

Now Introducing...

**Made in
America**

SMART-ENCODER™

**Product Line
Catalog**



Encoder Type & Resolution
Field Programmable



- **Drop-in Replacement for industry Standard BEI & Dynapar Encoders**
(Mechanical & Electrical form fit & function)

- **Competitively Priced**
- **Field Programmable Type/Count without computer**
- **4 Digit LED Display**
- **Wide Variety: Absolute, Incremental, End-mount, Side-mount, Servo-mount, Flange-mount, Size 15, 25, 40, Water submersible, Explosion Proof, Built-in gear trains**
- **NEMA 4/4X Construction**
- **Same-day Shipping for most popular models**
- **DeviceNet, Profibus, Interbus, SSI & Ethernet Options**

The Most Comprehensive Catalog of Autotech Encoders



Important Information

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Factory Customer Service/Sales

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 Phone: 630-668-3900
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Warranty Policy

Autotech Controls offers a 1 year limited warranty on its products. Consult factory for details of Warranty & Limitations.

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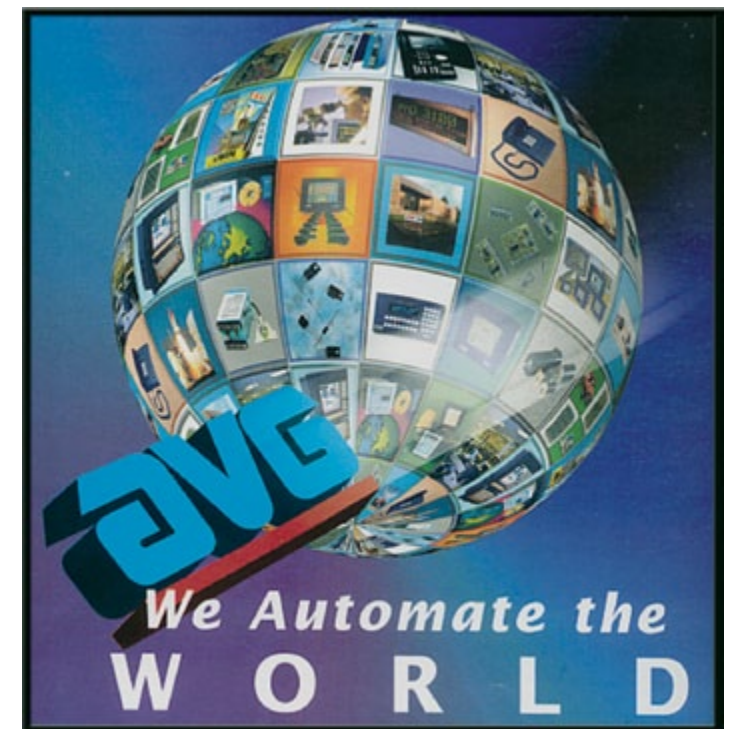
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A Brief Overview...

AVG, an American Group of companies, is vertically integrated to design and manufacture state-of-the-art electronic products, cost effectively, for the best "Return On Investment" for our customers.

Significant Highlights & Core Competencies....

- ◆ Established in 1968, AVG has introduced more than 500 innovative new products.
- ◆ Extensive hardware, firmware, and software design capability in Illinois & Iowa.
- ◆ Hold 25+ Patents & 5 new ones pending.
- ◆ Has an installed base of over \$1 Billion in fortune 500 companies such as Ford, GM, P&G, Abbot, Miller, & IBM.
- ◆ PCB fabrication.
- ◆ One of the largest semiconductor FABs.
- ◆ Thick Film Hybrids.
- ◆ Pioneers in Encoder, Resolver and PLS technology for rugged applications.
- ◆ Known for "Uticor Tough", high reliability, HALT-HASSed products, designed to operate in harsh industrial environments.
- ◆ In the forefront of High Technology such as BGA and controlled impedance high density board products.



Since the early 1970's, AVG's Autotech division has been a pioneer in Encoder, Resolver and PLS technology. Autotech was the first company to successfully introduce and apply encoder technology in the metal stamping industry. In fact, Autotech invented the world's first microprocessor-based Programmable Limit Switch (PLS) in 1975. With over 200,000 systems installed throughout the world, Autotech has become an industry leader in position sensor and control technology.

Autotech is famous for its five traits:

- Highest processing speed.
- Highest processing power and features per cubic inch.
- Simplest Human interface.
- Highest Reliability products
- Highest immunity to a hostile environment including electrical noise.

Autotech's products are "built like a tank" to perform in some of the harshest working environments on the planet ranging from extreme temperatures, to shock and vibration, to exposure to oil mist, coolants and solvents. It's no wonder so many Fortune 500 companies rely on Autotech for Encoder and controls needs.

"Innovation by Design"



Carol Stream, IL
Established 1975

Encoder & PLS Products



Due to the ruggedness of Autotech encoders & patented DMA techniques utilized in its PLSs to achieve 1° accuracy at even 3000 RPM, Autotech's M1250, 1450 series PLSs remain the exclusive standard for two piece can lines throughout the world.



AVG's Autotech division was the first company to introduce & apply encoder technology to metal stamping presses that became a standard in the automotive industry.

First integrated digital resolver, DigiSolver, Standard of the tire industry

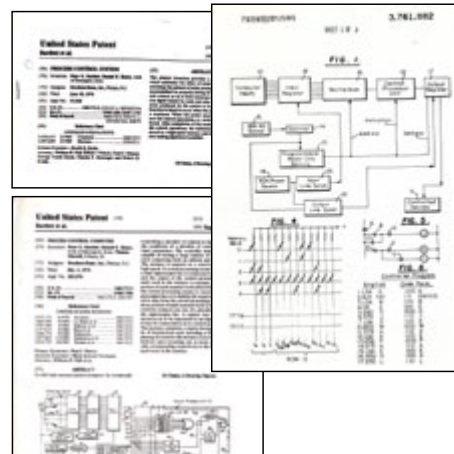


Autotech was also the inventor of the first microprocessor based Programmable Limit Switch. In fact Autotech was the first company to coin the phrase "PLS" for replacing electro-mechanical cam-banks. Autotech has always lived by its tradition of being the most innovative company in the field of Automation controls.

