Y – N – N – CE

MODEL
776 Slim Thru-Bore

HOUSING STYLE
A Completely encloses motor shaft, and eliminates access to motor shaft. For physical protection only.
B Thru-Bore housing version. Allows access to motor shaft.

OPERATING TEMPERATURE
S 0° to 70° C
H 0° to 100° C

CYCLES PER REVOLUTION
1 - 4096
See *CPR Options* below for available resolutions.
Price adder for CPR >1024

NUMBER OF CHANNELS[1]
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index
See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.

OUTPUT TYPE
5 - 28V In/Out[2]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[3]

BORE SIZE
G 1-7/16", 1.4375"
C 1-1/2", 1.500"
D 1-5/8", 1.625"
F 1-3/4", 1.750"
E 1-7/8", 1.875"
L 35 mm
I 38 mm
J 40 mm
M 42 mm
N 43 mm

CONNECTOR TYPE[4]
P Gland Nut with 24" Cable[5]
W 6-pin MS
Y 7-pin MS
X 10-pin MS
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)
9D 9-pin D-subminiature

ANTI-ROTATION FLEX MOUNT
N None
A Style A

MATING CONNECTOR
N No Connector
Y Yes

CERTIFICATION
N None
CE CE Marked[6]

MODEL 776 CPR OPTIONS

0060	0100	0120	0240	0250	0256	0500
0512	0600	1000	1024	2048	2500	4096

Contact Customer Service for other disk resolutions; not all disk resolutions available with all output types

NOTES:
1 Contact Customer Service for index gating options.
2 5 to 24 VDC max for high temperature option.
3 Not available with 5-pin M12 or 6-pin MS connector. Available with 7-pin MS connector only without Index Z.
4 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
5 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: P/6 = 6 feet of cable.
6 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 776 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face.
See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0475 to 4096 CPR: Gated to output A
0001 to 0474 CPR: Ungated
See *Waveform Diagrams*.

Max Frequency ..... 200 kHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Rise Time..... Less than 1 microsecond

Mechanical

Max Shaft Speed..... 3500 RPM. Higher shaft speeds may be achievable, contact Customer Service.

User Shaft Tolerances
Radial Runout ..... 0.005"
Axial Endplay..... ±0.030" with appropriate flex mount

Moment of Inertia ... 3.3 x 10^{-3} oz-in-sec^2 typical

Housing ..... All metal construction

Weight..... 1.0 lb with gland nut or D-sub connector option 1.5 lb with MS connector option
Note: All weights typical

Environmental

Storage Temp ..... -25° to 100° C

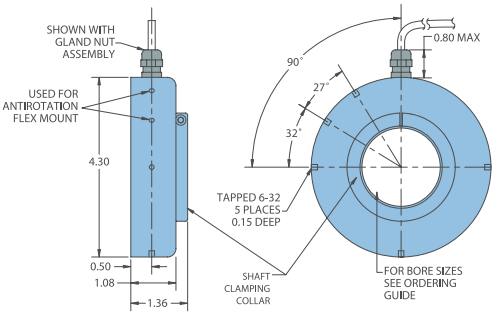
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

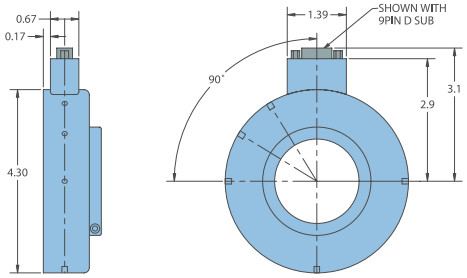
Shock..... 50 g @ 11 ms duration

Sealing..... IP50

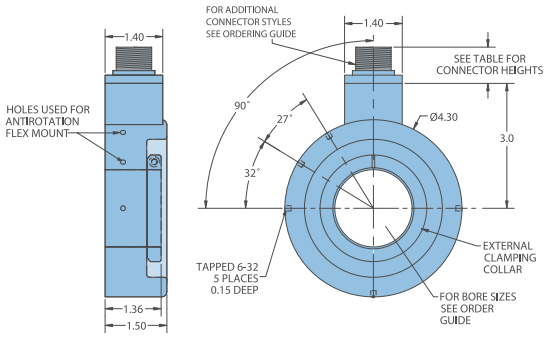
MODEL 776 WITH GLAND NUT CABLE (P)



MODEL 776 WITH 9-PIN D-SUB CONNECTOR (9D)



MODEL 776 EXTENDED HOUSING (W, X, Y, J, K)

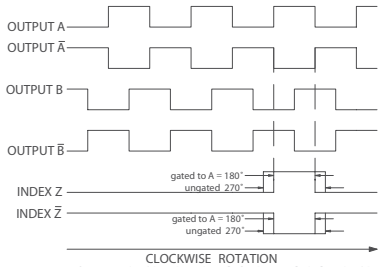


CONNECTOR TYPE	HEIGHT
6- OR 7-PIN MS	0.67"
10-PIN MS	0.90"
5- OR 8-PIN M12	0.50"

All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

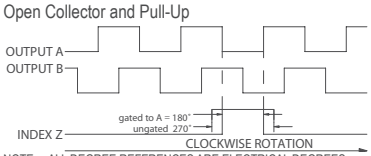
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. INDEX IS POSITIVE GOING.

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12++ PU, PP, OC	8-pin M12++	10-pin MS	7-pin MS HV	7-pin MS PU, PP, OC	6-pin MS PU, PP, OC	9-pin D-sub
Com	Black	3	7	F	F	F	A, F	9
+VDC	Red	1	2	D	D	D	B	1
A	White	4	1	A	A	A	D	2
A'	Brown	--	3	H	C	--	--	3
B	Blue	2	4	B	B	B	E	4
B'	Violet	--	5	I	E	--	--	5
Z	Orange	5	6	C	--	C	C	6
Z'	Yellow	--	8	J	--	--	--	7
Case	--	--	--	G**	G**	G**	--	8*
Shield	Bare*	--	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal Case.
**CE Option: Pin G is connected to Case. Non-CE Option: Pin G has No Connection.
*CE Option: Pin G is connected to Case. Non CE Option: Pin 8 has No Connection.
++CE Option: Read *Technical Bulletin TB111* at www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 770

FEATURES

Slim Profile—Only 1.00" Deep
Fits NEMA Size 56C Thru 184C Motor Faces (4.5" AK)
Incorporates Opto-ASIC Technology
Resolutions to 4096 CPR

The Model 770 C-Face encoder is a rugged, high resolution encoder designed to mount directly on NEMA C-Face motors. Both sides of the encoder are C-Face mounts, allowing additional C-Face devices to be mounted to this encoder. Unlike many C-Face kit type encoders, the Model 770 contains precision bearings and an internal flex mount, virtually eliminating encoder failures and inaccuracies induced by motor shaft runout or axial endplay. The advanced Opto-ASIC design provides the advanced noise immunity necessary for many industrial applications. This encoder is ideal for applications using induction motors and flux vector control. The Model 770 provides speed and position information for drive feedback in a slim profile—only 1.00" thick. The Thru-Bore design allows fast and simple mounting of the encoder directly to the accessory shaft or to the drive shaft of the motor, using the standard motor face (NEMA sizes 56C - 184C). The tough, all metal housing resists the vibration and hazards of an industrial environment.

COMMON APPLICATIONS

Motor Feedback, Velocity & Position Control, Conveyors, Variable Speed Drives, Mixing & Blending Motors, Assembly & Specialty Machines

MODEL 770 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

770 – A – H – 1024 – Q – OC – A – Y – N – N – CE

MODEL
770 4.5" NEMA "AK" Dimension

OPERATING TEMPERATURE
S 0° to 70° C
H 0° to 100° C

CYCLES PER REVOLUTION
1 - 4096
See *CPR Options* below for available resolutions.
Price adder for CPR >1024

OUTPUT TYPE
5 - 28V In/Out[3]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[4]

C-FACE GASKET KIT OPTION[1]
"B" HOUSING ONLY
N No
Y Yes

MATING CONNECTOR
N No Connector
Y Yes

CERTIFICATION
N None
CE CE Marked[7]

HOUSING STYLE
A Cover completely encloses motor shaft and eliminates access to motor shaft; IP65 rated. Includes C-face Gasket Kit.
B Thru-Bore housing version with IP50 dust seal[1]

NUMBER OF CHANNELS[2]
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index
See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.

BORE SIZE
A 5/8", 0.625"
B 3/4", 0.750"
C 7/8", 0.875"
D 1", 1.000"
H 14 mm
I 19 mm
K 24 mm

CONNECTOR TYPE[5]
P 24" Cable with Gland Nut[6]
B Terminal Strip in Conduit Box
X 10-pin MS on Conduit Box
Y 7-pin MS on Conduit Box
J 5-pin M12 on Conduit Box
K 8-pin M12 on Conduit Box
L 10-pin Industrial Clamp

MODEL 770 CPR OPTIONS

0060	0100	0120	0240	0250	0256	0500
0512	0600	1000	1024	2048	2500	4096

Contact Customer Service for other disk resolutions; not all disk resolutions available with all output types.

NOTES:
1 Thru-Bore version may be IP65 sealed if mounted between two C-Face devices with optional gasket kit. Select 'Yes' under C-Face Gasket Kit Option.
2 Contact Customer Service for index gating options.
3 5 to 24 VDC max for high temperature option.
4 Not available with 5-pin M12 connector. Available with 7-pin MS connector only without Index Z.
5 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
6 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: P/6 = 6 feet of cable.
7 Please refer to Technical Bulletin TB100: When to Choose the CE Option at www.encoder.com.

MODEL 770 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face.
See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0001 to 0474 CPR: Ungated
0475 to 4096 CPR: Gated to output A
See *Waveform Diagrams*.

Max Frequency ..... 200 kHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Rise Time..... Less than 1 microsecond

Mechanical

Max Shaft Speed..... 6000 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Bore Tolerance ..... +0.0015"/-0.000"

User Shaft Tolerances
Radial Runout ..... 0.005"
Axial Endplay..... ±0.050"

Moment of Inertia ... 3.3 x 10^{-3} oz-in-sec^2 typical

Housing ..... All metal construction

Weight..... 2.60 lb with gland nut
3.00 lb with all other connector options
Note: All weights typical

Environmental

Storage Temp ..... -25° to 100° C

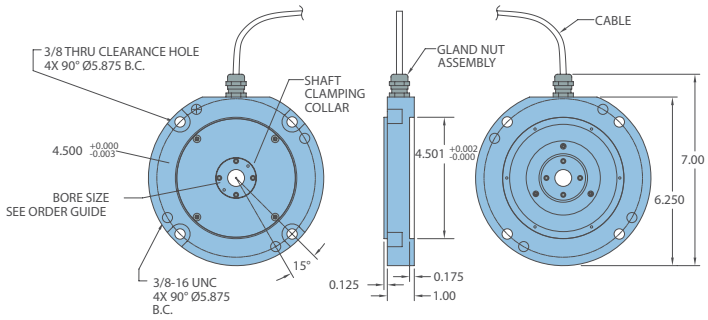
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

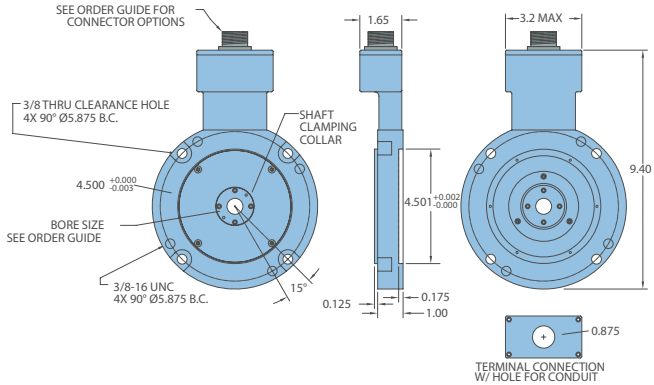
Shock..... 50 g @ 11 ms duration

Sealing ..... IP65 for Option A housing style with gasket kit IP50 for Option B housing style

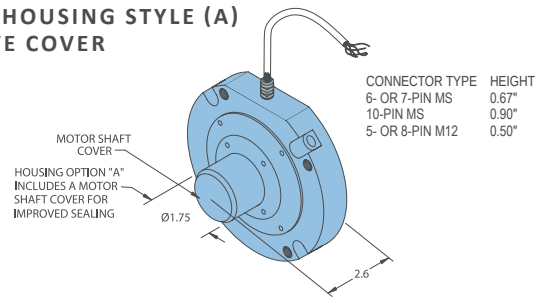
MODEL 770 WITH GLAND NUT (P)



MODEL 770 WITH CONDUIT BOX (B, X, Y, J, K)



OPTIONAL HOUSING STYLE (A) PROTECTIVE COVER

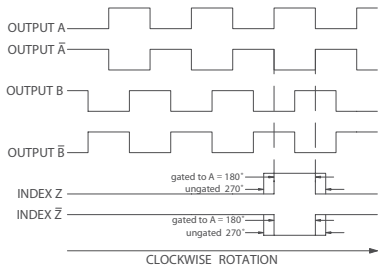


CONNECTOR TYPE	HEIGHT
6- OR 7-PIN MS	0.67"
10-PIN MS	0.90"
5- OR 8-PIN M12	0.50"

All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

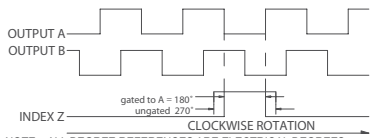
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES INDEX IS POSITIVE GOING

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12++ PU, PP, OC	8-pin M12++	10-pin MS	7-pin MS HV	7-pin MS PU, PP, OC	Term Block	10-pin Indust. Clamp
Com	Black	3	7	F	F	F	2	1
+VDC	Red	1	2	D	D	D	1	6
A	White	4	1	A	A	A	3	3
A'	Brown	--	3	H	C	--	4	8
B	Blue	2	4	B	B	B	5	2
B'	Violet	--	5	I	E	--	6	7
Z	Orange	5	6	C	--	C	7	4
Z'	Yellow	--	8	J	--	--	8	9
Case	--	--	--	G**	G**	G**	--	--
Shield	Bare*	--	--	--	--	--	9+	10+

*CE Option: Cable shield (bare wire) is connected to internal Case.
**CE Option: Pin G is connected to Case. Non-CE Option: Pin G has No Connection.
+CE Option: Pin G is connected to Case. Non CE Option: Pin 8 has No Connection.
++CE Option: Read *Technical Bulletin TB111* at www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 771

Ø9.0"

FEATURES

Large Bore Size to 1.875" or 43 mm
Fits NEMA Size 182TC Thru 256TC Motor Faces (8.5" AK)
Incorporates Opto-ASIC Technology
Resolutions to 4096 CPR

The Model 771 C-Face encoder is a rugged, high resolution encoder designed to mount directly on NEMA C-Face motors. Both sides of the encoder are C-Face mounts, allowing additional C-Face devices to be easily mounted. Many competitive C-Face units are kit type encoders, but the Model 771 contains precision bearings and an internal flex mount that virtually eliminates encoder failures and inaccuracies induced by motor shaft runout or axial endplay. The advanced Opto-ASIC design provides superior noise immunity necessary for many industrial applications. This encoder is ideal for applications using induction motors and flux vector control. A Thru-Bore design allows fast and simple mounting of the encoder directly to the accessory shaft or drive shaft of a motor using a NEMA standard motor face (sizes 182TC - 256TC). The tough, all metal housing resists the vibration and hazards of an industrial environment.

COMMON APPLICATIONS

Motor Feedback, Velocity & Position Control, Servo Control Systems, Assembly & Specialty Machines, Elevator Controls

MODEL 771 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

771 – A – H – 1024 – Q – OC – A – Y – N – N

MODEL
771 8.5" NEMA "AK" Dimension

OPERATING TEMPERATURE
S 0° to 70° C
H 0° to 100° C

CYCLES PER REVOLUTION
1 - 4096
See *CPR Options* below for available resolutions.
Price adder for CPR >1024

OUTPUT TYPE
5 - 28V In/Out[3]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[4]

C-FACE GASKET KIT OPTION[1]
N No
Y Yes

MATING CONNECTOR
N No Connector
Y Yes

HOUSING STYLE
A Cover completely encloses motor shaft and eliminates access to motor shaft; IP65 rated.
B Thru-Bore housing version with IP50 dust seal[1]

NUMBER OF CHANNELS[2]
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index
See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.

BORE SIZE
T 5/8", 0.625"
V 7/8", 0.875"
W 1", 1.000"
A 1-1/8", 1.125"
K 1-1/4", 1.250"
B 1-3/8", 1.375"
C 1-1/2", 1.500"
D 1-5/8", 1.625"
F 1-3/4", 1.750"
E 1-7/8", 1.875"
H 28 mm
Q 30 mm
R 32 mm
L 35 mm
I 38 mm
J 40 mm
M 42 mm
N 43 mm

CONNECTOR TYPE[5]
P Gland Nut with 24" cable[6]
B Terminal Strip in Conduit Box
X 10-pin MS on Conduit Box
Y 7-pin MS on Conduit Box
J 5-pin M12 (12 mm) on Conduit Box
K 8-pin M12 (12 mm) on Conduit Box
L 10-pin Industrial Clamp

MODEL 771 CPR OPTIONS

0060	0100	0120	0240	0250	0256	0500
0512	0600	1000	1024	2048	2500	4096

Contact Customer Service for other disk resolutions; not all disk resolutions available with all output types

NOTES:
1 Thru-Bore version may be IP65 sealed if mounted between two C-Face devices with optional gasket kit. Select 'Yes' under C-Face Gasket Kit Option.
2 Contact Customer Service for index gating options.
3 5 to 24 VDC max for high temperature option.
4 Not available with 5-pin M12 connector. Available with 7-pin MS connector only without Index Z.
5 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
6 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: P/6 = 6 feet of cable.

MODEL 771 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face. See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channe
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0001 to 0474 CPR: Ungated
0475 to 4096 CPR: Gated to output A
See *Waveform Diagrams*.

Max Frequency ..... 200 kHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Rise Time..... Less than 1 microsecond

Mechanical

Max Shaft Speed..... 3500 RPM. Higher shaft speeds may be achievable, contact Customer Service.
6000 RPM for 1.125", 1.250", 1.375", 28 mm, 30 mm, 32 mm bore diameter

User Shaft Tolerances
Radial Runout ..... 0.005"
Axial Endplay..... ±0.1"

Moment of Inertia ... 3.3 x 10^{-3} oz-in-sec^2 typical

Housing ..... All metal construction

Weight..... 7.0 lb typical

Environmental

Storage Temp ..... -25° to 100° C

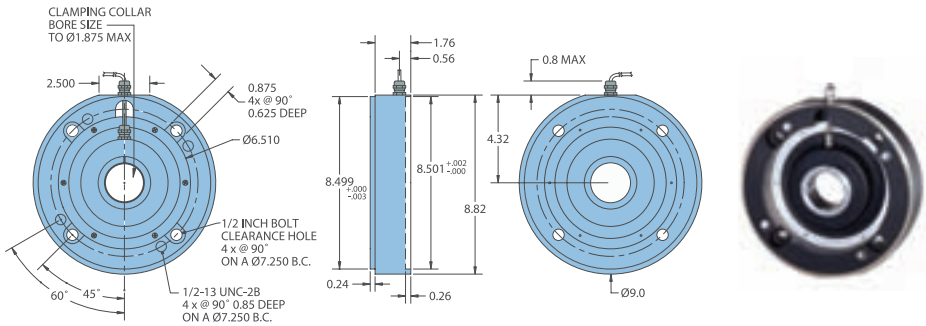
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

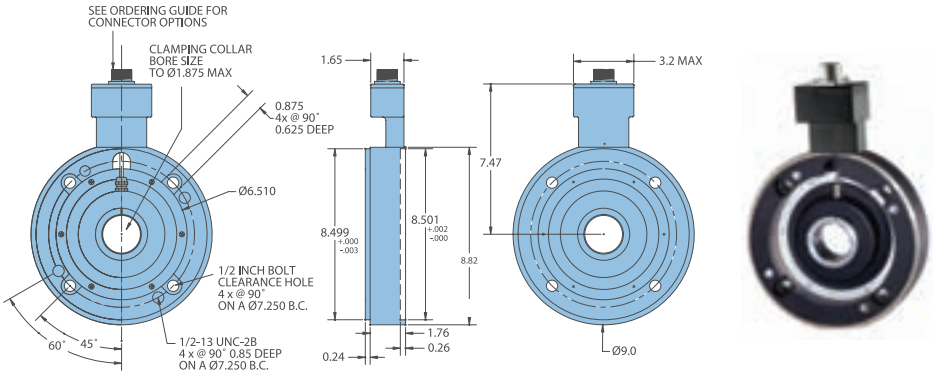
Shock..... 50 g @ 11 ms duration

Sealing ..... IP65 for Option A housing style with gasket kit IP50 for Option B housing style

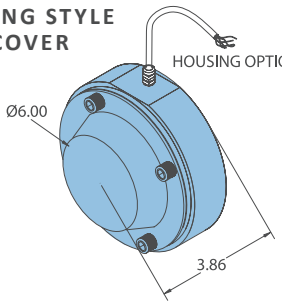
MODEL 771 WITH GLAND NUT CABLE (P)



MODEL 771 WITH CONDUIT BOX (B, X, Y, J, K)



OPTIONAL HOUSING STYLE (A) PROTECTIVE COVER

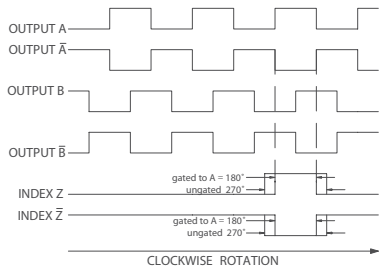


CONNECTOR TYPE	HEIGHT
6- OR 7-PIN MS	0.67"
10-PIN MS	0.90"
5- OR 8-PIN M12	0.50"

All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

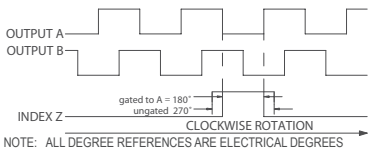
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES INDEX IS POSITIVE GOING

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12++ PU, PP, OC	8-pin M12++	10-pin MS	7-pin MS HV	7-pin MS PU, PP, OC	Term Block	10-pin Indust. Clamp
Com	Black	3	7	F	F	F	2	1
+VDC	Red	1	2	D	D	D	1	6
A	White	4	1	A	A	A	3	3
A'	Brown	--	3	H	C	--	4	8
B	Blue	2	4	B	B	B	5	2
B'	Violet	--	5	I	E	--	6	7
Z	Orange	5	6	C	--	C	7	4
Z'	Yellow	--	8	J	--	--	8	9
Case	--	--	--	G**	G**	G**	9+	10+
Shield	Bare*	--	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal Case.
**CE Option: Pin G is connected to Case. Non-CE Option: Pin G has No Connection.
+CE Option: Pin 10 is connected to Case. Non CE Option: Pin 10 has No Connection.
++CE Option: Read *Technical Bulletin TB111* at www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 755A NEMA

FEATURES

Standard NEMA Mounting
Up to 30,000 CPR
High Temperature Option

The Model 755A NEMA Mount Accu-Coder™, with its integral shaft coupling, mounts directly onto NEMA motors. It is designed for easy installation on industrial size 23 or 34 motor frames. It features standard bolt circle patterns, and can accommodate shaft sizes of 0.250", 0.375", or 6 mm. With its rugged all metal housing, and a wide range of CPR options, it will fit in many different applications, providing years of trouble free use.

COMMON APPLICATIONS

Robotics, Assembly Machines, Motor-Mounted Feedback, Phototypesetters, Printers & Digital Plotters, Elevator Controls, Medical Diagnostic Equipment

MODEL 755A NEMA ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

755A – 31 – S – 1000 – R – HV – 1 – 23A – S – CE

MODEL
755A Model 755A

SHAFT/BORE SIZE
31 Internal Shaft

OPERATING TEMPERATURE
L -40° to 70° C
S 0° to 70° C
H 0° to 100° C[1]

CYCLES PER REVOLUTION
1-30,000
See *CPR Options* below for available resolutions.
Price adder for CPR >1270

NUMBER OF CHANNELS[2]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[3]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver
8 - 28V In/5V Out[4,5]
H5 Line Driver
P5 Push-Pull

MAXIMUM FREQUENCY
1 Standard 100 kHz
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[6]
4 1 MHz, >10,000 CPR[6]

MOUNTING
23A NEMA 23 - 0.250" coupling
23B NEMA 23 - 0.375" coupling
23C NEMA 23 - 6 mm coupling
34A NEMA 34 - 0.250" coupling
34B NEMA 34 - 0.375" coupling
34C NEMA 34 - 6 mm coupling

CONNECTOR TYPE[7]
S Standard 18" Cable[8]
C01 8-pin Molex
C02 Terminal Block
J00 18" Cable with 5-pin M12[9]
K00 18" Cable with 8-pin M12[9]

CERTIFICATION
N None
CE CE Marked[10]

MODEL 755A NEMA CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*
0011*	0012*	0014*	0020	0021*	0024*	0025*	0028*
0030*	0032*	0033*	0034*	0035*	0038*	0040*	0042*
0045*	0050*	0060	0064*	0100	0120	0125	0128*
0144*	0150*	0160*	0192*	0200	0240*	0250	0254*
0256*	0300	0333*	0360	0400	0500	0512	0600
0625*	0635	0665*	0720	0768*	0800	0889	0900*
1000	1024	1200	1201*[a]	1203*[a]	1204*[a]	1250[a]	1270[a]
1440	1500	1800	2000	2048	2400[a]	2500	2540[a]
2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]
7500[a]	9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	
15,000[a]	18,000[a]	20,000[a]	20,480[a]	25,000[a]	30,000[a]		

*Contact Customer Service for High Temperature Option.
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 0° to 85° C for certain resolutions, see CPR Options.
2 Contact Customer Service for index gating options.
3 24 VDC max for high temperature option.
4 Standard temperature, 60 to 3000 CPR only.
5 H5 and P5 outputs are not available with CE option.
6 Standard cable lengths only. For details, please refer to Technical Bulletin TB 116: *Noise and Signal Considerations,* at www.encoder.com.
7 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
8 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: S/6 = 6 feet of cable.
9 5-pin not available with Line Driver (HV, H5) outputs. Additional cable lengths available. Please consult Customer Service.
10 Please refer to Technical Bulletin TB100: *When to Choose the CE Option.*

MODEL 755A NEMA SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0-100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face. See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.

Max Frequency ..... Up to 1 MHz.

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Symmetry..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 20,480 CPR: 180° (±36°) electrical

Quad Phasing ..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 20,480 CPR: 90° (±36°)

Min Edge Sep ..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical

Rise Time..... Less than 1 microsecond

Accuracy..... Instrument and Quadrature Error: For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

Mechanical

Max Shaft Speed..... 7500 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Starting Torque ..... 0.14 oz-in typical
4.0 oz-in typical for -40° C operation

Moment of Inertia ... 2.8×10^{-4} oz-in-sec^2

Max Acceleration ..... 1×10^5 rad/sec^2

Housing ..... Black non-corrosive finish

Bearings..... Precision ABEC ball bearings

Weight..... 4.50 oz typical on NEMA 23
6.75 oz typical on NEMA 34

Environmental

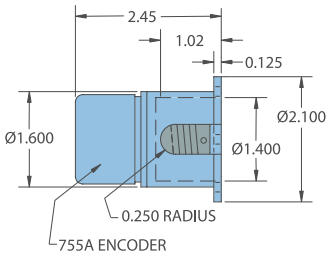
Storage Temp ..... -25° to +85° C

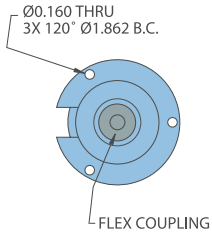
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

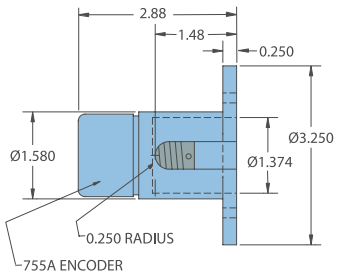
Shock..... 50 g @ 11 ms duration

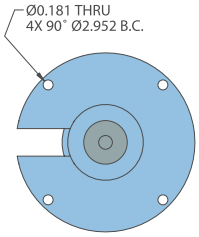
MODEL 755A SIZE 23 NEMA MOUNT (23A, 23B, 23C)





MODEL 755A SIZE 34 NEMA MOUNT (34A, 34B, 34C)

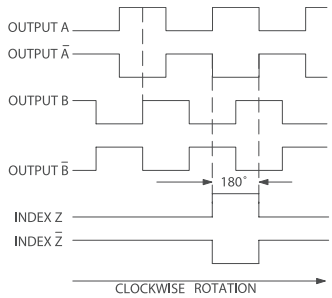




All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

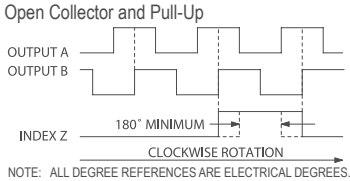
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. INDEX IS POSITIVE GOING.

WIRING TABLE

Function	Cable† Wire Color	Terminal Block	8-pin Molex	5-pin M12**	8-pin M12**
Com	Black	7	2	3	7
+VDC	White	8	1	1	2
A	Brown	1	8	4	1
A'	Yellow	2	7	--	3
B	Red	3	4	2	4
B'	Green	4	3	--	5
Z	Orange	6	6	5	6
Z'	Blue	5	5	--	8
Shield	Bare*	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**CE Option: Read Technical Bulletin TB111. Available at www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 702 MOTOR MOUNT

FEATURES

Up to 30,000 CPR
IP66 Sealing Available
Mounting Flange Available With Boss

The Model 702 Motor Mount Accu-Coder™ is a heavy duty, ultra-rugged, reliable, yet compact industry standard 2-inch diameter encoder. It is designed to withstand harsh factory and plant floor environments. The mounting flange, with integral shaft and coupling, allows the 702 encoder to be easily installed on a motor or shaft assembly, without the need for additional brackets or couplings. With the ability to handle shaft speeds of up to 8000 RPM and withstand the shock and vibration of high speed servo motors, you are sure to be pleased with the 702 Motor Mount Accu-Coder™.

COMMON APPLICATIONS

Servo & Stepper Motor Control, Robotics, X-Y Positioning Tables, Machine Tools

MODEL 702 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

702	–	31	–	S	–	1000	–	R	–	HV	–	1	–	B	–	1	–	E	X	–	N	–	CE

MODEL
702 Size 20 (2.0")

COUPLING BORE
31 1/4", 0.250"
32 3/8", 0.375"
33 1/2", 0.500"

OPERATING TEMPERATURE
S 0° to 70° C
H 0° to 100° C[1]

CYCLES PER REVOLUTION
1-30,000
See *CPR Options* below for available resolutions.
Price adder for CPR >1270

NUMBER OF CHANNELS[2]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[3]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[4]
8 - 28V In/5V Out[5,6]
H5 Line Driver[4]
P5 Push-Pull

MAXIMUM FREQUENCY
1 100 kHz (Standard)
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[7]
4 1 MHz, >10,000 CPR[7]

MOUNTING
I Integral Shaft Coupling
B Integral Coupling w/Boss

SEAL
N No Seal
1 IP66
2 IP64

CONNECTOR LOCATION
E End
S Side

CONNECTOR TYPE[8]
W 6-pin MS
Y 7-pin MS
X 10-pin MS
9D 9-pin D-subminiature
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)
G Gland, 24" Cable[9]
H 10-pin Bayonet

MATING CONNECTOR
N No
Y Yes

CERTIFICATION
N None
CE CE Marked[10]

MODEL 702 MOTOR MOUNT CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*
0011*	0012*	0014*	0020	0021*	0024*	0025*	0028*
0030*	0032*	0033*	0034*	0035*	0038*	0040*	0042*
0045*	0050*	0060	0064*	0100	0120	0125	0128*
0144*	0150*	0160*	0192*	0200	0240*	0250	0254*
0256*	0300	0333*	0360	0400	0500	0512	0600
0625*	0635	0665*	0720	0768*	0800	0889	0900*
1000	1024	1200	1201*[a]	1203*[a]	1204*[a]	1250[a]	1270[a]
1440	1500	1800	2000	2048	2400[a]	2500	2540[a]
2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]
7500[a]	9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	15,000[a]
18,000[a]	20,000[a]	20,480[a]	25,000[a]	30,000[a]			

*Contact Customer Service for High Temperature Option.
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 0° to 85° C for certain resolutions, see CPR Options.
2 Contact Customer Service for non-standard index gating options.
3 24 VDC max for high temperature option.
4 Not available with 5-pin M12 or 6-pin MS connector. Available with 7-pin MS connector only without Index Z.
5 Standard temperature, 60 to 3000 CPR only.
6 H5 and P5 outputs are not available with CE option.
7 Standard cable lengths only. For details, please refer to Technical Bulletin TB 116: *Noise and Signal Considerations* on the web at www.encoder.com.
8 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
9 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
10 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 702 MOTOR MOUNT SPECIFICATIONS

Electrical

Input Voltage .....4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C
Input Current .....100 mA max with no output load
Input Ripple .....100 mV peak-to-peak at 0 to 100 kHz
Output Format.....Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face. See *Waveform Diagrams*.
Output Types .....Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)
Index.....Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.
Max Frequency .....Up to 1 MHz.
Noise Immunity .....Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2
Symmetry.....1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 20,480 CPR: 180° (±36°) electrical
Quad Phasing.....1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 20,480 CPR: 90° (±36°) electrical
Min Edge Sep.....1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical
Rise Time.....Less than 1 microsecond
Accuracy.....Instrument and Quadrature Error: For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

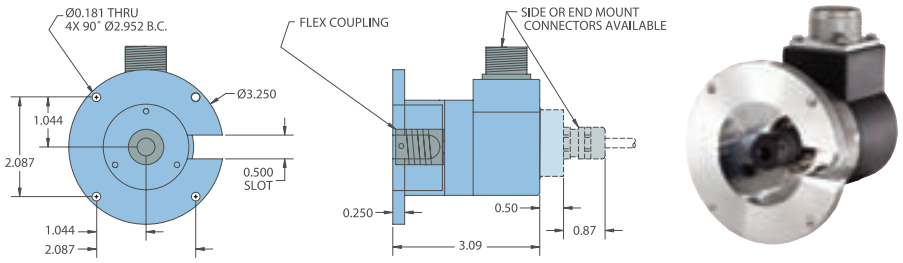
Mechanical

Max Shaft Speed.....8000 RPM. Higher shaft speeds may be achievable, contact Customer Service.
Starting Torque .....1.0 oz-in typical with IP64 seal or no seal
3.0 oz-in typical with IP66 shaft seal
Moment of Inertia....5.2 x 10^{-4} oz-in-sec^2
Max Acceleration.....1 x 10^5 rad/sec^2
Housing .....Black non-corrosive finish
Bearings .....Precision ABEC ball bearings
Weight.....14 oz typical

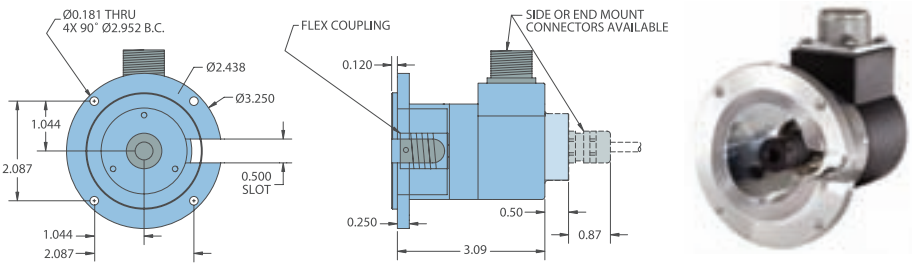
Environmental

Storage Temp.....-25° to +85° C
Humidity .....98% RH non-condensing
Vibration .....20 g @ 58 to 500 Hz
Shock.....75 g @ 11 ms duration
Sealing.....IP66 (NEMA 13 and 4/4X) with shaft seal; IP64 available

MODEL 702 WITH INTEGRAL COUPLING (I)



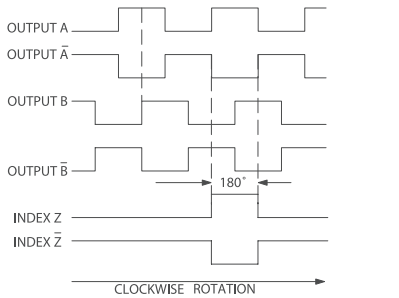
MODEL 702 WITH INTEGRAL COUPLING AND BOSS (B)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

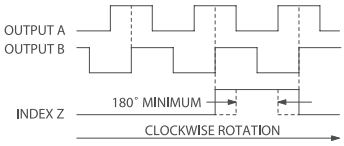
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
INDEX IS POSITIVE GOING.

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12**	8-pin M12**	10-pin MS	7-pin MS HV, H5	7-pin MS PU, PP, OC, P5	6-pin MS PU, PP, OC, P5	9-pin D-sub	10-pin Bayonet
Com	Black	3	7	F	F	F	A, F	9	F
+VDC	Red	1	2	D	D	D	B	1	D
A	White	4	1	A	A	A	D	2	A
A'	Brown	--	3	H	C	--	--	3	H
B	Blue	2	4	B	B	B	E	4	B
B'	Violet	--	5	I	E	--	--	5	J
Z	Orange	5	6	C		C	C	6	C
Z'	Yellow	--	8	J	--	--	--	7	K
Case	Green	--	--	G	G	G	--	8	G
Shield	Bare*	--	--	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**CE Option: Read Technical Bulletin TB111. Available at www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

SMALL MOTOR SOLUTIONS

MODEL	OPTO-ASIC	HI-TEMP	IP64/IP65 SEAL	M12 OPTION	FEATURES/BENEFITS	BRUSH SERVO	BRUSHLESS SERVO	STEPPER	PMDC	NEMA (SMALL)
15S Ø1.5" 	●	●	●	●	Metric and inch-standard shaft options compliment a host of US, European and Japanese mounting flange options making the Model 15S a versatile solution for a broad range of legacy field-replacement requirements. The small profile Model 15S has optional commutation, up to 10,000 CPR resolution, and the ability to handle the heat of high revving motors.	●		●		
15T/H Ø1.5" 	●	●	●	●	With a host of US, European and Japanese flex mount options, and bore sizes up to 0.375" or 10 mm, the Model 15T/H is a highly versatile solution for a broad range of both motor and non-motor-mount applications. A short 1.00" over-all height, resolutions to 10,000 CPR, and optional commutation makes the Model 15T is an ideal upgrade from less reliable modular encoders.	●	●	●	●	
260 Ø2.0" 	●	●	●	●	Broadly versatile design enables application to low and fractional HP NEMA motors with bore sizes up to 0.625" or demanding high-performance BLDC servo when configured with commutation tracks and 120° C temp rating. Largest bore size (0.625" or 15 mm) in the 2.00" O.D. class, making it a cost-effective replacement solution for many HS20 and HS25 type installations.	●	●	●	●	●
121 Ø2.1" 	●			●	Finely engineered for demanding high-speed applications above 10,000 RPM. The only all-metal modular encoder on the planet, featuring patented 1-2-3 gapping and centering design for quick and confident installation. With bore sizes up to 0.625" or 15 mm and commutation optional, the Model 121 is a reliable, all-metal upgrade from the fragile plastic modulars common in today's marketplace.	●	●	●		
225 Ø2.25" 				●	Historically selected as low cost digital alternative to tachometers on Permanent Magnet motors. Expansive Metric and inch-standard bore options (22 mm or 0.875") enable application to even larger frame motors. Flex Arm mounting kit and multiple connection options provides universal application to most US and IEC motor designs.				●	●
755A NEMA **NEMA 23/34** 	●	●			EPC still actively supports this integrated encoder and coupling mount design, originally employed by motor manufacturers prior to the advent of today's high-temp, thru-bore encoders. The 755A-NEMA is still a viable alternative for new applications where motor shaft run-out exceeds comfortable limits of thru-bore flex mount designs. The 755A NEMA boasts resolutions up to 30,000 CPR, and a frequency response up to 1MHz.	●		●		●

LARGE MOTOR SOLUTIONS

MODEL	OPTO-ASIC	HI-TEMP	IP64/IP65 SEAL	M12 OPTION	FEATURES/BENEFITS	FRACT HP	SMALL FRAME NEMA	SMALL FRAME IEC	LARGE FRAME NEMA	LARGE FRAME IEC	LARGE FRAME DC
260 Ø2.0" 	●	●	●	●	Small diameter bearing set enables operating speeds to 7500RPM. FB flex arm tether accommodates mounting to 56 C-Face motors (O.D.E.). 5-28 VDC regulated input voltage allows power supply from most any PLC or drive source. M12 body-mount and in-line options complement system connector standardization.	●	●	●			
25T Ø2.5" 	●	●	●	●	Large thru-bore capability—up to 1.125" or 28 mm in Size 25 package. One encoder accommodates both small and large frame motors. IP66 sealing provides extended protection in high-contaminant and moisture environments. Proprietary nylon composite housing enhances longevity in corrosive environments. Optional corrosive resistant version available.		●	●	●	●	●
775 **776** Ø4.3" 	●	●		●	Bore Sizes to 1.875" with Ultem inserts provide superior thermal and electrical isolation. Anti-rotation flex enables mounting to both 4.5" and 8.5" AK C-Face (5.875" and 7.250" BCs). Multiple cable/connector options including MS, M12 and cable gland.				●	●	●
770 Ø6.5" 	●	●	●	●	Fits Industry Standard 56C mounting. Double C-Face is standard, enabling the encoder to be placed between the motor and another C-Face device such as a brake or gearbox. Critical gapping, alignment, calibration assured via precision double bearing set; no special tools required. The only 56C on the market with 4096 CPR capability for high-performance velocity and position control loops.		●				
865T Ø6.5" 	●	●	●		Fits Industry Standard 56C mounting. 316 Stainless assures maximum corrosion protection in harsh food, beverage and chemical environments. IP66 combined with the 316 Stainless provides maximum wash-down protection. The only 56C on the market with 4096 CPR capability for high-performance velocity and position control loops.		●				
771 Ø9.0" 	●	●	●	●	Fits larger motor frame sizes with 8.5" AK. Double C-Face is standard. Optional protective cover affords IP65 sealing. Host of cable/connector options including MS, latching industrial, M12 and cable gland.				●		●

MODEL 711

FEATURES

The Original Industry-Standard Cube
Five Versatile Housing Styles
Unidirectional Output
Resolutions Available to 10,000 CPR

The Model 711 Accu-Coder™ is the original, industry standard cube encoder. Designed for compatibility with most programmable controllers, electronic counters, motion controllers, and motor drives, it is ideally suited for applications that require a simple, symmetrical, unidirectional square wave output in a single channel format. Critical performance specifications for the most popular resolutions and advanced Opto-ASIC circuitry—a single chip design that eliminates many board level components— increases the reliability of an already dependable and durable encoder. With new options continually being added, the Model 711 excels in a wide variety of industrial applications.