First microprocessor based modular PLS with an incredible scan-time of 57 microseconds for 20,000 setpoints



US Patent No. 3,761,882 issued to Uticor on Sept 25, 1973
Describing the first time use of programmable memories in PLCs



Bettendorf, IA
Established 1968

Uticor, formerly Struthers Dunn Systems division, has been in the forefront of PLC, welding controls, message displays and operator interface technology since 1968.

Uticor, in fact, was one of the early inventors of PLCs back in 1968. It held numerous patents on PLCs, then called Process Control Computers.

In the 1970's, Uticor applied its PLC technology to welding controls and became one of the top suppliers of this technology to the Automotive industry. In fact, Uticor provided university research grants in collaboration with Ford in this area.

In the 1980's, Uticor became known as the premier supplier of Message Displays and Marquees in North America. Its large LED marquees became an Automotive standard. Uticor always had a very conservative design philosophy and it showed in its products and thus earned worldwide recognition as "Built Like a Tank" or "Uticor Tough".

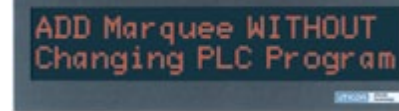
Uticor has been consistently rated as one of the top three names in message displays in the last two decades.



Uticor Touchpanel in a Coal Mine



"Built Like a Tank"



Uticor PMD Products have worldwide name recognition

Autotech's Rich History in Encoders since 1975

AVG's Autotech division introduced its **First Encoder product** back in 1975 that became a standard on USI Clearing presses. The encoder was used to determine the angular position and speed of the ram in a typical press cycle. It employed a metal disc and shock mounted optics to be able to withstand the shock and vibration of the press at its pinch point. Subsequently this MS650/MS670 product line became an automotive standard in the industry. The durability of this product is evident from the fact that there still are thousands of these presses in operation worldwide still using this product introduced more than 35 years ago.



MS Series Encoder



Clearing Metal Stamping Press



Stolle End Conversion Press

Moving on from automotive metal stamping presses, Autotech next addressed the need for a reliable encoder on the end conversion presses used in the 2pc aluminum can manufacturing industry. This turned out to be a bigger challenge as the vibration caused by these presses was so much that even the plant floors had to be reconstructed every couple of years. This was an absolute encoder application which was not possible through a metal disc, so Autotech first used a shock isolated traditional glass disc, then a plastic disc with maximum separation from optical readers and eventually a resolver based encoder. **Autotech encoders provide an accuracy of better than 0.1 deg at 3000 rpm on can manufacturing lines through out the world.**

For more than quarter of a century now, Autotech has supplied encoders for rugged applications, in metal stamping, can manufacturing, steel, tire, plating lines, drag lines, earth moving machinery, farm machinery, conveyors, oil drilling, packaging, dam/gate control, assembly, medical, dairy, food processing, semiconductor manufacturing, cranes, military, tank-turrets, textile, converting, printing, palletizing, ware-house control and numerous other industries.

In 1985 General motors chose Autotech to be its exclusive supplier for 92 resolver based encoders, known as Digi-solvers on each of its 100 Transfer press lines.