COMMON APPLICATIONS

Feedback for Counters, PLCs & Motors, Measuring For Packaging, Filling & Material Handling Machines, Wire Winding, Film Extrusion

MODEL 711 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

711 – 0256 – S – HD1 – 6 – S – S – N

MODEL
711 Unidirectional Cube (Single Channel)

CYCLES PER REVOLUTION (CPR)
1-10,000
See *CPR Options* below for available resolutions.
(1271 and above is a price adder)

OUTPUT TYPE
- S Pull-Up Resistor
- O Open Collector
- PP Push-Pull
- HV Line Driver

HOUSING TYPE
- S 2.25" Standard Housing
- S1 2.25" Standard Housing with IP50 Felt Shaft Seal[1]
- IND12 Industrial Housing with IP65 Shaft Seal
- HD1 3" x 3" x 6" Heavy Duty Housing
- HD3 Heavy Duty Housing with Conduit Connector & Terminal Strip
- HD5 Heavy Duty Housing with 10 mm Outer Bearing
- HD10 Heavy Duty Housing with Ultra Heavy Duty Bearings, 0.625" or 0.500" Shaft
- HD12 Heavy Duty Housing with IP65 Outer Shaft Seal
- HD14 Heavy Duty Housing with IP65 Shaft Seal and with Conduit Connector & Terminal Strip
- 5PY Standard Cube With 5PY Adaptor[2]
- EX Explosion-proof Housing

SHAFT DIAMETER[3]
- 4 1/4", 0.250"[4]
- 5 5/16", 0.3125"[5]
- 6 3/8", 0.375"
- 8 1/2", 0.500"[6]
- 10 5/8", 0.625"[6]

SHAFT TYPE
- S Single
- D Double ended[7]

CONNECTOR TYPE[8]
- S Standard 6-pin MS
- Y 7-pin MS
- J 5-pin M12 (12 mm)[7]
- K 8-pin M12 (12 mm)[7]
- G Gland Nut - 18" Cable[9]
- T Solder or Screw Terminal[10]
- B Solder Terminal with Conduit Box

MATING CONNECTOR
- N No Connector
- Y Yes

MODEL 711 CPR OPTIONS

0001 thru 0189*			0193	0198	0200	0205	0210	0240
0250	0256	0276	0298	0300	0305	0308	0315	0333
0336	0350	0360	0400	0480	0500	0512	0580	0597
0600	0700	0720	0800	0840	0960	1000	1024	1200
1250	1270	1500	1800*	2000	2048	2500	3000	3600*
4096	5000	6000	7200*	8192	10,000			

*Contact Customer Service for availability.

Contact Customer Service for other disk resolutions. Not all disk resolutions available with all output types.

NOTES:
1. Available with 0.250" shaft only.
2. Only available with 5/16" (0.3125") shaft.
3. Contact Customer Service for custom shaft lengths and diameters.
4. Standard housing only.
5. Standard or 5PY housing only.
6. HD10 housing only.
7. Not available for HD or EX housings.
8. For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
9. For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable. For CPR > 2500. Standard cable length only.
10. Screw terminals available for HD and EX housings. Solder terminals available for S and S1 housings.

MODEL 711 SPECIFICATIONS

Common to all cube housing styles.

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° C and 100° C.
Input Current..... 80 mA maximum with no output load
Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz
Output Format..... Incremental- Square wave with single channel
Output Types..... Open Collector- 250 mA max per channel
Pull-Up- 250 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Max Frequency ..... 1 to 2500 CPR 125 kHz
2501 to 5000 CPR 250 kHz
5001 to 10,000 CPR 500 kHz
Symmetry..... 180° (±18°) electrical
Rise Time..... Less than 1 microsecond
Accuracy..... Within 0.05° mechanical from one cycle to any other cycle, or 3 arc minutes.

Mechanical

Max Speed ..... 6000 RPM. Higher shaft speeds achievable, contact Customer Service.
Shaft Material ..... 303 Stainless Steel
Housing ..... Black non-corrosive finished 6063-T6 aluminum
Bearings..... Precision ABEC ball bearings

Environmental

Storage Temp ..... -25° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 50 g @ 11 ms duration

STANDARD CUBE HOUSING (S, S1) SPECIFICATIONS

Mechanical

Shaft Type ..... Single or double-ended (specify choice)
Radial Loading..... 15 lb maximum (0.250" diameter shaft)
40 lb maximum (0.375" diameter shaft)
Axial Loading..... 10 lb maximum (0.250" diameter shaft)
30 lb maximum (0.375" diameter shaft)
Starting Torque ..... 0.13 oz-in typical for 0.250" shaft
0.38 oz-in typical for 0.375" shaft
Moment of Inertia ... 6.5 x 10^{-6} oz-in-sec^2
Weight..... 10 oz for standard housing

WIRING TABLE

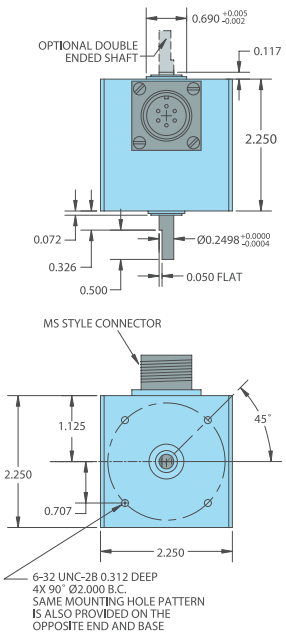
Function	Gland Cable† Wire Color	5-pin M12	8-pin M12	10-pin MS	7 pin MS HV	7-pin MS O,S PP	6-pin MS HV, No Index	6-pin MS O,S PP	Term. Block HV, No Index	Term. Block O,S HV,PP
Com	Black	3	7	F	F	F	A	A,F	1	1,6
+VDC	Red	1	2	D	D	D	B	B	2	2
A	White	4	1	A	A	A	C	D	3	4
A'	Brown	--	3	H	C	--	D	--	4	--
Case	--	--	--	G	G	G	--	--	--	--
Shield	Bare	--	--	--	--	--	--	--	--	--

†Standard cable is 24 AWG conductors with foil and braid shield.

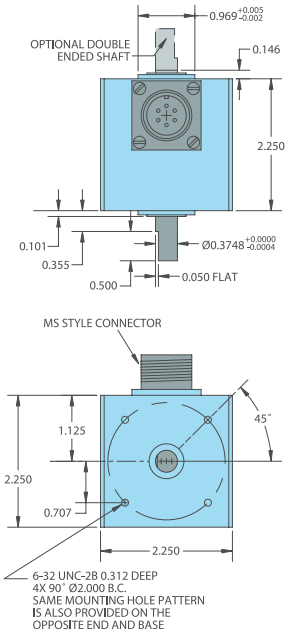
WAVEFORM DIAGRAM

STANDARD CUBE HOUSING (S, S1)

Cube Housing With 1/4" Shaft (4)



Cube Housing With 3/8" Shaft (6)



CUBE PIVOT MOUNTING BRACKETS

176430-01 Single Pivot
176431-01 Double Pivot
176430-02 Spring Loaded Single Pivot
176431-02 Spring Loaded Double Pivot

Encoder sold separately.

Dual Wheel

Single Wheel
(shown with Torsion Spring)

MODEL 715

FEATURES

The Original Industry-Standard Cube
Five Versatile Housing Styles
Bi-Directional, Constant Pulse Width
Resolutions Available up to 10,000 CPR

The Model 715 Accu-Coder™ is ideally suited for applications requiring bi-directional feedback with a constant pulse width. The Model 715 is available in two versions. The Model 715-1 provides output pulses for clockwise shaft rotation on one channel and pulses for counterclockwise rotation on another. The Model 715-2 provides output pulses for counting on one channel while the other channel indicates direction of rotation. Critical performance specifications for the most popular resolutions and advanced Opto-ASIC circuitry—a single chip design that eliminates many board level components—increases the reliability of an already dependable and durable encoder. With new options continually being added, the Model 715 excels in a wide variety of industrial applications.

COMMON APPLICATIONS

Measuring for Cut-to-Length, Labeling & Filling, Position Control, Motion Following, or Slaving Applications

MODEL 715 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

715-1 – 0256 – .2 – N – S – HD1 – 6 – S – S – N

MODEL
715-1 Two Channels
715-2 One Channel and Direction Line

PULSES PER REVOLUTION
(PPR) 2 - 10,000
See PPR Options below for available resolutions
(1202 and above is a price adder)

PULSE WIDTH
Values from .01 to 100 milliseconds

PULSE POLARITY
P Positive
N Negative

OUTPUT TYPE
S Pull-Up Resistor
O Open Collector

HOUSING TYPE
S 2.25" Standard Housing
S1 2.25" Standard Housing with IP50 Felt Shaft Seal[1]
IND12 Industrial Housing with IP65 Shaft Seal
HD1 3" x 3" x 6" Heavy Duty Housing
HD3 Heavy Duty Housing with Conduit Connector & Terminal Strip
HD5 Heavy Duty Housing with 10 mm Outer Bearing
HD10 Heavy Duty Housing with Ultra Heavy Duty Bearings, 0.625" or 0.500" Shaft
HD12 Heavy Duty Housing with IP65 Outer Shaft Seal
HD14 Heavy Duty Housing with IP65 Shaft Seal and with Conduit Connector & Terminal Strip
5PY Standard Cube With 5PY Adaptor[2]
EX Explosion-proof Housing

SHAFT DIAMETER[3]
4 1/4", 0.250"[4]
5 5/16", 0.3125"[5]
6 3/8", 0.375"
8 1/2", 0.500"[6]
10 5/8", 0.625"[6]

SHAFT TYPE
S Single
D Double ended[7]

CONNECTOR TYPE[8]
S Standard 6-pin MS
J 5-pin M12 (12 mm)[7]
K 8-pin M12 (12 mm)[7]
G Gland Nut - 18" Cable[9]
T Solder or Screw Terminal[10]
B Solder Terminal with Conduit Box

MATING CONNECTOR
N No Connector
Y Yes

MODEL 715 PPR OPTIONS

0001 thru 0189*			0193	0198	0200	0205	0210	0240	0250
0256	0276	0298	0300	0305	0308	0333	0336	0350	0360
0400	0480	0500	0512	0597	0600	0700	0720	0800	0840
0960	1000	1024	1200	1250	1270	1800	2000	2048	2500

2x and 4x, of all of the above resolutions are available
*Contact Customer Service for availability.

Contact Customer Service for other disk resolutions. Not all disk resolutions available with all output types

NOTES:
1 Available with 0.250" shaft only.
2 Only available with 5/16" (0.3125") shaft.
3 Contact Customer Service for custom shaft lengths and diameters.
4 Standard housing only.
5 Standard or 5PY housing only.
6 HD10 housing only.
7 Not available for HD or EX housings.
8 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
9 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
10 Screw terminals available for HD and EX housings. Solder terminals available for S and S1 housings.

MODEL 715 SPECIFICATIONS

Common to All Cube Housing Styles

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° to 100°C
Input Current ..... 80 mA maximum with no output load
Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz
Output Format..... Incremental- Square wave with timed output
Output Types..... Open Collector- 250 mA max per channel
Pull-Up- 250 mA max per channel
Max Frequency ..... 0 to 125 kHz
Rise Time..... Less than 1 microsecond
Accuracy..... Within 0.05° mechanical from one cycle to any other cycle, or 3 arc minutes

Mechanical

Max Speed ..... 6000 RPM. Higher shaft speeds achievable, contact Customer Service.
Shaft Material ..... 303 Stainless Steel
Housing ..... Black non-corrosive finished 6063-T6 aluminum
Bearings..... Precision ABEC ball bearings

Environmental

Storage Temp ..... -25° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 50 g @ 11 ms duration

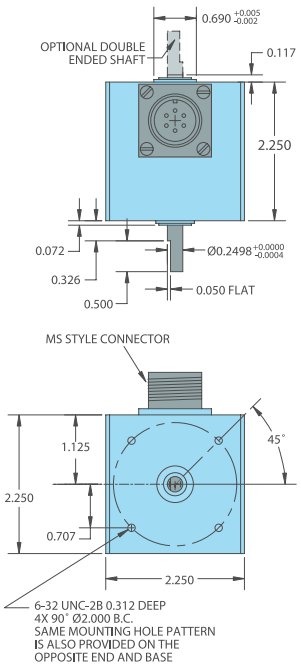
STANDARD CUBE HOUSING (S, S1) SPECIFICATIONS

Mechanical

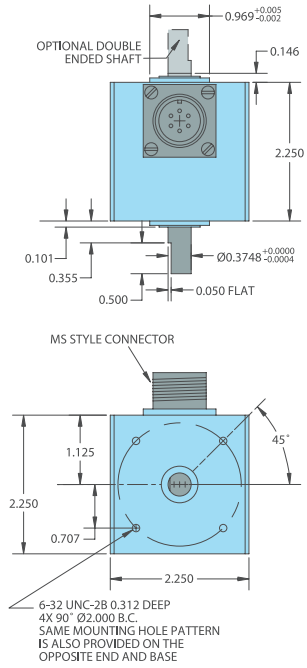
Shaft Type..... Single or double-ended (specify choice)
Radial Loading ..... 15 lb maximum (0.250" diameter shaft)
40 lb maximum (0.375" diameter shaft)
Axial Loading..... 10 lb maximum (0.250" diameter shaft)
30 lb maximum (0.375" diameter shaft)
Starting Torque..... 0.13 oz-in typical for 0.250" shaft
0.38 oz-in typical for 0.375" shaft
Moment of Inertia ... 6.5×10^{-6} oz-in-sec^2
Weight..... 10 oz for standard housing

STANDARD CUBE HOUSING (S, S1)

Cube Housing With 1/4" Shaft (4)



Cube Housing With 3/8" Shaft (6)



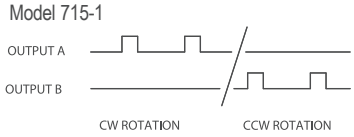
WIRING TABLE

Function	Cable† Wire Color	5-pin M12	8-pin M12	6-pin MS	Term. Block
Com	Black	3	7	A,F	1,6
+VDC	Red	1	2	B	2
A	White	4	1	D	4
B	Blue	2	4	E	5
Shield	Bare	--	--	--	--

†Standard cable is 24 AWG conductors with foil and braid shield.

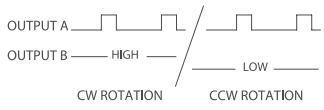
WAVEFORM DIAGRAMS

Model 715-1



Model 715-1 Bi-directional Encoder
The 715-1 provides two output channels, one with a constant pulse width output on one channel for clockwise shaft rotation, and on the other channel for counterclockwise shaft rotation. Specify PPR in any even numbered value between 2 and 10,000. Specify any pulse width from 10 microseconds to 100 milliseconds and pulse polarity. Some options require Heavy Duty housing. The Line Driver output option is not available.

Model 715-2



Model 715-2 Bi-directional Encoder
The 715-2 provides two output channels, one channel has a constant pulse width output regardless of shaft rotation. The other channel an up/down direction line with logic level "1" for clockwise shaft rotation, and level "0" for counterclockwise shaft rotation. Options are the same as for the Model 715-1.

CUBE PIVOT MOUNTING BRACKETS

176430-01 Single Pivot
176431-01 Double Pivot
176430-02 Spring Loaded Single Pivot
176431-02 Spring Loaded Double Pivot

Encoder sold separately.

Dual Wheel

Single Wheel
(shown with Torsion Spring)

MODEL 716

FEATURES

The Original Industry-Standard Cube
Five Versatile Housing Styles
Quadrature Output
New Resolutions Available to 10,000 CPR

The Model 716 Accu-Coder™ is ideally suited for applications requiring a quadrature output. Designed for compatibility with most programmable controllers, electronic counters, motion controllers, and motor drives, it is ideally suited for industrial applications where it is important that the direction of rotation be known. Critical performance specifications for the most popular resolutions and advanced Opto-ASIC circuitry—a single chip design that eliminates many board level components—increase the reliability of an already dependable and durable encoder. With new options continually being added, the Model 716 excels in a wide variety of industrial applications.

COMMON APPLICATIONS

Feedback for Counters, PLCs & Motors, Cut-to-Length, Labeling, Measuring For Packaging, Filling & Material Handling Machines, Wire Winding, Film Extrusion

MODEL 716 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

716 – 0256 – 1 – N – S – HD1 – 6 – S – S – N

MODEL
716 Quadrature Cube

CYCLES PER REVOLUTION (CPR)
1-10,000
See *CPR Options* below for available resolutions.
(601 and above is a price adder)

INDEX PULSE[1]
Blank No Index
1 Index Pulse

PULSE POLARITY[1]
P Positive
N Negative

OUTPUT TYPE
S Pull-Up Resistor
O Open Collector
PP Push-Pull
HV Line Driver

HOUSING TYPE
S 2.25" Standard Housing
S1 2.25" Standard Housing with IP50 Felt Shaft Seal[2]
IND12 Industrial Housing with IP65 Shaft Seal
HD1 3" x 3" x 6" Heavy Duty Housing
HD3 Heavy Duty Housing with Conduit Connector & Terminal Strip
HD5 Heavy Duty Housing with 10 mm Outer Bearing
HD10 Heavy Duty Housing with Ultra Heavy Duty Bearings, 0.625" or 0.500" Shaft
HD12 Heavy Duty Housing with IP65 Outer Shaft Seal
HD14 Heavy Duty Housing with IP65 Shaft Seal and with Conduit Connector & Terminal Strip
5PY Standard Cube With 5PY Adaptor[3]
EX Explosion-proof Housing

SHAFT DIAMETER[4]
4 1/4", 0.250"[5]
5 5/16", 0.3125"[6]
6 3/8", 0.375"
8 1/2", 0.500"[7]
10 5/8", 0.625"[7]

SHAFT TYPE
S Single
D Double ended[8]

CONNECTOR TYPE[9]
S Standard 6-pin MS
Y 7-pin MS
X 10-pin MS
J 5-pin M12 (12 mm)[8]
K 8-pin M12 (12 mm)[8]
G Gland Nut - 18" Cable[10]
T Solder or Screw Terminal[11]
B Solder Terminal with Conduit Box

MATING CONNECTOR
N No Connector
Y Yes

MODEL 716 CPR OPTIONS

0001 thru 0189*			0193	0198	0200	0205	0210	0240
0250	0256	0276	0298	0300	0305	0308	0315	0333
0336	0350	0360	0400	0480	0500	0512	0580	0597
0600	0700	0720	0800	0840	0960	1000	1024	1200
1250	1270	1500	1800*	2000	2048	2500	3000	3600*
4096	5000	6000	7200*	8192	10,000			

*Contact Customer Service for availability.

Contact Customer Service for other disk resolutions. Not all disk resolutions available with all output types.

NOTES:
1 Complete only if Index Pulse option is selected.
2 Available with 0.250" shaft only.
3 Only available with 5/16" (0.3125") shaft.
4 Contact Customer Service for custom shaft lengths and diameters.
5 Standard housing only.
6 Standard or 5PY housing only.
7 HD10 housing only.
8 Not available for HD or EX housings.
9 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
10 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable. For CPR > 2500. Standard cable length only.
11 Screw terminals available for HD and EX housings. Solder terminals available for S and S1 housings.

MODEL 716 SPECIFICATIONS

Common to All Cube Housing Styles

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° C and 100° C.
Input Current ..... 80 mA maximum with no output load
Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz
Output Format..... Incremental- Square wave with single channel
Output Types..... Open Collector- 250 mA max per channel
Pull-Up- 250 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)
Max Frequency..... 1 to 2500 CPR 125 kHz, 2501 to 5000 CPR 250 kHz, 5001 to 10,000 CPR 500 kHz
Index..... Once per revolution, 180° electrical gated to Channel A. *See Waveform Diagrams.*
Quadrature Edge Separation..... 67.5° electrical or better is typical, 54° electrical minimum at temperatures > 99° C
Rise Time..... Less than 1 microsecond
Accuracy..... Within 0.05° mechanical from one cycle to any other cycle, or 3 arc minutes

Mechanical

Max Speed ..... 6000 RPM. Higher shaft speeds achievable, contact Customer Service.
Shaft Material ..... 303 Stainless Steel
Housing ..... Black non-corrosive finished 6063-T6 aluminum
Bearings..... Precision ABEC ball bearings

Environmental

Storage Temp ..... -25° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 50 g @ 11 ms duration

STANDARD CUBE HOUSING (S, S1) SPECIFICATIONS

Mechanical

Shaft Type ..... Single or double-ended (specify choice)
Radial Loading..... 15 lb maximum (0.250" diameter shaft)
40 lb maximum (0.375" diameter shaft)
Axial Loading..... 10 lb maximum (0.250" diameter shaft)
30 lb maximum (0.375" diameter shaft)
Starting Torque ..... 0.13 oz-in typical for 0.250" shaft
0.38 oz-in typical for 0.375" shaft
Moment of Inertia ... 6.5×10^{-6} oz-in-sec^2
Weight..... 10 oz for standard housing

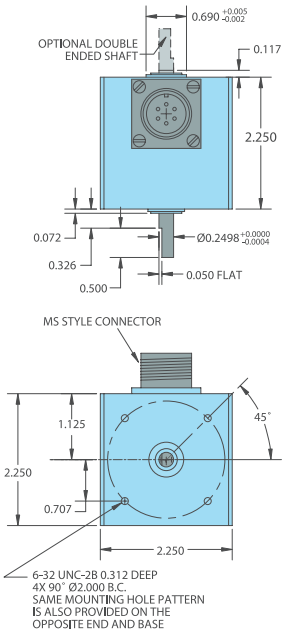
WIRING TABLE

Function	Cable† Wire Color	5-pin M12	8-pin M12	10-pin MS HV	7-pin MS HV	7-pin MS O,S,PP	6-pin MS HV,No Index	6-pin MS O,S,PP	Term. Block HV,No Index	Term. Block O,S,PP
Com	Black	3	7	F	F	F	A	A,F	1	1,6
+VDC	Red	1	2	D	D	D	B	B	2	2
A	White	4	1	A	A	A	C	D	3	4
A'	Brown	--	3	H	C	--	D	--	4	--
B	Blue	2	4	B	B	B	E	E	5	5
B'	Violet	--	5	I	E	--	F	--	6	--
Z	Orange	5	6	C	--	C	--	C	--	3
Z'	Yellow	--	8	J	--	--	--	--	--	--
Case	Green	--	--	G	G	G	--	--	--	--
Shield	Bare	--	--	--	--	--	--	--	--	--

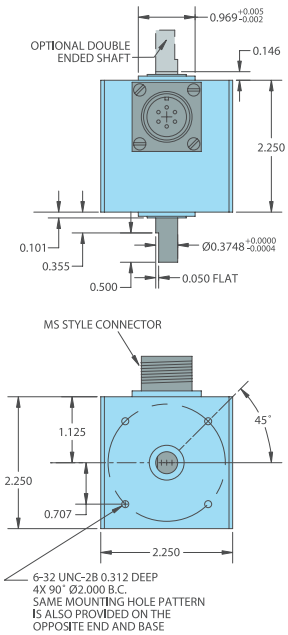
†Standard cable is 24 AWG conductors with foil and braid shield.

STANDARD CUBE HOUSING (S, S1)

Cube Housing With 1/4" Shaft (4)



Cube Housing With 3/8" Shaft (6)



CUBE PIVOT MOUNTING BRACKETS

Dual Wheel

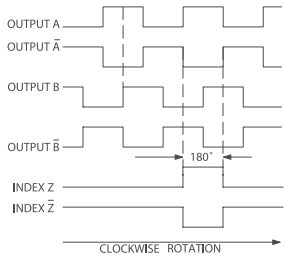
Single Wheel
(shown with Torsion Spring)

176430-01 Single Pivot
176431-01 Double Pivot
176430-02 Spring Loaded Single Pivot
176431-02 Spring Loaded Double Pivot

Encoder sold separately.

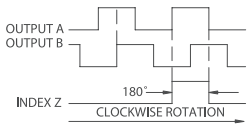
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



CUBE HOUSINGS

INDUSTRIAL CUBE HOUSING (IND12)

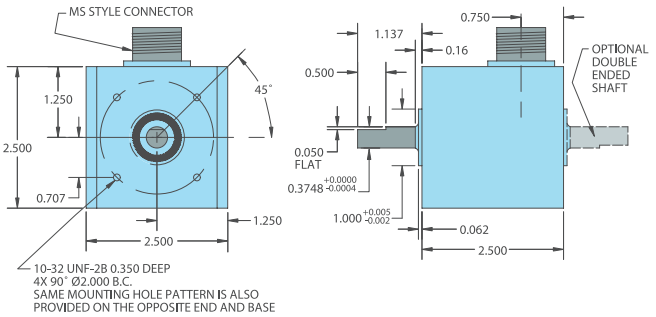
This more robust unit meets requirements between Standard and Heavy Duty housings while retaining the Cube design. The Industrial 12 (IND12) model features an IP65 shaft seal. The tough, sealed aluminum housing has a wall thickness of 0.187" and offers greater protection from wash down, sprays, dust, moisture, shock, vibration, and other hazards found in industrial environments.

INDUSTRIAL CUBE HOUSING (IND12) SPECIFICATIONS

Refer to all Standard Cube Housing specifications except as follows:

Mechanical

Shaft Size ..... 0.375" diameter
Shaft Type ..... Single- or Double-Ended Shaft Available
Radial Loading ..... 40 lb Maximum
Axial Loading ..... 30 lb Maximum
Starting Torque ..... 3 oz-in Starting Torque w/IP65 Shaft Seal



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified

HEAVY DUTY CUBE HOUSING (HD12)

The Heavy Duty housing uses a separate 0.375" diameter external shaft and bearing assembly to rotate the shaft of an internally mounted Cube Housing. This provides mechanical isolation from external loads and stress. A flexible coupling between the external shaft and the encoder protects the internal unit from axial and radial loading. The 0.250" aluminum walls protect the encoder from external shock, vibration, and the outside environment.

Heavy Duty Housing Options

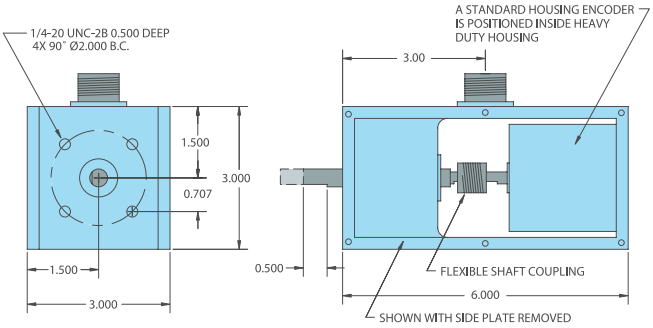
HD 1 Heavy Duty 3" x 6" housing
HD 3 Heavy Duty w/conduit connector (threaded for 0.500" NPT Conduit) and terminal strip
HD 5 Heavy Duty w/10 mm outer bearing
HD 12* Heavy Duty w/IP65 rated outer shaft seal
HD 14* Heavy Duty w/IP65 rated outer shaft seal, conduit connector (threaded for 0.500" NPT Conduit), and terminal strip
*These units have an outer boss diameter of 1.000"

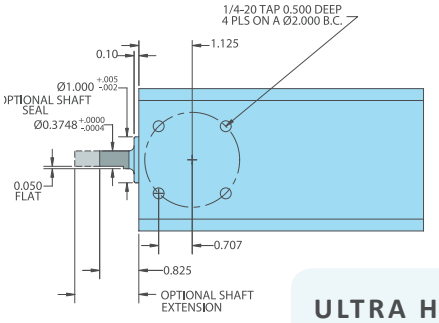
HEAVY DUTY CUBE HOUSING (HD12) SPECIFICATIONS

Refer to all cube specifications except as follows:

Mechanical

Max Speed ..... 6000 RPM
Shaft Size ..... 0.375"
Rotation ..... Either direction
Radial Loading ..... 40 lb maximum (50 lb for HD 5)
Axial Loading ..... 30 lb maximum (35 lb for HD 5)
Bearings ..... Precision ABEC ball bearings
Starting Torque ..... 1 oz-in; 3 oz-in w/IP65 seal
Mounting ..... Tapped holes face and base
Weight ..... 3.25 lb





ULTRA HEAVY DUTY CUBE HOUSING (HD10)

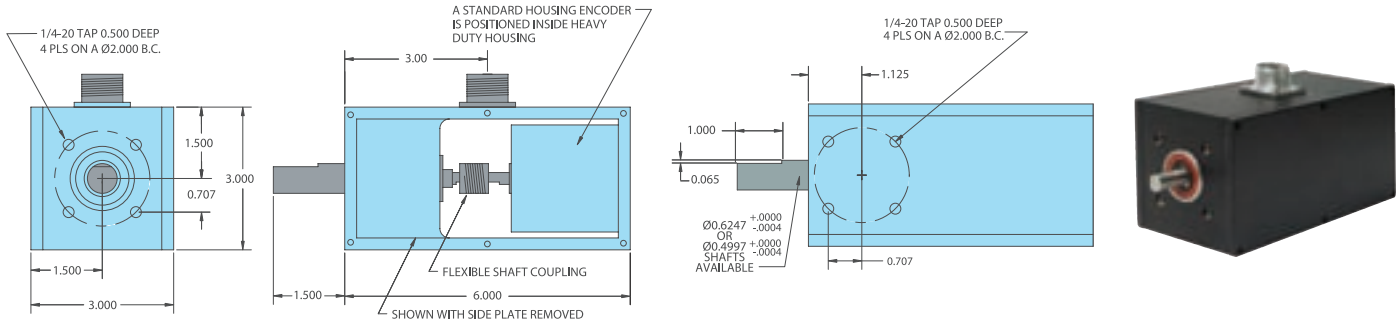
The HD 10 Ultra Heavy Duty encoder is designed for use in applications with severe shaft loading conditions. The HD 10 offers two shaft sizes: 0.500" and 0.625". Shaft material is 303 stainless steel. Bearings are conservatively rated at 95 lb radial and 60 lb axial shaft loading. IP65 shaft seal is standard on all units. The HD 10 Ultra Heavy Duty housing uses a larger external shaft and R10 bearing assembly to rotate the shaft of an internally mounted Cube Housing. This provides mechanical isolation from external loads and stress. A flexible coupling between the external shaft and the encoder protects the internal unit from axial and radial loading. The 0.250" aluminum walls protect the encoder from external shock, vibration, and the outside environment.

ULTRA HEAVY DUTY CUBE HOUSING (HD 10) SPECIFICATIONS

Mechanical

Max Speed ..... 6000 RPM
Shaft Size ..... 0.500" or 0.625"
Rotation ..... Either direction
Radial Loading ..... 95 lb operating
Axial Loading ..... 60 lb operating
Bearings ..... ABEC precision ball bearings
Bearing Life ..... 15,000 hours at rated load
Starting Torque ..... 3 oz-in IP65 rated
Mounting ..... Tapped holes face and base
Weight ..... 3.85 lb

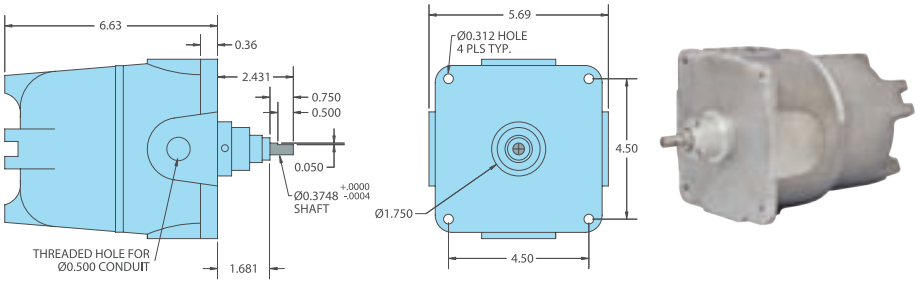
ULTRA HEAVY DUTY CUBE HOUSING (HD10)—CONT'D



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified

EXPLOSION-PROOF HOUSING (EX)

An explosion-proof housing is available for installing the Cube Series Accu-Coder™ in hazardous locations. The Cube Series encoder is mounted within the explosion-proof housing and is coupled to the 0.375" shaft assembly by a flexible shaft coupling. This decreases radial and axial loading on the internal encoder shaft and bearings to ensure long life. Electrical connection to the Accu-Coder™ is by an internal barrier terminal strip. A threaded hole for 0.500" NPT conduit is provided.



EXPLOSION-PROOF HOUSING (EX) SPECIFICATIONS

The explosion-proof housing is designed to meet the following:

NEC Class 1, Groups C and D
NEC Class 2, Groups E, F, and G
UL Standard 1203
Class 1, Division 1, Groups C and D
Class 2, Division 1, Groups E, F, and G
CSA Standard C 22.2 No. 30-M 1986
NEMA 7 and NEMA 9

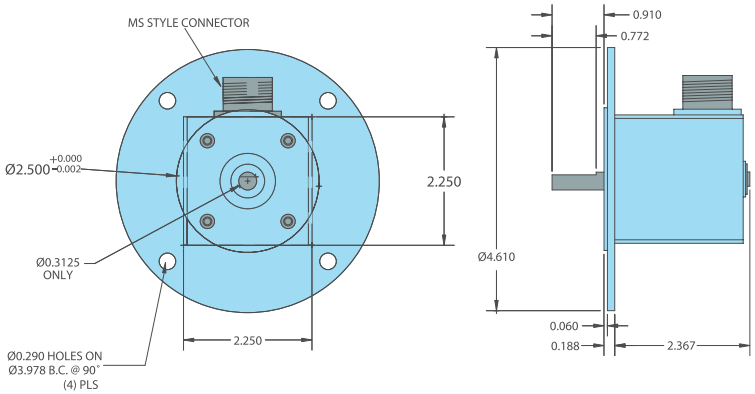
Refer to all cube specifications except as follows:

Mechanical

Max Speed ..... 4000 RPM
Radial Loading..... 30 lb operating
Axial Loading..... 10 lb operating
Weight..... 6 lb
Finish ..... Unpainted Aluminum

CUBE SERIES OPTIONAL 5PY ADAPTER (175443)

The all aluminum optional 5PY adapter allows any standard housing Cube Series encoder to replace DC tachometer technology. The 5PY adapter is interchangeable with any 5PY tach generator.



Order standard housing Cube Series Accu-Coder™ with 5/16" shaft and specify part #175443.

All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

MODEL 15S

FEATURES

Very High Performance Economical Encoder
Low Profile—Less Than 1.0" (25.4 mm) Height and 1.5" (38 mm) Diameter
Extended Temperature Operating Ranges Available
Up to 12 Pole Commutation Optional (for Brushless Motor Control)

The Model 15S Accu-Coder™ offers a high performance feedback solution in a low profile package, making the Model 15S ideal for commercial and light-duty industrial applications. This industry standard Size 15 (1.5" diameter) encoder features a precision bearing set, sealing available to IP64, a durable stainless steel shaft, and a selection of servo, flange, and face mount options. The Model 15S may also be specified with features such as extended operating temperatures from -40° C to +120° C, or up to 12 pole commutation for brushless motor control. The Model 15S features EPC's Opto-ASIC circuitry for a clean, reliable signal. Its durable, yet economical design makes it an ideal encoder for high precision OEM applications.

COMMON APPLICATIONS

Servo Motor Control, Robotics, Medical Diagnostic Equipment, Specialty Assembly Machines, Digital Plotters, Printers, Typesetting Equipment

MODEL 15S ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical | Optional Features (Leave Blank For Standard Options: -20° to +85° C Std, IP50 Std)

15S	–	19	M1	–	0500	N	5	A	OC	–	F00	–				

MODEL
15S Shaft Mount

SHAFT SIZE[1]
21 3/16", 0.1875"
23 4 mm
19 1/4", 0.250"
20 6 mm

MOUNTING
M1 3 hole 28 mm BC Servo Mount
M2 3 hole 1.210" BC Servo Mount
M3 2.093" Square Flange
M4 2.096" Servo Mount
M5 4 hole 1.100" Servo Mount
M6 4 hole 1.000" Servo Mount
M7 4 hole 1.181" Servo Mount
M8 3 hole 1.181/1.260" Servo Mount
M9 3 hole 1.210" BC Servo Mount

CYCLES PER REVOLUTION
See *CPR Options* below
Price adder >1800

COMMUTATION[2]
N No Commutation
A 4 Pole
B 6 Pole
C 8 Pole
E 10 Pole
D 12 Pole

INPUT VOLTAGE
5 5 VDC
V1 5 to 28 VDC

NUMBER OF CHANNELS[3]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A[4]
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
OC Open Collector
PP Push-Pull
HV Line Driver
PU Pull-Up Resistor[5]
OD Open Collector with Differential Outputs
Available on special request.
Additional lead times may apply:
LO Line Driver on ABZ, Open Collector on UVW[5]

CONNECTOR TYPE[6]
F00 18" Cable[7] (Std)
F01 12" Cable
F02 24" Cable
F03 36" Cable
M00 2M Cable[7]
J00 18" Cable with 5-pin M12[9]
K00 18" Cable with 8-pin M12[9]
A00 15-pin Header with 18"Cable[10]

MAXIMUM FREQUENCY
Standard
F3 Extended
See Specifications

OPERATING TEMPERATURE
-20° to +85° C (Std)
T1 -40° to +85° C
T2 -20° to +100° C
T3 -20° to +120° C[11]

SEALING
IP50 (Std)
S1 IP64

CERTIFICATION
None (Std)
CE CE Marked[12]

MODEL 15S CPR OPTIONS

0001 thru 0189*	0198	0200	0250	0256	0300	0315
0360	0400	0500	0512	0580	0600	0750
0800	1000	1024	1125	1200	1250	1500
1800	2000	2048	2500	2540	3000	3600
4000	4096	5000	6000	7200	8192	10,000

New CPR values are periodically added to those listed.
Contact Customer Service to determine all currently available values. Special disk resolutions are available upon request and may be subject to a one-time NRE fee.

NOTES:
1 Contact Customer Service for additional options not shown.
2 Not available in all configurations, and not available with V1 Input Voltage. Contact Customer Service for availability.
3 Contact Customer Service for non-standard index gating or phase relationship options.
4 Reverse Quadrature not available with PU output type.
5 With Input Voltage above 16 VDC, operating temperature is limited to 85° C.
6 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
7 For non-standard English cable lengths enter 'F' plus cable length expressed in feet. Example: F06 = 6 feet of cable. Frequency above 300 kHz standard cable lengths only.
8 For non-standard metric cable lengths enter 'M' plus cable length expressed in meters. Example: M06 = 6 meters of cable.
9 Not available with commutation. 5-pin not available with Line Driver (HV, OD, LO) outputs. Additional cable lengths available. Please contact Customer Service.
10 Pin Header available with 5 VDC Input Voltage, HV Line Driver and standard quadrature phasing only. Not available with CE Certification. IP50 sealing option only.
11 Only available with 5 VDC Input Voltage.
12 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 15S SPECIFICATIONS

Electrical

Input Voltage..... 5 VDC ±10% Fixed Voltage
4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° to 100° C

Input Current..... 100 mA max (65 mA typical) with no output load

Output Format ..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face.
See *Waveform Diagrams*.

Output Types..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Pull-Up- Open collector with 2.2K ohm Pull-Up 20mA max per channel
Line Driver- 20 mA max per channel (Meets RS 422 at 5 VDC supply.)

Index..... Once per revolution.
1 to 189 CPR: Ungated
190 to 10,000 CPR: Gated to output A
See *Waveform Diagrams*.

Max. Frequency ..... Standard Frequency Response is
200 kHz for CPR 1 to 2540
500 kHz for CPR 2541 to 5000
1 MHz for CPR 5001 to 10,000
Extended Frequency Response (optional) is
300 kHz for CPR 2000, 2048, 2500, and 2540

Noise Immunity..... Tested to BS EN61000-6-2; BS EN50081-2; BS EN61000-4-2; BS EN61000-4-3; BS EN61000-4-6; BS EN500811

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Waveform Symmetry.. 180°(±18°) electrical (single channel encoder)

Accuracy..... Within 0.017° mechanical or 1 arc-minute from true position. (for CPR>189)

Commutation..... Up to 12 pole. Contact Customer Service for availability.

Comm. Accuracy ..... 1° mechanical

Mechanical

Max Shaft Speed..... 8000 RPM. Higher speeds may be achievable, contact Customer Service.

Shaft Material ..... Stainless Steel

Radial Shaft Load .... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^{10} revolutions

Axial Shaft Load ..... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^{10} revolutions

Starting Torque ..... IP50- 0.05 oz-in
IP64- 0.4 oz-in

Moment of Inertia ... 6.7 x 10^{-5} oz-in-sec^2 (4.8 gm-cm^2)

Max Acceleration ..... 1 x 10^5 rad/sec^2

Weight..... 3 oz typical

Environmental

Storage Temp ..... -25° to +85° C

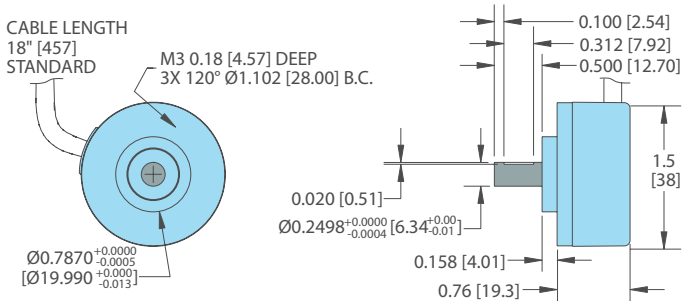
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

Shock..... 80 g @ 11 ms duration

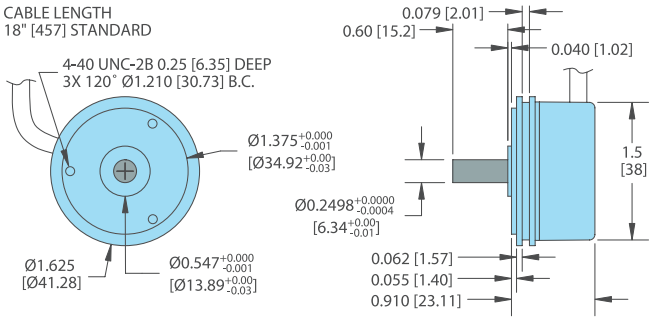
Sealing..... IP50 standard; IP64 available

MODEL 15S STANDARD SERVO MOUNT M1

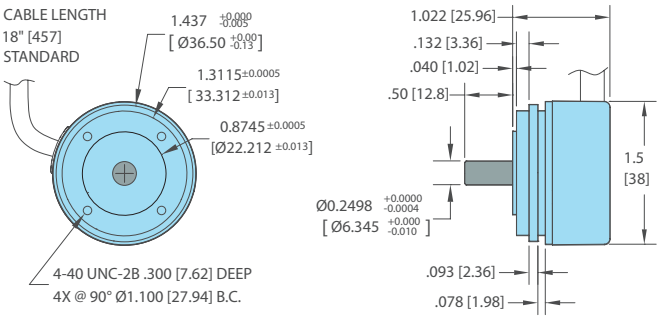


MODEL 15S SERVO MOUNT M2 & M9*

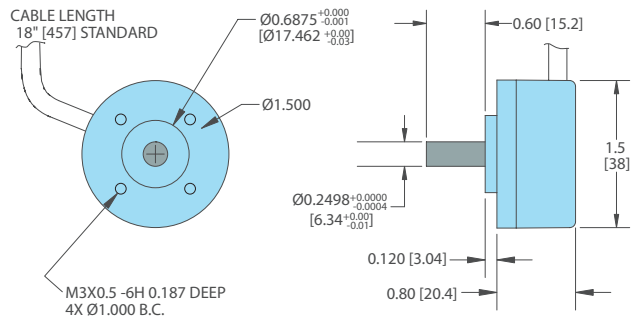
*M9 mount includes a 0.750" boss



MODEL 15S SERVO MOUNT M5



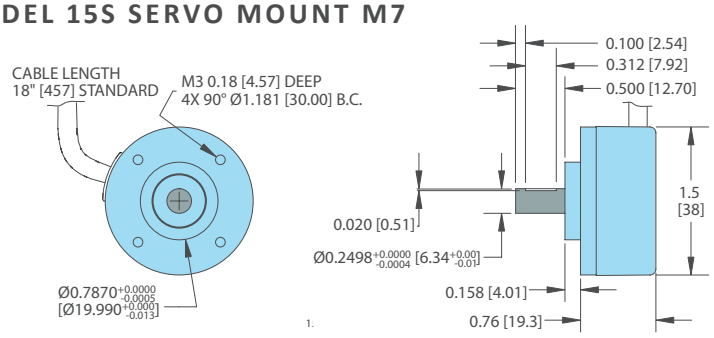
MODEL 15S SERVO MOUNT M6



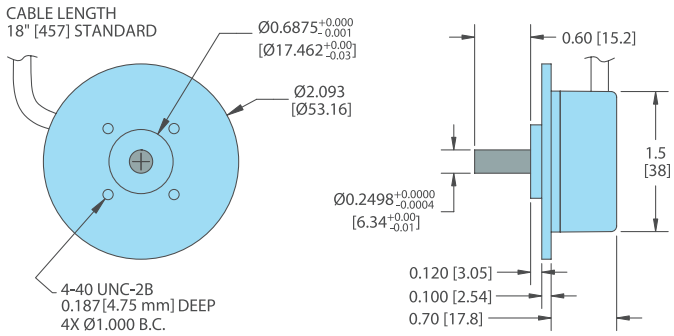
All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

MODEL 15S

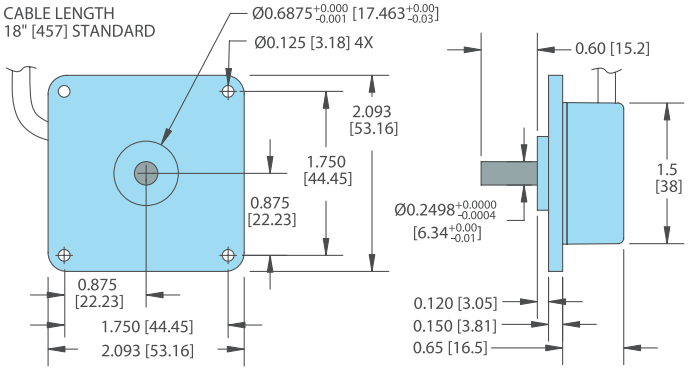
MODEL 15S SERVO MOUNT M7



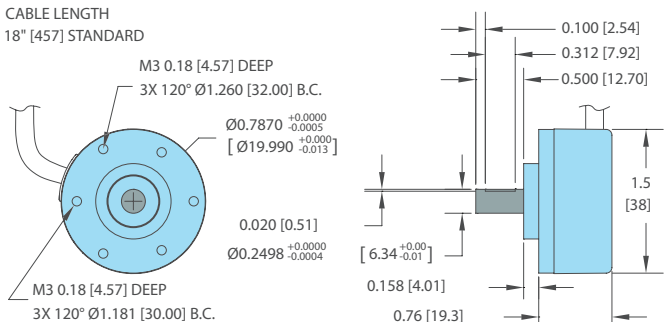
MODEL 15S SERVO MOUNT M4



MODEL 15S SQUARE FLANGE M3



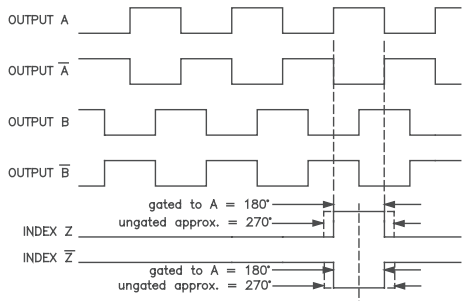
MODEL 15S SERVO MOUNT M8



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

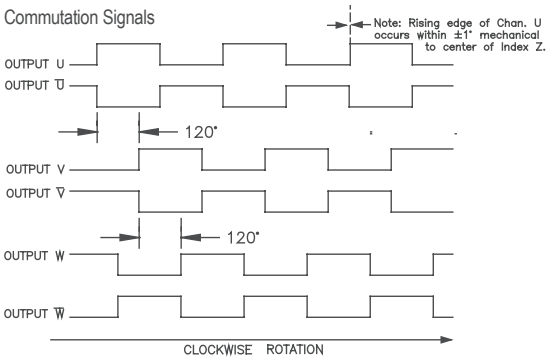
WAVEFORM DIAGRAMS

Incremental Signals



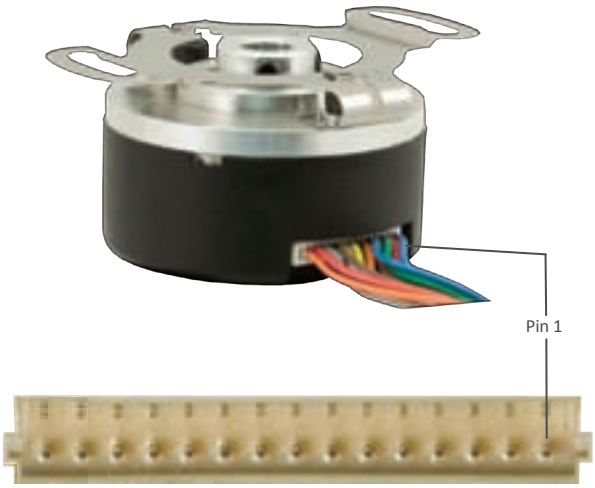
NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS $\overline{A}$, $\overline{B}$, $\overline{Z}$ FOR HV AND OD OUTPUTS ONLY.

Commutation Signals



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
PUSH-PULL OUTPUT DOES NOT INCLUDE COMPLIMENTARY CHANNELS.

15-PIN HEADER



WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**	15-pin Header
Com	Black	3	7	1
+VDC	White	1	2	2
A	Brown	4	1	4
A'	Yellow	--	3	3
B	Red	2	4	6
B'	Green	--	5	5
Z	Orange	5	6	7
Z'	Blue	--	8	8
U	Violet	--	--	10
U'	Gray	--	--	9
V	Pink	--	--	14
V'	Tan	--	--	13
W	Red/Green	--	--	12
W'	Red/Yellow	--	--	11
Shield	Bare*	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body. CE Option: Cable shield and M12 connector body is connected to internal case.
†Standard cable for non-commutated models is 24 AWG For commutated units, conductors are 28 AWG.

MODEL 755A

Ø1.5"

FEATURES

Miniature Size (1.5" Diameter)
Up to 30,000 CPR
Servo or Flange Mounting
1 MHz Frequency Response Available
Extended Temperature Operating Range Available

The Model 755A Size 15 Accu-Coder™ is ideal for applications requiring a small, high precision, high performance encoder. Approximately 1.5" in diameter and 1.5" long, it will fit where many encoders cannot. Designed with all metal construction and shielded ball bearings, it will provide years of trouble-free use. The standard servo mount (S) version is available with a variety of shaft sizes and lengths. Three additional servo style mounts (S1, S2, S3) are also available. The optional flange mounting (MF) is ideal for applications requiring a bolt-on, high precision encoder. With its high reliability and quick delivery, the Model 755A encoder is the perfect replacement encoder in this size category.

COMMOWWN APPLICATIONS

Robotics, Assembly Machines, Motor-Mounted Feedback, Phototypesetters, Printers & Digital Plotters, Elevator Controls, Medical Diagnostic Equipment

MODEL 755A ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

755A – 07 – S – 1000 – R – HV – 1 – S – S – CE

MODEL
755A Model 755A

SHAFT SIZE[1]
07 1/4", 0.250"
08 5 mm
06 6 mm
32 1/4", 0.250" Servo 1,2,or 3 only
20 6 mm x 0.500"
19 1/4", 0.250" x 0.500"

OPERATING TEMPERATURE
L -40° to 70° C
S 0° to 70° C
H 0° to 100° C[2]

CYCLES PER REVOLUTION
1-30,000
See *CPR Options* below for available resolutions.
Price adder for CPR >1270

NUMBER OF CHANNELS[3]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[4]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver
8 - 28V In/5V Out[5]
H5 Line Driver[6]
P5 Push-Pull[6]

MAXIMUM FREQUENCY
1 Standard 100 kHz
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[7]
4 1 MHz, >10,000 CPR[7]

MOUNTING & HOUSINGS
S Standard Servo Mount
MF Square Flange
S1 Servo Mount (Choose shaft 32)
S2 Servo Mount (Choose shaft 32)
S3 Servo Mount (Choose shaft 32)

CONNECTOR TYPE[8]
S Standard 18" Cable[9]
C01 8-pin Molex
C02 Terminal Block
J00 18" Cable with 5-pin M12[10]
K00 18" Cable with 8-pin M12[10]

CERTIFICATION
N None
CE CE Marked[11]

MODEL 755A CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*	0011*
0012*	0014*	0020	0021*	0024*	0025*	0028*	0030*	0032*
0033*	0034*	0035*	0038*	0040*	0042*	0045*	0050*	0060
0064*	0100	0120	0125	0128*	0144*	0150*	0160*	0192*
0200	0240*	0250	0254*	0256*	0300	0333*	0360	0400
0500	0512	0600	0625*	0635	0665*	0720	0768*	0800
0889	0900*	1000	1024	1200	1201*[a]	1203*[a]	1204*[a]	1250[a]
1270[a]	1440	1500	1800	2000	2048	2400[a]	2500	2540[a]
2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]	7500[a]
9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	15,000[a]	18,000[a]	20,000[a]
20,480[a]	25,000[a]	30,000[a]						

*Contact Customer Service for High Temperature Option (H).
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 Contact Customer Service for additional options.
2 0° to 85° C for certain resolutions, see CPR Options.
3 Contact Customer Service for index gating options.
4 24 VDC max for high temperature option.
5 Standard temperature, 60 to 3000 CPR only.
6 H5 and P5 outputs are not available with CE option.
7 Standard cable lengths only. For details, please refer to Technical Bulletin TB116: *Noise and Signal Considerations* at www.encoder.com.
8 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
9 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: S/6 = 6 feet of cable.
10 5-pin not available with Line Driver (HV, H5) outputs. Additional cable lengths available. Please consult Customer Service.
11 Please refer to Tehcnical Bulletin TB100: *When to Choose the CE Option.*

MODEL 755A SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C
Input Current ..... 100 mA max with no output load
Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz
Output Format ..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face.
See *Waveform Diagrams*.
Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)
Index..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.
Max Frequency ..... 100 kHz std; Up to 1 MHz optional. (See Ordering Guide for availability)
Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2
Symmetry..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 20,480 CPR: 180° (±36°) electrical
Quad Phasing ..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 20,480 CPR: 90° (±36°)
Min Edge Sep ..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical
Rise Time..... Less than 1 microsecond
Accuracy..... Instrument and Quadrature Error: For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

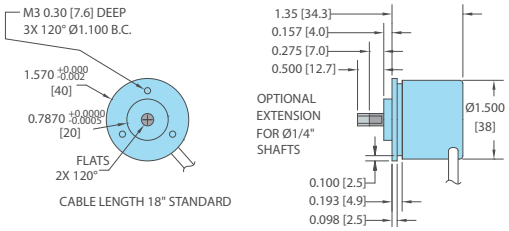
Mechanical

Max Speed ..... 7500 RPM. Higher shaft speeds may be achievable, contact Customer Service.
Shaft Rotation ..... Bi-directional
Radial Shaft Load ..... 5 lb
Axial Shaft Load ..... 3 lb
Starting Torque ..... 0.14 oz-in typical
4.0 oz-in typical for -40° C operation
Moment of Inertia ... 2.8×10^{-4} oz-in-sec^2
Max Acceleration ..... 1×10^5 rad/sec^2
Housing ..... Black non-corrosive finish
Bearings..... Precision ABEC ball bearings
Weight..... 3.10 oz servo mount, typical

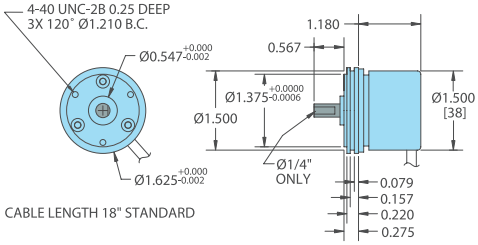
Environmental

Storage Temp ..... -25° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 50 g @ 11 ms duration

MODEL 755A STANDARD SERVO MOUNT (S)

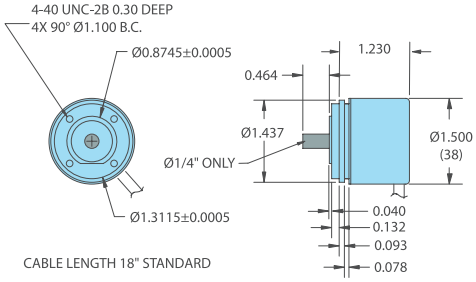


MODEL 755A SERVO MOUNTS (S1 & S2)

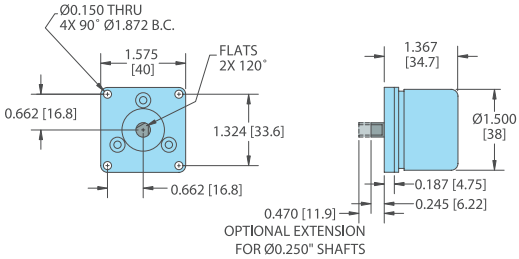


S2 Pictured below has a 0.750" Boss. S1 has a 0.547" Boss. See www.encoder.com to download drawings

MODEL 755A SERVO MOUNT (S3)



MODEL 755A 1.575" SQUARE FLANGE (MF)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01". unless otherwise specified metric dimensions are given in brackets [mm].

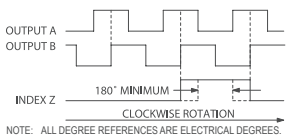
WIRING TABLE

Function	Cable† Wire Color	Term. Block	8-pin Molex	5-pin M12**	8-pin M12**
Com	Black	7	2	3	7
+VDC	White	8	1	1	2
A	Brown	1	8	4	1
A'	Yellow	2	7	--	3
B	Red	3	4	2	4
B'	Green	4	3	--	5
Z	Orange	6	6	5	6
Z'	Blue	5	5	--	8
Shield	Bare*	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body. CE Option: Cable shield and M12 connector body is connected to internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

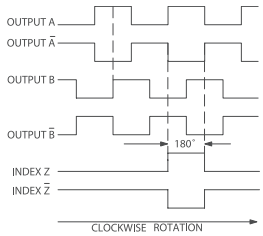
WAVEFORM DIAGRAMS

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. INDEX IS POSITIVE GOING.

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

MODEL 702 SHAFT

FEATURES

Standard Size 20 Package (2x2)
Flange and Servo Mounting
Up to 30,000 CPR
80 lb Maximum Axial and Radial Shaft Loading
IP67 Sealing Available

The Model 702 Size 20 Accu-Coder™ is a heavy duty, extremely rugged, reliable, yet compact industry standard 2" diameter encoder, designed for harsh factory and plant floor environments. The double shielded ball bearings are rated at 80 lb maximum axial and radial shaft loading to ensure a long operating life. Made to withstand the harsh effects of the real world, both the flange and servo models are rated IP67 with the optional heavy duty shaft seal. With a variety of mounting options in both the flange and servo models, the Model 702 is ideal for both new applications and replacements. If you need an encoder that won't let you down, the Model 702 is it.

COMMON APPLICATIONS

Motion Control Feedback, Conveyors, Elevator Controls, Machine Control, Food Processing, Process Control, Robotics, Material Handling, Textile Machines

MODEL 702 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

702	–	20	–	S	–	1000	–	R	–	HV	–	1	–	F	–	1	–	E	X	–	N	–	CE

MODEL
702 Size 20 (2.0")

SHAFT SIZE[1]
07 1/4", 0.250"
20 3/8", 0.375"
21 10 mm
30 3/8", 0.375"[2]
24 1/4", 0.250" No Flat

OPERATING TEMPERATURE
S 0° to 70° C
L -40° to 70° C
H 0° to 100° C[3]

CYCLES PER REVOLUTION
1-30,000
See *CPR Options* below for available resolutions.
Price adder for CPR >1270

NUMBER OF CHANNELS[4]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[5]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[6]
8 - 28V In/5V Out[7,8]
H5 Line Driver[6]
P5 Push-Pull

MAXIMUM FREQUENCY
1 100 kHz (Standard)
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[9]
4 1 MHz, >10,000 CPR[9]

MOUNTING
Flange Mounts
F 1.181" Female Pilot
L 0.687" Male Pilot
G 1.250" Male Pilot
K Size 25 w/30 Shaft
Servo Mounts
S #1 w/1.181" Female Pilot
U #1 w/0.687" Male Pilot
T #1 w/1.250" Male Pilot
C #2 w/1.181" Female Pilot
E #2 w/0.687" Male Pilot
D #2 w/1.250" Male Pilot
P #3 w/1.181" Female Pilot
Q #3 w/0.687" Male Pilot
R #3 w/1.250" Male Pilot
J Size 25 w/30 Shaft

SEAL
N No Seal
1 IP66
2 IP64[10]
5 IP67

CONNECTOR LOCATION
E End
S Side

CONNECTOR TYPE[11]
W 6-pin MS
Y 7-pin MS
X 10-pin MS
9D 9-pin D-subminiature
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)
G Gland, 24" Cable[12]
H 10-pin Bayonet

MATING CONNECTOR
N No
Y Yes

CERTIFICATION
N None
CE CE Marked[13]

MODEL 702 CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*	0011*
0012*	0014*	0020	0021*	0024*	0025*	0028*	0030*	0032*
0033*	0034*	0035*	0038*	0040*	0042*	0045*	0050*	0060
0064*	0100	0120	0125	0128*	0144*	0150*	0160*	0192*
0200	0240*	0250	0254*	0256*	0300	0333*	0360	0400
0500	0512	0600	0625*	0635	0665*	0720	0768*	0800
0889	0900*	1000	1024	1200	1201*[a]	1203*[a]	1204*[a]	1250[a]
1270[a]	1440	1500	1800	2000	2048	2400[a]	2500	2540[a]
2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]	7500[a]
9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	15,000[a]	18,000[a]	
20,000[a]	20,480[a]	25,000[a]	30,000[a]					

*Contact Customer Service for High Temperature Option.
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 Contact Customer Service for additional options.
2 Shaft with Size 25 Mounting Adapter, J or K mounting only.
3 0° to 85° C for certain resolutions, see CPR Options.
4 Contact Customer Service for non-standard index gating options.
5 24 VDC max for high temperature option.
6 Not available with 5-pin M12 or 6-pin MS connector. Available with 7-pin MS connector only without Index Z.
7 Standard temperature, 60 to 3000 CPR only.
8 H5 and P5 outputs are not available with CE option, or any End Mount MS Connector.
9 Please refer to Technical Bulletin TB 100: *When to Choose the CE Option* found at www.encoder.com.
10 IP64 not available in low temp option.
11 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
12 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
13 Standard cable lengths only. For details, please refer to Technical Bulletin TB116: *Noise & Signal Considerations*.

MODEL 702 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current..... 100 mA max with no output load

Input Ripple ..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face.
See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index ..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.

Max Frequency..... Up to 1 MHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Symmetry ..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 20,480 CPR: 180° (±36°) electrical

Quad Phasing..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 20,480 CPR: 90° (±36°) electrical

Min Edge Sep..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical

Rise Time ..... Less than 1 microsecond

Accuracy..... Instrument and Quadrature Error: For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

Mechanical

Max Shaft Speed ..... 8000 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Shaft Rotation..... Bi-directional

Radial Shaft Load..... 80 lb max. Rated load of 20 to 40 lb for bearing life of 1.5 x 10^9 revolutions

Axial Shaft Load..... 80 lb max. Rated load of 20 to 40 lb for bearing life of 1.5 x 10^9 revolutions

Starting Torque..... 1.0 oz-in typical with IP64 seal or no seal
3.0 oz-in typical with IP66 shaft seal
7.0 oz-in typical with IP67 shaft seal

Moment of Inertia.... 5.2 x 10^{-4} oz-in-sec^2

Max Acceleration..... 1 x 10^5 rad/sec^2

Housing..... Black non-corrosive finish

Bearings..... Precision ABEC ball bearings

Weight..... 11 oz typical

Environmental

Storage Temp ..... -25° to +85° C

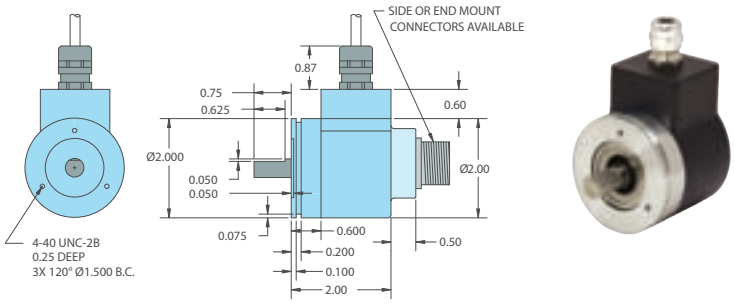
Humidity..... 98% RH non-condensing

Vibration..... 20 g @ 58 to 500 Hz

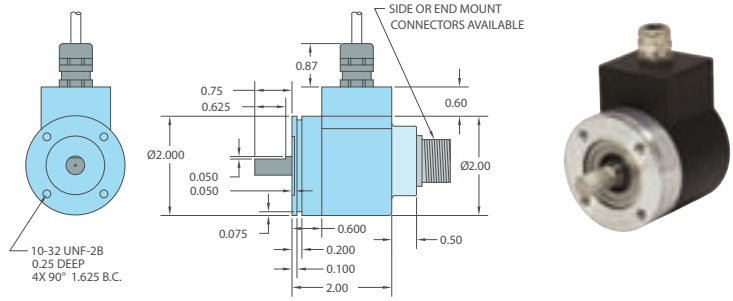
Shock..... 75 g @ 11 ms duration

Sealing..... IP50 standard; IP64, IP66 or IP67 optional

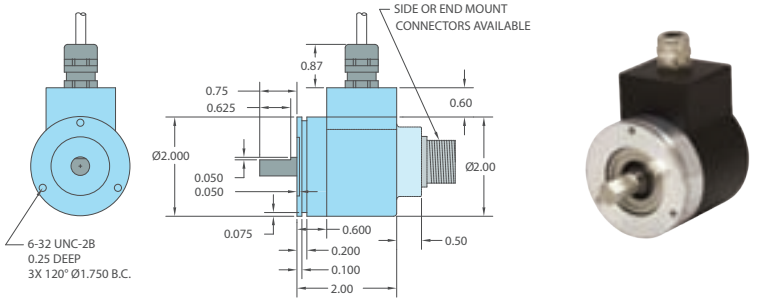
MODEL 702 2.0" SERVO MOUNT (S)



MODEL 702 2.0" SERVO MOUNT (C)

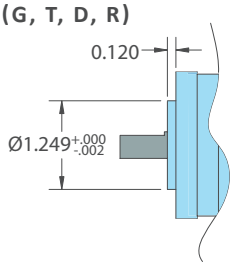


MODEL 702 2.0" SERVO MOUNT (P)

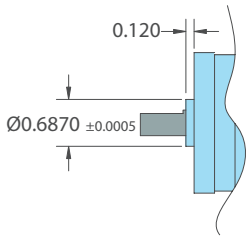


OPTIONAL PILOTS FOR FLANGE AND SERVO MOUNTS

(G, T, D, R)



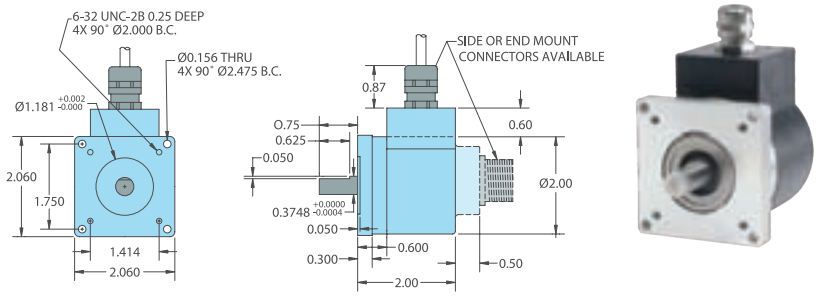
(L, U, E, Q)



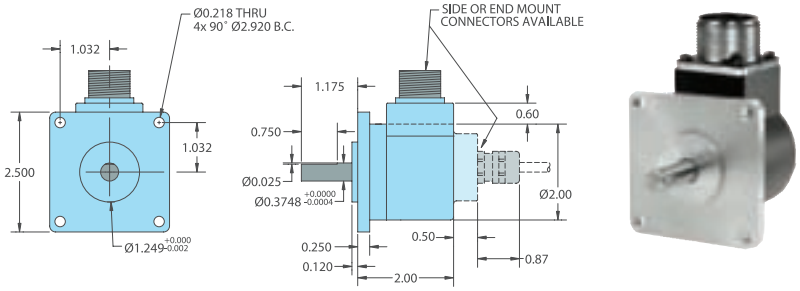
All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

MODEL 702 SHAFT

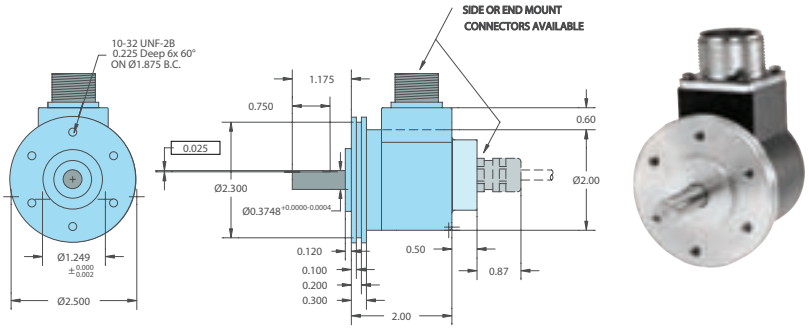
MODEL 702 2.0" FLANGE MOUNT (F)



MODEL 702 WITH 2.5" FLANGE MOUNT (K)



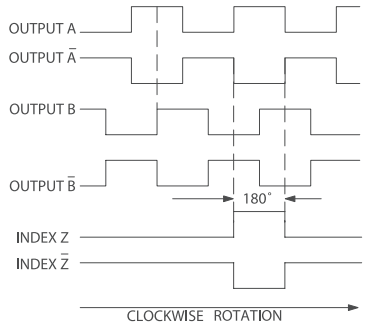
MODEL 702 WITH 2.5" SERVO MOUNT (J)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

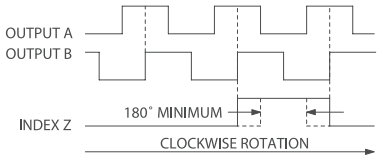
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. INDEX IS POSITIVE GOING.

WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**	10-Pin MS	7-pin MS HV,H5	7-pin MS PU,PP, OC,P5	6-pin MS PU,PP OC,P5	9-pin D-sub	10-pin Bayonet
Com	Black	3	7	F	F	F	A,F	9	F
+VDC	Red	1	2	D	D	D	B	1	D
A	White	4	1	A	A	A	D	2	A
A'	Brown	--	3	H	C	--	--	3	H
B	Blue	2	4	B	B	B	E	4	B
B'	Violet	--	5	I	E	--	--	5	J
Z	Orange	5	6	C	--	C	C	6	C
Z'	Yellow	--	8	J	--	--	--	7	K
Case	Green	--	--	G	G	G	--	8	G
Shield	Bare*	--	--	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body. CE Option: Cable shield and M12 connector body is connected to internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 702

Ultra Rugged 2.0" Encoder

QUICK SPECS

- Rugged Industrial Encoder
- 2” x 2” Housing
- CPR to 30,000
- Flex Mount for Easy Installation
- Many Output Types
- RPM to 8000
- Sealing to IP66
- High Temperature Option

Mounting Options

The 702 Motor Mount comes with coupling and available with a Bossed Hub to attach directly to fast revving motors.

The 702 Shaft has many different servo mounts and mounting flanges available and able to handle heavy loads.

OTHER RELATED PRODUCTS

The Model 802S Accu-Coder™ is an industry standard Size 20 (2.0" diameter) encoder housed in a heavy duty 316 stainless steel package. It's specifically designed for harsh factory and plant floor environments. A variety of flange and servo mounting styles, make it easy to use in a broad range of applications.

Model 725 Size 25 Accu-Coder™ optical shaft encoder is specifically designed for the challenges of an industrial environment. But don't let its tough, industrial package fool you; it still has the performance to reach resolutions up to 30,000 cycles per revolution.

The Model 858S European Size 58 Accu-Coder™ is a heavy duty, extremely rugged, reliable encoder in a 316 stainless steel package. Its compact design is well suited for harsh factory and plant floor environments calling for a metric solution.

Encoder Products Company has specialized in building durable, dependable encoders for 45 years. We proudly offer:

A 3-Year Warranty

Superior Customer Service

More Configurations Than Any Other Encoder Manufacturer

Expert Cross Reference Service

Next Day Expedite Delivery Option

For specification assistance call **Customer Service at 1-800-366-5412.**

ENCODER PRODUCTS COMPANY

MODEL 725

FEATURES

Standard Size 25 Package (2.5" x 2.5")
Up to 30,000 CPR
Standard and Industrial Housings
Servo and Flange Mounting
IP67 Sealing Available

Model 725 Size 25 Accu-Coder™ optical shaft encoder is specifically designed for the challenges of an industrial environment. But don't let its tough, industrial package fool you—it still has the performance to reach resolutions up to 30,000 cycles per revolution. The Model 725 offers both flange and servo mounting options, and is available in two distinctive housing styles. The rugged Standard Housing (N) isolates the internal electronics from the shock and stress of the outer environment. The extra heavy-duty Industrial Housing (I) features a fully isolated internal encoder unit that prolongs bearing life by using an internal flexible mount to protect the encoder from severe axial and radial shaft loading. The Industrial Housing option is the recommended solution for applications subject to continuous side loads, such as those that drive the encoder with a measuring wheel, pulley or chain and sprocket.

COMMON APPLICATIONS

Motion Control Feedback, Conveyors, Elevator Controls, Machine Control, Food Processing, Process Control, Robotics, Material Handling, Textile Machines

MODEL 725 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

725	N	–	4	–	S	–	1000	–	R	–	HV	–	1	–	F	–	1	–	E	X	–	N	–	CE

MODEL
725 Size 25 (2.5")

HOUSING STYLE
N Standard Housing
I Heavy Duty Industrial with Internal Flex Mount

SHAFT SIZE
S 3/8", 0.375" (standard)
4 1/4", 0.250"
19 5/16", 0.3125"
25 3/8", 0.375" - No flat[1]
06 6 mm
18 8 mm
21 10 mm

OPERATING TEMPERATURE
S 0° to 70° C
L -40° to 70°C
H 0° to 100° C[2]

CYCLES PER REVOLUTION
1-30,000
See *CPR Options* for available resolutions.
Price adder for CPR >1270

NUMBER OF CHANNELS[3]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[4]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[5]
8 - 28V In/5V Out[6,7]
H5 Line Driver[5]
P5 Push-Pull

MAXIMUM FREQUENCY
1 Standard 100 kHz
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[8]
4 1 MHz, >10,000 CPR[8]

MOUNTING
F Flange
S 2.50" Servo
R 2.50" Servo
Q 2.50" Servo
L 2.62" Servo
P 5PY

SEAL
N No Seal
1 IP66
2 IP64[9]
5 IP67

CONNECTOR LOCATION
S Side
E End

CONNECTOR TYPE[10]
W 6-pin MS
Y 7-pin MS
X 10-pin MS
9D 9-pin D-subminiature
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)
G Gland, 24" Cable[11]

MATING CONNECTOR
N No
Y Yes

CERTIFICATION
N None
CE CE Marked[12]

MODEL 725 CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*	0011*	0012*
0014*	0020	0021*	0024*	0025*	0028*	0030*	0032*	0033*	0034*
0035*	0038*	0040*	0042*	0045*	0050*	0060	0064*	0100	0120
0125	0128*	0144*	0150*	0160*	0192*	0200	0240*	0250	0254*
0256*	0300	0333*	0360	0400	0500	0512	0600	0625*	0635
0665*	0720	0768*	0800	0889	0900*	1000	1024	1200	1201*[a]
1203*[a]	1204*[a]	1250[a]	1270[a]	1440	1500	1800	2000	2048	2400[a]
2500	2540[a]	2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]
7500[a]	9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	15,000[a]	18,000[a]	20,000[a]
20,480[a]	25,000[a]	30,000[a]							

*Contact Customer Service for High Temperature Option (H).
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 Available with Industrial Housing (I) only.
2 0° to 85° C for certain resolutions, see CPR Options.
3 Contact Customer Service for index gating options.
4 24 VDC max for high temperature option.
5 Not available with 5-pin M12 or 6-pin MS connector. Available with 7-pin MS connector only without Index Z.
6 Standard temperature, 60 to 3000 CPR only.
7 H5 and P5 outputs not available with CE option, or any End Mount MS connector.
8 Standard cable lengths only. For details, please refer to Technical Bulletin TB116: *Noise and Signal Distortion Considerations* at www.encoder.com.
9 IP64 not available in low temp option.
10 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
11 For Non-Standard Cable Lengths add a forward slash (/) plus cable length expressed in feet. Example: SG/6 = 6 feet of cable.
12 Please refer to Technical Bulletin TB100: *When to Choose the CE Option*.

MODEL 725 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face. See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel (Meets RS 422 at 5 VDC supply)

Index ..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.

Max Frequency ..... Up to 1 MHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Symmetry ..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 20,480 CPR: 180° (±36°) electrical

Quad Phasing..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 20,480 CPR: 90° (±36°) electrical

Min Edge Sep..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical

Rise Time ..... Less than 1 microsecond

Accuracy..... Instrument and Quadrature Error: For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

Mechanical

Max Shaft Speed..... 8000 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Shaft Material ..... 303 Stainless Steel

Shaft Rotation ..... Bi-directional

Radial Shaft Load. .... 80 lb max (standard housing)
80 lb max (industrial housing)

Axial Shaft Load ..... 80 lb max (standard housing)
80 lb max (industrial housing)

Starting Torque ..... 1.0 oz-in typical with IP64 seal or no seal
3.0 oz-in typical with IP66 shaft seal
7.0 oz-in typical with IP67 shaft seal

Moment of Inertia ... 5.2×10^{-4} oz-in-sec^2

Max Acceleration ..... 1×10^5 rad/sec^2

Housing ..... Black non-corrosive finish

Bearings..... Precision ABEC ball bearings

Weight..... 20 oz typical

Environmental

Storage Temp ..... -25° to +85° C

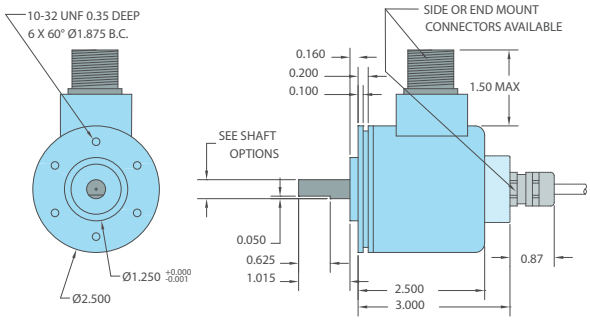
Humidity..... 95% RH non-condensing

Vibration..... 725N: 10 g @ 58 to 500 Hz
725I: 20 g @ 58 to 500 Hz

Shock..... 725N: 50 g @ 11 ms duration
725I: 75 g @ 11 ms duration

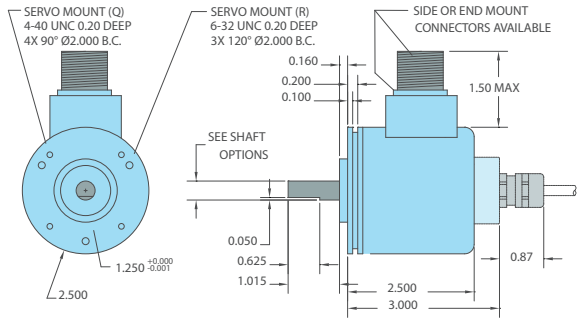
Sealing..... IP50 standard; IP64, IP66 or IP67 optional

MODEL 725 2.5" SERVO MOUNT (S)

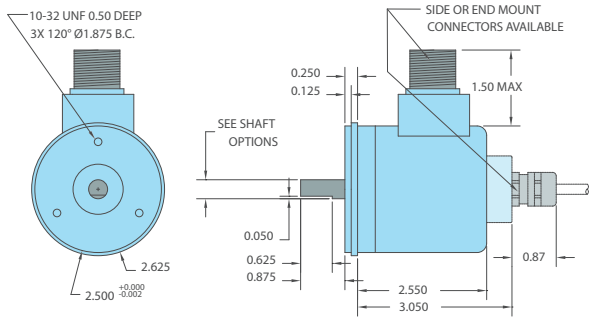


MODEL 725 2.5" SERVO MOUNT (Q)

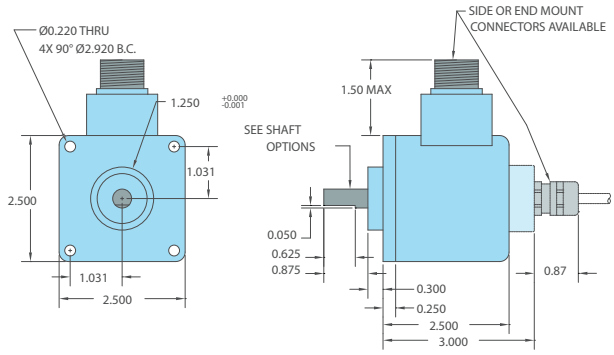
Servo mount (R) has been discontinued and replaced by servo mount (Q)



MODEL 725 2.62" SERVO MOUNT (L)



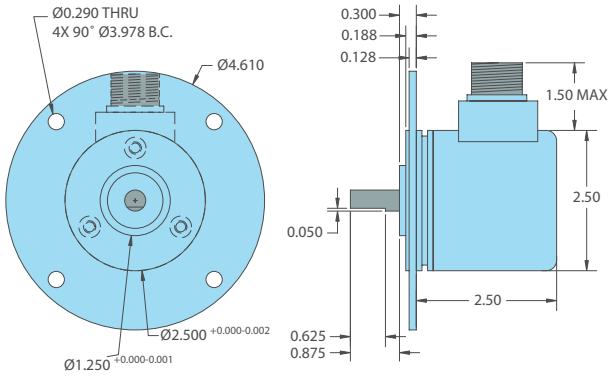
MODEL 725 FLANGE MOUNT (F)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

MODEL 725

MODEL 725 OPTIONAL 5PY MOUNTING (P)

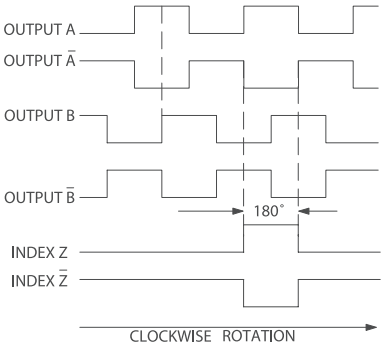


The optional 5PY adapter is made of all aluminum construction and allows Model 725 encoder to replace DC tachometer technology. The 5PY adapter is mechanically interchangeable with any 5PY tach generator.

All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

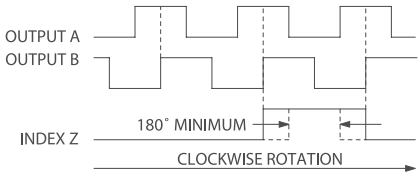
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. INDEX IS POSITIVE GOING.

WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**	10-pin MS	7-pin MS HV,H5	7-pin MS PU,PP,OC,P5	6-pin MS PU,PP,OC,P5	9-pin D-sub
Com	Black	3	7	F	F	F	A,F	9
+VDC	Red	1	2	D	D	D	B	1
A	White	4	1	A	A	A	D	2
A'	Brown	--	3	H	C	--	--	3
B	Blue	2	4	B	B	B	E	4
B'	Violet	--	5	I	E	--	--	5
Z	Orange	5	6	C	--	C	C	6
Z'	Yellow	--	8	J	--	--	--	7
Case	Green	--	--	G	G	G	--	8
Shield	Bare*	--	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body. CE Option: Cable shield and M12 connector body is connected to internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 725N

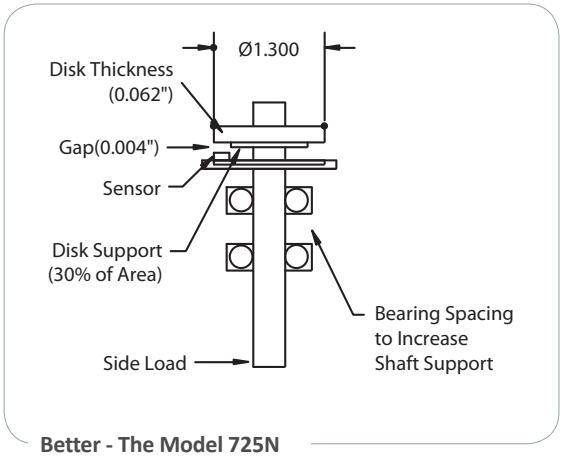
A Step Above the Rest

Size 25 encoders (2.5" diameter) are among the most popular encoders in the world. As a result, nearly every encoder manufacturer in the world makes them. The problem is, not every Size 25 encoder is built to the same exacting standards of quality and reliability as the Model 725 Accu-Coder™ from Encoder Products Company (EPC).

So, what's the problem? If you have used other Size 25 encoders, you have probably experienced reliability problems such as sensor crashes and disk breakage. The typical construction of a Size 25 encoder uses a single set of closely spaced shaft bearings and a large diameter (typically 2.0") glass disk mounted to the shaft. The glass disk is generally supported on the shaft hub by just 15% of the surface area and has a thickness of 0.030". In addition, these units commonly require a relatively narrow air gap (typically 0.002") between the disk and sensor in order to properly calibrate the signal. Because of this combination, a small amount of side loading (force from installation requirements, vibration, shock, or other conditions) to move the shaft enough for the attached disk to make contact with the sensor or some other portion of the stationary PCB. The result is damage to the disk or sensor, or even disk breakage.

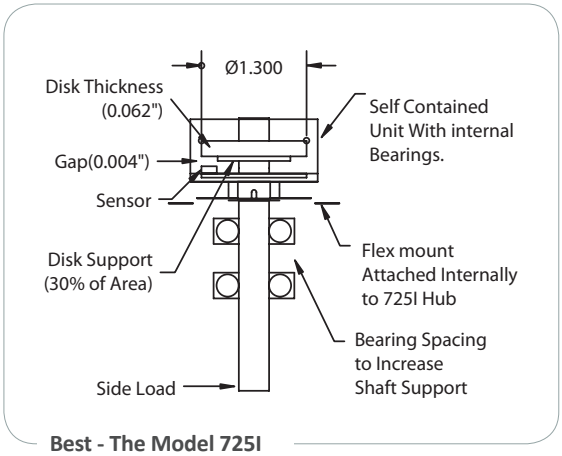
Then, what's the solution? When design engineers at EPC set out to design a better Size 25 encoder, their goal was to solve the typical problems without affecting the price of the encoder. The result is the Model 725N, a Size 25 encoder worthy of the Accu-Coder™ name. The first goal was to make it more difficult for shaft movement from side load to cause damage. Using EPC's advanced sensor technology, the air gap between the disk and sensor doubled from 0.002" to 0.004", and the disk diameter was reduced from 2.0" to 1.3". The next goal was to increase the durability of the disk itself. Disk thickness was more than doubled (from 0.030" to 0.062"), manufactured using EPC's proprietary process, and supported by 30% of the disk surface area. Finally, it was time to improve the resistance to side load movement altogether, so the 725N was given dual heavy-duty bearings, generously spaced to disperse the load over a larger portion of the shaft.

But EPC's innovative engineering team wasn't satisfied. They really wanted to solve the problems of a truly rough environment. What they designed was the Model 725I with the industrial 725 housing option. An encoder that is as robust as possible within its price category. Using the improvements developed in the 725N, EPC's engineering team developed the "encoder-within-an-encoder" design. With this design, the 725I adds two extra, heavy-duty bearings to the two contained within the internal encoder for a total of four bearings. These two extra bearing sets are separated in such a way that side load stresses become isolated between the two bearing sets and never reach the inner encoder. In addition, the internal encoder is mounted to the 725I's housing using EPC's pioneering flex mount, further isolating the internal optics and electronics from outside forces.



Better - The Model 725N

EPC has designed out the common problems experienced by the average Size 25 encoder. Notice the generous air gap (double that of typical Size 25 encoders), thick code disk (more than twice the thickness), small diameter, large disk support area, and large bearing spacing—each an element which increases durability and reliability.



Best - The Model 725I

The design improvements made in the Model 725N, places them in their own internal encoder housing, and surrounds the internal unit with a second, rugged housing with a separate set of heavy duty bearings, all for an encoder that excels in applications where other encoders don't quite measure up.