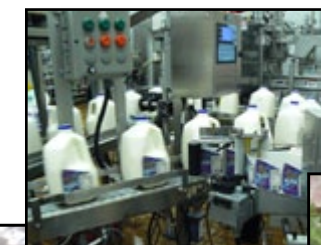
92 Autotech Encoders per line



Komatsu Transfer Press Line



Assembly Machine



Dairy Plant



Earth Moving Equipment

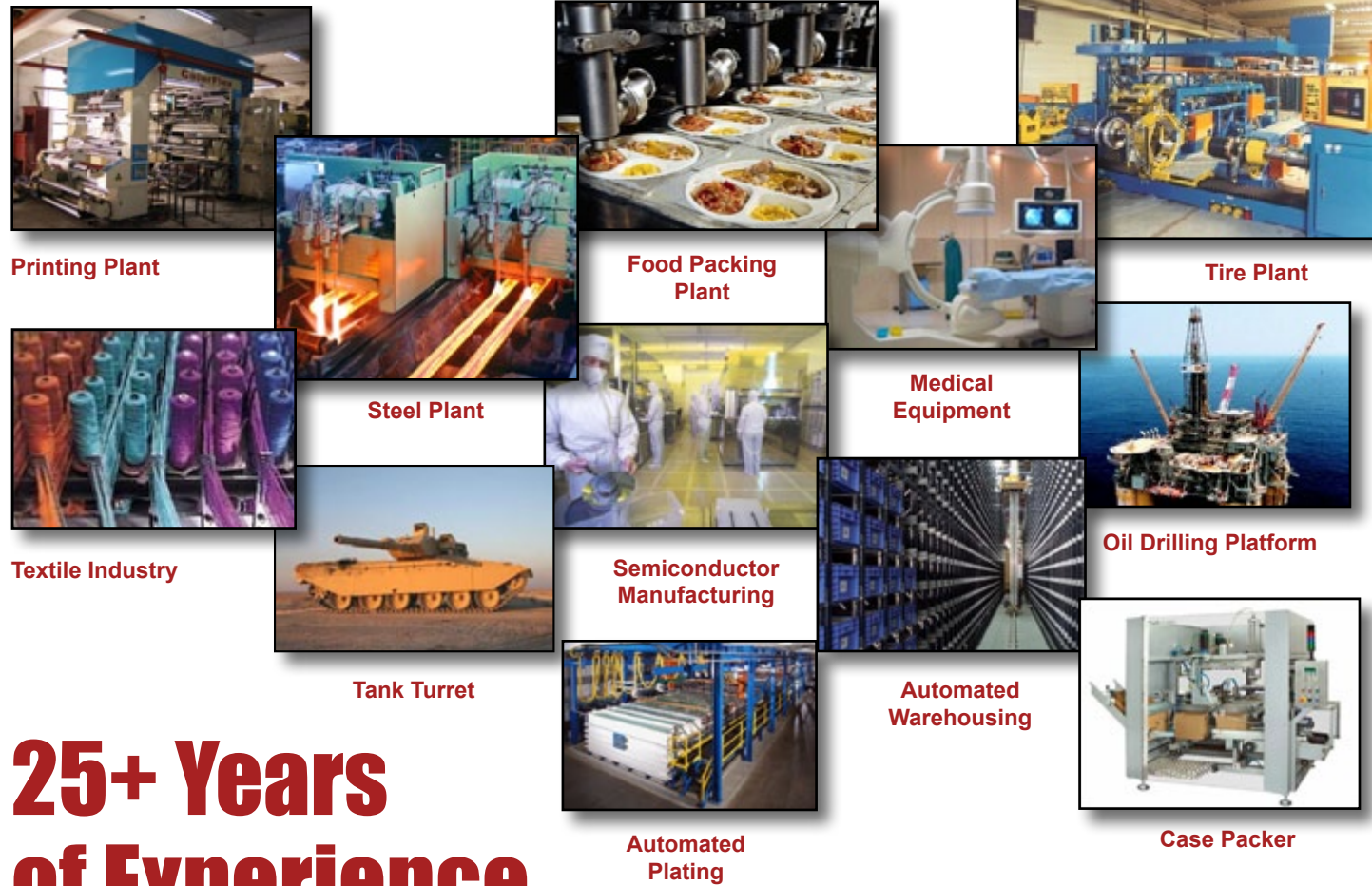


Conveyor Control



Dam Control

Autotech Encoder Applications



**25+ Years
of Experience**

in supplying encoders to a wide variety of industries

The Most Innovative and Broadest Line of Encoders for every application and all budgets

With the introduction of this catalog and a totally new and innovative concept of the Smart-encoder product line, Autotech intends to become your single source for every application and all budgets.



With Smart-Encoder™ You will Never Look at Encoders the same way Again !

Autotech has always prided itself in listening to its customers while spending serious time in the trenches in the plants where its products get used. And one of the most common requests we have seen from the plants, is to have a **programmable encoder that can be easily configured without a computer and software**, so that the **plant's stock room is not having to contend with tens of part numbers for different encoders, and you don't have to lug a laptop and special cables to program them**. Whereas the functionality as well as reliability of encoders from most major suppliers has consistently increased over the last two decades, the number of different models and part numbers remains a headache for the industry.

There are literally thousands and thousands of different part numbers with unacceptable delivery times, requiring suppliers to offer "express service" for additional cost. Smart-encoder product line cuts this down by at least a factor of ten. Smart-encoder has a built-in display and an extremely simple user interface with just two buttons to configure your encoder right on the machine, in seconds, without needing a laptop or any software. **This patent pending feature comes at no additional cost either**. You will find that Smart-encoder is quite price competitive with your current fixed count/type and inflexible encoder. Further, Smart-encoder comes with many different mechanical configurations to cover the vast majority of applications.



Configure Smart-Encoder™ right on the machine in seconds without needing a laptop or software



Size 25 Flange mount, Quadrature Smart-Encoder. Drop-in Replacement for BEI H25, Dynapar HR25, HA25, H42 and EPC 725N, 725I

Note: Smart-Encoder feature is available on all models size 25 and above.

Selecting the Right Encoder for Your Application

Autotech offers one of the broadest lines of encoders in the industry, from a tiny size 15 (housing diameter to be 1.5”), industry standard size 25 (2.5” dia), to explosion proof encoders and everything in between including built-in gear trains, along with wide variety of position sensing technologies, electrical characteristics and communication options. This section is written to provide a reference guide to selecting the right encoder for your application.

Basics:

Many industrial control systems need position and speed feedback. In the initial stages, the encoders consisted of potentiometers, brush encoders, magnetic encoders and rarely optical encoders and resolvers. Each device had certain limitations. The potentiometers and magnetic encoders had limited resolution. The brush encoders required frequent maintenance. The optical encoders used incandescent lamps, which were large in size and had limited life expectancy. The resolvers could offer better resolution and accuracy, but were very expensive due to the decoding electronics required.

The recent technological developments have brought significant improvements in the initial models. Today optical encoders and resolvers are more commonly used in industry. **And with the introduction of cost effective Smart-Encoders by Autotech, there will be a paradigm shift in the selection and use of encoders.**

Types of Encoders:

Absolute and Incremental: The incremental encoder, when it rotates, generates pulses, which are counted to give position information relative to a known point, whereas an absolute encoder provides a unique value at each position and retains actual shaft position even if power fails and the shaft moves. Incremental encoders are less complex and have fewer outputs, 2 or 3, whereas Absolute encoders typically have 12 outputs, and are generally more expensive.

Incremental encoder applications typically require a reset input to zero out the count and start a fresh cycle whereas absolute encoders do not need a reset input as the output is always unique and absolute.

Absolute encoders are also available as multi-turn units with built-in gear trains suitable for linear applications where it takes several revolutions of the encoder shaft to complete one machine or process cycle.