For specification assistance call
Customer Service at **1-800-366-5412.**

ENCODER PRODUCTS COMPANY

MODEL 758

Ø58 mm

FEATURES

Standard Size 58 Mounting (58 mm Diameter)
Up to 30,000 CPR
80 lb Max. Axial and Radial Shaft Loading
High Temperature Option (100° C)
IP67 Sealing Available

The Model 758 Size 58 Accu-Coder™ is a heavy duty, extremely rugged, reliable, yet compact European standard 58 millimeter diameter encoder, designed for harsh factory and plant floor environments. Shaft loading is no problem for the double-shielded ball bearings—their 80 lb load rating ensures a long operating life. With the optional heavy-duty shaft seal, the Model 758 is rated IP67. Two European standard mounting options are available: Clamping Flange (20 Type) or Synchro Flange (26 Type). The Model 758 is the perfect replacement encoder for units requiring the European mount.

COMMON APPLICATIONS

Motion Control Feedback, Machine & Elevator Controls, Food Processing, Robotics, Material Handling, Conveyors, Textile Machines

MODEL 758 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

758 – A – 21 – S – 1000 – R – HV – 1 – 1 – E – R – CE

MODEL
758 Model 758

MOUNTING TYPE[1]
A Clamping Flange (20 Type)
B Synchro Flange (26 Type)

SHAFT SIZE[1]
06 6 mm
21 10 mm
07 0.250", 1/4"
20 0.375", 3/8"

OPERATING TEMPERATURE
S 0° to 70° C
L -40° to 70° C
H 0° to 100° C[2]

CYCLES PER REVOLUTION
1-30,000
See *CPR Options* below for available resolutions.
Price adder for CPR >1270

NUMBER OF CHANNELS[3]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[4]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[5]
8 - 28V In/5V Out[5,6]
H5 Line Driver[7]
P5 Push-Pull

MAXIMUM FREQUENCY
1 100 kHz Standard
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[8]
4 1 MHz, >10,000 CPR[8]

SEAL
N No Seal
1 IP66
2 IP64[9]
5 IP67

CONNECTOR LOCATION
S Side
E End

CONNECTOR TYPE[10]
G Gland, 24" Cable[11]
R 12-pin M23
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)
X 10-pin MS
Y 7-pin MS

CERTIFICATION
N None
CE CE Marked[12]

MODEL 758 CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*	0011*
0012*	0014*	0020	0021*	0024*	0025*	0028*	0030*	0032*
0033*	0034*	0035*	0038*	0040*	0042*	0045*	0050*	0060
0064*	0100	0120	0125	0128*	0144*	0150*	0160*	0192*
0200	0240*	0250	0254*	0256*	0300	0333*	0360	0400
0500	0512	0600	0625*	0635	0665*	0720	0768*	0800
0889	0900*	1000	1024	1200	1201*[a]	1203*[a]	1204*[a]	1250[a]
1270[a]	1440	1500	1800	2000	2048	2400[a]	2500	2540[a]
2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]	7500[a]
9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	15,000[a]	18,000[a]	
20,000[a]	20,480[a]	25,000[a]	30,000[a]					

*Contact Customer Service for High Temperature Option (H).
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 The shaft on 20 Type mountings includes a 15.58 mm flat. The shaft on 26 Type mountings is provided without a flat.
2 0° to 85° C for certain resolutions, see CPR Options.
3 Contact Customer Service for index gating options.
4 24 VDC max for high temperature option.
5 H5 and P5 outputs are not available with CE option, or any End Mount MS Connector.
6 Standard temperature, 60 to 3000 CPR only.
7 Not available with 5-pin M12 connector. Available with 7-pin MS connector only without Index Z.
8 Standard cable lengths only. For details, please refer to Technical Bulletin TB116: *Noise and Signal Considerations* at www.encoder.com.
9 IP64 not available in low temp option.
10 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
11 For Non-Standard Cable Lengths add a forward slash (/) plus cable length expressed in feet. Example: SG/6 = 6 feet of cable.
12 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* available at www.encoder.com.

MODEL 758 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C
Input Current ..... 100 mA max with no output load
Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz
Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face.
See *Waveform Diagrams*.
Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)
Index..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.
Max Frequency ..... Up to 1 MHz
Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2
Symmetry..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 20,480 CPR: 180° (±36°) electrical
Quad Phasing..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 20,480 CPR: 90° (±36°)
Min Edge Sep..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical
Rise Time..... Less than 1 microsecond
Accuracy..... Instrument and Quadrature Error:
For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

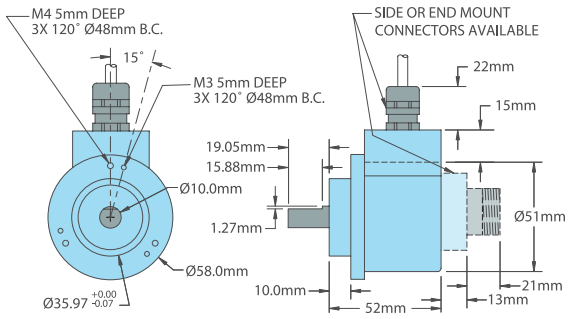
Mechanical

Max Shaft Speed..... 8000 RPM. Higher shaft speeds may be achievable, contact Customer Service.
Shaft Rotation ..... Bi-directional
Radial Shaft Load ..... 80 lb max. Rated load of 20 to 40 lb for bearing life of 1.5 x 10^9 revolutions
Axial Shaft Load ..... 80 lb max. Rated load of 20 to 40 lb for bearing life of 1.5 x 10^9 revolutions
Starting Torque ..... 1.0 oz-in typical with IP64 seal or no seal
3.0 oz-in typical with IP66 shaft seal
7.0 oz-in typical with IP67 shaft seal
Moment of Inertia ... 5.2 x 10^{-4} oz-in-sec^2
Max. Acceleration .... 1 x 10^5 rad/sec^2
Housing ..... Black non-corrosive finish
Bearings..... Precision ABEC ball bearings
Weight..... 11 oz typical

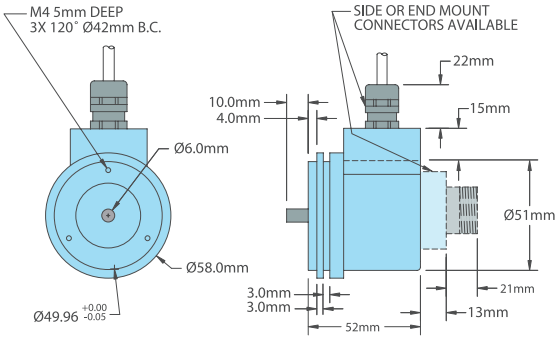
Environmental

Storage Temp ..... -25° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 20 g @ 58 to 500 Hz
Shock..... 75 g @ 11 ms duration
Sealing..... IP50 standard; IP64, IP66 or IP67 optional

MODEL 758 CLAMPING FLANGE 20 TYPE (A)



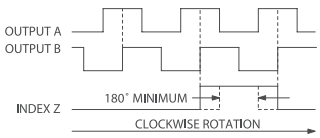
MODEL 758 SYNCHRO FLANGE 26 TYPE (B)



All dimensions are in millimeters with a tolerance of ±0.17 mm unless otherwise specified.

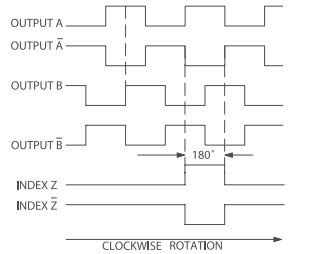
WAVEFORM DIAGRAMS

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.INDEX IS POSITIVE GOING.

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**	10-pin MS	7-pin MS HV,H5	7-pin MS PU,PP P5,OC	12-pin M23
Com	Black	3	7	F	F	F	10
+VDC	Red	1	2	D	D	D	12
A	White	4	1	A	A	A	5
A'	Brown	--	3	H	C	--	6
B	Blue	2	4	B	B	B	8
B'	Violet	--	5	I	E	--	1
Z	Orange	5	6	C	--	C	3
Z'	Yellow	--	8	J	--	--	4
Shield	Bare*	--	--	--	--	--	--
+VDC Sense	--	--	--	--	--	--	2
Com Sense	--	--	--	--	--	--	11
Case	Green	--	--	G	G	G	9

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body.
CE Option: Cable shield and M12 connector body is connected to internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL TR1 TRU-TRAC™

FEATURES

Encoder and Measuring Wheel Solution Integrated Into One Compact Unit
Spring Loaded Torsion Arm Makes Wheel Pressure Adjustments a Snap
Easily Installed in a Vertical, Horizontal or Upside Down Orientation
Operates Over a Variety of Surfaces at Speeds up to 3000 Feet per Minute
Integrated Module Simplifies Your System Design, Reducing Cost

The TR1 Tru-Trac™ is a versatile solution for tracking velocity, position, or distance over a wide variety of surfaces in almost any application. An integrated encoder and spring loaded measuring wheel assembly available in one, the TR1 is both easy-to-use and compact. Its spring-loaded torsion arm offers adjustable torsion load, allowing the TR1 to be mounted in almost any orientation—even upside-down. The threaded shaft on the pivot axis is field reversible providing mounting access from either side. The TR1 housing is a durable, conductive composite material that will eliminate static build up. With operating speeds up to 3000 feet per minute and a wide variety of configuration options, it's easy to see the TR1 Tru-Trac™ is the ideal solution for countless applications.

COMMON APPLICATIONS

Web Tension Control, Paper Monitoring, Glue Dispensing, Linear Material Monitoring, Conveyor Systems, Printing, Labeling, Document Handling

MODEL TR1 TRU-TRAC™ ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical | Optional Features (Leave Blank For Standard Options: -20° to +85°C Std | IP50 Std | None Std)

TR1 – U1 R4 – 0500 N V1 A OC F00 [ ] [ ] [ ] [ ]

MODEL
TR1 Tru-Trac™

WHEEL TYPE & CIRCUMFERENCE
U1 Urethane 6" cir
U2 Urethane 200 mm cir
K1 Knurled 6" cir
K2 Knurled 200 mm cir
19 No Wheel - 1/4" shaft
20 No Wheel - 6 mm shaft

CYCLES PER REVOLUTION
See *CPR Options* below
Price adder >1999

PIVOT SHAFT MOUNTING[1]
R4 Right side 1/4-20 thread
L4 Left side 1/4-20 thread
R6 Right side M6 thread
L6 Left side M6 thread

COMMUTATION
N None

INPUT VOLTAGE
V1 5 to 28 VDC

NUMBER OF CHANNELS[2]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A[3]
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
OC Open Collector
PP Push-Pull
HV Line Driver
PU Pull-Up Resistor[4]
OD Open Collector with Differential Outputs

CONNECTOR TYPE[5]
F00 18" Cable[6] (Std)
F01 12" Cable
F02 24" Cable
F03 36" Cable
M00 2M Cable[7]
J00 18" Cable with 5-pin M12[8]
K00 18" Cable with 8-pin M12[8]

MAXIMUM FREQUENCY
Standard
F3 Extended
See Specifications

OPERATING TEMPERATURE
-20° to +85° C (Std)
T1 -40° to +85° C
T2 -20° to +100° C

SEALING
IP50 (Std)
S2 IP65
S3 IP66

CERTIFICATION
None (Std)
CE CE Marked[9]

MODEL TR1 TRU-TRAC™ CPR OPTIONS

0001 thru 0189*	0198	0200	0250	0256	0300	0315	0360	
0400	0500	0512	0580	0600	0750	0800	1000	1024
1125	1200	1250	1500	1800	2000	2048	2500	2540
3000	3600	4000	4096	5000	6000	7200	8192	10,000

*Contact Customer Service For Availability

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available values. Special disk resolutions are available upon request and may be subject to a one-time NRE fee.

NOTES:
1 See mechanical drawing. Shaft is reversible in the field.
2 Contact Customer Service for non-standard index gating or phase relationship options.
3 Reverse Quadrature not available with PU output type.
4 With Input Voltage above 16 VDC, operating temperature is limited to 85° C.
5 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
6 For non-standard English cable lengths enter 'F' plus cable length expressed in feet. Example: F06 = 6 feet of cable. Frequency above 300 kHz standard cable lengths only.
7 For non-standard metric cable lengths enter 'M' plus cable length expressed in meters. Example: M06 = 6 meters of cable.
8 5-pin not available with Line Driver (HV) output. Additional cable lengths available. Please consult Customer Service.
8 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL TR1 TRU-TRAC™ SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° C to 100° C

Input Current ..... 100 mA max (65 mA typical) with no output load

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the wheel side. See *Waveform Diagram*.

Output Types..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Pull-Up- Open collector with 2.2K ohm Pull-Up Resistor- 20mA max per channel
Line Driver- 20 mA max per channel (Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0001 to 0189 CPR: Ungated
0190 to 10,000 CPR: Gated to output A
See *Waveform Diagram*.

Max. Frequency ..... Standard Frequency Response is
200 kHz for CPR 1 to 2540
500 kHz for CPR 2541 to 5000
1 MHz for CPR 5001 to 10,000
Extended Frequency Response (optional) is 300 kHz for CPR 2000, 2048, 2500, and 2540

Noise Immunity..... Tested to BS EN61000-6-2; BS EN50081-2; BS EN61000-4-2; BS EN61000-4-3; BS EN61000-4-6; BS EN500811

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Waveform Symmetry... 180°(±18°) electrical (single channel encoder)

Accuracy..... Within 0.017° mechanical or 1 arc-minute from true position (for CPR>189)

Mechanical

Max Shaft Speed..... 6000 RPM. Higher speeds may be achievable, contact Customer Service.

Shaft Material ..... Stainless Steel

Shaft Tolerance ..... +0.0000/-0.0004" [+0.000/-0.010 mm]

Radial Shaft Load ..... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^{10} revolutions

Axial Shaft Load ..... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^{10} revolutions

Starting Torque ..... IP50 0.05 oz-in
IP65 0.4 oz-in
IP66 0.8 oz-in

Housing ..... Stainless steel fibers in a high temperature nylon composite

Wheel Width..... 0.25"

Weight..... 5 oz typical

Environmental

Storage Temp ..... -25° to +85° C

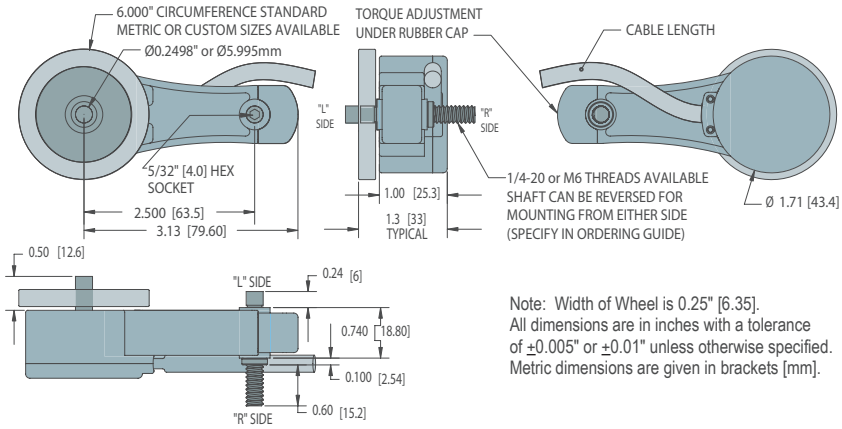
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

Shock..... 80 g @ 11 ms duration

Sealing..... IP50 standard; IP65 or IP66 available

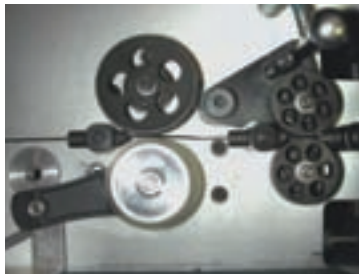
MODEL TR1 TRU-TRAC™



Note: Width of Wheel is 0.25" [6.35].
All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

MODEL TR1 TRU-TRAC™ APPLICATIONS

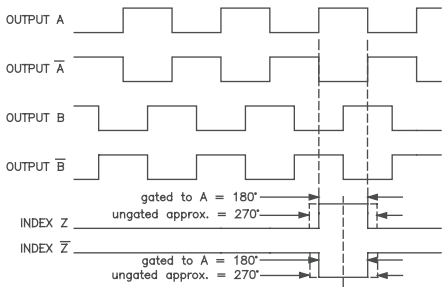
For linear applications the Tru-Trac™ can be mounted above or below the moving object, and the tension on the wheel adjusted for a wide range of applications such as packaging, conveyors, mail sorting, cut to length, labeling, gantries, etc.



For rotational applications the Tru-Trac™ can be mounted in any orientation to monitor the position or velocity of many types of rotating equipment such as web tension control drums, rotary tables, printing, spooling, etc.

WAVEFORM DIAGRAM

Incremental Signals



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**
Com	Black	3	7
+VDC	White	1	2
A	Brown	4	1
A'	Yellow	--	3
B	Red	2	4
B'	Green	--	5
Z	Orange	5	6
Z'	Blue	--	8
Shield	Bare*	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body.
CE Option: Cable shield is connected to M12 connector body and internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL TR2 TRU-TRAC™ WITH RACK AND PINION GEARING

FEATURES

Encoder with Rack and Pinion Gear Integrated Into One Compact Unit
Easily Installed in a Vertical, Horizontal or Upside Down Orientation
Operates at Speeds up to 400 Feet per Minute
Spring Loaded Torsion Arm Eliminates Gear Backlash
Integrated Module Simplifies Your System Design

The TR2 Tru-Trac™ is a versatile solution for tracking velocity, position, or distance in almost any application and features an integrated encoder with a rack and pinion gear assembly. Using the rack and pinion gear system, encoder readings can be obtained with repeatable positioning, providing excellent accuracy. Racks can be ordered in varying lengths, and with the accessory spacer block, multiple lengths of rack can be joined for easy installation. The spring loaded torsion arm provides easily adjustable torsion load, giving the TR2 all the flexibility and maneuverability of the original TR1 Tru-Trac™. It can be installed in a horizontal, vertical, or upside down position. The threaded shaft on the TR2's pivot axis is field reversible, providing mounting access from either side, and the durable conductive composite housing material will eliminate static build up.

COMMON APPLICATIONS

X-Y Tables, Gantry Systems, Packaging Machinery, Cut-To-Length, Printing, Labeling, Document Handling, Machine Shop Equipment

MODEL TR2 TRU-TRAC™ ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical | Optional Features (Leave Blank For Standard Options)

TR2	–	D1	R4	–	0800	N	V1	A	OC	–	F00	–				
													-20° to +85°C Std	IP50 Std	None Std	

MODEL
TR2 Tru-Trac™

CYCLES PER REVOLUTION
See Resolution Chart Below
Price adder >1999

INPUT VOLTAGE
V1 5 to 28 VDC

OUTPUT TYPE
OC Open Collector
PP Push-Pull
HV Line Driver
PU Pull-Up Resistor[4]
OD Open Collector with Differential Outputs

CONNECTOR TYPE[5]
F00 18" Cable[6] (Std)
F01 12" Cable
F02 24" Cable
F03 36" Cable
M00 2M Cable[7]
J00 18" Cable with 5-pin M12[8]
K00 18" Cable with 8-pin M12[8]

MAXIMUM FREQUENCY
Standard
F3 Extended
See Specifications

OPERATING TEMPERATURE
-20° to +85° C (Std)
T1 -40° to +85° C
T2 -20° to +100° C

SEALING
IP50 (Std)
S2 IP65
S3 IP66

CERTIFICATION
None (Std)
CE CE Marked[9]

PIVOT SHAFT MOUNTING[1]
R4 Right side 1/4-20 thread
L4 Left side 1/4-20 thread
R6 Right side M6 thread
L6 Left side M6 thread

COMMUTATION
N None

NUMBER OF CHANNELS[2]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A[3]
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

PINION GEAR
D1 40 Tooth Pinion Gear for Stainless Steel Rack
D2 40 Tooth Pinion Gear for Flexible Rack
19 No Pinion, 1/4" Shaft
20 No Pinion, 6 mm Shaft

MODEL TR2 TRU-TRAC™ CPR OPTIONS

0001 thru 0189*	0198	0200	0250	0256	0300	0315	0360	
0400	0500	0512	0580	0600	0750	0800	1000	1024
1125	1200	1250	1500	1800	2000	2048	2500	2540
3000	3600	4000	4096	5000	6000	7200	8192	10,000

Blue resolutions are common. See resolution charts for more information.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available values. Special disk resolutions are available upon request and may be subject to a one time NRE fee.

NOTES:
1 See mechanical drawing. Shaft is reversible in the field.
2 Contact Customer Service for non-standard index gating or phase relationship options.
3 Reverse Quadrature not available with PU output type.
4 With Input Voltage above 16 VDC, operating temperature is limited to 85° C.
5 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
6 For non-standard English cable lengths enter 'F' plus cable length expressed in feet. Example: F06 = 6 feet of cable. Frequency above 300 kHz standard cable lengths only.
7 For non-standard metric cable lengths enter 'M' plus cable length expressed in meters. Example: M06 = 6 meters of cable.
8 5-pin not available with Line Driver (HV) output. Additional cables lengths available.
9 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL TR2 TRU-TRAC™ SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C 4.75 to 24 VDC for temperatures between 85° C to 100° C

Input Current ..... 100 mA max (65 mA typical) with no output load

Output Format ..... Incremental - Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the wheel side. See *Waveform Diagram*.

Output Types..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Pull-Up- Open collector with 2.2K ohm Pull-Up Resistor- 20mA max per channel
Line Driver- 20 mA max per channel (Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0190 to 10,000 CPR: Gated to output A.
0001 to 0189 CPR: Ungated
See *Waveform Diagram*.

Max. Frequency ..... Standard Frequency Response is
200 kHz for CPR 1 to 2540
500 kHz for CPR 2541 to 5000
1 MHz for CPR 5001 to 10,000
Extended Frequency Response (optional) is
300 kHz for CPR 2000, 2048, 2500, & 2540

Noise Immunity..... Tested to BS EN61000-6-2; BS EN50081-2; BS EN61000-4-2; BS EN61000-4-3; BS EN61000-4-6, BS EN500811

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Waveform Symmetry ... 180°(±18°) electrical (single channel encoder)

Accuracy ..... Within 0.017° mechanical or 1 arc-minute from true position (for CPR>189)

Mechanical

Radial Shaft Load .... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^{10} revolutions

Axial Shaft Load ..... 5 lb max. Rated load of 2 to 3 lb for bearing life of 1.2 x 10^{10} revolutions

Starting Torque ..... IP50 0.05 oz-in
IP65 0.4 oz-in
IP66 0.8 oz-in

Housing ..... Stainless steel fibers in a high temperature nylon composite

Weight..... 5 oz typical

Environmental

Storage Temp ..... -25° to +85° C

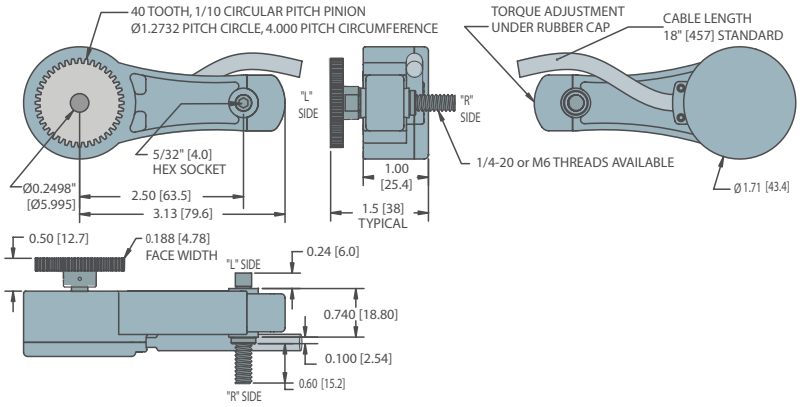
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

Shock..... 80 g @ 11 ms duration

Sealing..... IP50 standard; IP65 or IP66 available

MODEL TR2 TRU-TRAC™



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

WIRING TABLE

Function	Cable† Wire Color	5-pin M12**	8-pin M12**
Com	Black	3	7
+VDC	White	1	2
A	Brown	4	1
A'	Yellow	--	3
B	Red	2	4
B'	Green	--	5
Z	Orange	5	6
Z'	Blue	--	8
Shield	Bare*	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**Non-CE Option: Cable shield is connected to M12 connector body. CE Option: Cable shield is connected to M12 connector body and internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

RESOLUTIONS—English Units

Inches per Pulse	Pulses per Inch	Disc Cycles per Revolution
0.01	100	400
0.005	200	800
0.004	250	1000
0.002	500	2000
0.001	1000	2000*
0.0005	2000	2000**
0.0004	2500	2500**
0.0002	5000	2500**+
0.0001	10,000	2500**++

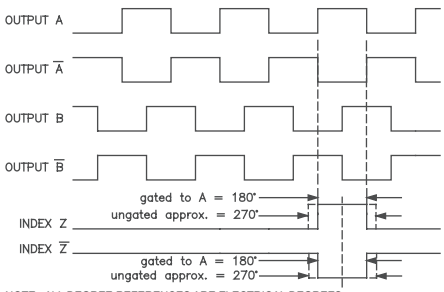
*Requires 2x external quadrature counting.
**Requires 4x external quadrature counting.
+Requires 2x Interpolation.
++Requires 4x Interpolation.

RESOLUTIONS—Metric Units

mm per Pulse	Pulses per mm	Disc Cycles per Revolution
0.04	25	2540
0.02	50	2540*
0.01	100	2540**

*Requires 2x external quadrature counting.
**Requires 4x external quadrature counting.

WAVEFORM DIAGRAM



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES.
WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

MODEL TR2 TRU-TRAC™ WITH RACK AND PINION GEARING

MODEL TR2 TRU-TRAC™ SPECIFICATIONS

For Steel & Flexible Rack

Mechanical - Stainless Steel Rack

Max Linear Speed .... 400 Feet Per Minute. Speeds over 200 FPM require lubricant, such as MoS_2 paste, to reduce gearing wear. Higher speeds may be achievable, contact Customer Service.
Rack Material ..... 303 Stainless Steel
Gearing Tolerance .... AGMA 10, 20 degree pressure angle teeth
Accuracy ..... ±0.0005 inch/inch max accumulated error
Repeatability ..... ±0.0001 inch

Mechanical - Flexible Rack

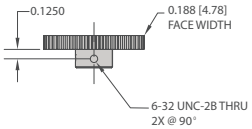
Max Linear Speed .... 200 Feet Per Minute
Rack Material ..... Acetal
Gearing Geometry ... 20° pressure angle teeth
Accuracy ..... ±0.002 inch/inch max accumulated error
Repeatability ..... ±0.001 inch for Flexible Rack

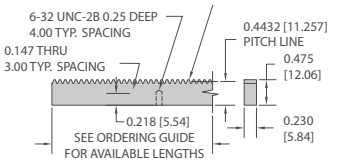
MODEL TR2 TRU-TRAC™ APPLICATIONS

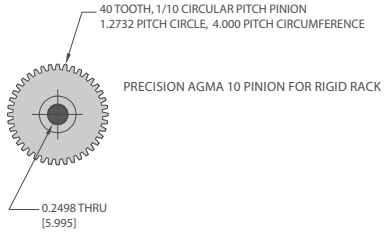
For reciprocating linear motion applications, the TR2 provides accurate reliable feedback. The adjustable spring inside the torsion arm allows the TR2 to be oriented in any direction, while still ensuring the pinion gear is properly engaged with the rack. The precision pinion gear, when paired with EPC's stainless steel or flexible rack system provides feedback with virtually no backlash.

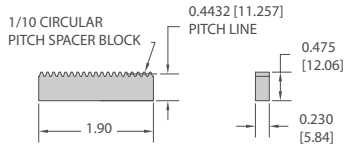
Left: The TR2 is ideal for gauging and backstop applications typically found on a variety of metal working equipment.
Above Right: The TR2 is applied to provide vertical speed and position feedback for a fork lift tower.

PINION GEAR FOR STAINLESS STEEL RACK

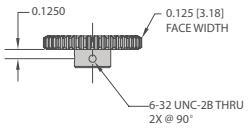


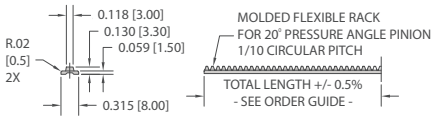


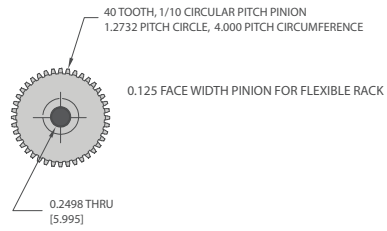




PINION GEAR FOR FLEXIBLE RACK



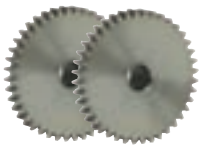




Racks and Accessories for the TR2
(rack must be ordered separately)

Part #	Length
176216	12" for Stainless Steel
176217	24" for Stainless Steel
176218	36" for Stainless Steel
176219	Spacer Block for Stainless Steel
161546	2 meter Flexible Rack
161548	Flexible rack clamps 10pk (with M4x0.7 x 1) mm Phillips pan head machine screws.
161547	1 meter guide rail for flexible rack (does not work with 176220 gear)
140104	Angle Mounting Bracket
176220	40 Tooth Pinion Gear (for use with Stainless Steel Rack)
176302	40 Tooth Pinion Gear (for use with Flexible Rack)

See drawings for rack dimensions. For lengths over 36", order multiple pieces of stainless steel rack or the flexible option. A spacer block must be used to accurately join two or more pieces of rack. See Technical Bulletin TB-522 or TB-523 for details.



Additional Pinion Gears for TR2 Tru-Trac™ can be ordered separately as part #176220 (stainless steel rack) or part #176302 (flexible rack).

TR2 Tru-Trac™ flexible rack.

Accessory Angle Mounting Bracket for TR2 Tru-Trac™ can be ordered separately as part #140104. Dimensional drawing available at www.encoder.com.

TRU–FLEXIBILITY

The Tru-Trac™ Family of Linear Solution Encoders

Most companies spend costly hours designing measuring wheel and bracket assemblies attached to an encoder for measuring position or velocity. Once designed, adjusting the pressure of the measuring wheel is often a major problem. Thanks to our Tru-Trac™ encoders, those days are a thing of the past.

Model TR1

Easy to use and very compact, the Tru-Trac™ encoders are fully adjustable integrated encoders with spring loaded measuring wheel assemblies. Monitoring speed, velocity or position has never been easier or more cost effective. Designed for use in almost any position and orientation, installation possibilities are endless. The threaded shaft on the pivot axis makes these units reversible, allowing measuring from either side of the assembly.

A variety of available measuring wheels, together with the flexibility of the adjustable spring loaded torsion arm, prevents slippage over many different surfaces or textures. For applications with unique surfaces or measurements, you can provide your own measuring wheel. Simple torsion control provides easy wheel pressure adjustment in seconds, allowing various thicknesses of materials to be measured.

Model TR2

Common applications include, Web Tension Control, Paper Monitoring, Glue Dispensing, Linear Material Monitoring, Conveyor Systems, Printing, Labeling and Document Handling.

The Tru-Trac™ encoders are perfect for linear applications and can be mounted above or below the moving object. The spring loaded torsion arm allows the tension on the wheel to be adjusted, so that measurement can be obtained over a variety of different surfaces and textures. Perfect for cut-to-length, packaging, conveyors, mail sorting and gantry applications.

Model TR3

The Tru-Trac™ encoders can be mounted in any orientation to monitor velocity. This is perfect for many rotational applications such as web tension control drums, rotary tables, printing, spooling, etc.

Please visit **www.encoder.com/techbltn.html** for additional information.

The Tru-Trac™ by Encoder Products Company is a versatile solution for tracking velocity, position, or distance over a wide variety of surfaces in almost any application.

For specification assistance call Customer Service at **1-800-366-5412.**

ENCODER PRODUCTS COMPANY

MODEL TR3 HEAVY DUTY TRU-TRAC™

FEATURES

Integrated Heavy Duty Encoder and Measuring Wheel In One
Spring Loaded Torsion Arm for Quick Wheel Pressure Adjustments
Easily Installed in a Vertical, Horizontal or Upside-Down Orientation
Operates Over a Variety of Surfaces at Speeds up to 3000 Feet per Minute
Integrated Module Simplifies System Design, Reducing Cost

The TR3 Heavy Duty Tru-Trac™ is an integrated heavy duty encoder and spring loaded measuring wheel assembly all in one, easy-to-use, compact unit. Available in a single, or optional dual-wheel format, the TR3 Heavy Duty Tru-Trac™ is a versatile solution for tracking velocity, position or distance over a wide variety of surfaces in many industrial applications. Its spring loaded torsion arm provides a simple-to-adjust torsion load, allowing the TR3 Heavy Duty Tru-Trac™ to be mounted in any orientation, even upside-down. The TR3 Heavy Duty Tru-Trac™ housing is an all metal work horse, specifically designed to take on your toughest application environments at operating speeds up to 3000 feet per minute. Just one look and it's easy to see the TR3 Heavy Duty Tru-Trac™ is the ideal solution for countless applications.

COMMON APPLICATIONS

Lumber, Corrugated, Converting, Metal Roll Forming, Paper Monitoring, Glue Dispensing, Linear Material Monitoring, Conveyor Systems, Printing, Labeling, Mining, Construction

MODEL TR3 HEAVY DUTY TRU-TRAC™ ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical | Optional Features (Leave Blank For Standard Options: -20° to +85° C Std | IP50 Std | None Std)

TR3 – U3 | A – 0500 | N | V1 | A | OC – F00 – [ ] [ ] [ ] [ ] [ ]

MODEL
TR3 Tru-Trac™

WHEEL TYPE & CIRCUMFERENCE
U3 Urethane 12" cir
U5 Urethane 300 mm cir
K3 Knurled 12" cir
K5 Knurled 300 mm cir
25 No Wheel 3/8" (0.375") Shaft
A3 Hard Anodized Knurled 12" cir
A5 Hard Anodized Knurled 1/3 M cir

WHEEL CONFIGURATION
A Single
B Double

CYCLES PER REVOLUTION
See *CPR Options* below
Price adder >1999

COMMUTATION
N None

INPUT VOLTAGE
V1 5 to 28 VDC

NUMBER OF CHANNELS[1]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A[2]
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
OC Open Collector
PP Push-Pull
HV Line Driver
PU Pull-Up Resistor[3]
OD Open Collector with Differential Outputs

CONNECTOR TYPE[4]
F00 18" Cable[5] (Std)
F01 12" Cable
F02 24" Cable
F03 36" Cable
M00 2M Cable[6]
SMW 6-pin MS[7]
SMY 7-pin MS[7]
SMX 10-pin MS[7]
SMJ 5-pin M12[7]
SMK 8-pin M12[7]

CONNECTOR ORIENTATION
(See Drawing)
Standard Rear Exit
L1 60° From Standard
L2 120° From Standard
L3 180° From Standard
L4 240° From Standard
L5 300° From Standard

MAXIMUM FREQUENCY
Standard
F3 Extended
See Specifications

OPERATING TEMPERATURE
-20° to +85° C (Std)
T1 -40° to +85° C[8]
T2 -20° to +100° C

SEALING
IP50 (Std)
S3 IP66
S4 IP67

CERTIFICATION
None (Std)
CE CE Marked[9]

MODEL TR3 TRU-TRAC™ CPR OPTIONS

0001 thru 0189*	0198	0200	0250	0256	0300	0315	0360	
0400	0500	0512	0580	0600	0750	0800	1000	1024
1125	1200	1250	1500	1800	2000	2048	2500	2540
3000	3600	4000	4096	5000	6000	7200	8192	10,000

*Contact Customer Service For Availability

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available values. Special disk resolutions are available upon request and may be subject to a one-time NRE fee.

NOTES:
1 Contact Customer Service for non-standard index gating or phase relationship options.
2 Reverse Quadrature not available with PU output type.
3 With Input Voltage above 16 VDC, operating temperature is limited to 85° C.
4 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
5 For non-standard English cable lengths enter 'F' plus cable length expressed in feet. Example: F06 = 6 feet of cable. Frequency above 300 kHz standard cable lengths only.
6 For non-standard metric cable lengths enter 'M' plus cable length expressed in meters. Example: M06 = 6 meters of cable.
7 Body Mount connector options only available with connector orientation L1 thru L5.
8 Rated to -40° C during encoder operation. Storage and startup below -25° C not recommended.
9 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL TR3 TRU-TRAC™ SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° C to 100° C

Input Current ..... 100 mA max (65 mA typical) with no output load

Output Format ..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the wheel side.
See *Waveform Diagram*.

Output Types..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Pull-Up- Open collector with 2.2K ohm Pull-Up Resistor- 20mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0190 to 10,000 CPR: Gated to output A
0001 to 0189 CPR: Ungated
See *Waveform Diagram*.

Max. Frequency ..... Standard Frequency Response is
200 kHz for CPR 1 to 2540
500 kHz for CPR 2541 to 5000
1 MHz for CPR 5001 to 10,000
Extended Frequency Response (optional) is
300 kHz for CPR 2000, 2048, 2500, and 2540

Noise Immunity..... Tested to BS EN61000-6-2; BS EN50081-2; BS EN61000-4-2; BS EN61000-4-3; BS EN61000-4-6, BS EN500811

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Waveform Symmetry .. 180°(±18°) electrical (single channel encoder)

Accuracy..... Within 0.017° mechanical or 1 arc-minute from true position (for CPR>189).

Mechanical

Max Linear Speed .... 3000 FPM not to exceed a maximum shaft speed of 6000 RPM.

Shaft Material ..... Stainless Steel

Radial Shaft Load ..... Up to 10 lb max. Controlled by spring torsion feature

Starting Torque ..... 1.0 oz-in typical with IP50 seal
2.5 oz-in typical with IP66 seal and single wheel
4.0 oz-in typical with IP66 seal and dual wheel
7.0 oz-in typical with IP67 seal and single wheel
14.0 oz-in typical with IP67 seal and dual wheel

Housing ..... Powder coated aluminum

Wheel Width..... 3/4" standard

Weight..... 2.5 lb typical with single wheel
3.0 lb typical with dual wheel

Environmental

Storage Temp ..... -25° to +85° C

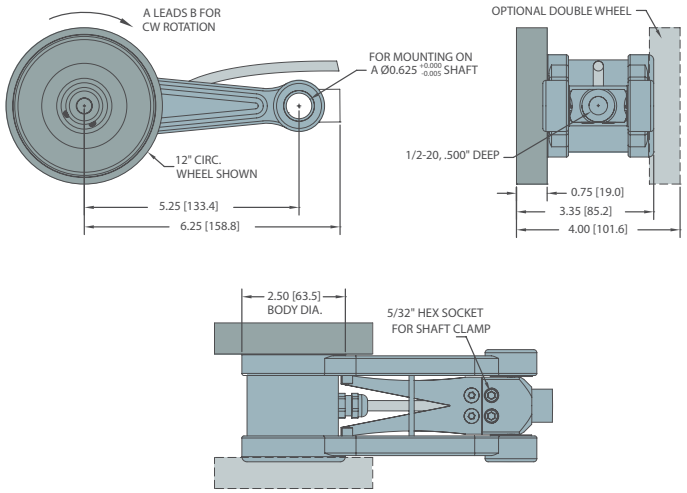
Humidity..... 98% RH non-condensing

Vibration..... 10 g @ 58 to 500 Hz

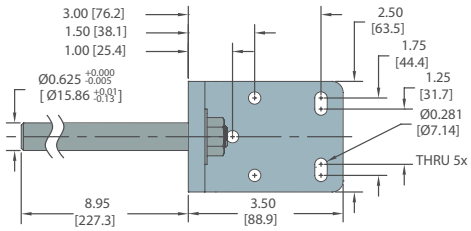
Shock..... 80 g @ 11 ms duration

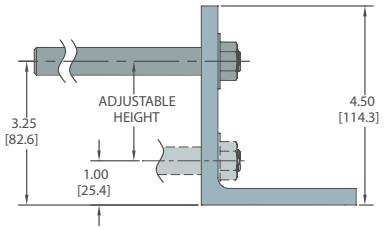
Sealing..... IP50 standard; IP66 or IP67 optional

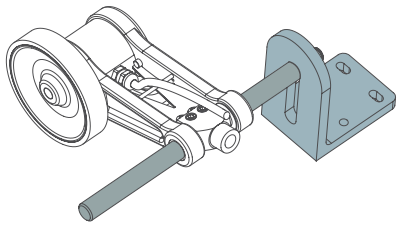
MODEL TR3 HEAVY DUTY TRU-TRAC™

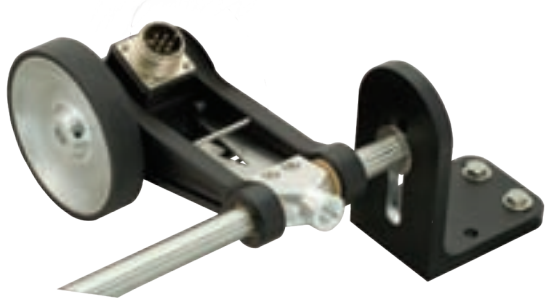


MODEL TR3 MOUNTING BRACKET







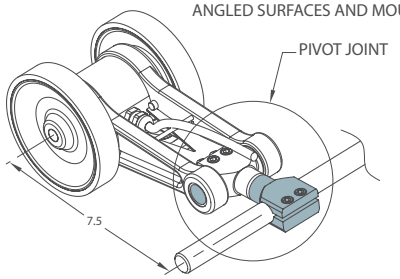


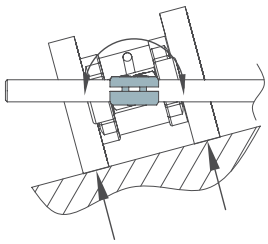
Optional Accessory Mounting Bracket (stock #176389-01) for TR3 Heavy Duty Tru-Trac™ can be ordered separately.

MODEL TR3 HEAVY DUTY TRU-TRAC™

MODEL TR3 DOUBLE WHEEL PIVOT

ALLOWS UNIT TO ROTATE FREELY TO MAINTAIN EQUAL PRESSURE ON BOTH WHEELS, ACCOMODATING UNEVEN/ ANGLED SURFACES AND MOUNTING MISALIGNMENT



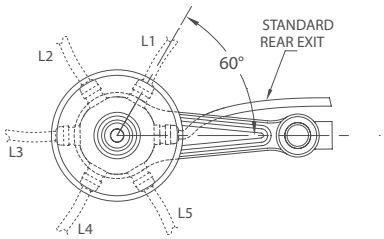


WIRING TABLE

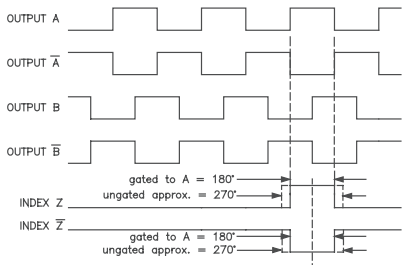
Function	Gland Cable† Wire Color	5-pin M12**	8-pin M12**	10-pin MS	7-pin MS HV, OD	7-pin MS PU, PP, OC	6-pin MS PU, PP, OC
Com	Black	3	7	F	F	F	A, F
+VDC	White	1	2	D	D	D	B
A	Brown	4	1	A	A	A	D
A'	Yellow	--	3	H	C	--	--
B	Red	2	4	B	B	B	E
B'	Green	--	5	I	E	--	--
Z	Orange	5	6	C	--	C	C
Z'	Blue	--	8	J	--	--	--
Case	--	--	--	G	G	G	--
Shield	Bare*	--	--	--	--	--	--

*CE Option: Cable shield (bare wire) is connected to internal case.
**CE Option: Read Technical Bulletin TB111. Available on www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL TR3 CONNECTOR ORIENTATION



WAVEFORM DIAGRAM



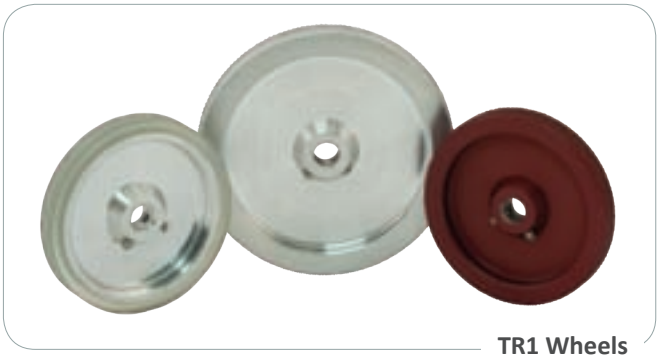
NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS $\overline{A}$, $\overline{B}$, $\overline{Z}$ FOR HV OUTPUT ONLY. CLOCKWISE ROTATION AS VIEWED FROM SINGLE WHEEL SIDE.