Choice of Optical or Resolver:

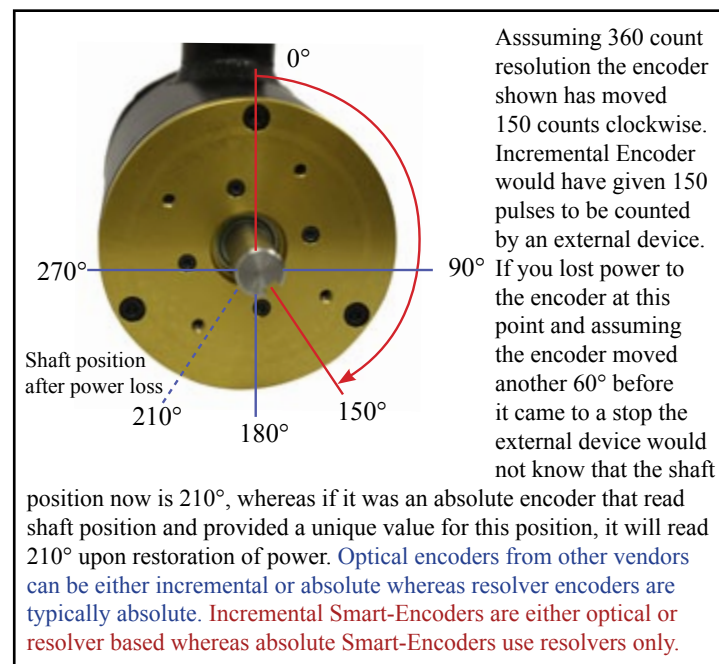
Optical Encoders

The Optical Encoders typically consist of a rotating and a stationary member. The rotor is usually a metal or glass disc mounted on its shaft. The disc has an optical pattern.

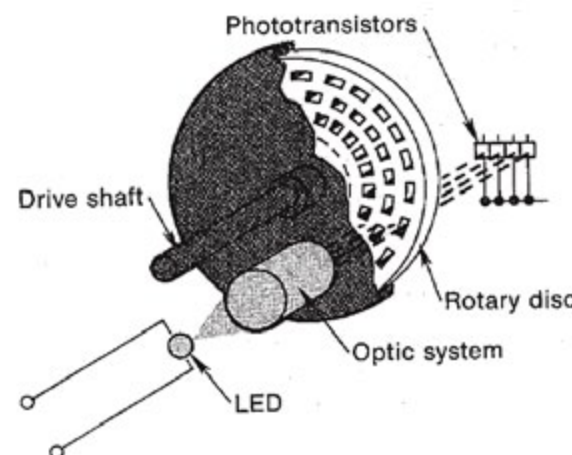
The stator has an LED block and phototransistors arranged so that the LED light shines through the transparent sections of the rotor disc and received by phototransistors on the other side.

Incremental Optical Encoder

The incremental optical encoders uses a simple disc pattern. This slotted rotor disc alternately interrupts the light beam between the LED & phototransistor and thus produces a pulse output. The number of pulses depends on the number of slots on the disc. The pulses are then fed to a counter, where they are counted to give position information. The pulse rate indicates shaft speed. An additional phototransistor can also determine the direction of rotation. Some models also provide a marker pulse output, which is generated once every revolution at a fixed shaft position and can be used to mark a zero reference point. Many different pulse

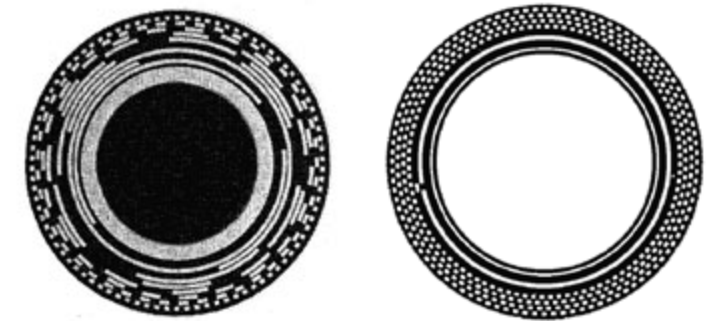


configurations are available, but the most commonly known is called the “quadrature”, where two square wave pulses 90° apart from each other are generated.



Absolute Optical Encoders

As you can see from the picture of the disc used in an absolute optical encoder, it is much more complex than the simple disc used in incremental encoders. Since the absolute encoder needs to encode a unique value for the shaft position, the number of tracks on the disc and corresponding phototransistors depend on the resolution sought and number of bits used. For example, for a 12 bit absolute encoder with resolution of 4096, you need 12 tracks on the disc. Depending upon the shaft position, the photo-transistor output is modulated in a gray-code pattern, which can be converted internally to binary or BCD. The size, complexity and cost of absolute optical encoders increases exponentially with resolution, as the pattern gets increasingly complex with increased number of bits.



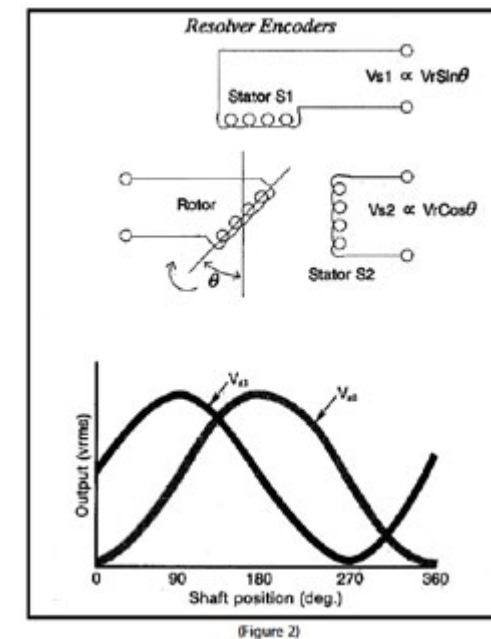
Optical disc for Absolute Encoder

Optical disc for Incremental Encoder

Resolver Encoders

Resolvers, invented during World War II for military applications are by far the most rugged position transducers available. Resolver is essentially a rotary transformer, having one rotor winding and two stator windings. The stator windings are located 90° apart. Either rotor or stator winding can be used as primary. Typically, the rotor winding is driven by a reference voltage at a frequency ranging from 400 Hz to several KHz.

As the shaft rotates, the output voltages of the stator windings vary as the sine and cosine of the shaft angle. *See figure 2.* The two induced stator voltages are a measure of the shaft angle and are converted to a digital signal in resolver-to-digital decoder.