MEASURING WHEELS

Increasing the Versatility of Encoders

When properly selected and installed, measuring wheel encoders can provide years of trouble free and cost effective performance. In many types of applications, wheeled encoders can provide more convenient installations and higher accuracy than shaft or hollow bore encoders. The basic components of a completely integrated measuring wheel solution include: the encoder, the measuring wheel(s), a spring mechanism to apply a wheel load, and a pivot mounting bracket. There are many important considerations when selecting a measuring wheel encoder but two of the more significant decisions will be the number of wheels needed as well as what type of wheel will best suit the application's environment.

A single measuring wheel may be the only option for your application, depending on the width of the material being measured. Single measuring wheels must be aligned perpendicular to the material to avoid error induced by uneven wear and a change in the wheel's effective turning diameter. Double measuring wheels result in twice the traction, reducing the potential for wheel slippage, and when coupled with a pivot mount that allows the encoder to rotate freely, the measuring wheels will align with the measured material and maintain equal pressure on both wheels. EPC's TR3 has this option, and more.



TR1 Wheels

Important factors in selecting the best measuring wheel are the circumference and the surface material. The surface material must be chosen to give optimal traction without unduly compromising wear, while the circumference should be selected to give the best accuracy within the mounting constraints available. EPC offers many different measuring wheel sizes, including but not limited to 6", 12", 1/3 meter, 200 mm, and all with a choice of either rubber, knurled or knurled anodized styles, and are made of aluminum alloy.

The actual selection of the various materials is determined by the type of material that is to be measured. The rubber offers the best traction in most applications, but it can be short lived with some materials. The 80 urethane is somewhat harder than the rubber and usually lasts longer. The 90 urethane is the hardest of the coated wheels and provides the longest life under the most circumstances at the cost of less traction. Performance may vary depending on your application.

TR3 Wheels

Another important consideration to keep in mind when selecting a measuring wheel encoder is that it is capable of handling both the mechanical and electrical speed of your application. For Instance, EPC's model TR1 can handle applications with linear speeds up to 3000 feet per minute and electrical frequencies up to 1 MHz.

Debris collecting on a measuring wheel will increase the effective diameter of the wheel and cause potentially unacceptable error. If there will be significant debris in your application, it is best to install the measuring wheel encoder in a location that is least likely to have the debris collect on the wheel. Rather than mounting the measuring wheel on the top surface of a conveyor belt, mount it upside down and on the interior surface of the belt. If not possible, then installing a brush on the measured material just ahead of the wheel, or in contact with the wheel itself can reduce or even eliminate this problem.

For long service life a measuring wheel encoder should be selected that will withstand the environment in which it will be exposed. All measuring wheels, like EPC's Accu-Coder™ brand encoders, are manufactured to EPC's exacting standards, and feature EPC's exclusive 3-year standard product warranty, ensuring years of trouble free use.

Check out our complete list of measuring wheels on page 106 of this catalog.

For specification assistance call
Customer Service at **1-800-366-5412.**

ENCODER PRODUCTS COMPANY

MODEL LCE

FEATURES

Low Cost Linear Solution
Resolutions from 2-500 Cycles per Inch
IP65 Sealing Available
Cable Measurement from 0-50"

The Linear Cable Encoder (LCE) provides a low cost alternative for obtaining accurate linear measurements. As opposed to typical rotary shaft style encoders, the LCE has a retractable stainless steel cable, allowing for numerous measuring configurations. Placing the LCE away from harsh environmental conditions, while still providing precise measurements, gives the LCE an outstanding advantage over shaft style encoders. Installation is easy with a variety of cable exit directions, and perfect parallel alignment no longer necessary. The heart of the LCE is the popular Cube Accu-Coder™, the original cube style encoder. The LCE provides a reliable digital pulse train in either single channel or quadrature format, with resolutions down to 0.002" per cycle. The small overall size, a variety of resolutions, and many different connector types, makes the versatility of the LCE unbeatable.

COMMON APPLICATIONS

Robotics, Extrusion Presses, Valve Positioning, Textile Machinery, Control Gate Positioning

MODEL LCE ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

LCE01 – 1 – 002 – Q – PU – S

MODEL
LCE01 Standard
LCE02 IP65 (Industrial)

CABLE EXIT
1 Option 1
2 Option 2
3 Option 3
4 Option 4

CYCLES PER INCH
See chart below
Price adder for CPI >100

NUMBER OF CHANNELS
Q Quadrature A & B
R Quadrature A & B with Index Z

OUTPUT TYPE
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver

CONNECTOR TYPE[1]
S Standard 6-pin MS
Y 7-pin MS
X 10-pin MS
J 5-pin M12 (12 mm)
K 8-pin M12 (12 mm)
G Gland Nut, 18" cable[2]
T Solder Terminal
B Solder Terminal with Conduit Box

Model LCE features.a retractable stainless steel cable at a standard length of 50". Longer lengths may be available, please contact Customer Services.

MODEL LCE RESOLUTION TABLE

Cycles Per Inch	002	020	040	050	100	200	250	500
Resolution	0.500"	0.050"	0.025"	0.020"	0.010"	0.005"	0.004"	0.002"

Contact Customer Service for other resolutions.

NOTES:
1 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
2 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6=6 feet of cable.

MODEL LCE SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 85° C
4.75 to 24 VDC for temperatures between 85° and 100° C
Input Current ..... 80 mA maximum with no output load
Input Ripple..... 100 mV peak-to-peak at 0 to100 kHz
Output Format ..... Incremental- Square wave with channel A leading B during linear extension
Output Type..... Open Collector- 250 mA max per channel
Pull-Up- 250 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)
Index ..... Once per 5" cable extension or retraction
Max Frequency ..... 0 to 125 kHz

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99° C

Rise Time..... Less than 1 microsecond

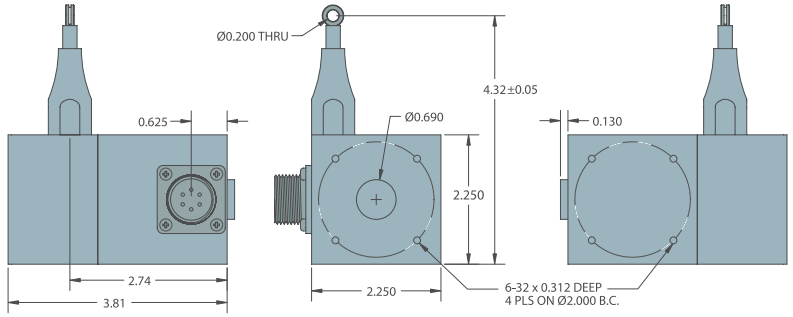
Mechanical

Full Stroke ..... 50" standard. Longer measuring ranges
Length (FSL) may be available, please contact Customer Service.
Finish ..... Black powder coated aluminum
Accuracy..... ±0.10% of FSL
Repeatability ..... ±0.015% of FSL
Linear Resolution..... Up to 500 cycles per inch (0.002" per cycle)
Cable Material..... 0.034" nylon coated stainless steel rope
Cable Tension ..... 20 oz maximum typical
Life (cycles)..... 1,000,000 predicted at zero angle cable exit
Weight..... 19 oz typical

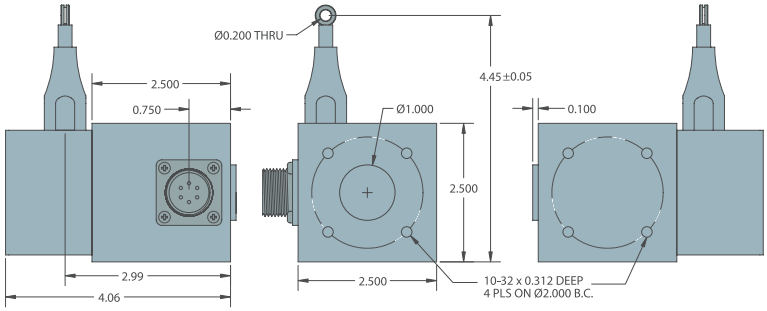
Environmental

Sealing..... IP65 for Industrial LCE

MODEL LCE STANDARD HOUSING (LCE01)

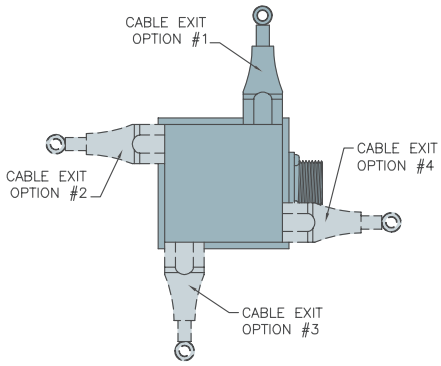


MODEL LCE IP65 INDUSTRIAL HOUSING (LCE02)

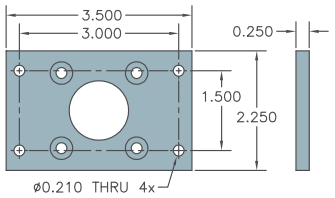


All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

CABLE EXIT OPTIONS



Optional Mounting Plate
Attaches to Standard or Industrial LCE in three different orientations. Order Accessory Item #176064-01.



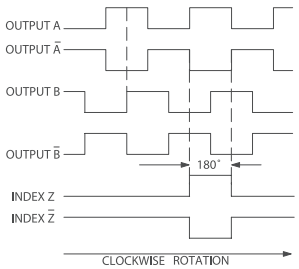
WIRING TABLES

Function	Gland Cable† Wire Color	5-pin M12	8-pin M12	10-pin MS	7-pin MS HV	7-pin MS O, S, PP	6-pin MS HV, No Index	6-pin MS O, S, PP	Term. Block HV, No Index	Term Block O, S, PP
Com	Black	3	7	F	F	F	A	A, F	1	1, 6
+VDC	Red	1	2	D	D	D	B	B	2	2
A	White	4	1	A	A	A	D	D	3	4
A'	Brown	--	3	H	C	--	D	--	4	--
B	Blue	2	4	B	B	B	E	E	5	5
B'	Violet	--	5	I	E	--	F	--	6	--
Z	Orange	5	6	C	--	C	--	C	--	3
Z'	Yellow	--	8	J	--	--	--	--	--	--
Case	Green	--	--	G	G	G	--	--	--	--
Shield	Bare	--	--	--	--	--	--	--	--	--

*E-Cube only.
†Standard cable is 24 AWG conductors with foil and braid shield.

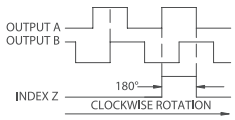
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



MODEL 802S

FEATURES

Industry Standard Size 20 (2" Diameter) Stainless Steel Package Flange and Servo Mounting
Up to 30,000 CPR
80 lb Maximum Axial and Radial Shaft Loading
IP67 Sealing Available

The Model 802S Accu-Coder™ is a heavy duty, industry standard Size 20 (2.0" diameter) encoder specifically designed for harsh factory and plant floor environments. The Model 802S is available with a variety of flange and servo mounting styles, making it easy to use in a broad range of applications. Its heavy duty, double shielded ball bearings are rated at 80 pounds maximum axial and radial shaft load, ensuring long operating life. This ultra-rugged, yet compact encoder is housed in a type 316 stainless steel enclosure, making it ideal for applications where contamination or exposure to caustic chemicals is a concern. But don't let its tough exterior fool you, the Model 802S provides the precise, reliable output you've come to expect from Accu-Coder™.

COMMON APPLICATIONS

Food Processing, Oil, Gas & Chemical Processing, Material Handling, Conveyors, Robotics, Elevator Controls, Textile Machines

MODEL 802S ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

802S – 20 – S – 1000 – R – HV – 1 – F – 1 – E – G – CE

MODEL
802S Size 20 (2.0")

SHAFT SIZE[1]
07 1/4", 0.250"
20 3/8", 0.375"
21 10 mm
30 3/8", 0.375"[2]

OPERATING TEMPERATURE
S 0° to 70° C
H -40° to 70° C
H 0° to 100° C[3]

CYCLES PER REVOLUTION
1-30,000
Price adder for CPR>1270
(See table below)

NUMBER OF CHANNELS[4]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5 - 28V In/Out[5]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver
8 - 28V In/5V Out[6,7]
H5 Line Driver (5V)
P5 Push-Pull (5V)

MAXIMUM FREQUENCY
1 100 kHz (Standard)
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[8]
4 1 MHz, >10,000 CPR[8]

MOUNTING
Flange Mounts
F 1.181" Female Pilot
L 0.687" Male Pilot
G 1.250" Male Pilot
K Size 25 w/30 Shaft
Servo Mounts
S 1.181" Female Pilot
U 0.687" Male Pilot
T 1.250" Male Pilot
J Size 25 w/30 Shaft

SEAL
N No Seal
1 IP66
2 IP64[9]
5 IP67

CONNECTOR LOCATION
E End
S Side

CONNECTOR TYPE[10]
G Gland, 24" cable[11]
J 5-Pin M12 (12mm)[12]
K 8-Pin M12 (12mm)[12]

CERTIFICATION
N None
CE CE Marked[13]

MODEL 802S CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*	0011*	0012*
0014*	0020	0021*	0024*	0025*	0028*	0030*	0032*	0033*	0034*
0035*	0038*	0040*	0042*	0045*	0050*	0060	0064*	0100	0120
0125	0128*	0144*	0150*	0160*	0192*	0200	0240*	0250	0254*
0256*	0300	0333*	0360	0400	0500	0512	0600	0625*	0635
0665*	0720	0768*	0800	0889	0900*	1000	1024	1200	1201*[a]
1203*[a]	1204*[a]	1250[a]	1270[a]	1440	1500	1800	2000	2048	2400[a]
2500	2540[a]	2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]
7500[a]		9000[a]	10,000[a]		10,240[a]	12,000[a]	12,500[a]		14,400[a]
15,000[a]		18,000[a]	20,000[a]		20,480[a]	25,000[a]	30,000[a]		

*Contact Customer Service for High Temperature Option.
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 Contact Customer Service for additional options.
2 Shaft with Size 25 Mounting Adapter, J or K mounting only.
3 0° to 85° C for certain resolutions, see CPR Options.
4 Contact Customer Service for non-standard index gating options.
5 24 VDC max for high temperature option.
6 Standard temperature, 60 to 3000 CPR only.
7 CE not available with H5/P5 output type options.
8 Standard cable lengths only. For additional information please refer to Technical Bulletin TB116: *Noise and Signal Considerations* at www.encoder.com.
9 IP64 not available in low temp option.
10 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
11 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
12 M12 connector available on side mount option only.
13 For additional information please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 802S SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face. See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.

Max Frequency ..... Up to 1 MHz.

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Symmetry..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 30,000 CPR: 180° (±36°) electrical

Quad Phasing..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 30,000 CPR: 90° (±36°) electrical

Min Edge Sep..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical

Rise Time..... Less than 1 microsecond

Accuracy..... Instrument and Quadrature Error: For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

Mechanical

Max Shaft Speed..... 8000 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Radial Shaft Load ..... 80 lb max. Rated load of 20 to 40 lb for bearing life of 1.5 x 10^9 revolutions

Axial Shaft Load ..... 80 lb max. Rated load of 20 to 40 lb for bearing life of 1.5 x 10^9 revolutions

Starting Torque ..... 1.0 oz-in typical with IP64 seal or no seal
3.0 oz-in typical with IP66 shaft seal
7.0 oz-in typical with IP67 shaft seal

Moment of Inertia ... 5.2 x 10^{-4} oz-in-sec^2

Max Acceleration ..... 1 x 10^5 rad/sec^2

Housing ..... Type 316 Stainless Steel

Bearings..... Precision ABEC ball bearings

Weight..... 1.5 lb typical

Environmental

Storage Temp ..... -25° to +85° C

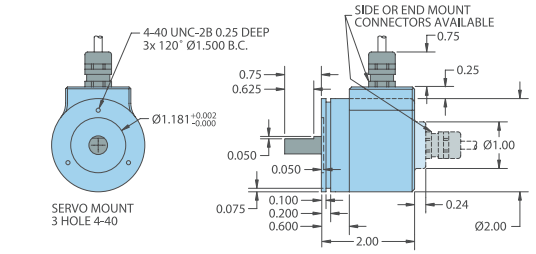
Humidity..... 98% RH non-condensing

Vibration..... 20 g @ 58 to 500 Hz

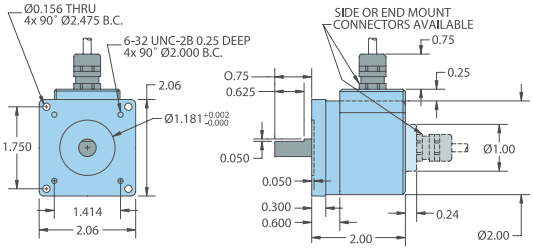
Shock..... 75 g @ 11 ms duration

Sealing..... IP50 standard; IP64, IP66, IP67 optional

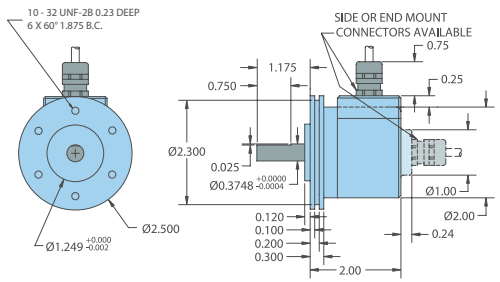
MODEL 802S SERVO MOUNT (S)



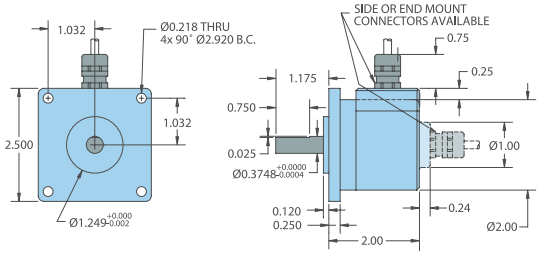
MODEL 802S FLANGE MOUNT (F)



MODEL 802S SIZE 25 (2.5") SERVO MOUNT (J)



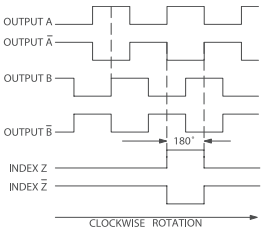
MODEL 802S SIZE 25 (2.5") FLANGE MOUNT (K)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

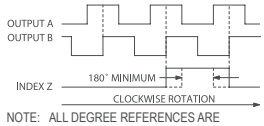
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. INDEX IS POSITIVE GOING.

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12	8-pin M12
Com	Black	3	7
+VDC	Red	1	2
A	White	4	1
A'	Brown	--	3
B	Blue	2	4
B'	Violet	--	5
Z	Orange	5	6
Z'	Yellow	--	8
Case	Green	--	--
Shield	Bare*	--	--

*CE Option: Cable Shield (bare wire) is connected to internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 858S

FEATURES

Industry Standard Size 58 (58 mm Diameter) Stainless Steel Package
Up to 30,000 CPR
80 lb Maximum Axial and Radial Shaft Loading
100° C Operating Temperature Available
IP67 Sealing Available

The Model 858S European Size 58 Accu-Coder™ is a heavy duty, extremely rugged, reliable encoder, in a 316 stainless steel package. Its compact design is well suited for harsh factory and plant floor environments that call for a metric solution. The double-shielded ball bearings are rated at 80 pound maximum axial and radial shaft loading, to ensure a long operating life. Shock rating is 75 g for 11 milliseconds duration. With the optional heavy-duty shaft seal installed, the Model 858S is rated at IP67. Two European standard mounting options are available, the Clamping Flange (20 Type), or the Synchro Flange (26 Type).

COMMON APPLICATIONS

Food Processing, Oil, Gas & Chemical Processing, Material Handling, Conveyors, Robotics, Elevator Controls, Textile Machines

MODEL 858S ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

858S – A – 21 – S – 1000 – R – HV – 1 – 1 – E – G – CE

MODEL
858S Size 58 mm

MOUNTING TYPE[1]
A 20 Type Clamping
B 26 Type Synchro

SHAFT SIZE[1]
07 1/4", 0.250"
20 3/8", 0.375"
06 6 mm
21 10 mm

OPERATING TEMPERATURE
S 0° to 70° C
L -40° to 70° C
H 0° to 100° C[2]

CYCLES PER REVOLUTION
1-30,000
Price adder for CPR >1270
(See table below)

NUMBER OF CHANNELS[3]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index

OUTPUT TYPE
5-28V In/Out[4]
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver
8-28V In/5V Out[5,6]
H5 Line Driver (5V)
P5 Push-Pull (5V)

MAXIMUM FREQUENCY
1 100 kHz (Standard)
2 200 kHz
5 250 kHz, >3000 CPR
3 500 kHz, >6000 CPR[7]
4 1 MHz, >10,000 CPR[7]

SEAL
N No Seal
1 IP66
2 IP64[8]
5 IP67

CONNECTOR LOCATION
E End
S Side

CONNECTOR TYPE[9]
G Gland, 24" cable[10]
J 5-Pin M12 (12mm)[11]
K 8-Pin M12 (12mm)[11]

CERTIFICATION
N None
CE CE Marked[12]

MODEL 858S CPR OPTIONS

0001*	0002*	0004*	0005*	0006*	0007*	0008*	0010*	0011*	0012*
0014*	0020	0021*	0024*	0025*	0028*	0030*	0032*	0033*	0034*
0035*	0038*	0040*	0042*	0045*	0050*	0060	0064*	0100	0120
0125	0128*	0144*	0150*	0160*	0200	0240*	0250	0254*	0256*
0300	0333*	0360	0400	0500	0512	0600	0625*	0635	0665*
0720	0768*	0800	0889	0900*	1000	1024	1200	1201*[a]	1203*[a]
1204*[a]	1250[a]	1270[a]	1440	1500	1800	2000	2048	2400[a]	2500
2540[a]	2880[a]	3000[a]	3600[a]	4000[a]	4096[a]	5000[a]	6000[a]	7200[a]	7500[a]
9000[a]	10,000[a]	10,240[a]	12,000[a]	12,500[a]	14,400[a]	15,000[a]	18,000[a]	20,000[a]	20,480[a]
25,000[a]	30,000[a]								

*Contact Customer Service for High Temperature Option.
[a]High Temperature Option (H) limited to 85° C maximum for these CPR options.

New CPR values are periodically added to those listed. Contact Customer Service to determine all currently available CPR values. Special disk resolutions are available upon request. A one-time NRE fee may apply.

NOTES:
1 The shaft on 20 Type mountings includes a 15.58mm flat. The shaft on 26 Type mountings is provided without a flat.
2 0° to 85° C for certain resolutions, see CPR Options.
3 Contact Customer Service for non-standard index gating options.
4 24 VDC max for high temperature option.
5 Standard temperature, 60 to 3000 CPR only.
6 CE not available with H5/P5 output type options.
7 Standard cable lengths only. For additional information please refer to Technical Bulletin TB116: *Noise and Signal Considerations* at www.encoder.com.
8 IP64 not available in low temp option.
9 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
10 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
11 M12 connector available on side mount option only.
12 For additional information please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 858S SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the encoder mounting face. See *Waveform Diagrams*.

Output Types ..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Occurs once per revolution. The index for units >3000 CPR is 90° gated to Outputs A and B. See *Waveform Diagrams*.

Max Frequency ..... Up to 1 MHz.

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Symmetry..... 1 to 6000 CPR: 180° (±18°) electrical at 100 kHz output
6001 to 30,000 CPR: 180° (±36°) electrical

Quad Phasing..... 1 to 6000 CPR: 90° (±22.5°) electrical at 100 kHz output
6001 to 30,000 CPR: 90° (±36°) electrical

Min Edge Sep..... 1 to 6000 CPR: 67.5° electrical at 100 kHz output
6001 to 20,480 CPR: 54° electrical
>20,480 CPR: 50° electrical

Rise Time..... Less than 1 microsecond

Accuracy..... Instrument and Quadrature Error:
For 200 to 1999 CPR, 0.017° mechanical (1.0 arc minutes) from one cycle to any other cycle. For 2000 to 3000 CPR, 0.01° mechanical (0.6 arc minutes) from one cycle to any other cycle. Interpolation error (units > 3000 CPR only) within 0.005° mechanical. (Total Optical Encoder Error = Instrument + Quadrature + Interpolation)

Mechanical

Max Shaft Speed..... 8000 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Radial Shaft Load ..... 80 lb max. Rated load of 20 to 40 lb for bearing life of 1.5 x 10^9 revolutions

Axial Shaft Load ..... 80 lb max. Rated load of 20 to 40 lb for bearing life 1.5 x 10^9 revolutions

Starting Torque ..... 1.0 oz-in typical with IP64 seal or no seal
3.0 oz-in typical with IP66 shaft seal
7.0 oz-in typical with IP67 shaft seal

Moment of Inertia ... 5.2 x 10^{-4} oz-in-sec^2

Max Acceleration ..... 1 x 10^5 rad/sec^2

Housing ..... Type 316 Stainless Steel

Bearings..... Precision ABEC ball bearings

Weight..... 1.5 lb typical

Environmental

Storage Temp ..... -25° to +85° C

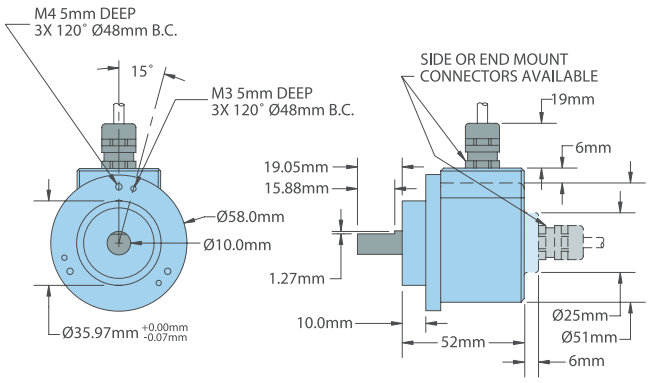
Humidity..... 98% RH non-condensing

Vibration..... 20 g @ 58 to 500 Hz

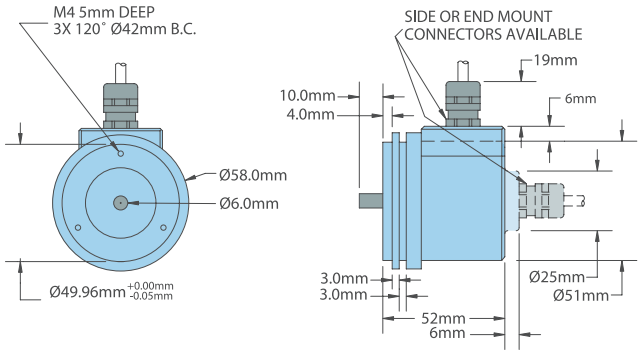
Shock..... 75 g @ 11 ms duration

Sealing..... IP50 standard; IP64, IP66, IP67 optional

MODEL 858 CLAMPING FLANGE 20 TYPE (A)



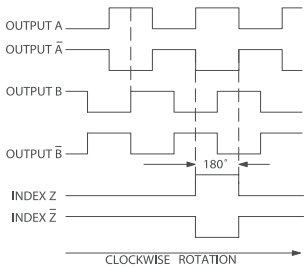
MODEL 858 SYNCHRO FLANGE 26 TYPE (B)



All dimensions are in millimeters with a tolerance of ±0.17 mm unless otherwise specified.

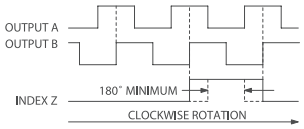
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES INDEX IS POSITIVE GOING

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12	8-pin M12
Com	Black	3	7
+VDC	Red	1	2
A	White	4	1
A'	Brown	--	3
B	Blue	2	4
B'	Violet	--	5
Z	Orange	5	6
Z'	Yellow	--	8
Shield	Bare*	--	--
Case	Green	--	--

*CE Option: Cable Shield (bare wire) is connected to internal case.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 865T

FEATURES

A C-Face Thru-Bore Encoder with Stainless Steel Housing
Fits NEMA Size 56C Thru 184C Motor Faces (4.5" AK)
Slim Profile—Only 1.00" Deep
Incorporates Opto-ASIC Technology
Resolutions to 4096 CPR

The Model 865T C-Face encoder is a rugged, high resolution encoder designed to mount directly on NEMA C-Face motors. Both sides of the encoder are C-Face mounts, allowing additional C-Face devices to be mounted to this encoder. Unlike many C-Face kit type encoders, the Model 865T contains precision bearings and an internal flex mount, virtually eliminating encoder failures and inaccuracies induced by motor shaft runout or axial endplay. The advanced Opto-ASIC design provides advanced noise immunity necessary for many industrial applications. This encoder is ideal for applications using induction motors and flux vector control. The 1.00" thick model 865T provides speed and position information for drive feedback in a slim profile. The thru-bore design allows fast and simple mounting of the encoder directly to the accessory shaft or to the drive shaft of the motor, using the standard motor face (NEMA sizes 56C - 184C). The tough 316 stainless steel housing resists the corrosion and hazards of a caustic industrial environment.

COMMON APPLICATIONS

Motor Feedback, Velocity & Position Control, Conveyors, Variable Speed Drives, Mixing & Blending Motors, Assembly & Specialty Machines

MODEL 865T ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical | Optional Features (Leave Blank For Standard Options: 0° to +70° C std; None Std)

865T – 34 H1 – 0500 N V1 R OC – F02 – [ ] [ ]

MODEL
865T 4.5" NEMA "AK" Dimension, Stainless Steel Thru-Bore

BORE SIZE
11 5/8", 0.625"
34 3/4", 0.750"
18 7/8", 0.875"
80 1", 1.000"
13 14 mm
19 19 mm
24 24 mm

HOUSING STYLE
H1 Thru-Bore housing version with IP50 dust seal[1]
H2 Cover completely encloses motorshaft and eliminates access to motor shaft; IP66 rated.

CYCLES PER REVOLUTION
See *CPR Options* below
Price adder for CPR >1024

INPUT VOLTAGE
V1 5 to 28 VDC[2]

NUMBER OF CHANNELS[3]
A Channel A
Channel A Leads B
Q Quadrature A & B
R Quadrature A & B with Index
Channel B Leads A
K Reverse Quadrature A & B
D Reverse Quadrature A & B with Index
See http://www.encoder.com/literature/index-phasing.pdf for additional options, and waveforms.

OUTPUT TYPE
OC Open Collector
PU Pull-Up Resistor
PP Push-Pull
HV Line Driver[4]

CONNECTOR TYPE[5]
F02 24" Cable wit Gland Nut[6]
SMJ 5-Pin M12
SMK 8-Pin M12

OPERATING TEMPERATURE
0° to 70° C (Std)
T4 0° to 100° C

CERTIFICATION
None (Std)
CE CE Marked[7]

MODEL 865T CPR OPTIONS

0060	0100	0120	0240	0250	0256	0500
0512	0600	1000	1024	2048	2500	4096

Contact Customer Service for other disk resolutions; not all disk resolutions available with all output types.

NOTES:
1 Housing style H1 Thru-Bore version equipped with IP50 dust seal. Unit must be mounted between two C-Face devices with supplied gasket kit to be IP66 sealed.
2 5 to 24 VDC max for high temperature option.
3 Contact Customer Service for index gating options.
4 Not available with 5-Pin M12 connector.
5 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
6 For non-standard cable lengths enter 'F' plus cable length expressed in feet. Example: F06 = 6 feet of cable.
7 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 865T SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 28 VDC max for temperatures up to 70° C
4.75 to 24 VDC for temperatures between 70° C to 100° C

Input Current ..... 100 mA max with no output load

Input Ripple..... 100 mV peak-to-peak at 0 to 100 kHz

Output Format..... Incremental- Two square waves in quadrature with channel A leading B for clockwise shaft rotation, as viewed from the mounting face.
See *Waveform Diagrams*.

Output Types..... Open Collector- 100 mA max per channel
Pull-Up- 100 mA max per channel
Push-Pull- 20 mA max per channel
Line Driver- 20 mA max per channel
(Meets RS 422 at 5 VDC supply)

Index..... Once per revolution.
0001 to 0474 CPR: Ungated
0475 to 4096 CPR: Gated to output A
See *Waveform Diagrams*.

Max Frequency ..... 200 kHz

Noise Immunity..... Tested to BS EN61000-4-2; IEC801-3; BS EN61000-4-4; DDENV 50141; DDENV 50204; BS EN55022 (with European compliance option); BS EN61000-6-2; BS EN50081-2

Quadrature..... 67.5° electrical or better is typical,
Edge Separation 54° electrical minimum at temperatures > 99°C

Rise Time..... Less than 1 microsecond

Mechanical

Max Shaft Speed..... 6000 RPM. Higher shaft speeds may be achievable, contact Customer Service.

Bore Tolerance ..... +0.0015"/-0.000"

User Shaft Tolerances
Radial Runout ..... 0.005"
Axial Endplay..... +0.050"

Moment of Inertia ... 3.3 x 10^{-3} oz-in-sec^2 typical

Housing ..... Type 316 Stainless Steel

Weight..... 6 lb typical

Environmental

Storage Temp ..... -25° to 100°C

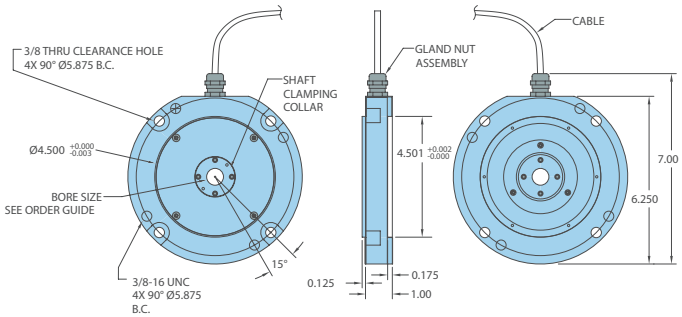
Humidity..... 98% RH non-condensing

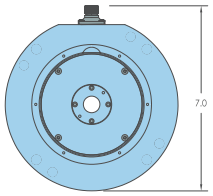
Vibration..... 10 g @ 58 to 500 Hz

Shock..... 50 g @ 11 ms duration

Sealing..... IP66 when mounted between two C-Face devices with supplied gasket kit, or with H1 cover. IP50 if not installed in either manner.

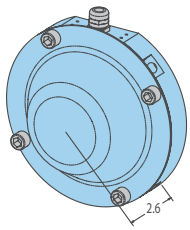
MODEL 865T CONNECTOR OPTIONS





Model 865T shown with
M12 connector option. Specify
5-pin or 8-pin using Ordering Guide.

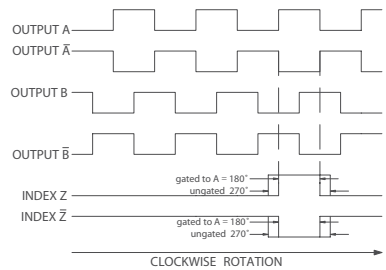
MODEL 865T OPTIONAL HOUSING COVER (H2)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

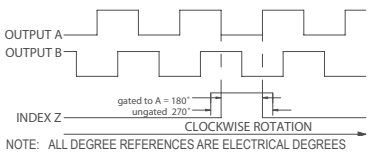
WAVEFORM DIAGRAMS

Line Driver and Push-Pull



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES. WAVEFORM SHOWN WITH OPTIONAL COMPLEMENTARY SIGNALS Ā, B̄, Z̄ FOR HV OUTPUT ONLY.

Open Collector and Pull-Up



NOTE: ALL DEGREE REFERENCES ARE ELECTRICAL DEGREES
INDEX IS POSITIVE GOINGS

WIRING TABLE

Function	Gland Cable† Wire Color	5-pin M12* PU, PP, OC	8-pin M12*
Com	Black	3	7
+VDC	Red	1	2
A	White	4	1
A'	Brown	--	3
B	Blue	2	4
B'	Violet	--	5
Z	Orange	5	6
Z'	Yellow	--	8
Shield	Bare	--	--

*CE Option: Read Technical Bulletin: TB111 which can be found at www.encoder.com.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 925

Ø2.5"

FEATURES

Standard Size 25 Package (2.5")
Resolutions up to 12-Bit (4096 Counts)
Incorporates Opto-ASIC Technology
Industrial Grade, Heavy Duty Housing
Optional IP67 Seal

The Model 925 Single Turn Absolute Accu-Coder™ is ideal for a wide variety of industrial applications that require an encoder with the capability of absolute positioning output. Its fully digital output and innovative use of Opto-ASIC technology make the Model 925 an excellent choice for all applications, especially ones with a high presence of noise. Available with either round servo or square flange mounting, and a variety of connector and cabling options, the Model 925 is easily designed into a variety of application requirements. The Model 925, with its wide selection of shaft sizes supported by industrial grade, heavy duty bearings and its optional IP67 seal is ideal for rough environments.

COMMON APPLICATIONS

Machine Tools, Robotics, Telescopes, Antennas, Rotary & X-Y Positioning Tables, Medical Scanners

MODEL 925 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

925 – B – F – XXXX – CW – S – G/6 – 07 – N – PP – N

MODEL
925 Absolute Series
Size 25 (2.5")

OUTPUT CODE
G Gray
B Natural Binary
X Excess Gray

MOUNTING
F Flange
S 2.5" Servo

RESOLUTION
See Table Below

COUNT DIRECTION/ CODE INVERSION
CW Clockwise
CCW Counter Clockwise
CWI Clockwise/Inverted
CCI Counter Clockwise/Inverted

CONNECTOR LOCATION
S Side
E End

CONNECTOR TYPE [1,2]
C10 10-pin MS[3]
C16 16-pin M23
C19 19-pin Bayonet
G Gland, 24" cable (standard)[4]

SHAFT SIZE
07 1/4", 0.250"
19 5/16", 0.3125"
20 3/8", 0.375"
06 6 mm
18 8 mm
21 10 mm

SHAFT SEAL
N No Seal
1 IP66
2 IP64
5 IP67

OUTPUT TYPE
PP Push-Pull (standard)
OC Open Collector

CERTIFICATION
N None
CE CE Marked[5]

MODEL 925 RESOLUTION TABLE

Output Code	Counts Per Resolution						
Gray Code	0256	0512	1024	2048	4096		
Natural Binary	0250	0256	0360	0500	0512	0720	1000
	1024	1440	2000	2048	2880	4000	4096
Excess Gray	0180	0250	0360	0500	0720	1000	1440
	2000	2880	4000				

NOTES:
1 For additional connector styles please contact Customer Service.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 Only available with 8-bit resolution encoder. Not available with CE.
4 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
5 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com. Contact Customer Service for availability.

MODEL 925 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 26 VDC max
Regulation..... 100 mV peak-to-peak, max ripple at 0 to 10 kHz
Input Current..... 100 mA max with no external load
Output Format..... Absolute- Parallel Outputs
Output Type..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Code..... Gray Code, Natural Binary Code, Excess Gray Code
Max Frequency..... 50 kHz (LSB)
Rise Time..... Less than 1 microsecond
Resolution..... Up to 12 bit
Accuracy..... ±1/2 LSB

Control

Directional Control... Field selectable for increasing counts (CW or CCW)

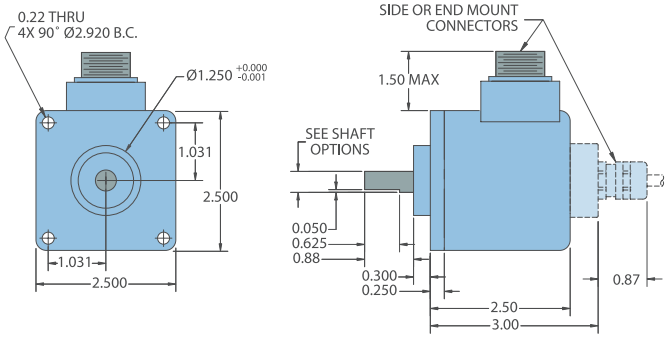
Mechanical

Max Shaft Speed..... 6000 RPM continuous
Radial Shaft Load..... 35 lb max
Axial Shaft Load..... 40 lb max
Starting Torque..... 1.0 oz-in typical for no seal
2.0 oz-in typical with IP64 seal
3.0 oz-in typical with IP66 shaft seal
7.0 oz-in typcial with IP67 shaft seal
Max Acceleration..... 1 x 10^5 rad/sec^2
Housing..... Aluminum
Weight..... 22 oz typical

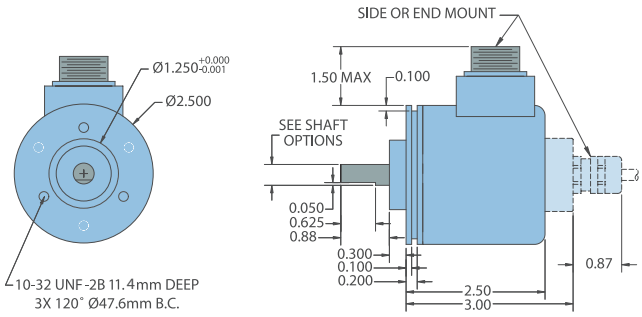
Environmental

Storage Temp..... -20° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 20 g @ 11 ms duration
Sealing..... IP50 standard; IP64, IP66 or IP67 optional

MODEL 925 2.5" FLANGE MOUNT (F)



MODEL 925 2.5" SERVO MOUNT (S)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

WIRING TABLE

Function	Cable† Wire Color	19-pin Bayonet KPT02E14-19P	16-pin M23	10-pin MS*
S1 MSB	Brown	A	3	A
S2	White	B	5	B
S3	Green	C	6	C
S4	Orange	D	7	D
S5	Blue	E	8	E
S6	Violet	F	9	F
S7	Gray	G	10	G
S8 LSB 8-bit	Pink	H	11	H
S9 LSB 9-bit	Red/Green	J	12	--
S10 LSB 10-bit	Red/Yellow	K	13	--
S11 LSB 11-bit	Turquoise	L	14	--
S12 LSB 12-bit	Yellow	M	15	--
Direction+	Red/Blue	R	4	--
Case Ground	Drain/Screen	S	16	--
0V Common	Black	T	1	J
Special**	White/Red	U	--	--
+VDC	Red	V	2	I

*Only available with 8-bit resolution encoder. Not available with CE.
**Where fitted.
+Direction control Standard is CW increasing when viewed from the shaft end. Direction pin is pulled high to 5V internally. Direction pin must be pulled low (GND, Common) to reverse count direction. Applied voltage to direction pin should not exceed 5V.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 958

Ø58 mm

FEATURES

European Size 58 (58 mm) Package
Resolutions up to 12 Bit (4096 PPR equivalent)
Incorporates Opto-ASIC Technology
Industrial Grade, Heavy Duty Housing
Wide Range of Operating Voltages (4.75 to 26 VDC)

The Model 958 Single Turn Absolute Accu-Coder™ is ideal for a wide variety of industrial applications requiring an encoder with European Size 58 (58 mm) mounting and absolute positioning output. With an industrial grade housing and innovative Opto-ASIC circuitry, the Model 958 is both rugged and reliable, performing especially well in situations with high levels of electrical noise. Available with a choice of either Clamping Flange (Type 20) or Synchro Flange (Type 26) servo mounting, sealing up to IP66, and a variety of connector and cabling options. The Model 958 is easily designed into a variety of applications. With so many options that make the Model 958 ultra-durable, this absolute encoder can handle the toughest environments.