Ratiometric Tracking Converter

(A typical block diagram for a Ratiometric Tracking Converter is shown in figure 3.)

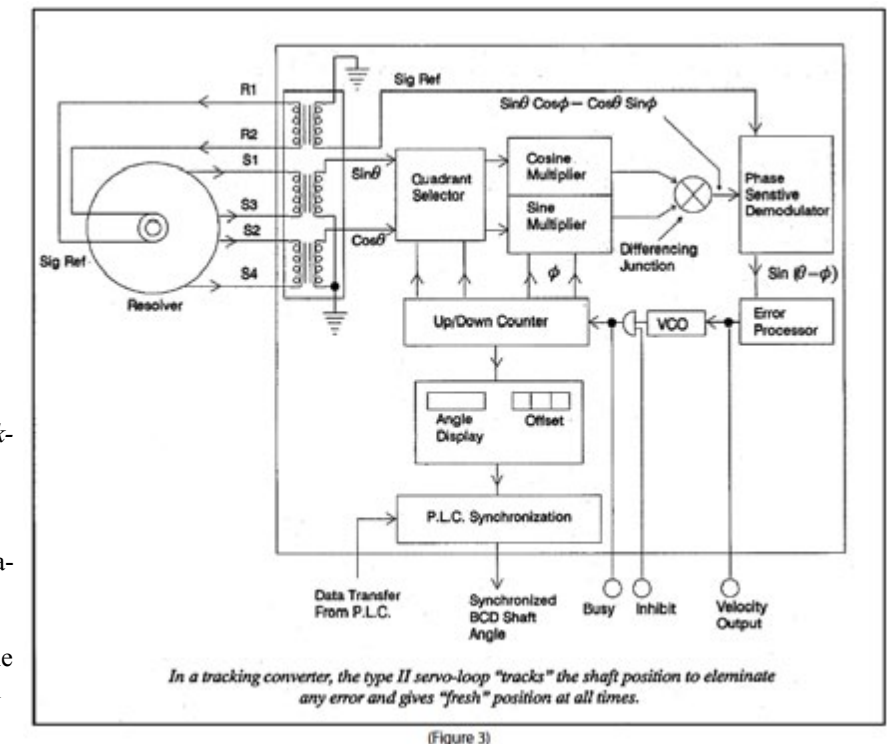
The circuit features a Type II servo-loop that comprises of sine/cosine multiplier and an error amplifier together with phase sensitive demodulator, error processor, voltage controlled oscillator (VCO) and an up/down counter. Since the VCO is controlled by an error integrator, the greater the lag between the actual shaft angle and the digital angle in the counter, faster will the counter be

called upon to “catch-up” or “track” and eliminate the error. The information produced by this type of converter is always “fresh”, being continually updated and always available at the output. As an added bonus, additional outputs, such as, an analog output proportional to the shaft RPM to eliminate external tachometers and a busy signal pulse for incremental pulse applications, are also available. The basis of determining the shaft angle in a ratiometric converter is the ratio between the two stator signals:

From this relationship it can be noted that the angle is no longer a function of the induced rotor voltage V_r , but rather the ratio of V_{S1} and V_{S2} . Therefore, variations in the rotor voltage V_r , frequency and temperature are no longer factors in a ratiometric converter. This results in a highly accurate and repeatable resolver-to-digital converter.

$$\frac{V_{S1}}{V_{S2}} = \frac{V_r \sin \theta}{V_r \cos \theta} = \tan \theta; \therefore \theta = \tan^{-1} = \frac{(V_{S1})}{(V_{S2})}$$

Resolver encoders from Autotech are available both as Incremental as well as Absolute outputs.



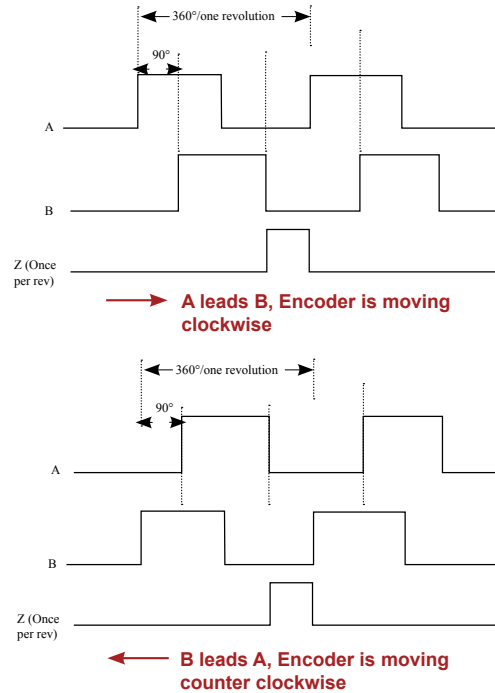
In a tracking converter, the type II servo-loop “tracks” the shaft position to eliminate any error and gives “fresh” position at all times.

(Figure 3)

How do you Determine direction of rotation and resolution in an Incremental Quadrature Encoder?

A typical **Incremental Quadrature encoder**, both **optical and resolver**, has two channels called A and B. These electrical outputs from the encoder are phase shifted to each other by 90 degrees, which allows a counter to be able to determine the direction of rotation. If A leads B (that is A transition occurs before B), the counter can determine which direction the encoder is moving, either clockwise or counterclockwise. If B begins to lead A, it means the encoder has changed direction. A third channel called Z (for Zero) is an optional signal which provides a pulse once per revolution that can be used to synchronize zero value in the counter.

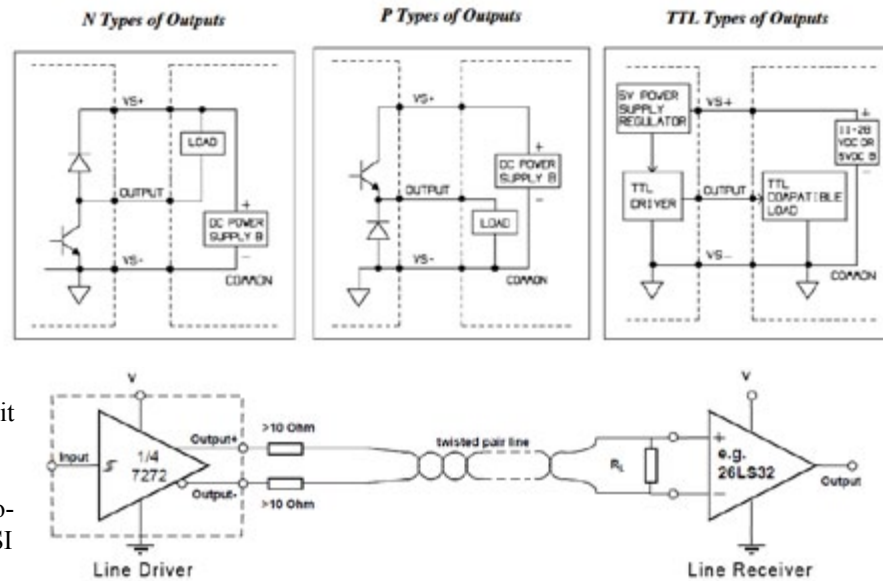
PPR is the number of pulses per revolution of a single channel, for example A output. It is also sometimes referred to as Resolution which is somewhat of a misnomer as the total resolution available from an encoder is 4 times the term PPR or Resolution. Essentially, one cycle of A and B has four signal transitions. Thus an encoder with a Resolution or PPR of 1000 will resolve the encoder shaft to 4000 counts per revolution or $360/4000 = 0.09^\circ$ or 5.4 minutes of rotation.



Other Encoder Specifying Options:

Power Supply and Types of Output Signals:

Power supply for both the Optical and Resolver Encoders used in the industrial environment is typically 12 or 24 VDC. The outputs can be either single ended N type (current sinking) with pull up resistors, P type (current sourcing) with pull down resistors, T type for standard TTL totem pole or differential line driver for greater noise immunity and longer cable lengths between the encoder and the interface device. One of the more common output drivers used in today's encoders is a semiconductor chip called "7272" which can be used as single ended or differential output. 7272 outputs are short circuit proof and have an automatic thermal shut down. Incremental encoders can be ordered in 5 Pin, 7 Pin, 8 Pin or 10 Pin MS connectors, whereas Absolute encoders are available in either 10 Pin (for SSI protocol), 17 or 19 Pin MS connectors.



Higher Level Communication Options:

All Autotech absolute encoders have the option to directly interface to networks such as Devicenet, Profibus, or Ethernet I/P, Ethernet Modbus TCP/IP or Ethernet UT/IP or Ethernet SRTP. Additionally, the Absolute Smart-Encoder can also have SSI output. These protocols and networks allow the use of standard network cables in these applications.

Mechanical Configuration Options:

Encoder package selection is based upon the application need of mechanical stress on the encoder shaft and housing, and the environment in which the encoder shall be operating. The encoder can be either a Flange mount or Servo mount unit. Shaft is made of Stainless Steel and the housing is either Aluminum or Stainless Steel. The workhorse of the industry is the Flange mount NEMA 4/IP66 Size 25 or 2.5" diameter encoder with 3/8" shaft with dual bearings having shaft seals, and aluminum housing. See the Table below.

Housing	Size 40 4.0" dia.	Size 40 explosion-proof 4.0" dia.	Size 25 2.5" dia.	Size 15 1.5" dia.
Max. Starting Torque @ 25 °C (oz. in.)	8 (576.1)	8 (576.1)	5 (360.04)	0.07 (5.04)
Moment of Inertia (oz*in^2)	6.4×10^{-4}	6.4×10^{-4}	4×10^{-4}	2×10^{-4}
Max. Slew Speed (RPM)	5000	5000	5000	5000
Shaft Size	5/8"	5/8"	3/8"	1/4"
Max. Shaft Loading Axial and Radial:	120 lb.	120 lb.	80 lb.	15 lb.
Bearing Life at Max. Mfr. Spec. (Rev.)	2×10^9	2×10^9	2×10^9	2×10^9
Shock		200 g for 11 ms	50 g for 11 ms	
Vibration		20 g to 2000 Hz	15 g to 2000 Hz	
Enclosure	NEMA 4/IP 66	NEMA 4X (Div. I, Class 1, Groups B, C, and D)	NEMA 4/IP 66	NEMA 4/IP 66

Factors to be considered for Selection of Encoders

Incremental vs. Absolute

Can you afford to lose position in case of power failure? If the answer is no, then you must use an absolute encoder. An incremental encoder simply generates pulses proportional to the position, whereas an absolute encoder generates a unique code for each position. After a power outage, with an absolute encoder the machine operation will pick up from where it had left off even if the encoder shaft had moved during power down which is very typical as the encoder shaft will coast to a stop when power is lost. In an incremental encoder the pulses generated are counted in a counter and at power loss it will lose the count and consequently you will have to home the machine before you can start the operation. Typical application examples for Incremental Encoders are "Cut to Length", Conveyor Control, Augur Control, metering equipment, and machines that use lead screws for motion control such as a milling machine. Upon power down, you have to re-sync the controlled apparatus. Absolute Encoders are used when the machine/process has to know the true position all the time and re-sync is not allowed, such as a Press or Assembly machine or a Dam control or an Oil Valve control. Also, an incremental encoder is generally more susceptible to electrical noise. Whereas absolute encoder may give you a false output under noisy conditions, the true position is restored when noise is gone. On the other hand, if you can false counts with noise when using an incremental encoder, the bad count would remain there until reset or re-synced. The absolute encoders are more expensive than the incremental encoders, therefore, a price/feature trade-off may be worth considering.