COMMON APPLICATIONS

Machine Tools, Robotics, Telescopes, Antennas, Rotary & X-Y Positioning Tables, Medical Scanners

MODEL 958 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

958 – B – 20 – XXXX – CW – S – G/6 – 07 – N – PP – N[4]

MODEL
958 Absolute Series
Size 58 (58 mm)

OUTPUT CODE
G Gray
B Natural Binary
X Excess Gray

MOUNTING
20 Clamping Flange (20 Type)
26 Synchro Flange (26 Type)

RESOLUTION
See Table Below

COUNT DIRECTION/ CODE INVERSION
CW Clockwise
CCW Counter Clockwise
CWI Clockwise/Inverted
CCI Counter Clockwise/Inverted

CONNECTOR LOCATION
S Side
E End

CONNECTOR TYPE[1,2]
C16 16-pin M23
C19 19-pin Bayonet
G Gland, 24" cable (standard)[3]

SHAFT SIZE
07 1/4", 0.250"
20 3/8", 0.375"
06 6 mm
21 10 mm

SHAFT SEAL
N No Seal
1 IP66
2 IP64

OUTPUT TYPE
PP Push-Pull (standard)
OC Open Collector

CERTIFICATION
N None
CE CE Marked[5]

MODEL 958 RESOLUTION TABLE

Output Code	Counts Per Resolution						
Gray Code	0256	0512	1024	2048	4096		
Natural Binary	0250	0256	0360	0500	0512	0720	1000
	1024	1440	2000	2048	2880	4000	4096
Excess Gray	0180	0250	0360	0500	0720	1000	1440
	2000	2880	4000				

NOTES:
1 For additional connector styles please contact Customer Service.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
4 Also available in stainless steel housing. Contact Customer Service for details.
5 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com. Contact Customer Service for availability.

MODEL 958 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 26 VDC max
Regulation ..... 100 mV peak-to-peak, max ripple at 0 to 100 kHz
Input Current ..... 100 mA max with no external load
Output Format ..... Absolute- Parallel Outputs
Output Type ..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Code ..... Gray Code, Natural Binary Code, Excess Gray Code
Max Frequency ..... 50 kHz (LSB)
Rise Time..... Less than 1 microsecond
Resolution ..... Up to 12 bit
Accuracy..... +1/2 LSB

Control

Directional Control... Field selectable for increasing counts (CW or CCW)

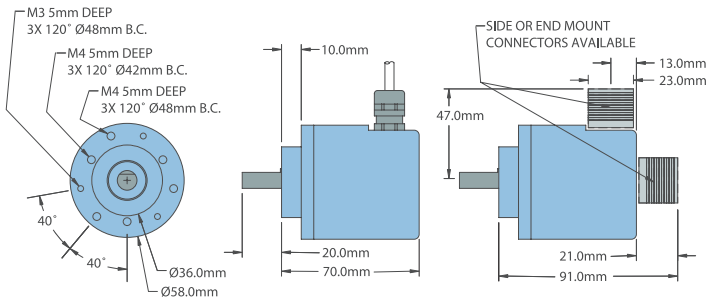
Mechanical

Max Shaft Speed..... 6000 RPM continuous
Radial Shaft Load ..... 27 lb max
Axial Shaft Load ..... 27 lb max
Starting Torque ..... 1.0 oz-in typical for no seal
2.0 oz-in with IP64 shaft seal
3.0 oz-in typical with IP66 shaft seal
Max Acceleration ..... 1×10^5 rad/sec^2
Housing ..... Aluminum
Weight..... 22 oz typical

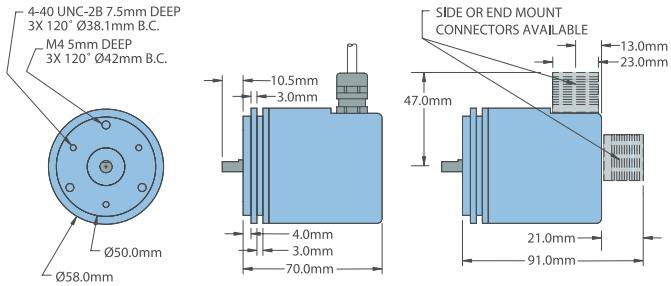
Environmental

Storage Temp ..... -20° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 20 g @ 11 ms duration
Sealing..... IP54 (standard), IP64, or IP66 (NEMA 13 and 4) optional

MODEL 958 CLAMPING FLANGE 20 TYPE (20)



MODEL 958 SYNCHRO FLANGE 26 TYPE (26)



All dimensions are in millimeters with a tolerance of ±0.17 mm unless otherwise specified.

WIRING TABLE

Function	Cable† Wire Color	19-pin Bayonet KPT02E14-19P	16-pin M23
S1 MSB	Brown	A	3
S2	White	B	5
S3	Green	C	6
S4	Orange	D	7
S5	Blue	E	8
S6	Violet	F	9
S7	Gray	G	10
S8 LSB 8-bit	Pink	H	11
S9 LSB 9-bit	Red/Green	J	12
S10 LSB 10-bit	Red/Yellow	K	13
S11 LSB 11-bit	Turquoise	L	14
S12 LSB 12-bit	Yellow	M	15
Direction**	Red/Blue	R	4
Case Ground	Drain/Screen	S	16
0V Common	Black	T	1
Special*	White/Red	U	--
+VDC	Red	V	2

*Where fitted.
**Direction control standard is CW increasing when viewed from the shaft end. Direction pin is pulled high to 5V internally. Direction pin must be pulled low (GND, Common) to reverse count direction. Applied voltage to direction pin should not exceed 5V.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL 960

FEATURES

Low-Profile—1.55"
Thru-Bore or Hollow Bore Styles
Industrial Grade, Heavy Duty Housing
State-of-the-Art Opto-ASIC Circuitry

The single-turn Model 960 Absolute Series Accu-Coder™ provides a unique solution to a wide variety of industrial applications requiring absolute position information. By providing a low profile package of just 1.55", as well as a variety of hollow and thru-bore sizes and an easy to use flexible mounting system, the Model 960 goes where traditional absolute encoders do not fit. In addition, its innovative Opto-ASIC circuitry, coupled with its digital output, make it an excellent choice in those applications plagued by an unusually high level of electrical noise. The Model 960 can easily be mounted directly on a motor shaft, bringing the advantage of absolute positioning in an all metal housing while eliminating the fixtures, couplers and adapters required by other absolute encoder designs.

COMMON APPLICATIONS

Machine Tools, Robotics, Telescopes, Antennas, Rotary & X-Y Positioning Tables, Medical Scanners

MODEL 960 ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

960 – T – 01 – G – 09 – PP – SF – G/6 – CE

MODEL
960 Absolute Series Thru-Bore

HOUSING STYLE
T Thru-Bore
B Hollow Bore

BORE SIZE
01 1/4", 0.250"
02 3/8", 0.375"
04 6 mm
14 8 mm
05 10 mm

OUTPUT CODE
G Gray Code

RESOLUTION
(Bits, Counts Per Revolution)
08 8 bit, 0256
09 9 bit, 0512
10 10 bit, 1024
11 11 bit, 2048
36 9 bit, 360 (XS76)
72 10 bit, 720 (XS152)

OUTPUT TYPE
PP Push Pull (Standard)
OC Open Collector

MOUNTING
SF Standard Slotted Flex Mount
FA Flexible Arm

CONNECTOR TYPE
G Gland, 18" Cable[1]

CERTIFICATION
N None
CE CE Marked[2]

NOTES:
1 For non-standard cable lengths, add a forward slash (/) plus cable length expressed in feet. Example: G/6 = 6 feet of cable.
2 Please refer to Technical Bulletin TB100: *When to Choose the CE Option* at www.encoder.com.

MODEL 960 SPECIFICATIONS

Electrical

Input Voltage..... 4.75 to 26 VDC max
Regulation..... 100 mV peak-to-peak, max ripple at 0 to 10 kHz
Input Current..... 100 mA max with no external load
Output Format..... Absolute- Parallel Outputs
Output Type..... Open Collector- 20 mA max per channel
Push-Pull- 20 mA max per channel
Code..... Gray Code, Excess Gray Code
Max Frequency..... 25.6 kHz (LSB)
Rise Time..... Less than 1 microsecond
Resolution..... Up to 11 bit
Accuracy..... ±1/2 LSB

Control

Directional Control... Field selectable for increasing counts (CW or CCW). Standard configuration user selects the applicable MSB wire for direction of count. Direction control option allows user to select count direction by applying 0 VDC to an encoder input. See *Wiring Table*.

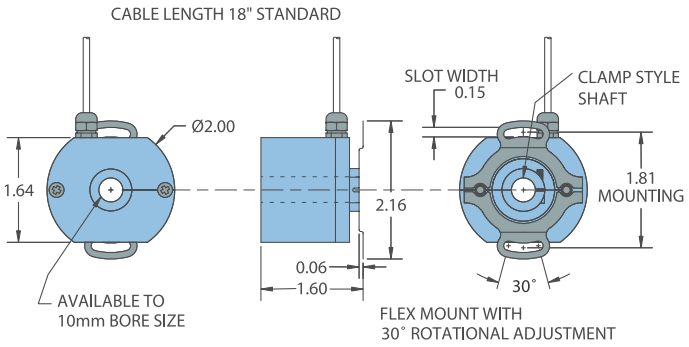
Mechanical

Max Shaft Speed..... 6000 RPM continuous
Bore Size..... 0.250", 0.3125", 0.375", 6 mm, 8 mm, 10 mm
Bore Tolerance..... -0.0000" / +0.0006"
User Shaft Tolerances
Radial Runout..... 0.007"
Axial Endplay..... ±0.030"
Starting Torque..... 0.3 oz-in typical for thru-bore
0.14 oz-in typical for hollow bore
Max Acceleration..... 1 x 10^5 rad/sec^2
Electrical Conn..... Gland with 18" cable (braid shield, 30 AWG conductors)
Housing..... Aluminum with non-corrosive finish
Mounting..... Slotted Flex Mount standard, Flex Arm optional
Weight..... 7 oz typical

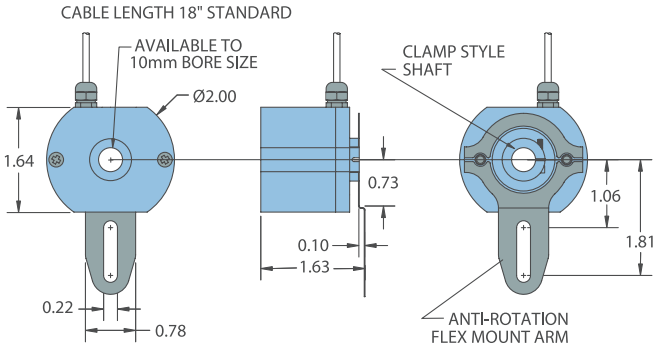
Environmental

Operating Temp..... 0° to 70° C
Storage Temp..... -20° to +85° C
Humidity..... 98% RH non-condensing
Vibration..... 10 g @ 58 to 500 Hz
Shock..... 20 g @ 11 ms duration

MODEL 960 SLOTTED FLEX MOUNT (SF)



MODEL 960 WITH FLEX ARM (FA)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.

WIRING TABLE

Function	Gland Cable† Wire Color
Common	Black
+VDC	Red
S1 CW MSB	Brown
S1 CCW MSB	Yellow
S2	White
S3	Green
S4	Orange
S5	Blue
S6	Violet
S7	Gray
S8 LBS 8-bit	Pink
S9 LSB 9-bit	Red/Green
S10 LSB 10-bit	Red/Yellow
S11 LSB 11-bit	Turquoise
Direction Control**	Red/blue
Case Ground*	Shield

*CE Option only.
**Standard is CW increasing count (when viewed from shaft end, and using brown wire for MSB). Red/Blue is pulled up internally to 5 VDC. To reverse count direction, Red/Blue must be pulled to low (0 VDC). If 5 VDC is applied to Red/Blue, unit remains in standard CW increasing count mode. Count direction can also be reversed by using the yellow MSB wire instead of the Brown. At no time should voltage applied to Red/Blue exceed 5 VDC.
†Standard cable is 24 AWG conductors with foil and braid shield.

MODEL MA36H MULTITURN ABSOLUTE

Ø36 mm

FEATURES

Standard Size 36 mm Package (1.42")
Durable Magnetic Technology
Multiturn Absolute Encoder (14 Bit/40 Bit)
SSI and CANopen Communications
Proven Turns Counting Technology—No Gears or Batteries
Flex Mount Eliminates Couplings and is Ideal for Motors or Shafts

The Model MA36H Multiturn Absolute Accu-Coder™ is ideal for a wide variety of industrial applications that require an encoder with the capability of absolute positioning output, even in power off scenarios. Its fully digital output and innovative use of battery-free multiturn technology make the Model MA36H an excellent choice for all applications, especially ones with a high presence of noise. Its durable magnetic technology and high IP rating make it a perfect choice for dirty industrial environments. Available with a 1/4" or 6 mm hollow bore and a selection of flexible mounting options, the Model MA36H is easily designed into a variety of applications.

COMMON APPLICATIONS

Robotics, Telescopes, Antennas, Medical Scanners, Windmills, Elevators, Lifts, Motors, Automatic Guided Vehicles, Rotary and X/Y Positioning Tables

MODEL MA36H ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.
For single turn applications see Model SA36H.

Mechanical | Electrical

MA36H – 01 SF – 12 10 V3 P2 C1 A – EMJ

MODEL
MA36H Absolute Series Hollow Bore

BORE SIZE
01 1/4", 0.250"
04 6 mm

MOUNTING
SF 1.812" (46 mm) Slotted Flex-Mount
SD 1.575" (40 mm) Slotted Flex Mount
SW 1.653" (42 mm) Slotted Flex-Mount

SINGLE TURN RESOLUTION
12 Bit (CANopen)
08 to 14 Bit (SSI)

MULTITURN RESOLUTION
18 18 Bit (CANopen)
40 40 Bit (CANopen)
01 to 40 Bit (SSI Only)
Price adder for Bit > 18

INPUT VOLTAGE
5 5 VDC[1]
V3 10 to 30 VDC

COMM PROTOCOL
P1 CANopen
P2 SSI

OUTPUT CODE
C1 Binary
C2 Gray[1]

SOFTWARE REV
A Revison A

CONNECTOR TYPE[2]
EMJ 5-pin M12 End Mount[3]
EMK 8-pin M12 End Mount[1]
EC6 6 Ft End Mount Cable with Gland Nut[1]
SC6 6 Ft Side Mount Cable with Grommet[1]

NOTES:
1 Available with SSI only.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 Available with CANopen only.

Please note that configuration options for this product have changed. Confirm configuration options before ordering or contact Customer Service for assistance.

MODEL MA36H SPECIFICATIONS

Electrical

Input Voltage..... 10 to 30 VDC max SSI or CANopen
5 VDC SSI Only
Input Current ..... 50 mA max with no external load

Power
Consumption..... 0.5 W max

Resolution (Single)... 12 bit (CANopen)
8 to 14 bit (SSI)
Resolution (Multi).... Up to 40 bit multiturn (CANopen or SSI)
Accuracy..... +/- 0.35°
Repeatability ..... +/- 0.2°

CANopen Interface

Protocol..... CANopen:
Communication profile CiA 301
Device profile for encoder CiA 406 V3.2
class C2
Node Number ..... 0 to 127 (default 127)
Baud Rate..... 10 Kbaud to 1 Mbaud with automatic
bit rate detection

Note: The standard settings as well as any customization in the software can be changed via LSS (CiA 305) and the SDO protocol (e.g. PDOs, scaling, heartbeat, node-ID, baud rate, etc.)

Programmable CANopen Transmission Modes

Synchronous..... When a synchronization telegram (SYNC) is received from another bus node, PDOs are transmitted independently
Asynchronous..... A PDO message is triggered by an internal event (e.g. change of measured value, internal timer, etc.)

SSI Interface

Clock Input ..... Via opto coupler
Clock Frequency..... 100KHz to 500KHz
Data Output ..... RS485 / RS422 compatible
Output Code ..... Gray or binary
SSI Output ..... Angular position value
Parity Bit..... Optional (even/odd)
Error Bit..... Optional
Turn On Time ..... <1.5 sec
Pos. Counting Dir..... Connect DIR to GND for CW
Connect DIR to VDC for CCW
(when viewed from shaft end)
Set to Zero..... Apply VDC for 2 sec
Protection ..... Galvanic Isolation

Mechanical

Max Shaft Speed..... 12,000 RPM
Bore Size..... 6 mm, .250"
Bore Depth..... 17 mm [.669"]

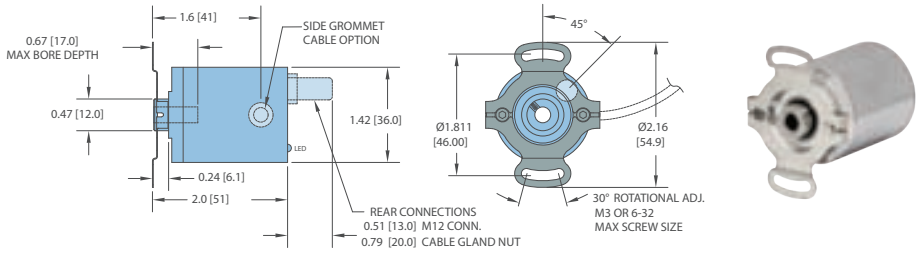
User Shaft
Radial Runout..... 0.005" max

Starting Torque ..... <0.45 oz-in typical
Housing ..... Ferrous chrome-plated magnetic screening
Mounting ..... Hollow shaft with flex mount
Weight..... 5 oz typical

Environmental

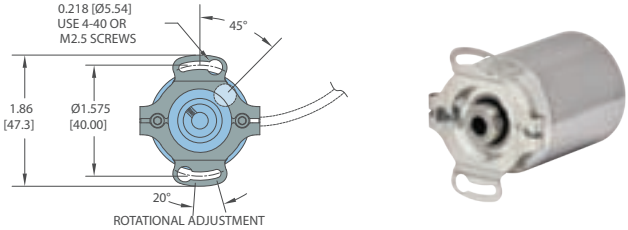
Operating Temp ..... -40° to +80° C
Storage Temp ..... -40° to +100° C
Humidity..... 95% RH non-condensing
Vibration..... 5 g @ 10 to 2000 Hz
Shock..... 100 g @ 6 ms duration
Sealing..... IP67, shaft sealed to IP65

MODEL MA36H 1.812" (46 MM) SLOTTED FLEX MOUNT (SF)

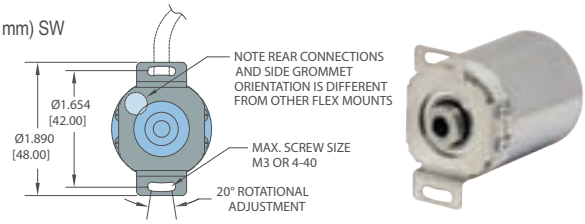


MODEL MA36H OPTIONAL FLEX MOUNTS

1.575" (40 mm) SD



1.653" (42 mm) SW



All dimensions are in inches with a tolerance of +0.005" or +0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

WIRING TABLES

SSI ENCODERS

Function	Cable† Wire Color	8-pin M-12
Ground (GND)	White	1
+VDC	Brown	2
SSI CLK+	Green	3
SSI CLK-	Yellow	4
SSI DATA+	Gray	5
SSI DATA-	Pink	6
PRESET	Blue	7
DIR	Red	8
Shield	Side - Exit Housing End - Exit N/C	Housing

†Standard cable is 24 AWG conductors with foil and braid shield.

CANOPEN ENCODERS

Function	Pin
+VDC	2
Ground (GND)	3
CAN $_{High}$	4
CAN $_{Low}$	5
CAN $_{GND}$ / Shield	1

MODEL MA36S MULTITURN ABSOLUTE

Ø36 mm

FEATURES

Standard Size 36 mm Package (1.42")
Durable Magnetic Technology
Multiturn Absolute Encoder (12 Bit/40 Bit)
SSI and CANopen Communications
Proven New Turns Counting Technology—No Gears or Batteries

The Model MA36S Multiturn Absolute Accu-Coder™ is ideal for a wide variety of industrial applications that require an encoder with the capability of absolute positioning output, even in power off scenarios. Its fully digital output and innovative use of battery-free multiturn technology make the Model MA36S an excellent choice for all applications, especially ones with a high presence of noise. Its durable magnetic technology and high IP rating make it a perfect choice for dirty industrial environments. Available with a 6 mm or 1/4" shaft and a servo mount, the Model MA36S is easily designed into a variety of applications.

COMMON APPLICATIONS

Robotics, Telescopes, Antennas, Medical Scanners, Windmills, Elevators, Lifts, Motors, Automatic Guided Vehicles, Rotary and X/Y Positioning Tables

MODEL MA36S ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.
For single turn applications see Model SA36S.

Mechanical | Electrical

MA36S – 19 MB – 12 10 V3 P2 C1 A – EMJ

- MODEL: MA36S Absolute Series
- SHAFT SIZE: 19 1/4", 0.250"; 20 6 mm
- MOUNTING: MB 36 mm Servo Mount
- SINGLE TURN RESOLUTION: 12 Bit (CANopen); 08 to 14 Bit (SSI)
- MULTITURN RESOLUTION: 18 18 Bit (CANopen); 40 40 Bit (CANopen); 01 to 40 Bit (SSI Only); Price adder for Bit > 18
- INPUT VOLTAGE: 5 5 VDC[1]; V3 10 to 30 VDC
- COMM PROTOCOL: P1 CANopen; P2 SSI
- OUTPUT CODE: C1 Binary; C2 Gray[1]
- SOFTWARE REV: A Revison A
- CONNECTOR TYPE[2]: EMJ 5-pin M12 End Mount[3]; EMK 8-pin M12 End Mount[1]; EC6 6 Ft End Mount Cable with Gland Nut[1]; SC6 6 Ft Side Mount Cable with Grommet[1]

NOTES:
1 Available with SSI only.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 Available with CANopen only.

Please note that configuration options for this product have changed. Confirm configuration options before ordering or contact Customer Service for assistance.

MODEL MA36S SPECIFICATIONS

Electrical

Input Voltage..... 10 to 30 VDC max SSI or CANopen
5 VDC SSI Only
Input Current ..... 50 mA max with no external load

Power
Consumption ..... 0.5 W max

Resolution
(Single) ..... 12 bit (CANopen)
8 to 14 bit (SSI)
Resolution (Multi) .... Up to 40 bit multiturn (CANopen or SSI)
Accuracy..... +/- 0.35°
Repeatability ..... +/- 0.2°

CANopen Interface

Protocol..... CANopen:
Communication profile CiA 301
Device profile for encoder CiA 406 V3.2
class C2
Node Number ..... 0 to 127 (default 127)
Baud Rate..... 10 Kbaud to 1 Mbaud with automatic
bit rate detection

Note: The standard settings as well as any customization in the software can be changed via LSS (CiA 305) and the SDO protocol (e.g. PDOs, scaling, heartbeat, node-ID, baud rate, etc.)

Programmable CANopen Transmission Modes

Synchronous..... When a synchronization telegram (SYNC) is received from another bus node, PDOs are transmitted independently
Asynchronous..... A PDO message is triggered by an internal event (e.g. change of measured value, internal timer, etc.)

SSI Interface

Clock Input ..... via opto coupler
Clock Frequency..... 100KHz to 500KHz
Data Output ..... RS485 / RS422 compatible
Output Code ..... Gray or binary
SSI Output ..... Angular position value
Parity Bit..... Optional (even/odd)
Error Bit..... Optional
Turn On Time ..... <1.5 sec
Pos. Counting Dir..... Connect DIR to GND for CW
Connect DIR to VDC for CCW
(when viewed from shaft end)
Set to Zero..... Apply VDC for 2 sec
Protection ..... Galvanic Isolation

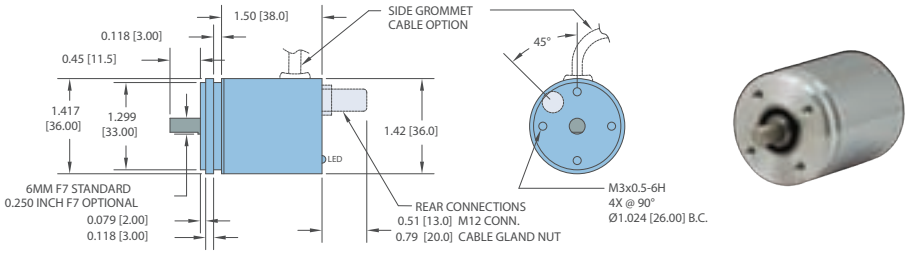
Mechanical

Max Shaft Speed..... 12,000 RPM
Radial Shaft Load ..... 7 lb (32 N) = bearing life 1.10^{10} revs
3.6 lb (16 N) = bearing life 1.10^{11} revs
Axial Shaft Load ..... 5 lb (20 N) = bearing life 1.10^{10} revs
2.3 lb (10 N) = bearing life 1.10^{11} revs
Starting Torque ..... <0.45 oz-in typical
Housing ..... Ferrous chrome-plated magnetic screening
Weight..... 5 oz typical

Environmental

Storage Temp ..... -40° to +100° C
Humidity..... 95% RH non-condensing
Vibration..... 5 g @ 10 to 2000 Hz
Shock..... 100 g @ 6 ms duration
Sealing..... IP67, shaft sealed to IP65

MODEL MA36S SOLID SHAFT



All dimensions are in inches with a tolerance of +0.005" or +0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

WIRING TABLES

SSI ENCODERS

Function	Cable† Wire Color	8-pin M-12
Ground (GND)	White	1
+VDC	Brown	2
SSI CLK+	Green	3
SSI CLK-	Yellow	4
SSI DATA+	Gray	5
SSI DATA-	Pink	6
PRESET	Blue	7
DIR	Red	8
Shield	Side - Exit Housing End - Exit N/C	Housing

†Standard cable is 24 AWG conductors with foil and braid shield.

CANOPEN ENCODERS

Function	Pin
+VDC	2
Ground (GND)	3
CAN_{High}	4
CAN_{Low}	5
CAN_{GND} / Shield	1

MODEL SA36H SINGLE TURN ABSOLUTE

Ø36 mm

FEATURES

Standard Size 36 mm Package (1.42")
Durable Magnetic Technology
Up to 14 Bits of Single Turn Resolution
SSI and CANopen Communications
Proven Turns Counting Technology—No Gears or Batteries
Flex Mount Eliminates Couplings and is Ideal for Motors or Shafts

The Model SA36H Single Turn Absolute Accu-Coder™ is ideal for a wide variety of industrial applications that require an encoder with the capability of absolute positioning output, even in power off scenarios. Its fully digital output, rugged magnetic technology and high IP rating make the Model SA36H an excellent choice for all applications, especially ones with a high presence of noise. Available with a 1/4" or 6 mm hollow bore and a wide selection of flexible mounting options, the Model SA36H is easily designed into a variety of applications.

COMMON APPLICATIONS

Robotics, Telescopes, Antennas, Medical Scanners, Windmills, Elevators, Lifts, Motors, Automatic Guided Vehicles, Rotary and X/Y Positioning Tables

MODEL SA36H ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.
For multi-turn applications see Model MA36H.

Mechanical | Electrical

SA36H – 01 SF – 12 V3 P1 C1 A – EMJ

MODEL
SA36H Absolute Series

BORE SIZE
01 1/4", 0.250"
04 6 mm

MOUNTING
SF 1.812" (46 mm) Slotted Flex-Mount
SD 1.575" (40 mm) Slotted Flex Mount
SW 1.653" (42 mm) Slotted Flex-Mount

RESOLUTION
12 Bit (CANopen)
08 to 14 Bit (SSI)

INPUT VOLTAGE
5 5 VDC[1]
V3 10 to 30 VDC

COMM PROTOCOL
P1 CANopen
P2 SSI

OUTPUT CODE
C1 Binary
C2 Gray[1]

SOFTWARE REV
A Revison A

CONNECTOR TYPE[2]
EMJ 5-pin M12 End Mount[3]
EMK 8-pin M12 End Mount[1]
EC6 6 Ft End Mount Cable with Gland Nut[1]
SC6 6 Ft Side Mount Cable with Grommet[1]

NOTES:
1 Available with SSI only.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 Available with CANopen only.

Please note that configuration options for this product have changed. Confirm configuration options before ordering or contact Customer Service for assistance.

MODEL SA36H SPECIFICATIONS

Electrical

Input Voltage..... 10 to 30 VDC max SSI or CANopen
5 VDC SSI Only
Input Current ..... 50 mA max with no external load

Power
Consumption..... 0.5 W max

Resolution ..... 12 bit (CANopen)
8 to 14 bit (SSI)
Accuracy..... +/- 0.35°
Repeatability ..... +/- 0.2°

CANopen Interface

Protocol..... CANopen:
Communication profile CiA 301
Device profile for encoder CiA 406
V3.2 class C2
Node Number ..... 0 to 127 (default 127)
Baud Rate..... 10 Kbaud to 1 Mbaud with automatic bit rate detection

Note: The standard settings as well as any customization in the software can be changed via LSS (CiA 305) and the SDO protocol (e.g. PDOs, scaling, heartbeat, node-ID, baud rate, etc.)

Programmable CANopen Transmission Modes

Synchronous..... When a synchroniz ation telegram (SYNC) is received from another bus node, PDOs are transmitted independently
Asynchronous..... A PDO message is triggered by an internal event (e.g. change of measured value, internal timer, etc.)

SSI Interface

Clock Input ..... Via opto coupler
Clock Frequency..... 100KHz to 500KHz
Data Output ..... RS485 / RS422 compatible
Output Code ..... Gray or binary
SSI Output ..... Angular position value
Parity Bit..... Optional (even/odd)
Error Bit..... Optional
Turn On Time ..... <1.5 sec
Pos. Counting Dir..... Connect DIR to GND for CW
Connect DIR to VDC for CCW
(when viewed from shaft end)
Set to Zero..... Apply VDC for 2 sec
Protection ..... Galvanic Isolation

Mechanical

Max Shaft Speed..... 12,000 RPM
Bore Depth..... 17 mm (.669")

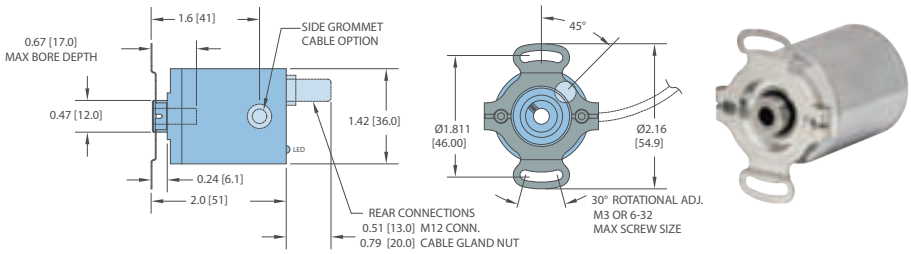
User Shaft
Radial Runout..... 0.005" max

Starting Torque ..... <0.45 oz-in typical
Housing ..... Ferrous chrome-plated magnetic screening
Weight..... 5 oz typical

Environmental

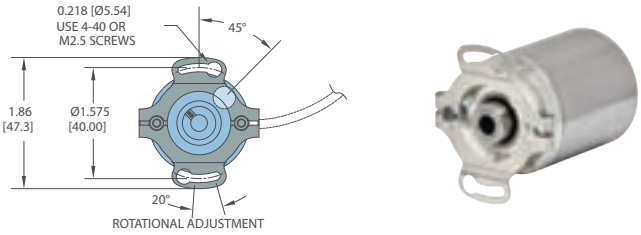
Storage Temp ..... -40° to +100° C
Humidity..... 95% RH non-condensing
Vibration..... 5 g @ 10 to 2000 Hz
Shock..... 100 g @ 6 ms duration
Sealing..... IP67, shaft sealed to IP65

MODEL SA36H 1.812" (46 MM) SLOTTED FLEX MOUNT (SF)

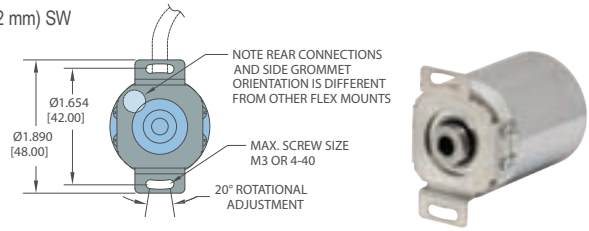


MODEL SA36H OPTIONAL FLEX MOUNTS

1.575" (40 mm) SD



1.653" (42 mm) SW



All dimensions are in inches with a tolerance of +0.005" or +0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

WIRING TABLES

SSI ENCODERS

Function	Cable† Wire Color	8-pin M-12
Ground (GND)	White	1
+VDC	Brown	2
SSI CLK+	Green	3
SSI CLK-	Yellow	4
SSI DATA+	Gray	5
SSI DATA-	Pink	6
PRESET	Blue	7
DIR	Red	8
Shield	Side -Exit Housing End - Exit N/C	Housing

†Standard cable is 24 AWG conductors with foil and braid shield.

CANOPEN ENCODERS

Function	Pin
+VDC	2
Gound (GND)	3
CAN $_{High}$	4
CAN $_{Low}$	5
CAN $_{GND}$ / Shield	1

MODEL SA36S SINGLE TURN ABSOLUTE

Ø36 mm

FEATURES

Standard Size 36 mm Package (1.42")
Durable Magnetic Technology
Up to 14 Bits of Single Turn Resolution
SSI and CANopen Communications

The Model SA36S Single Turn Absolute Accu-Coder™ is ideal for a wide variety of industrial applications that require an encoder with the capability of absolute positioning output. Its fully digital output, rugged magnetic technology and high IP rating make the Model SA36S an excellent choice for all applications, especially ones with a high presence of noise. Available with a 6 mm or 1/4" shaft and a servo mount, the Model SA36S is easily designed into a variety of applications.

COMMON APPLICATIONS

Robotics, Telescopes, Antennas, Medical Scanners, Windmills, Elevators, Lifts, Motors, Automatic Guided Vehicles, Rotary and X/Y Positioning Tables

MODEL SA36S ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.
For multi-turn applications see Model MA36S.

Mechanical | Electrical

SA36S	–	19	MB	–	12	V3	P1	C1	A	–	EMJ

MODEL
SA36S Absolute Series

SHAFT SIZE
19 1/4", 0.250"
20 6 mm

MOUNTING
MB 36 mm Servo Mount

RESOLUTION
12 Bit (CANopen)
08 to 14 Bit (SSI)

INPUT VOLTAGE
5 5 VDC[1]
V3 10 to 30 VDC

COMM PROTOCOL
P1 CANopen
P2 SSI

OUTPUT CODE
C1 Binary
C2 Gray[1]

SOFTWARE REV
A Revison A

CONNECTOR TYPE[2]
EMJ 5-pin M12 End Mount[3]
EMK 8-pin M12 End Mount[1]
EC6 6 Ft End Mount Cable with Gland Nut[1]
SC6 6 Ft Side Mount Cable with Grommet[1]

NOTES:
1 Available with SSI only.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 Available with CANopen only.

Please note that configuration options for this product have changed. Confirm configuration options before ordering or contact Customer Service for assistance.

MODEL SA36S SPECIFICATIONS

Electrical

Input Voltage.....10 to 30 VDC max SSI or CANopen
5 VDC SSI Only
Input Current .....50 mA max with no external load

Power
Consumption.....0.5 W max

Resolution .....12 bit (CANopen)
8 to 14 bit (SSI)
Accuracy .....+/- 0.35°
Repeatability .....+/- 0.2°

CANopen Interface

Protocol.....CANopen:
Communication profile CiA 301
Device profile for encoder CiA 406
V3.2 class C2
Node Number .....0 to 127 (default 127)
Baud Rate.....10 Kbaud to 1 Mbaud with automatic bit rate detection

Note: The standard settings as well as any customization in the software can be changed via LSS (CiA 305) and the SDO protocol (e.g. PDOs, scaling, heartbeat, node-ID, baud rate, etc.)

Programmable CANopen Transmission Modes

Synchronous.....When a synchronization telegram (SYNC) is received from another bus node, PDOs are transmitted independently
Asynchronous.....A PDO message is triggered by an internal event (e.g. change of measured value, internal timer, etc.)

SSI Interface

Clock Input .....Via opto coupler
Clock Frequency.....100KHz to 500KHz
Data Output .....RS485 / RS422 compatible
Output Code .....Gray or binary
SSI Output .....Angular position value
Parity Bit.....Optional (even/odd)
Error Bit.....Optional
Turn On Time .....<1.5 sec
Pos. Counting Dir.....Connect DIR to GND for CW
Connect DIR to VDC for CCW
(when viewed from shaft end)
Set to Zero.....Apply VDC for 2 sec
Protection .....Galvanic Isolation

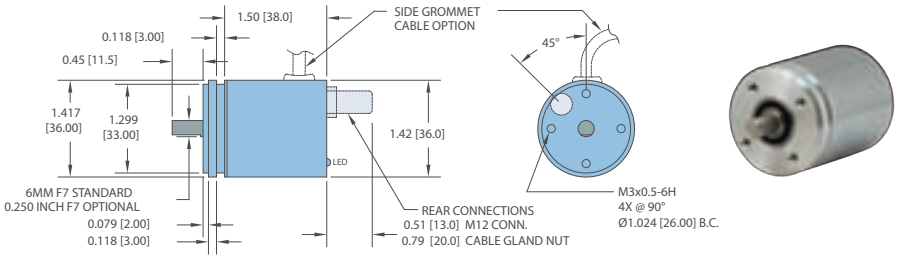
Mechanical

Max Shaft Speed.....12,000 RPM
Radial Shaft Load .....7 lb (32 N) = bearing life 1.10^{10} revs
3.6 lb (16 N) = bearing life 1.10^{11} revs
Axial Shaft Load .....5 lb (20 N) = bearing life 1.10^{10} revs
2.3 lb (10 N) = bearing life 1.10^{11} revs
Starting Torque .....<0.45 oz-in typical
Housing .....Ferrous chrome-plated magnetic screening
Weight.....5 oz typical

Environmental

Storage Temp .....-40° to +100° C
Humidity.....95% RH non-condensing
Vibration.....5 g @ 10 to 2000 Hz
Shock.....100 g @ 6 ms duration
Sealing.....IP67, shaft sealed to IP65

MODEL SA36S SOLID SHAFT



All dimensions are in inches with a tolerance of +0.005" or +0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

WIRING TABLES

SSI ENCODERS

Function	Cable† Wire Color	8-pin M-12
Ground (GND)	White	1
+VDC	Brown	2
SSI CLK+	Green	3
SSI CLK-	Yellow	4
SSI DATA+	Gray	5
SSI DATA-	Pink	6
PRESET	Blue	7
DIR	Red	8
Shield	Side - Exit Housing End - Exit N/C	Housing

†Standard cable is 24 AWG conductors with foil and braid shield.

CANOPEN ENCODERS

Function	Pin
+VDC	2
Ground (GND)	3
CAN $_{High}$	4
CAN $_{Low}$	5
CAN $_{GND}$ / Shield	1

MODEL MA63S MULTITURN ABSOLUTE

FEATURES

Standard Size 25 Package (2.5" x 2.5")
Durable Magnetic Technology—No Gears or Batteries
Servo and Flange Mounting
Multiturn Absolute Encoder (14 Bit/40 Bit)
SSI and CANopen Communications
IP67 Sealing Available

The Model MA63S Multiturn Absolute Accu-Coder™ is ideal for a wide variety of industrial applications that require an encoder with the capability of absolute positioning output, even in power-off scenarios. Its fully digital output and innovative use of battery-free multiturn technology make the Model MA63S exceptionally reliable. The MA63's robust and durable magnetic technology and available IP67 seal readily handle the harshest industrial environments, including those with elevated electrical noise. Available with several shaft sizes and mounting styles, the Model MA63S is easily designed into OEM and aftermarket applications.

COMMON APPLICATIONS

Robotics, Telescopes, Antennas, Medical Scanners, Wind Turbines, Elevators, Lifts, Motors, Automatic Guided Vehicles, Rotary and X/Y Positioning Tables

MODEL MA63S ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Mechanical | Electrical

MA63S	–	38	MA	–	12	10	V3	P2	C1	A	–	SMJ	–		–	

MODEL
MA63S Absolute Series

SHAFT SIZE
38 3/8", 0.375"
10 10 mm

MOUNTING
MA 2.50" Flange
MC 2.50" Servo Mount

SINGLE TURN RESOLUTION
12 Bit (CANopen)
08 to 14 Bit (SSI)

MULTITURN RESOLUTION
18 18 Bit (CANopen)
40 40 Bit (CANopen)
01 to 40 Bit (SSI Only)
Price adder for Bit > 18

INPUT VOLTAGE
5 5 VDC[1]
V3 10 to 30 VDC

COMM PROTOCOL
P1 CANopen
P2 SSI

OUTPUT CODE
C1 Binary
C2 Gray[1]

SOFTWARE REV
A Revison A

CONNECTOR TYPE[2]
SMJ 5-pin M12 Side Mount[3]
SMK 8-pin M12 Side Mount[1]

TEMP
0-80° C Std
T5 -40-80° C

SEAL
IP50 Std
S3 IP66
S4 IP67

NOTES:
1 Available with SSI only.
2 For mating connectors, cables, and cordsets see Encoder Accessories on page 102 or visit www.encoder.com. For Pin Configuration Diagrams, see page 107 or visit www.encoder.com.
3 Available with CANopen only.

MODEL MA63S SPECIFICATIONS

Electrical

Input Voltage.....10 to 30 VDC max SSI or CANopen
5 VDC SSI Only
Input Current .....50 mA max with no external load
Power Consumption ....0.5 W max
Resolution (Single) .....12 bit (CANopen)
8 to 14 bit (SSI)
Resolution (Multi).....Up to 40 bit multiturn
(CANopen or SSI)
Accuracy.....+/- 0.35°
Repeatability .....+/- 0.2°

CANopen Interface

Protocol.....CANopen:
Communication profile CiA 301
Device profile for encoder CiA 406
V3.2 class C2
Node Number .....0 to 127 (default 127)
Baud Rate.....10 Kbaud to 1 Mbaud with automatic
bit rate detection

Note: The standard settings as well as any customization in the software can be changed via LSS (CiA 305) and the SDO protocol (e.g. PDOs, scaling, heartbeat, node-ID, baud rate, etc.)

Programmable CANopen Transmission Modes

Synchronous.....When a synchronization telegram (SYNC) is received from another bus node, PDOs are transmitted independently
Asynchronous.....A PDO message is triggered by an internal event (e.g. change of measured value, internal timer, etc.)

SSI Interface

Clock Input .....Via opto coupler
Clock Frequency.....100KHz to 500KHz
Data Output .....RS485 / RS422 compatible
Output Code .....Gray or binary
SSI Output .....Angular position value
Parity Bit.....Optional (even/odd)
Error Bit.....Optional
Turn On Time .....<1.5 sec
Pos. Counting Dir.....Connect DIR to GND for CW
Connect DIR to VDC for CCW
(when viewed from shaft end)
Set to Zero.....Apply VDC for 2 sec
Protection .....Galvanic Isolation

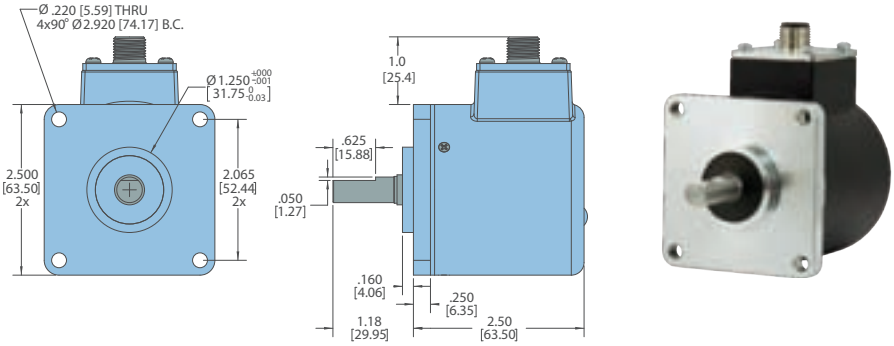
Mechanical

Max Shaft Speed.....8,000 RPM
Shaft Material .....303 Stainless Steel
Radial Shaft Load .....80 lb maximum
Axial Shaft Load .....80 lb maximum
Starting Torque .....1.0 oz-in typical with no seal
3.0 oz-in typical with IP66 shaft seal
7.0 oz-in typical with IP67 shaft seal
Housing .....Black non-corrosive finish
Weight.....20 oz typical

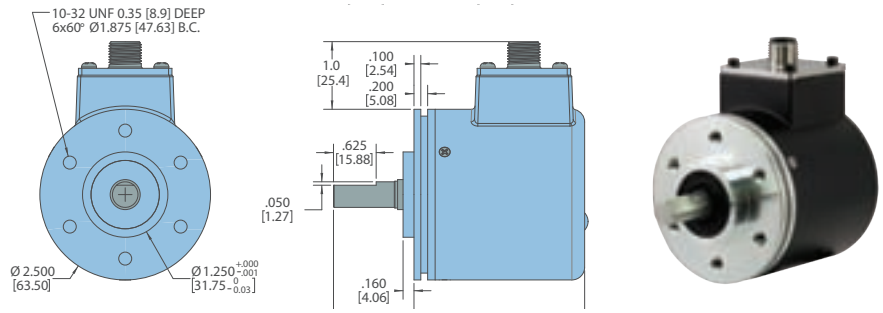
Environmental

Storage Temp .....-25° to +100° C
Humidity.....95% RH non-condensing
Vibration.....5 g @ 10 to 2000 Hz
Shock.....100 g @ 6 ms duration
Sealing.....IP50 standard; IP66 or IP67 optional

MODEL MA63S 2.5" FLANGE MOUNT (MA)



MODEL MA63S 2.5" SERVO MOUNT (MB)



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.
Metric dimensions are given in brackets [metric].