Optical Encoder vs. Resolver

This decision is primarily based on the operating environment. The environmental integrity of a brushless resolver is unchallenged. Being simple rotary transformers, the resolvers can take

much more abuse than optical encoders and exhibit no significant wear or aging. Especially, if the operating temperature is below freezing or above 150 °F, there is no other choice, but to go for resolvers. Operating temperature range of resolvers is typically between -67 °F to +248 °F. In extremely hostile environment such as continuous mechanical shock and vibrations, humidity, oil mist, coolants and solvents, resolver is the best choice.

Mechanical ratings

Choice of encoder size and NEMA rating also depends on the operating environment. where as size 25 is the work force of the industry due to its ideal size and mechanical strength, NEMA 4 size 15 from Autotech with 50 pound load strength would be ideal where space is a constraint. Size 40, water submersible and explosion proof encoders are self explanatory. Please also note that built-in gear trains are available in only size 40 encoders.

Electrical ratings:

We recomend 24VDC power and 7272 outputs for highest reliability and imuunity to electrical noise.

Single-Turn vs. Multi-Turn

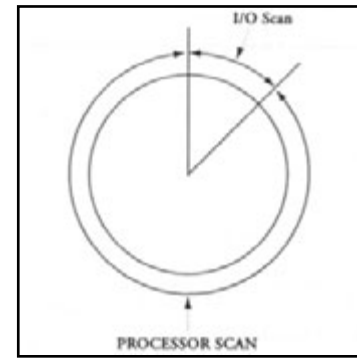
In a single-turn encoder, the encoder shaft makes one revolution for one complete cycle of machine operation, where as in a multi-turn application, the encoder shaft makes more than one revolutions to complete one machine cycle. Absolute multi-turn encoders and resolvers are available with various built-in gear ratios.

Built-in vs. Remote Decoder

In resolver based encoders Autotech offers a choice of built-in decoder inside the encoder housing or remote decoder. In outdoor applications where temperature could be extreme as well as applications where the encoder is located far away(up to 2500 ft) from the control panel, remote decoder is the best choice.

Interfacing Absolute Position Decoders ...

Microcomputers and PLCs are sequential logic devices. In contrast to a real-time hardware logic, which can perform many operations at the same time, a PLC can perform only a single operation before



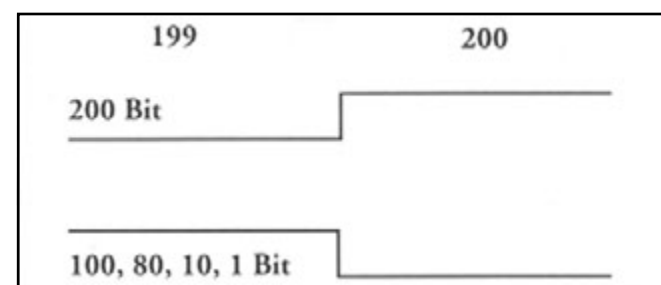
proceeding to the next logical step. The figure describes the logical operation of a PLC, which is cyclical in nature. During the I/O scan, the PLC looks at the input terminals and activates the outputs based on the ladder logic. During the processor scan, the new input data is processed by the Central Processing Unit (CPU) according to the ladder program and the outputs are updated during the next I/O scan. This cycle repeats again and again.

The expression "garbage in, garbage out" fits very well with the PLC. If the input data is invalid or incorrect, the corresponding machine operation will also be incorrect. Therefore, it is very important that when the PLC reads the decoder input during the I/O scan, the decoder data is valid and free of any ambiguities.

There are two main inherent characteristics of electronic devices that could cause wrong decoder data into the PLC:

a) PLC Reading the Changing Bit Pattern:

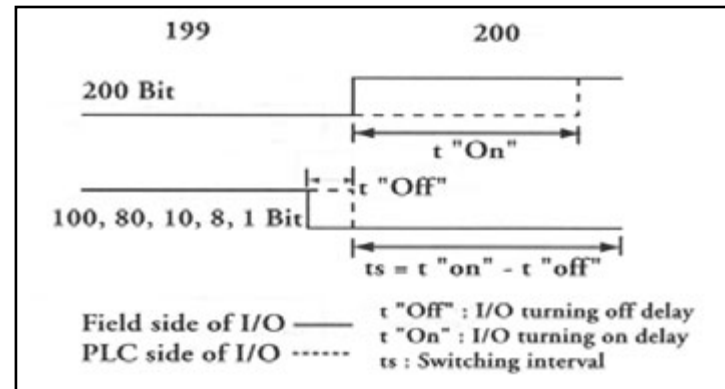
As we all know, a BCD, binary, or gray code number is composed of various bits that change state when decoder position passes from one number to the next. Inherently, in Gray Code only 1 bit changes state when changing from one number to the next, while in BCD or Binary data more than one bits may change for each number change. Let us consider the example of changing decoder position from 199°



to 200°. In a BCD code, for this 1° change of position, 6 bits will change state, i.e., 100, 80, 10, 8, and 1 bits go LOW and 200 bit will go HIGH. And, due to the reaction time of electronic components, all these bits do not change state at the same time. At a given time when PLC reads the data, some bits might have gone LOW while others may still be HIGH. Therefore, while reading the above changing bit pattern the PLC is liable to read a wrong number.

b) Reaction Time of Input Modules:

PLC I/O modules, even the TTL compatible ones, have lengthy and inconsistent time delays when they change their logic state. This inconsistency gets further compounded by long wiring runs between the decoder and the PLC, and also the limited current drive capability of the decoder outputs. In the above example, when the input to the I/O modules goes from 199° to 200°, the output may stay at 000 for a time, depending on the I/O module reaction time.



An I/O scan during this time (2 to 10 ms in typical installations) will read false data to the PLC. The solid line is the field side of the I/O module and the dashed line is the PLC side. During the switching time (TS), the decoder information as seen on the PLC side is 0, which is invalid.