WIRING TABLES

SSI ENCODERS

Function	Pin
Ground (GND)	1
+VDC	2
SSI CLK+	3
SSI CLK-	4
SSI DATA+	5
SSI DATA-	6
PRESET	7
DIR	8
Shield	Housing

CANOPEN ENCODERS

Function	Pin
+VDC	2
Ground (GND)	3
CAN $_{High}$	4
CAN $_{Low}$	5
CAN $_{GND}$ / Shield	1

RX/TXD RECEIVER–TRANSMITTER UNIT VERSATILE ENCODER INTERFACE

FEATURES

DIN Rail Mount
Level Changes from Vcc to 5V
Signal Conditioner or Repeater for Distance Transmission
2 or 3 Way Splitter/Level Changer
Encoder Tester/Verifier

This lightweight DIN rail mountable unit, Line Driver and Line Receiver, is composed of a PC/ABS self-extinguishing material blend. Configurable as a level changer, line repeater, splitter or encoder tester, the RX/TXD will accept TTL, RS422, RS485, PP, NPN, NPN OC, or PNP encoder inputs at 5V, or HTL, PP, NPN, NPN OC & PNP at 5-24V. It will provide up to three outputs in any combination of TTL, RS422, RS485, PP, at 5V, or HTL, PP at 5-24V. A series of LEDs on the front panel indicates power and signal presence. Connections are made via the easily accessible screw terminals as standard. This device may be used as both a Line Driver and Line Receiver.

RX/TXD ORDERING GUIDE

Blue type indicates price adder options. Not all configuration combinations may be available. Contact Customer Service for details.

Electrical

RXTXD – 1 – V3 – 5V – 5H – 4P – 4H – 5P

MODEL
RXTXD Receiver/Transmitter

VERSION
1 Receiver/Transmitter (one set of outputs)
2 Receiver/Transmitter (two sets of outputs)
3 Receiver/Transmitter three sets of outputs)

INPUT VOLTAGE
V5 5V Only
V3 5-24V[1]

ENCODER/SENSOR POWER
5V 5V Only
24V 5-24 Vcc[2]

INPUT SIGNAL
5H 5V Differential Driver[3]
5N 5V NPN Open-Collector
5P 5V Push-Pull S/Ended[4]
24H 24V Differential Driver[5]
24N 24V NPN Open-Collector
24P 24V Push-Pull S/Ended[6]

One Output
Two Outputs
Three Outputs

FINAL OUTPUT SIGNAL
5H 5V Differential Driver[3]
5P 5V Push-Pull S/Ended[4]
4H 24V Differential Driver[5]
4P 24V Push-Pull S/Ended[6]

NOTES:
1 24V Maximum Voltage.
2 Encoder/Sensor and output signal voltages are limited to the input voltage supplied.
3 TTL, RS422 & RS485 Compatible.
4 TTL, NPN (Sink), PNP (Source), PP.
5 HTL Compatible.
6 NPN (Sink), PNP (Source), PP.

RX/TXD SPECIFICATIONS

Electrical

Input Voltage..... 5V to 24V Max

Current Consumption..... 250 mA Typical

Repeater Output Voltage ..... 5V or Vcc

Frequency Response..... Up to 800 Khz

Mechanical

Weight..... 250g

Enclosure..... PC/ABS, IP20

Terminal ..... Screw Type 30/12 AWG

Definitions

Version ..... Number of complete sets of output channels.

Input Voltage..... The voltage supplied to the RX/TXD. The input voltage sets the maximum voltage the RX/TXD can supply the encoder/sensor and maximum voltage of the output signals.

Encoder/Sensor Power ..... The voltage supplied by the RX/TXD to the encoder/sensor.

Input Signal ..... The signal voltage level from the encoder/sensor to the RX/TXD.

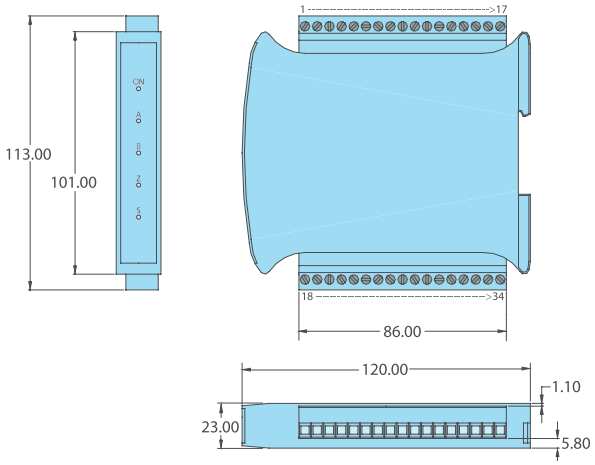
Final Output Signal ..... The singal voltage level from the RX/TXD to the receiving device. Example: If input voltage is V3, encoder/sensors power is 24V. Output 1 is 4H, output 2 is 5H.

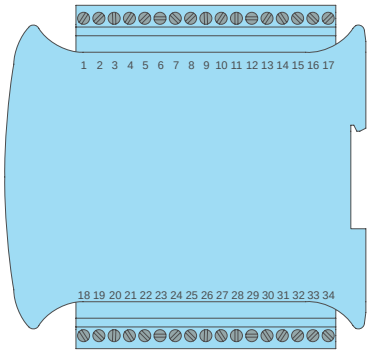
Set input voltage:

To 24V ..... Encoder/sensor power = 24V
Output 1 = 24V
Output 2 = 5V

To 12V ..... Encoder/sensor power = 12V
Output 1 = 12V
Output 2 = 5V

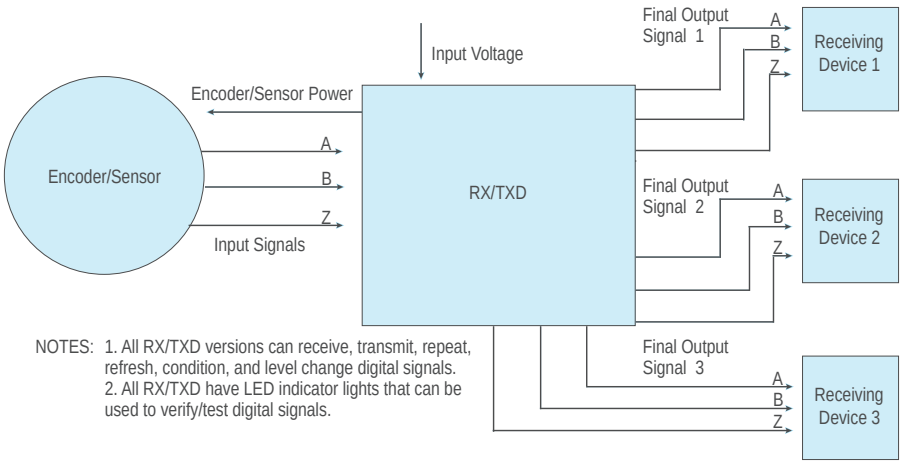
RX/TXD RECEIVER-TRANSMITTER





TMNL	SIGNAL		TMNL	SIGNAL	
1	Z'		18	N/C	
2	Z		19	Z'	
3	B'		20	Z	
4	B	*Output 3 Signals*	21	B'	
5	A'		22	B	*Output 1 Signals*
6	A		23	A'	
7	COM		24	A	
8	N/C		25	COM	
9	Z'		26	N/C	
10	Z		27	Z'	
11	B'		28	Z	
12	B	*Output 2 Signals*	29	B'	*Input Signals from Encoder*
13	A'		30	B	
14	A		31	A'	
15	COM		32	A	
16	COM	*Input Power*	33	COM	*Encoder Supply*
17	+VDC		34	+VDC	

All inputs and outputs may not be present, depending on the RX/TXD version.



NOTES: 1. All RX/TXD versions can receive, transmit, repeat, refresh, condition, and level change digital signals.
2. All RX/TXD have LED indicator lights that can be used to verify/test digital signals.

RX/TX CONVERTER

RX/TX CONVERTER ORDERING INFORMATION

(Specify stock # when ordering)

Differential = A,A', B,B', Z,Z'
Single Ended = A, B, Z

	Channel 1		Channel 2	
	INPUT	OUTPUT	INPUT	OUTPUT
Stock #	Differential Line Reciever MAX 3095	Single Ended Push Pull Output 7272	Single Ended 7272	Differential Line Driver 7272
100020-1	5V	Vcc	5V, OC[1]	Vcc
100020-2	5V	Vcc	5V, OC[1]	5V
100020-3	5V	Vcc	5V[2]	Vcc
100020-4	5V	Vcc	5V[2]	5V
100020-5	6-12V	Vcc	5V, OC[1]	Vcc
100020-6	6-12V	Vcc	5V, OC[1]	5V
100020-7	6-12V	Vcc	5V[2]	Vcc
100020-8	6-12V	Vcc	5V[2]	5V
100020-9	13-24V	Vcc	5V, OC[1]	Vcc
100020-10	13-24V	Vcc	5V, OC[1]	5V
100020-11	13-24V	Vcc	5V[2]	Vcc
100020-12	13-24V	Vcc	5V[2]	5V

[1]OC- Open Collector input designed with a 2k pull-up resistor for an open collector output encoder or device.
[2]Inputs can be from devices with pull-up, push-pull or TTL type outputs.
[3]Vcc should range between 5-24 VDC

FEATURES

The RX/TX Converter converts a Push-Pull or NPN encoder output to an RS422 compatible differential Line Driver output. In addition, it will also convert Line Driver/ RS422 encoder output to single ended signals (Push-Pull) for compatibility with certain PLC's.

Each converter has two independent channels: Channel 1 is equipped with a differential Line Receiver on the input. It then converts these differential signals (A, A', B, B', Z, Z') to Push-Pull output signals (A, B, Z), with an amplitude equivalent to Vcc.

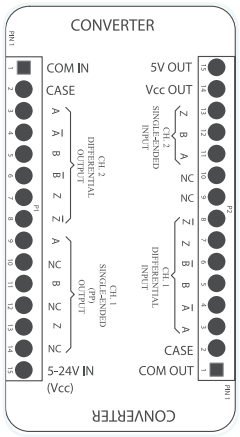
Channel 2 will convert single ended signals from a Push-Pull or NPN Open Collector encoder to Differential Line Driver signals. Differential Line Driver signals include complementary outputs A', B', and Z' which offer greater immunity to electrical noise, signal distortion, and interference, especially with long cable runs.

APPLICATIONS

To provide differential signals for data transmission over long distances between a push-pull, or NPN open collector transmitter and receiver. To enable devices with different output/input circuits to be connected. To properly terminate differential signals to eliminate/reduce signal distortions.

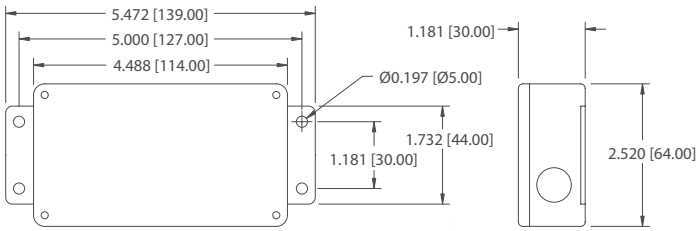
SPECIFICATIONS

Supply Source (Vcc)..... 5 to 24 VDC
Current Consumption ..... 20 mA max (plus encoder and output load requirements)
Max Frequency ..... Up to 1 MHz
Enclosure..... IP54 (dust proof)
Earth Circuit ..... Grounded to Case
Input Voltage..... Channel 1: 24 VDC Max Diff
Channel 2: 5 VDC Max
Output Voltage..... Channel 1: Vcc
Channel 2: 5 VDC or Vcc
Output Current ..... 30 mA/Channel Max



NOTES UNLESS OTHERWISE SPECIFIED

1. TERMINATE CABLE SHIELD/DRAIN WIRES TO THE CASE TERMINAL OF P1 AND P2, IF APPLICABLE. BARE CONDUCTORS MUST BE ELECTRICALLY INSULATED FROM THE CIRCUIT BOARD WITH A NONCONDUCTIVE SLEEVE SUCH AS HEAT SHRINK TUBING.
2. RECOMMENDED CABLE FOR DIFFERENTIAL/ COMPLEMENTARY ENCODER SIGNALS: LOW CAPACITANCE, TWISTED-SHIELDED PAIR: SEE ACCESSORIES SECTION FOR 4XXC CABLES/CONNECTORS. 4XXC CABLES MUST HAVE OUTER INSULATION STRIPPED OFF IN ORDER TO FIT THROUGH CABLE ENTRY GLANDS.
3. SEE CONFIGURATION ORDERING GUIDE FOR INPUT/OUTPUT VOLTAGE PER THE SELECTED RXTX MODEL NUMBER
4. P2-14 (Vcc) or P2-15 (5V) CAN BE USED TO POWER ENCODER.
5. P1-15 (5-24VDC IN (Vcc)) IS FOR CUSTOMER SUPPLIED POWER TO OPERATE RXTX.



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

RX/TX REPEATER

RX/TX REPEATER ORDERING INFORMATION

(Specify stock # when ordering)

Differential = A,A', B,B', Z,Z'
Single Ended = A, B, Z

Stock #	INPUT Differential Line Receiver - MAX 3095	OUTPUT Differential Line Driver 7272
100020-13	5V	Vcc
100020-14	5V	Vcc[2]
100020-15	6-12V	Vcc
100020-16	6-12V	Vcc[2]
100020-17	13-24V	Vcc
100020-18	13-24V	Vcc[2]

[1]Vcc should range between 5-24 VDC.
[2]Outputs will be equivalent to voltage applied to Vcc (Pin P1-15)

FEATURES

The RX/TX Repeater retransmits signals from an encoder output in order to drive signals over a longer distance with reduced noise and distortion free waveforms. The input is equipped with a Differential Line Receiver and a Differential Line Driver. It takes the differential signals (A, A', B, B', Z, Z') , squares the signals up, and then repeats the signals at the outputs.

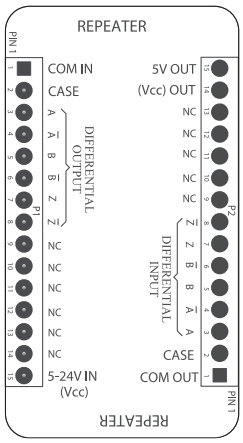
Benefits are greater immunity from electrical noise, signal distortion, and interference, especially with long cable runs. The output signal can be 5 VDC or an amplitude equivalent to Vcc.

APPLICATIONS

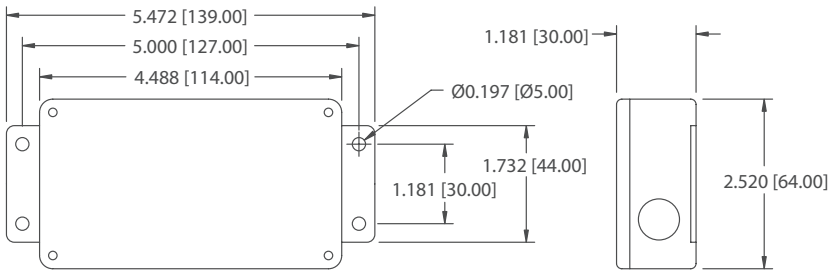
Repeat differential signals for data transmission over long distances. To properly terminate differential signals to eliminate/reduce signal distortions. Increase output current drive capability in order to drive multiple receivers

SPECIFICATIONS

Supply Source (Vcc)..... 5 to 24 VDC
Current Consumption ..... 20 mA max (plus encoder and output load requirements)
Max Frequency ..... Up to 1 MHz
Enclosure..... IP54 (dust proof)
Earth Circuit ..... Grounded to Case
Input Voltage..... 24 VDC Max Diff
Output Voltage..... 5 VDC or Vcc
Output Current ..... 30 mA/Channel Max



NOTES UNLESS OTHERWISE SPECIFIED
1. TERMINATE CABLE SHIELD/DRAIN WIRES TO THE CASE TERMINAL OF P1 AND P2, IF APPLICABLE. BARE CONDUCTORS MUST BE ELECTRICALLY INSULATED FROM THE CIRCUIT BOARD WITH A NONCONDUCTIVE SLEEVE SUCH AS HEAT SHRINK TUBING.
2. RECOMMENDED CABLE FOR DIFFERENTIAL/ COMPLEMENTARY ENCODER SIGNALS: LOW CAPACITANCE, TWISTED-SHIELDED PAIR: SEE ACCESSORIES SECTION FOR 4XXC CABLES/CONNECTORS. 4XXC CABLES MUST HAVE OUTER INSULATION STRIPPED OFF IN ORDER TO FIT THROUGH CABLE ENTRY GLANDS.
3. SEE CONFIGURATION ORDERING GUIDE FOR INPUT/OUTPUT VOLTAGE PER THE SELECTED RXTX MODEL NUMBER
4. P2-14 (Vcc) or P2-15 (5V) CAN BE USED TO POWER ENCODER.
5. P1-15 (5-24VDC IN (Vcc)) IS FOR CUSTOMER SUPPLIED POWER TO OPERATE RXTX.



All dimensions are in inches with a tolerance of ±0.005" or ±0.01" unless otherwise specified.
Metric dimensions are given in brackets [mm].

RX/TX SPLITTER

RX/TX SPLITTER ORDERING INFORMATION

(Specify stock # when ordering)

Differential = A,A', B,B', Z,Z'

Single Ended = A, B, Z

Stock #	INPUT TYPE	INPUT VOLTAGE (From Encoder)	OUTPUT VOLTAGES (single ended or differential-7272) CH1	CH.2
100020-20	Differential	5V	5V	5V
100020-21	Differential	5V	Vcc	Vcc
10002022	Differential	5V	Vcc	5V
100020-23	Differential	6-12V	5V	5V
100020-24	Differential	6-12V	Vcc	Vcc
100020-25	Differential	6-12V	Vcc	5V
100020-26	Differential	13-24V	5V	5V
100020-27	Differential	13-24V	Vcc	Vcc
100020-28	Differential	13-24V	Vcc	5V
100020-29	Single Ended	5V OC	5V	5V
100020-30	Single Ended	5-24V OC	Vcc	Vcc
100020-31	Single Ended	5V OC	Vcc	5V
100020-32	Single Ended	5V PP, PU, TTL	5V	5V
100020-33	Single Ended	5-24V PP, PU, TTL	Vcc	Vcc
100020-34	Single Ended	5V PP, PU, TTL	Vcc	5V

[1]Choose an input channel of signal type differential or single ended that is to be split into two output channels. These input signals are typically from an incremental encoder. Refer to the block diagram below for the input and output signal flow.
[2]For OC type inputs, 2K ohm resistors are used for pull-up internally.
[3]The output channels may be used in the differential mode (A,A', B,B', Z,Z') or as A, B, Z (PP) referenced to circuit common.
[4]Vcc is the RXTX Splitter supply voltage and ranges from 5 to 24 VDC.
[5]Single ended input voltage must be less than or equal to the output voltage (Vcc or 5V), Whichever is applicable.
[6]Vcc (5-24VDC) or a PCB generated 5V is supplied to the output drivers (channels).

FEATURES

The RX/TX Splitter has one input and two separate output channels. There are two different types of inputs available. One input type is a differential line receiver where differential input signals (A, A', B,B',Z,Z') are split into two identical differential output channels. Alternatively, the input can be configured for a single ended Push-Pull, NPN, Open Collector, or Pull-Up encoder (A,B,Z), which will split the signal into two independent differential line driver outputs (A, A', B,B',Z,Z'). Refer to the block diagram below for the signal flow through the device. Line Driver signals include complementary outputs A', B', and Z', and offer greater immunity from electrical noise, signal distortion, and interference especially with long cable runs. The output signal can be approximately 5 VDC or a voltage amplitude equivalent to the RXTX supply (Vcc).

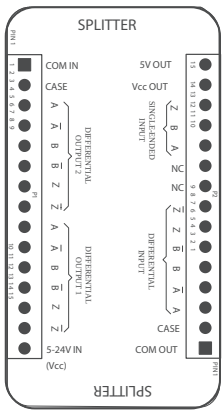
To order, choose the type of input (differential or single ended), the expected encoder signal voltage and the voltage output options. Use the RXTX Splitter ordering guide below to establish the stock number.

APPLICATIONS

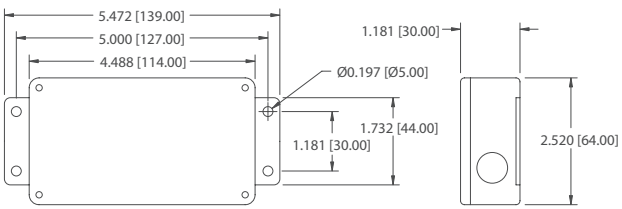
To split differential, or single ended signals for data transmission over long or short distances to two different devices. To properly terminate differential signals to eliminate/ reduce signal distortion. To increase output current drive capability in order to drive multiple receivers. To split the input signal and provide the two output channel drivers with differing voltage outputs.

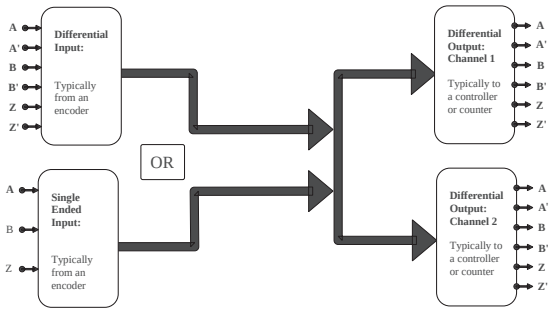
SPECIFICATIONS

Supply Source (Vcc)..... 5 to 24 VDC
Current Consumption ..... 20 mA max (plus encoder & output load requirements)
Max Frequency ..... Up to 1 MHz
Enclosure..... IP54 (dust proof)
Earth Circuit ..... Grounded to Case
Input Voltage..... 24 VDC Max Diff
Output Voltage.....5 VDC or Vcc
Output Current.....30 mA/Channel Max



NOTES UNLESS OTHERWISE SPECIFIED
1. TERMINATE CABLE SHIELD/DRAIN WIRES TO THE CASE TERMINAL OF P1 AND P2, IF APPLICABLE. BARE CONDUCTORS MUST BE ELECTRICALLY INSULATED FROM THE CIRCUIT BOARD WITH A NONCONDUCTIVE SLEEVE SUCH AS HEAT SHRINK TUBING.
2. RECOMMENDED CABLE FOR DIFFERENTIAL/ COMPLEMENTARY ENCODER SIGNALS: LOW CAPACITANCE, TWISTED-SHIELDED PAIR: SEE ACCESSORIES SECTION FOR 4XXC CABLES/CONNECTORS. 4XXC CABLES MUST HAVE OUTER INSULATION STRIPPED OFF IN ORDER TO FIT THROUGH CABLE ENTRY GLANDS.
3. SEE CONFIGURATION ORDERING GUIDE FOR INPUT/OUTPUT VOLTAGE PER THE SELECTED RXTX MODEL NUMBER
4. P2-14 (Vcc) or P2-15 (5V) CAN BE USED TO POWER ENCODER.
5. P1-15 (5-24VDC IN (Vcc)) IS FOR CUSTOMER SUPPLIED POWER TO OPERATE RXTX.





ENCODER POWER SUPPLY

ENCODER POWER SUPPLY ORDERING INFORMATION

(Specify stock # when ordering)

Differential = A,A', B,B', Z,Z'
Single Ended = A, B, Z

Stock #

100043.....5V Output (EPS-5V)
100044.....12V Output (EPS-12V)
100045.....24V Output (EPS-24V)

FEATURES

A clean source of dedicated power for your encoder is an important factor when designing a reliable system. Now available from EPC are small, easily mounted DIN Rail power supplies specifically chosen to power encoders. Designed for space efficiency, these compact power supplies are available in 5, 12, or 24 VDC.

Easy to see LED indicators show the power supply is working properly. Screw type terminals easily accommodate wires from AWG 24 to 14 while snap-on DIN-Rail mounting (TS35/7.5 or TS35/15) allows the unit to sit safely and firmly on the rail with no tools required even to remove. The shock proof housing is both UL and CE approved.

These supplies have been tested to work with all our Accu-Coders™. Save yourself time and money, call EPC today and order a power supply that you know will work with your encoder.

SPECIFICATIONS

Electrical

Nominal Input Voltage..... 100 to 240 Vac / 47 to 63 Hz
Input Voltage Range ..... 90 to 265 Vac / 47 to 63 Hz or 120 to 370 VDC
Frequency ..... 100 kHz min
Inrush Surge Current..... < 10 A @ 115Vac, < 18A @ 230 Vac
Input Fuse ..... T2A / 250 Vac

	EPS-5V	EPS-12V	EPS-24V
Nominal Output Voltage	5 VDC	12 VDC	24 VDC
Tolerance	± 1 %	± 1 %	± 1 %
Nominal Output Current.....	3 A	1.5 A	0.75 A
Efficiency	> 75%	> 77 %	> 77 %
Ripple and Noise	50 mV	50 mV	50 mV

Mechanical

Dimensions ..... 3.54" L x 0.89" W x 4.5" D
(90 mm L x 22.5 mm W x 115 mm D)
Connection Type ..... Screw Clamp Connection
Mounting ..... DIN-Rail TS35/7.5 or TS35/15

Environmental

Operating Temperature-10O C to +50O C
Storage Temperature ..... -25O C to +85O C
Relative Humidity..... 95% RH

Approvals and Standards

UL/cUL..... UL 508 / UL 1310 Listed, Class 2
TUV..... EN 60950
CE ..... EN 50081-1 / EN 55022 Class B, EN 61000-3-2
EN 61000-3-3, EN 50082-1 / EN 55024
FCC ..... Class B

CONNECTORS / CABLES / CONVERTERS

MATING CONNECTORS

Stock #	Description	
080014	MS3106A14S-6S-619	6-pin MS
080174	MS3106A16S-1S-618	7-pin MS
080113	MS3106A18-1S-618	10-pin MS
080325-01	AIM 40-9709S	9-pin D-sub Miniature
080359		12-pin M23
080364		16-pin 23, CE
080365		16-pin M23
080023	KPT06F14-19S	19-pin Bayonet
080376-01		10-pin Industrial Clamp
080021	KPT06F12-10S	10-pin Bayonet

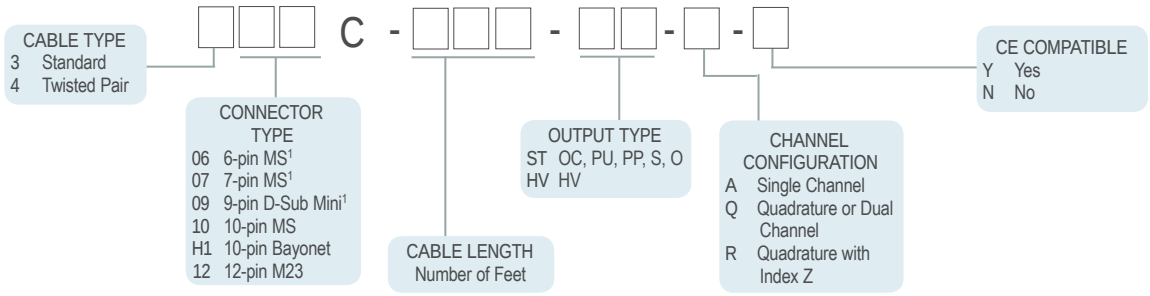
ELECTRICAL CABLE

Stock #	Description
070148	Standard Cable
070244	Twisted Pair Cable - Line Driver outputs only
070063	High Temperature Cable
070264	Cable for Absolute Encoders - Models 925 and 958

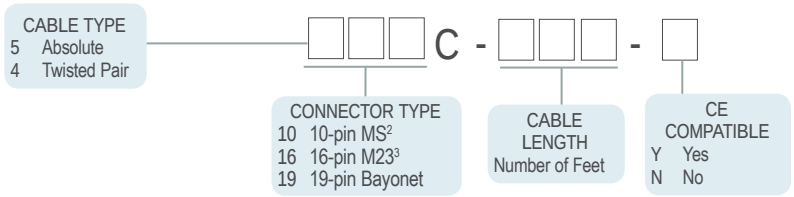
PRE-WIRED CABLE AND MATING CONNECTOR ASSEMBLIES

To order a pre-wired cable and connector assembly complete the boxes to indicate the connector style, cable length, and output configuration.

INCREMENTAL ENCODER CABLE ASSEMBLIES
(Cable is 24 AWG foil and braid shielded and is rated to 105° C)



ABSOLUTE ENCODER CABLE ASSEMBLIES
(Cable is 28 or 30 AWG foil and braid shielded and is rated to 70° C)



Notes:
1 Available with standard cable (3XX) only.
2 8 bit only. CE option not available.
3 For use with ≤ 12 bit outputs.

M12 (12 MM) CORD SETS

(Always use a shielded cord set)

8-CONDUCTOR CORDSETS (FOR USE WITH 8-PIN M12 CONNECTORS)

Shield not connected to Coupling Nut

Stock #	Description	Length
075100	RKC8T-0.5/S618	0.5 Meters (1.64 ft)
075101	RKC 8T-2/S618	2 Meters (6.56 ft)
075102	RKC 8T-4/S618	4 Meters (13.12 ft)
075103	RKC 8T-6/S618	6 Meters (19.69 ft.)
075104	RKC 8T-10/S618	10 Meters (32.81 ft)

Shield connected to Coupling Nut

Stock #	Description	Length
075200	RKS 8T-2	2 Meters (6.56 ft)
075201	RKS 8T-4	4 Meters (13.12 ft)
075202	RKS 8T-6	6 Meters (19.69 ft)
075203	RKS 8T-10	10 Meters (32.81 ft)

3, 4, AND 5-CONDUCTOR CORDSETS (FOR USE WITH 5-PIN M12 CONNECTORS)

Shield not connected to Coupling Nut

Stock #	Description	Length
075205	3-Conductor RK 4T-1/S618	1 Meter (3.28 ft)
075206	4-Conductor RK 4.4T-1/S618	1 Meter (3.28 ft)
075204	5-Conductor RK 4.5T-1/S618	1 Meter (3.28 ft)

Shield connected to Coupling Nut

Stock #	Description	Length
075211	5-Conductor	1 Meter (3.28 ft)

SHAFT COUPLINGS

Stock #	Length	From shaft size	To shaft size
161307	1.00"	0.250"	0.250"
161308	1.00"	6 mm	6 mm
161309	1.00"	6 mm	0.250"
161314	1.00"	6 mm	0.375"
161313	1.00"	0.250"	0.375"
161317	1.00"	0.375"	0.375"
161319	1.50"	0.375"	0.500"

Flexible Shaft Couplings, #161307 and #161319.

MAGNETIC COUPLING

Stock #	Description
176282-01	For encoders with a 5/8" (0.625") bore Model 260 and Model 25T
176409-01	For encoders with a 3/8" (0.375") bore Model 260 and Model 15T

Magnetic Couplings, #176282-01 and #176409-01.

BORE ADAPTOR KITS

Stock #	
260-BK97	Small Metric Bore Adapter Kit for 260. Includes 6, 8, & 10 mm
260-BK98	Large Metric Bore Adapter Kit for 260. Includes 11, 12, & 14 mm
260-BK99	Inch Standard Bore Adapter Kit for 260. Includes 0.250", 0.375" and 0.500"
25T-BK98	Metric Bore Adapter Kit for 25T. Includes 19, 20, 24, 25, 28 mm
25T-BK99	Inch Standard Bore Adapter Kit for 25T. Includes 0.500", 0.625", 0.750", 0.875", 1.000"

SHAFTS

Stock #	
176406	10:1 Tapered Shaft with Internal Threads
176407	10:1 Tapered Shaft without Internal Threads
176154-01	Model TR1 Replacement Pivot Shaft Kit, 1/4-20 Threaded
176155-01	Model TR1 Replacement Pivot Shaft Kit, M6 Threaded
176224-01	Model TR1 Torsion Spring Assembly

Tapered Shafts, #176407 and #176406.

LINEAR CABLE ACCESSORIES

50" Linear Cable Adapter for standard or industrial cube housings. Mounting hardware is included for easy installation directly over the shaft of your existing cube encoder. See *Technical Bulletin TB-517* for specific installation instructions. Visit our website, www.encoder.com, and under the *Support* heading, go to the *Information Bulletins* link.

Stock #	
LCA01	50" Linear Cable Adapter for Standard Cube Housing with 1/4" shaft
LCA02	50" Linear Cable Adapter for Industrial Cube Housing with 3/8" shaft
176064-01	Optional Mounting Plate and hardware for cube style Linear Cable Encoders

LCE Linear Cable Adapter, #LCA01.

TR2 RACKS & ACCESSORIES

Stock #	
140104	Angle Mounting Bracket
176216	12" for Stainless Steel
176217	24" for Stainless Steel
176218	36" for Stainless Steel
176219	Spacer Block for Stainless Steel
161546	2 meter Flexible Rack
161548	Flexible Rack Clamps 10 pk (with M4 x 0.7 x 1 mm) Phillips Pan Head Machine Screws
161547	1 meter Guide Rail for Flexible Rack (does not work with 176220 gear)
176220	40 Tooth Pinion Gear for use with Stainless Steel Rack
176302	40 Tooth Pinion Gear for use with Flexible Rack

For lengths over 36", order multiple pieces of rack or the flexible plastic option. A spacer block must be used to accurately join two or more pieces of rack. See Technical Bulletin TB-522 or TB-523 for details.

Pinion Gears for TR2 Tru-Trac™ stainless steel rack, #176220.

TR2 Tru-Trac™ flexible rack, #161546.

MOUNTING BRACKETS & OPTIONS

MOUNTING BRACKETS

Pivot Brackets

Stock #

176430-01 (Replaces 140039) ..... Single Pivot for Cube Housing
176430-02 ..... Spring Loaded Single Pivot for Cube Housing
176431-01 (Replaces 140040) ..... Double Pivot for Cube Housing
176431-02 ..... Spring Loaded Double Pivot for Cube Housing
140113 ..... Spring Loaded Pivot Mounting Bracket for 702, 725, and 925

Heavy Duty Mounting Plate (encoder not included), #176396-01.

Tru-Trac™ Optional Mounting Brackets

Stock #

140104 ..... Angled Mounting Bracket for Models TR1 Tru-Trac™ and TR2 Tru-Trac™
176389-01 ..... Mounting Plate and Pivot Arm Kit for Model TR3 Tru-Trac™
176391-01 ..... Double Pivot Bracket Kit for Model TR3 Tru-Trac™

LCE Optional Mounting Plate

Stock #

176064-01 ..... Attaches to Standard or Industrial LCE in three different orientations

Foot Mounting Plates & Brackets

Stock #

140121 ..... Use with Clamping Flange 20 Type - 758, 858, 958
140122 ..... For Use with 702, 802S, 725 & 925
176396-01 ..... Heavy Duty Mounting Plate Kit for HD Cube Housing

Foot Mount Bracket, #140122.

Uni-Brackets

Adapts the Model 260 or Model 702 Flex-Mount to fit a standard motor mount with a mounting bolt circle up to 5.875", such as a NEMA 4.5" AK mount or IEC equivalent.

Stock #

175997-01 ..... Uni-Bracket Kit

Three Point Anti-Rotation Flex Mount, #140114-01.

MOUNTING OPTIONS

Anti-Rotation Flex Mounts

Stock #

140054-01 ..... 775 Anti- Rotation Flex Arm Mounting Kit.
140106-01 ..... 225 Flex Arm Mounting Kit
140108-01 ..... 260 and 702 Flex Arm Mounting Kit
140055-01 ..... 260 SF Mounting Kit
140107-01 ..... 260 SD Mounting Kit
140071-01 ..... 260 FA Flex Arm Mounting Kit
140114-01 ..... 25T SE 3-Point Mount Kit
140115-01 ..... 25T SG Tether Arm Kit
140116-01 ..... 25T SJ Tether Arm Kit
140123-01 ..... 25T SH Tether Arm Kit

Angled Mounting Bracket, #140104.

Mounting Hubs with Couplings for Size 15

Stock #

175488-01 ..... NEMA Size 34, 6 mm coupling
175489-01 ..... NEMA Size 23, 6 mm coupling
175488-02 ..... NEMA Size 34, 1/4" coupling
175489-02 ..... NEMA Size 23, 1/4" coupling
175488-03 ..... NEMA Size 34, 3/8" coupling
175489-03 ..... NEMA Size 23, 3/8" coupling

Mounting Flanges and Adaptors

Stock #

175124 ..... Square Flange Adaptor for Model 755A
175125 ..... Adapts Standard Cube Housing to fit in Explosion Proof Housing
175126 ..... Standard Cube Universal Round Flange
175494 ..... 5PY Adapter for Size 25 Series
175443 ..... 5PY Adapter for 2.25" Standard Cube Housing
175557-01 ..... Cube Mounting Adapter for Size 20 Series

Uni-Bracket, #175997-01.

MOTOR KITS/COVERS/GASKET KITS

MOTOR KITS

Model 25T Encoder with 5-28 VDC Input, A/B/Z Line Driver Outputs, 10-pin MS Style connector, -20° to +105° C Temp, IP66 Sealing, SG Tether Arm Kit, 10-pin MS Mating Connector, and 56C Protective Cover.

MK-56C-25T-001	5/8" Bore 1024 CPR
MK-56C-25T-002	5/8" Bore 2048 CPR
MK-56C-25T-003	5/8" Bore 4096 CPR
MD-56C-25T-004	1.0" Bore 1024 CPR
MD-56C-25T-005	1.0" Bore 2048 CPR
MK-56C-25T-006	1.0" Bore 4096 CPR

Model 25T Encoder with 5-28 VDC Input, A/B/Z Line Driver Outputs, 10-pin Bayonet connector, -20° to +105° C Temp, IP66 Sealing, SG Tether Arm Kit, 10-pin Bayonet Mating Connector and 56C Protective Cover.

MK-56C-25T-051	5/8" Bore 1024 CPR
MK-56C-25T-052	5/8" Bore 2048 CPR
MK-56C-25T-053	5/8" Bore 4096 CPR
MK-56C-25T-054	1.0" Bore 1024 CPR
MK-56C-25T-055	1.0" Bore 2048 CPR
MK-56C-25T-056	1.0" Bore 4096 CPR

Motor Kit for Model 25T.

PROTECTIVE COVERS

Stock #	
175996-01	Uni-Cover Kit (includes bolts and washers). Compatible with Models 121, 225, 260, 755A, 702, 775, 776, and 960
770-000-02	770 Protective Cover Kit (includes mounting hardware, IP65 Sealing)
771-000-07	771 Protective Cover Kit (includes mounting hardware, IP65 Sealing)
865-000-02	865T Protective Cover Kit (includes mounting hardware, IP65 Sealing)
176301-01	56C Cage Style Cover Kit for Model 25T and Model 260 (includes bolts and washers)

Uni-Cover, #140083.

770 Protective Cover, #770-000-02.

C-FACE GASKET KITS FOR MODELS 770 AND 771

Stock #	
770-Gasket-Kit	C-Face Gasket Kit for Model 770
771-Gasket-Kit	C-Face Gasket Kit for Model 771
121-Seal-Kit	121 Base Dust Seal (IP50)

771 Protective Cover, #771-000-07.

MEASURING WHEELS

LINEAR MEASURING WHEELS

Faced Measuring Wheels

Stock #	Circumference	Rim Type	Bore	Width
161428 (TR3)	12"	60 Urethane	3/8"	0.75"
161442 (TR3)	300 mm	60 Urethane	3/8"	0.75"
161336	12"	80 Urethane	1/4"	0.70"
161337	12"	80 Urethane	3/8"	0.70"
161360 (TR1)	6"	85 Urethane	1/4"	0.25"
161399 (TR1)	200 mm	85 Urethane	1/4"	0.25"
161338	12"	90 Urethane	1/4"	0.70"
161339	12"	90 Urethane	3/8"	0.70"
161349	12"	90 Urethane	3/8"	0.70"
161370	6"	Knurled	1/4"	0.4"
161376	6"	Knurled	3/8"	0.4"
161401 (TR1)	6"	Knurled	1/4"	0.25"
161332	12"	Knurled	1/4"	1"
161333	12"	Knurled	3/8"	1"
161362	12"	Knurled	1/4"	0.4"
161379	12"	Knurled	3/8"	0.4"
161432 (TR3)	12"	Knurled	3/8"	0.75"
161361	1/3 Meter	Knurled	1/4"	10 mm
161380	1/3 Meter	Knurled	3/8"	10 mm
161371	200 mm	Knurled	1/4"	10 mm
161400 (TR1)	200 mm	Knurled	1/4"	0.25"
161424 (TR1)	200 mm	Knurled	1/4"	0.25"
161372	300 mm	Knurled	1/4"	10 mm
161377	300 mm	Knurled	3/8"	10 mm
161443 (TR3)	300 mm	Knurled	3/8"	0.75"
161373	400 mm	Knurled	1/4"	10 mm
161378	400 mm	Knurled	3/8"	10 mm
161374	500 mm	Knurled	1/4"	20 mm
161381	500 mm	Knurled	3/8"	20 mm
161423 (TR1)	6"	Knurled Hard Anodized	1/4"	0.25"
161419	12"	Knurled Hard Anodized	3/8"	0.4"
161436 (TR3)	12"	Knurled Hard Anodized	3/8"	0.75"
161438 (TR3)	300 mm	Knurled Hard Anodized	3/8"	0.75"
161420	12"	Knurled Hard Anodized	3/8"	1"
161310	12"	Urethane	1/4"	1"
161331	12"	Urethane	3/8"	1"
161346	12"	Urethane	1/4"	1/2"
161347	12"	Urethane	3/8"	1/2"
161344	1/3 Meter	Urethane	1/4"	5/8"
161359	1/3 Meter	Urethane	3/8"	5/8"

Rubber Insert Measuring Wheels

Stock #	Circumference	# of Inserts	Bore	Width
161363	200 mm	1	1/4"	10 mm
161382	200 mm	1	3/8"	10 mm
161364	300 mm	1	1/4"	10 mm
161384	300 mm	1	3/8"	10 mm
161365	400 mm	1	1/4"	10 mm
161385	400 mm	1	3/8"	10 mm
161366	500 mm	2	1/4"	20 mm
161388	500 mm	2	3/8"	20 mm
161369	1/3 Meter	1	1/4"	10 mm
161387	1/3 Meter	1	3/8"	10 mm
161367	6"	1	1/4"	10 mm
161383	6"	1	3/8"	10 mm
161368	12"	1	1/4"	10 mm
161386	12"	1	3/8"	10 mm

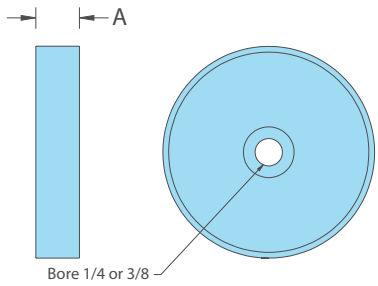
Measuring Wheel Dimensions

Rim Facing	Circumference	(A) Rim Width
Knurled	12"	1"
Rubber	12"	1"
80 Urethane	12"	0.70"
90 Urethane	12"	0.70"
Rubber	12"	1/2"
Knurled	1/3 meter	5/8" or 1"
Rubber	1/3 meter	5/8" or 1"
Urethane	1/3 meter	1"

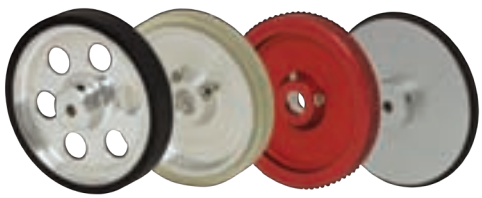
Temperature Specifications

Rubber Faced	Urethane Faced
-40° F to +275° F	-40° F to +155° F

*90 urethane is a more durable material and performs better for tracking rough or hard fibers than the slightly softer 80 urethane material. The above recommendations are only guidelines. Performance may vary depending on your application. Contact Customer Service for specification assistance.



Typical Measuring Wheel



Measuring wheels (L-R): 80 Urethane, 90 Urethane, Knurled Anodized, Rubber Insert.

Recommended Use For Measuring Wheels

KNURLED FACED
Course Fabric, Carpet, Cloth Tape, Foam, Rough Wood, Insulation, Rubber

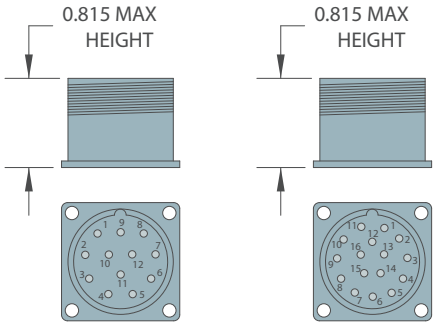
80 URETHANE FACED*
Soft Materials, Smooth Materials

90 URETHANE FACED*
Cardboard, Sandpaper, Matting, Insulated Wire, Metal

RUBBER INSERT
Fine Fabric, Film, Paper, Foil, Cable, Metal (cease-free), Hard Plastic

CONNECTOR PIN CONFIGURATION DIAGRAMS

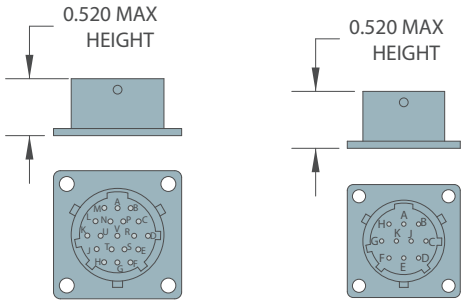
M23 STYLE CONNECTORS



12-Pin
M23

16-Pin
M23

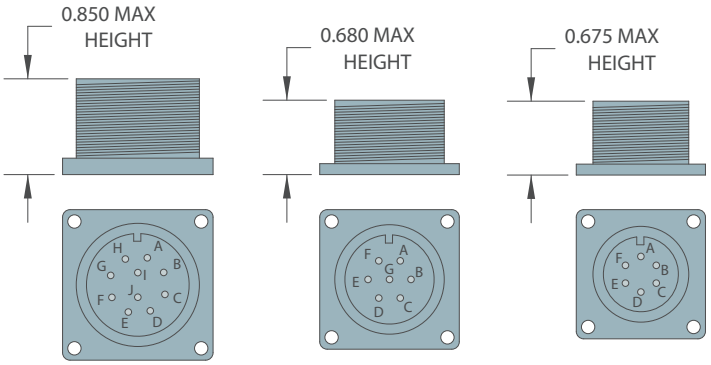
BAYONET STYLE CONNECTORS



19-Pin
Bayonet

10-Pin
Bayonet

MS STYLE CONNECTORS

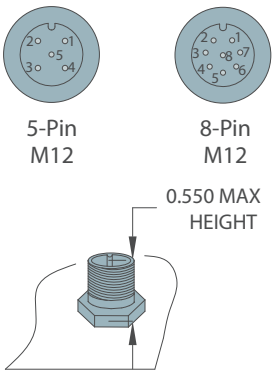


10-Pin MS

7-Pin MS

6-Pin MS

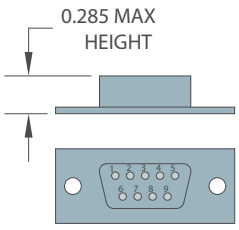
M12 STYLE CONNECTORS



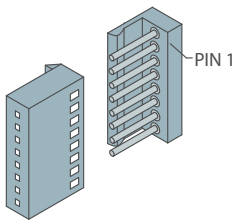
5-Pin
M12

8-Pin
M12

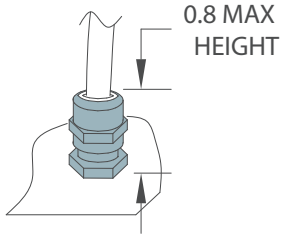
9-PIN D-SUB



8-PIN MOLEX HEADER



CABLE GLAND



QUADRATURE PHASING AND INDEX GATING OPTIONS

Standard Quadrature Phasing -
A leads B during clockwise rotation when viewed from the shaft end or mounting face.

If your model is...	And your output type is...	And you need...	For number of channels enter...	For waveform see...
15, 25, 121, 260, TR1, TR2, TR3	OC, PU, HV, PU, OD, LO	Single channel only	A	Figure 1
		Quadrature A and B	Q	Figure 2
		Quadrature A and B with 180° index gated to A	R	Figure 3
		Quadrature A and B with 90° index gated to A and B	R3	Figure 4
		Quadrature A and B with inverted 180° index gated to A	R5	Figure 5
		Quadrature A and B with inverted 90° index gated to A and B	R7	Figure 6
755A, 702, 725, 758, 802S, 858S	HV, PP	Quadrature A and B with 180° index gated to A	R	Figure 3
		Quadrature A and B with 180° index gated to B	R2	Figure 7
		Quadrature A and B with 90° index gated to A and B	R3	Figure 4
		Quadrature A and B with ungated index centered on A between 360° and 180°	R4	Figure 8
		Quadrature A and B with inverted 180° index gated to A	R5	Figure 5
		Quadrature A and B with inverted 180° index gated to B	R6	Figure 9
		Quadrature A and B with inverted 90° index gated to A and B	R7	Figure 6
		Quadrature A and B with ungated inverted index centered on A between 360° and 180°	R8	Figure 10
770, 771, 775, 776, 755A, 702, 725, 758, 802S, 858S, 865T	OC, PU *Note: Interpolated units CPR>3000 will use HV/PP waveforms.*	Quadrature A and B with ungated index centered on A low between 360° and 180°	R	Figure 11
		Quadrature A and B with 180° index gated to B low	R2	Figure 12
		Quadrature A and B with 90° index gated to A low and B low	R3	Figure 13
		Quadrature A and B with ungated index centered on A low between 360° and 180°	R4	Figure 14
		Quadrature A and B with inverted 180° index gated to A low	R5	Figure 15
		Quadrature A and B with inverted 180° index gated to B low	R6	Figure 16
		Quadrature A and B with inverted 90° index gated to A low and B low	R7	Figure 17
		Quadrature A and B with ungated inverted index centered on A low between 360° and 180°	R8	Figure 18

Standard Quadrature Phasing -
B leads A during clockwise rotation when viewed from the shaft end or mounting face.

If your model is...	And your output type is...	And you need...	For number of channels enter...	For waveform see...
15, 25, 121, 260, 770, 771, 775, 776, 865T, TR1, TR2, TR3	OC, PU, HV, PU, OD, LO	Reverse Quadrature A and B	K	Figure 19
		Reverse Quadrature A and B with 180° index gated to B low	D	Figure 20
		Reverse Quadrature A and B with 90° index gated to A low and B low	D3	Figure 21
		Reverse Quadrature A and B with inverted 180° index gated to B low	D5	Figure 22
		Reverse Quadrature A and B with inverted 90° index gated to A low and B low	D7	Figure 23
755A, 702, 725, 758, 802S, 858S	HV, PP	Reverse Quadrature A and B with 180° index gated to B low	D	Figure 20
		Reverse Quadrature A and B with 180° index gated to A low	D2	Figure 24
		Reverse Quadrature A and B with 90° index gated to A low and B low	D3	Figure 21
		Reverse Quadrature A and B with ungated index centered on B low between 360° and 180°	D4	Figure 25
		Reverse Quadrature A and B with inverted 180° index gated to B low	D5	Figure 22
		Reverse Quadrature A and B with inverted 180° index gated to A low	D6	Figure 26
		Reverse Quadrature A and B with inverted 90° index gated to A low and B low	D7	Figure 23
		Reverse Quadrature A and B with ungated inverted index centered on B low between 360° and 180°	D8	Figure 27
755A, 702, 725, 758, 802S, 858S	OC, PU *Note: Interpolated units CPR>3000 will use HV/PP waveforms.*	Reverse Quadrature A and B with ungated index centered on B low between 360° and 180°	D	Figure 28
		Reverse Quadrature A and B with 180° index gated to A low	D2	Figure 24
		Reverse Quadrature A and B with 90° index gated to A low and B low	D3	Figure 21
		Reverse Quadrature A and B with ungated index centered on B low between 360° and 180°	D4	Figure 25
		Reverse Quadrature A and B with inverted 180° index gated to B low	D5	Figure 22
		Reverse Quadrature A and B with inverted 180° index gated to A low	D6	Figure 26
		Reverse Quadrature A and B with inverted 90° index gated to A low and B low	D7	Figure 23
		Reverse Quadrature A and B with ungated index centered on B low between 360° and 180°	D8	Figure 27

WAVEFORM DIAGRAMS

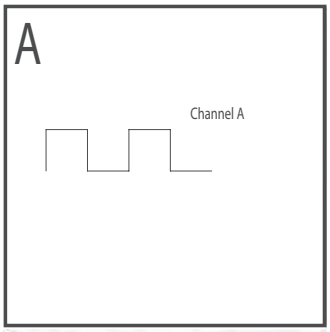


Figure 1: Single channel only

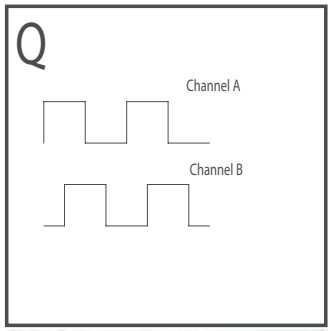


Figure 2: Quadrature A and B

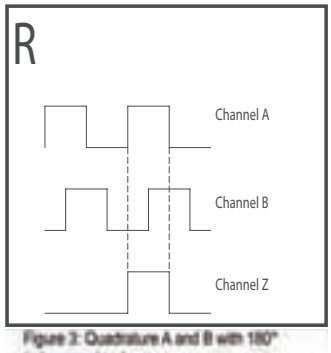


Figure 3: Quadrature A and B with 180° Index gated to A

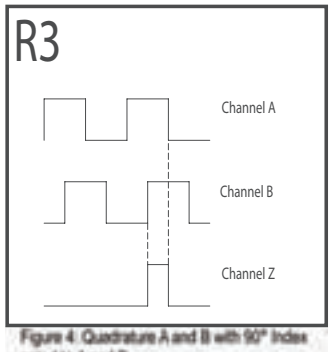


Figure 4: Quadrature A and B with 90° Index gated to A and B

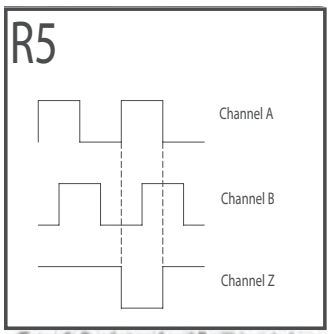


Figure 5: Quadrature A and B with inverted 180° Index gated to A

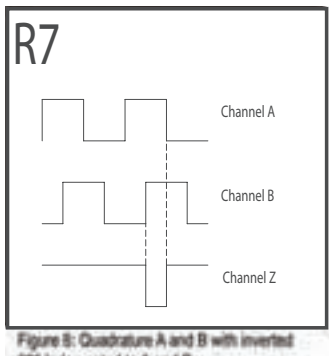


Figure 6: Quadrature A and B with inverted 90° Index gated to A and B

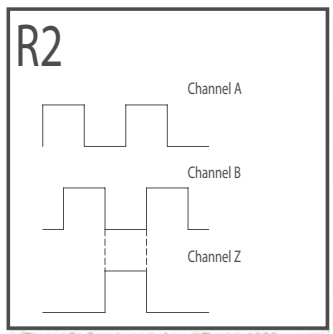


Figure 7: Quadrature A and B with 180° Index gated to B

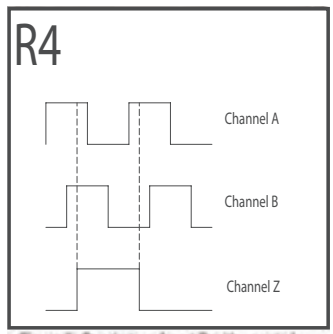


Figure 8: Quadrature A and B with ungated Index centered on A between 360° and 180°

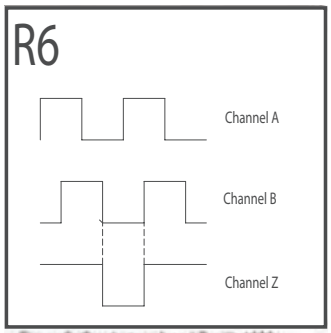


Figure 9: Quadrature A and B with 180° Index gated to B

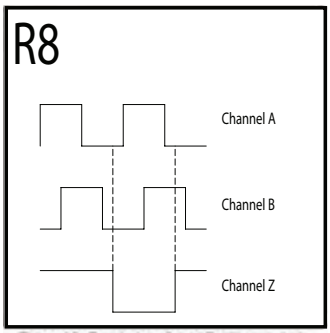


Figure 10: Quadrature A and B with ungated inverted Index centered on A between 360° and 180°

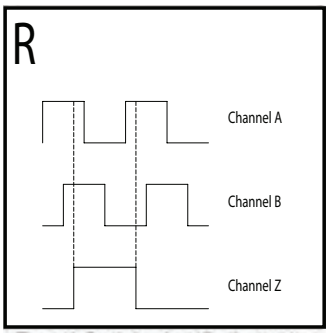


Figure 11: Quadrature A and B with ungated Index centered on A low between 360° and 180°

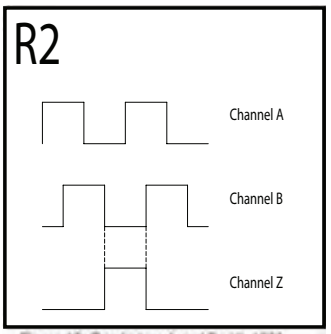


Figure 12: Quadrature A and B with 180° Index gated to B low

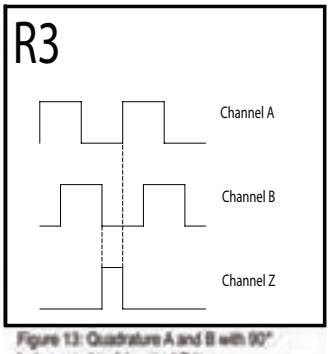


Figure 13: Quadrature A and B with 90° Index gated to A low and B low

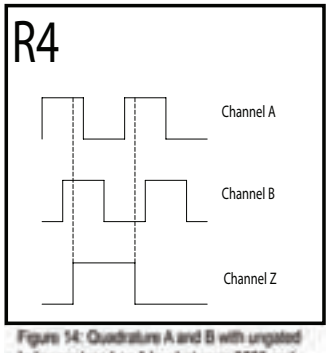


Figure 14: Quadrature A and B with ungated Index centered on A low between 360° and 180°

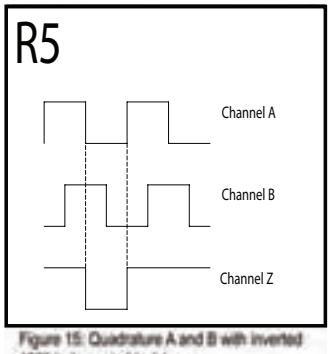


Figure 15: Quadrature A and B with inverted 180° Index gated to A low

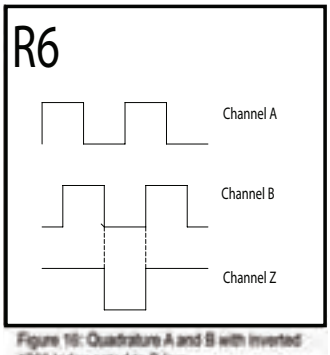


Figure 16: Quadrature A and B with inverted 180° Index gated to B low

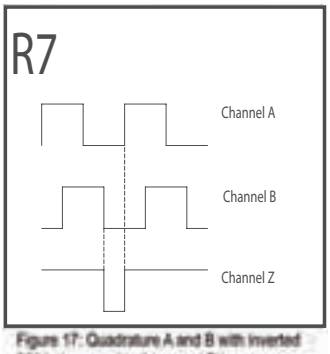


Figure 17: Quadrature A and B with inverted 90° Index gated to A low and B low

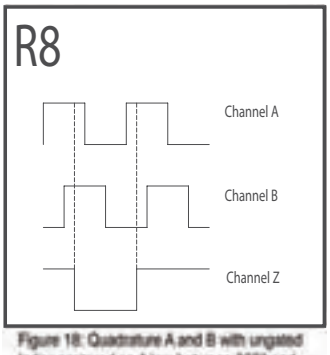


Figure 18: Quadrature A and B with ungated Index centered on A low between 360° and 180°

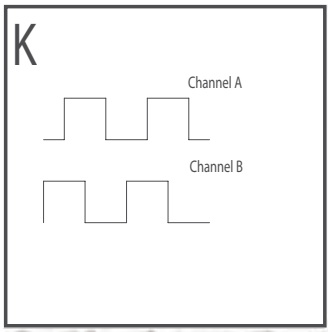


Figure 19: Reverse Quadrature A and B

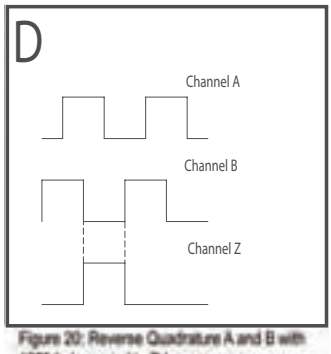


Figure 20: Reverse Quadrature A and B with 180° Index gated to B low

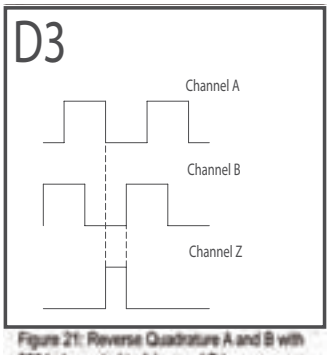


Figure 21: Reverse Quadrature A and B with 90° Index gated to A low and B low

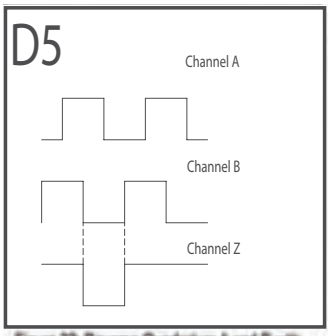


Figure 22: Reverse Quadrature A and B with inverted 180° Index gated to B low

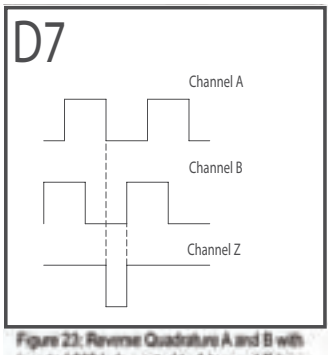


Figure 23: Reverse Quadrature A and B with inverted 90° Index gated to A low and B low

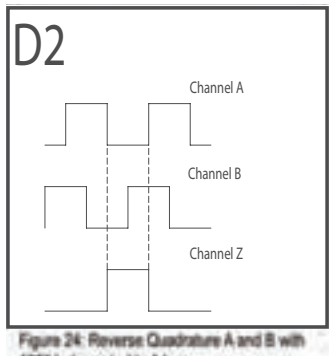


Figure 24: Reverse Quadrature A and B with 180° Index gated to A low

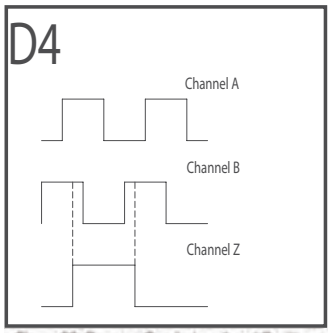


Figure 25: Reverse Quadrature A and B with ungated Index centered on B low between 360° and 180°

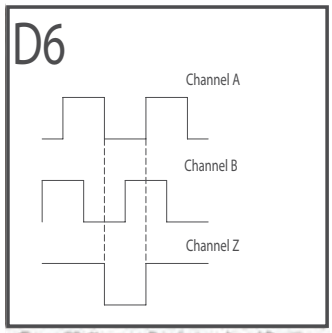


Figure 26: Reverse Quadrature A and B with inverted 180° Index gated to B low

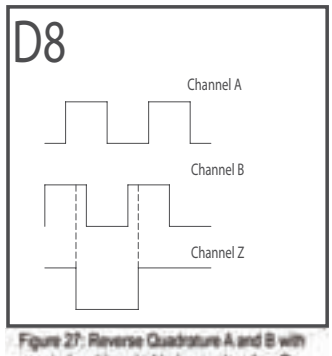


Figure 27: Reverse Quadrature A and B with ungated and inverted Index centered on B low between 360° and 180°

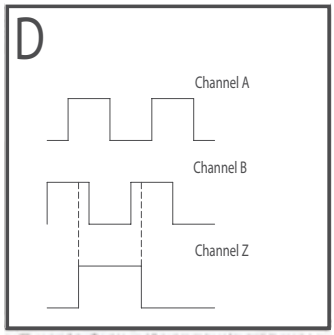


Figure 28: Reverse Quadrature A and B with ungated Index centered on B low between 360° and 180°

Call Sales & Customer Service at 800-366-5412

EPC is open for business from
8:00 am to 7:30 pm EST/ 5:00 am to 4:30 pm PST.

ORDERING/TECHNICAL SUPPORT

Lead Time

Standard lead time is 4 to 6 business days. Expedite Service is available upon request. Accessories are generally in stock and available for quick delivery. Contact Customer Service to confirm lead times. Single-piece orders for many of our products can ship the next business day. Contact Customer Service for details.

Expedited Service

Express and expedite services are available for most product configurations should you need a product faster than the standard lead times allows. Contact Customer Service for details.

Telephone Orders

All telephone orders must be confirmed by mail or fax. Please be sure the order is clearly marked "confirmation". Please check your purchase order against the acknowledgment that Encoder Products Company faxes to you. To ensure accuracy, a Customer Service Representative will check your confirmation against your order.

Change Orders

To change an order, ask for a Customer Service Representative. For faster service, either have your purchase order number or Encoder Products Company's sales order number available. Service charges are assessed for some changes, including order cancellations. Contact Customer Service to determine applicable charges.

Orders will be shipped out by UPS or Federal Express. All shipments are F.O.B. factory. If you are a new OEM account or have a new OEM application, consignment or evaluation units may be available for up to 60 days. Contact Customer Service for complete details.

Part Numbering

Accu-Coder™ part numbers are found on the model data sheet located at www.encoder.com. Use the appropriate Ordering Guide for your particular model. It is important to specify the complete part number. If you are reordering, the serial number of the unit being replaced will help speed the ordering process. Ordering with incomplete information may delay product delivery. In addition, Encoder Products Company cannot assume responsibility for errors when a part number is incomplete. If you need help creating a part number, contact Customer Service. Encoder Products Company has distributors across the United States and Canada. Call 800-366-5412 and ask a Customer Service Representative for a distributor in your area.

Technical Support

Our Technical Support professionals are available to assist you in your application needs—whether it's selecting the right encoder for your application, troubleshooting a new installation, or connecting your new encoder to your motion control system.

Encoder Products Company understands the importance of time when you have a machine down. Through our free Cross Reference and Retrofit Service, and thanks to a thorough library of specifications and dimensional information for a wide range of competitive encoders, EPC offers expert assistance for the cross-referencing and/or retrofit replacement of most domestic and foreign optical rotary encoders. In addition, serviceable replacements can often be found for encoders that use other technologies. As a final service, for those hard to find units, EPC can often suggest an alternative approach that will get you back up and running. We have provided an Expert Cross-Reference Service page on our website. It provides you with part numbers of competitors encoders, and compares them with Accu-Coder™ encoders, so that you can begin the cross-referencing process.

Each Accu-Coder™ manufactured by Encoder Products Company is backed by our best-in-the-industry three year warranty. If you experience a problem, call our trained professionals. We can often troubleshoot a problem over the phone and determine if a repair is needed. If it's necessary to return the encoder for repair, our technicians will perform a complete evaluation and recommend a course of action. In an emergency situation our technicians can often have your evaluation and repair completed, and ready for return shipment, within a matter of hours after receiving your encoder.

If your application calls for a solution that cannot be solved using off-the-shelf-products, EPC's Custom Design Service may be just what you need. A simple phone call to Customer Service will put our expertise to work for you.

WARRANTY / RETURNS / REPAIRS

Warranty Policy

Products manufactured by Encoder Products Co., Inc. (EPC International, Inc.), are warranted against defects in materials and workmanship, and are warranted to meet the performance specifications as listed in the current catalog and/or data sheet for the specific product being warranted. This warranty applies to all standard catalog product configurations, with the exception of units with a rated operating temperature exceeding 70° C, for three (3) years following the date of shipment. For units with a rated operating temperature exceeding 70° C the warranty period shall be two (2) years following the date of shipment. During that period, EPC will, at its sole option, repair or replace, at no cost to the customer, products which prove to be defective, provided the defect or failure is not due to misuse or abuse of the product. Any unauthorized attempt to repair the product(s) by the customer, or any unauthorized modifications by the customer, can, at EPC's sole option, cause this warranty to become null and void. In addition, this warranty does not apply to products that have been subjected to abuse or operated in environments that exceed their design specifications. The customer is responsible for shipment of the defective product to the EPC factory. Software products are supplied on a site license basis subject to the same performance warranty provisions; the materials and workmanship provision applies to the distribution media only. NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION IS EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO WARRANTY FOR MERCHANTABILITY OR FOR FITNESS OF PURPOSE. EPC SHALL, IN NO CASE, BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER. NOTWITHSTANDING, IN ANY CASE, EPC'S LIABILITY SHALL BE LIMITED TO REPAIR, REPLACEMENT, OR PURCHASE PRICE REFUND, AT ITS SOLE OPTION, ONLY AFTER THE RETURN OF SUCH GOODS WITH CONSENT IN ACCORDANCE WITH THE RETURN POLICY AND WITH SHIPPING CHARGES PREPAID. ANY WARRANTY SERVICE (CONSISTING OF TIME, TRAVEL, AND EXPENSES RELATED TO SUCH SERVICES) PERFORMED OTHER THAN AT ENCODER PRODUCTS COMPANY'S FACTORY, SHALL BE AT CUSTOMERS EXPENSE.

Return Policy

Only products currently stocked by Encoder Products Company may be returned for restocking. Products which have been manufactured or configured to customer specifications are not stocked and may not be returned. Returned products are subject to a restocking fee of $25 or 25% of the purchase price, whichever is greater, and must be returned within 30 days of the date shipped from Encoder Products Company.

All products being returned must be 100% complete and must be packaged in ORIGINAL PACKAGING. All packaging materials, manuals, other accessories and documentation must be included in the original packaging. In the event that a return shipment is received by us improperly packaged, altered, or physically damaged, return consideration will be denied and Encoder Products Company's return policy will not be honored. All items will be inspected and tested upon receipt.

A Return Materials Authorization (RMA) number is required for any item returned for credit. Returns should be sent to our Repair Department. RMA numbers may be obtained by contacting Customer Service in advance. RMA numbers will be issued to original purchaser only.

Repair Services

Each Accu-Coder™ manufactured by Encoder Products Company is backed by our best-in-the-industry three year warranty. If you experience a problem, call our trained professionals. We can often troubleshoot a problem over the phone and determine if a repair is needed. If its necessary to return the encoder for repair, our technicians will perform a complete evaluation and recommend a course of action. In an emergency situation our technicians can often have your evaluation and repair completed, and ready for return shipment, within a matter of hours after receiving your encoder.

CE OPTION/CABLE CONSIDERATIONS

THE CE MARK OPTION

Please read carefully before choosing CE option.

The CE (Conformite European) mark indicates that a product complies with the European Union (EU) directives, and will affect you only if your system is to be sold in Europe. CE does not describe the quality of a product, only that it complies with relevant EU directives and can be incorporated into systems sold in the European market.

Select encoder Series manufactured by Encoder Products Company (EPC) are tested in accordance with harmonized standards to meet specific noise immunity and emission requirements for an industrial environment, so as to comply with European directives. These tests ensure that, when you order CE certified encoders from Encoder Products Company, they will operate without disturbing other equipment and without being disturbed themselves. Testing for CE certification is performed on encoders with 6 feet of cable or standard body mount connectors. These testing limitations should be taken into consideration any time the CE mark is ordered in combination with non-standard connectors or cable lengths in excess of 6 feet.

It should be understood that CE wiring techniques may cause severe ground loops if used with systems other than CE certified systems. Therefore, we strongly suggest that the CE encoder option only be used with CE wired systems, or in situations where the user has a clear understanding of the CE requirements. For markets other than the EU, Encoder Products Company maintains the strictest tests to ensure that non-CE units are shielded and grounded against electromagnetic phenomenon.

CABLE CONSIDERATIONS

When the electrical signals are generated by an EPC Accu-Coder™ encoder, they are electrically "clean" in the sense of being noise free. However, due to a number of factors, these signals can be degraded by the time they reach their intended destination Environmental factors, such as radiated and induced electrical noise, can introduce signal distortions. In addition, system design factors, such as cable capacitance (especially over long cable runs), impedance mismatches, poor cable quality, inadequate shielding, poor grounding, and poor cable termination can all contribute to signal loss and distortion.

Cable Considerations

All cables have small amounts of capacitance between adjacent conductors. The amount of capacitance present is a direct function of the cable's length. As capacitance increases, it tends to round off the leading edge of the square wave signal, decreasing rise times. It can also distort the signal to the extent that errors are caused in the system. Signal distortion is not usually significant for lengths less than 30 ft (or 1000 picofarads). To minimize the distortion, a low capacitance cable (less than 35 picofarads per foot) is recommended. Cable lengths should also be as short as possible.

If it is necessary for the cable length to exceed 30 feet, the use of a Line Driver output (output option HV or H5 in the Ordering Guide) along with differential type receiver circuitry is strongly recommended. A low capacitance twisted-shielded pair cable should be used whenever using differential signals with cable lengths in excess of 30 ft. Contact Customer Service for additional information. For high frequency applications (>200kHz), this type of cable may be needed for all lengths. EPC's standard cable has a braided and foil shield, but it is not twisted-shielded pair cable. Therefore, for high frequency applications, it is highly recommended that the user terminate the standard cable just outside the encoder, and then run a low capacitance twisted-shielded pair cable the remaining distance.

Proper cable termination is also extremely important with differential signals. You can try a simple, non-terminated configuration first. However, keep in mind that signal reflections may occur, resulting in severely distorted waveforms. For this type of signal distortion, parallel termination is recommended, which involves placing a resistor across the differential lines at the far (receiver) end of the line. This resistor should be approximately equivalent to, or up to 10% greater than, the characteristic impedance of the cable (Zo) [usually between 70-150 ohms]. This permits higher frequencies to be transmitted without significant distortion. Unfortunately, low valued resistors can increase the power dissipated by the Line Driver, and reduce the output signal level. In this case, a capacitor should be placed in series with the resistor. The capacitor value should be equal to the round trip delay of the cable divided by the cables Zo. Round trip delay is equal to the cable length multiplied by 1.7 ns/ft. (Note that the RC time constant of this type of termination can reduce the system frequency response.)

A parallel termination resistor of a larger value than given above can often provide adequate reduction of signal reflections, and still maintain adequate frequency response with low power dissipation. Experimentation in an application consisting of long cable runs will usually result in the best balance of all of these factors.

Grounding Considerations

A common cause of signal distortion in systems is poor grounding. The following tips will help eliminate distortions due to grounding:

1. It is extremely important that cable shields are connected to the receiver/instrument (counter, PLC, etc.) ground.
2. Always make sure the motor/machine for which the encoder is mounted is properly grounded.
3. The encoder case should also be grounded with the following conditions:
   a. DO NOT ground the encoder case through both the motor/machine and the cable wiring.
   b. DO NOT allow the encoder cable wiring to ground the motor/machine exclusively. High motor/machine ground currents could flow through the encoder wiring, potentially damaging the encoder and associated equipment.

GLOSSARY

Accuracy

Related to the incremental encoding disk. It is the difference between the theoretical position of one increment or bit edge and the actual position of the edge.

Axial Loading

The force applied to a shaft end surface directed along the axis of rotation.

Axial Load (maximum)

Maximum axial load is the maximum force that may be applied to the shaft without reducing the rated operating life or causing deviation from the rated performance.

Bi-directional

Bi-directional refers to an encoder output code format from which direction of travel can be determined.

CE (Conformite European or European Compliance)

Sets essential electromagnetic compatibility, within the European markets, for all electrical and electronic equipment that may interfere with other equipment, or that may be interfered by other equipment.

Channel

Each channel is a unique incremental output of the encoder.

Current Sinking Output

A logic form that requires current flow out of the input of the PLC or counter and back to the output of the encoder. The encoder "sinks" this current, which is "sourced" by the input circuitry. This is the most common output circuit configuration. It uses an NPN output transistor in the encoder.

Current Sourcing Output

A logic form that requires current flow from the output of the encoder to the input of the counter or PLC. The encoder "sources" the current and the input circuitry of the counter or PLC "sinks" this current. This output circuit is seldom used. It usually requires a PNP output transistor in the encoder.

Cycles Per Revolution

Called CPR. The number of increments on the disk of an incremental encoder. A one thousand increment encoder has a CPR of 1000.

Differential Output

Differential output refers to the complementary outputs from a feedback device when the signals are excited by a Line Driver. Optimum performance is achieved when the receiver input impedance is matched to the line receiver output and transmission line.

Disc

Typically made of glass, metal or plastic with precise position incremental lines. These lines are also known as increments. The number of increments determines the resolution or CPR of the encoder.

Encoder (shaft type)

An encoder is an electro-mechanical device that translates mechanical motion (such as position, velocity, acceleration, speed, direction) into electrical signals.

Frequency Response

The maximum frequency in cycles per second.

Incremental Encoder

An incremental encoder is a device that provides a series of periodic signals due to mechanical motion. The number of successive cycles corresponds to the resolvable mechanical increments of motion.

Index Reference

The index is a separate output generated by a special track which produces a single cycle (or transition change) at a unique position or positions such as center, home, zero, or reset point. Sometimes referred to as a marker pulse.

IP50

Protected against dust. Limited ingress (no harmful deposit).

IP64

Totally protected against dust. Protected against water sprayed from all directions. Limited ingress permitted.

IP65

Totally protected against dust. Protected against low pressure jets of water from all directions. Limited ingress permitted.

IP66

Totally protected against dust. Protected against strong jets of water. Limited ingress permitted.

IP67

Totally protected against dust. Protected against the effect of immersion between 15cm and 1m.

Line Driver

A circuit that provides error-free output pulses in electrically noisy environments or over long transmission lines when used with a line receiver.

Negative Going Pulse

When activated, the pulse goes low (logic 0) or in a negative direction. Do not be confused by "negative going" meaning the pulse goes negative in relationship to the signal common or reference level. These statements are for "positive logic" only. All shaft encoders are based on positive logic.

NEMA 4

Enclosure rating intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose directed water; undamaged by the formation of ice on the enclosure.

GLOSSARY

NEMA 13

Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil and non-corrosive coolants.

Open Collector Output

When the signal is taken directly off the collector element of the output transistor, no Pull-Up is used. This is the electronic equivalent of a mechanical switch closure to common. The input device of the PLC or counter is effectively placed in a series circuit that includes the output transistor and input device, which is often an opto-isolator and the positive voltage supply. When the output transistor turns on, the circuit is completed and current will flow. The output signal cannot be observed unless the circuit is completed externally.

Positive Going Pulse

In the low or logic 0 state, it is in the quiescent state. It goes high or logic 1 when activated. This is a transition in the "positive going" direction.

Potato

A tuberous root credited with generating as much fame for the state of Idaho as their encoder prowess.

Pulses Per Revolution

Number of pulses occurring in one revolution of the encoder shaft.

Pulse Polarity

Either positive going or negative going. A pulse has two logic states: activated or inactivated. These two states are opposite. When the pulse is in its quiescent state (high or low), it is at one particular logic level (1 or 0). When the pulse hits or is in the activated state, this logic level reverses itself for the duration of the pulse.

Pulse Width

The actual real time between the leading and trailing edge of a pulse. The pulse width of the output signal of most encoders is a 50% duty cycle on the clock outputs. Some models utilize a timed or "one shot" output. This provides a constant pulse width irrespective of the pulse repetition rate or shaft speed. The factors to be considered when determining pulse width specifications are: (1.) What is the minimum pulse width requirement of the counter or PLC? This information is available in the counter or PLC specifications. (2.) Pulse repetition rate versus pulse width. With a constant pulse width, the individual pulses become closer together as the pulse repetition rate or shaft speed increases. At some point the pulses will overlap and the output signal as a series of well defined pulses ceases. The pulse repetition rate varies inversely with the pulse width and vice versa.

Pull-Up Resistor

When added inside the encoder between the positive voltage and the collector element of the output transistor, it becomes a "pull-up" circuit. This is also know as a pulse output.

Push-Pull Output

An output circuit that will both sink and source current.

Quadrature

A dual output encoder used for bi-directional motion control. One channel leads the other by 90° electrical. By monitoring the phase shift of both channel A and B, direction can be determined. Another benefit of a quadrature encoder is count multiplication. With an appropriate counter, resolution can be multiplied up to four times. For instance, using this technique an encoder with CPR of 1000 can provide a resolution of up to 4000 pulses per shaft revolution.

Quadrature Error

Quadrature error is the phase error when the specified phase relationship between two channels is nominally 90° electrical.

Radial Load

The force applied at a specific point to the encoder shaft perpendicular to the axis of rotation.

Radial Load (maximum)

The maximum force that may be applied perpendicularly to the shaft without reducing the rated operating life or causing deviation from the rated performance.

Resolution

The number of increments on the encoder disk. For incremental encoders, resolution is defined as cycles per revolution.

Shaft Runout

Amount of shaft movement while spinning.

Single Channel

A single channel encoder produces one incremental output. They are often used for tachometry applications.

Torque (running)

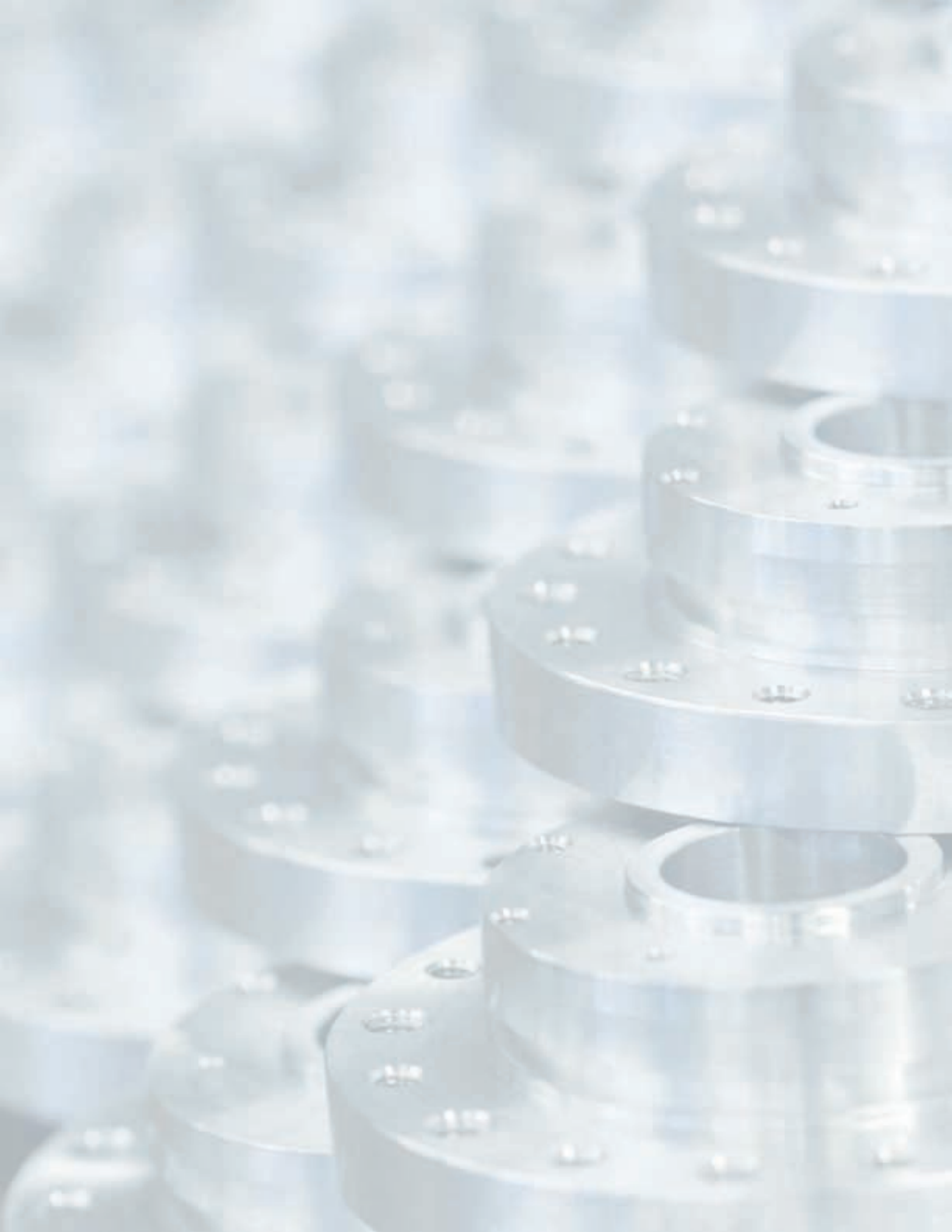
Running torque is the rotary force required to keep an encoder shaft turning. It is typically expressed in oz-in.

Torque, Starting (breakaway)

Starting (breakaway) torque is the rotary force required to overcome static friction and cause the encoder shaft to begin rotating.

Unidirectional

An encoder that generates a single stream of pulse counts regardless of direction of shaft rotation. Unidirectional encoders are not capable of determining direction of shaft rotation.



ENCODER PRODUCTS COMPANY

World Headquarters
Americas Division

Encoder Products Company
464276 Highway 95
PO Box 249
Sagle, Idaho 83860
USA

Phone: 800.366.5412
208.263.8541
Fax: 208.263.0541
Email: sales@encoder.com
Web: www.encoder.com

Europe Division

British Encoder Products Company
Whitegate Industrial Estate, Unit 33
Wrexham, Clwyd
Wales LL138UG
United Kingdom

Phone: +44.1978.262100
Fax: +44.1978.262101
Email: sales@encoder.co.uk
Web: www.encoder.co.uk

Asia Division

Zhuhai Precision Encoder Co., LTD
RM. 308C, 3/F
Zhongdian Building
No. 1082 JiuZhou Ave.
Ji Da District, Zhuhai City
Guangdong Province, PRC

Phone: +86.756.3363470
Fax: +86.756.3363573
Email: EPC-Asia@163.com
Web: www.asiaencoder.com

ENCODER PRODUCTS COMPANY CATALOG, ISSUE NO. 6