Even dedicated microprocessor controls with faster scan times are faced with the above two problems, though to a lesser degree. In microprocessors the TS is in microseconds (µs) and software can be designed to ignore inconsistent data. If your microprocessor does not have this software provision or if you are using a PLC, the hardware synchronization described below must be used to assure the integrity of the incoming decoder data.

... to PLCs and Microcomputers

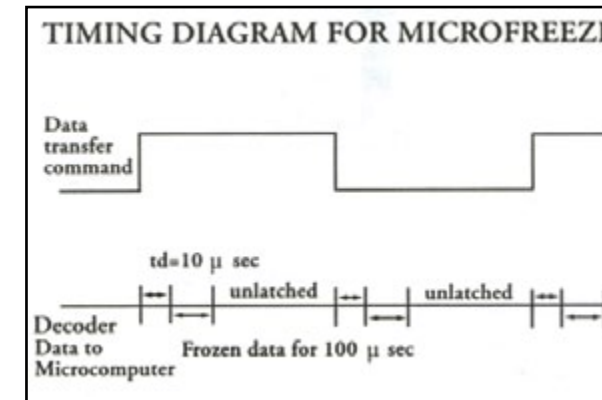
PLC Synchronization (PC-Handshake):

Whenever the PLC scans the decoder input, it must see stable data. In order to ensure this, the PLC gives a data transfer command and a predetermined time later the PLC synch circuit stabilizes the data for the PLC to read. This time is adjustable on some Autotech units (2 µs to 30 ms), whereas it is fixed on others (50 µs, 100 µs, etc.). The variable time feature, when available, can be used to provide the most fresh data to the PLC.

For example, the time interval between the data transfer and read commands might be 12 ms and say the time delay is set at 5 ms. After 5 ms of the data transfer command the stable data is available to the input modules of the PLC and when the PLC commands the data to be read 12 ms later, it is stable and valid.

Microcomputer Synchronization (Microfreeze):

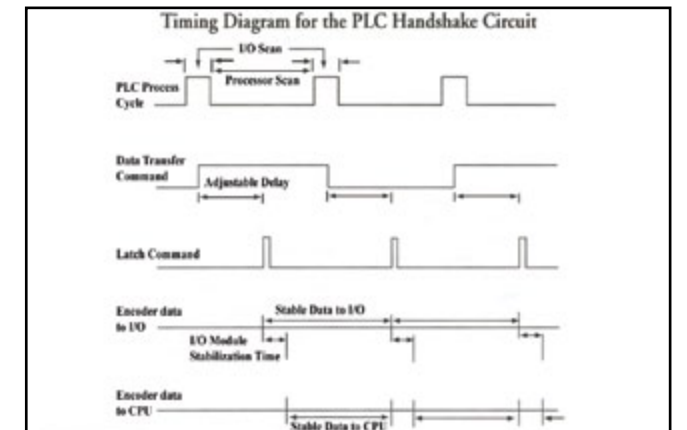
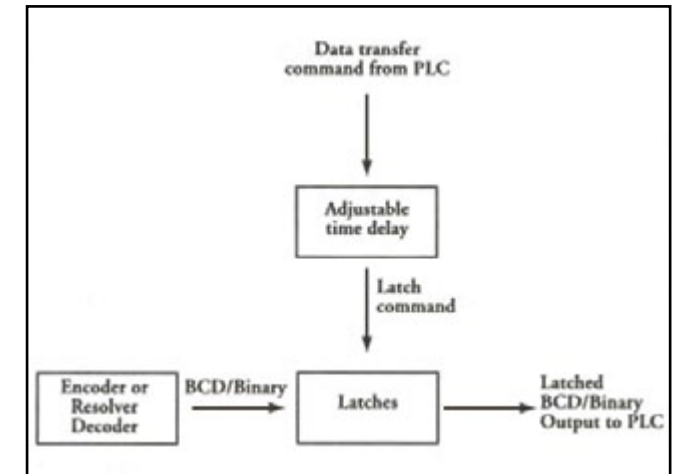
The Microfreeze can also be called as transparent PC-Handshake. This feature is particularly useful when interfacing data directly to a microcomputer where speed of operation is much higher. In this case the decoder position data is continuously updated at full speed. The data are frozen for 100 µs +/- 10% after a delay of 10 µs from either transition edge of data transfer command. The microcomputer can read stable data during these 100 µs and it automatically unlatches.



Software Filtering:

The problem of synchronizing BCD data to a PLC can also be addressed by software filtering. Software filtering is usually done in one of the following two ways:

1. A window is created around the last correct reading based on the known operating speed of the decoder. If new position is outside of this window, the data is rejected.



2. Three samples of position data are taken, of which two must agree before data is accepted.

Either of these approaches will increase the scan time of the PLC. Since scan time is an important factor in system speed and resolution, the software approach is usually not a viable approach.

Notes:

1. The synchronization problem does not exist when using Gray Code absolute decoders because only one bit changes state at a time.
2. The synchronization process described above does not result in faster machine operation. The system resolution and permissible decoder speed will still be limited by the PLC scan time. As a rule of thumb, a PLC with 16.67 ms (One AC cycle) scan time will permit 1° resolution at 10 RPM (The rule of 10:1:1).
3. **The Synchronization issues do not apply to Networkable Resolvers/Encoders because of built-in handshake.**

SMART-ENCODER™

Intuitive, Simple to Program without PC or Software, Shows Position/RPM on 4 digit LED Display

**A25-PI
Optical
Incremental**



**A25-RI
Resolver
Incremental**



Resolution Programming

Field Programmable

1 to 1024 counts per revolution

4096 Pulse Transitions with Quadrature 4x



Change Counts/Rev in seconds while installed and connected

- **NO laptop**
- **NO Special Cable**
- **NO Software**
- **NO Unplugging/plugging connectors**

Simple as 1-2-3



BEI H25 encoder series has literally 215 part numbers for different resolutions. Combine these with various output formats (3904, 7406, 3302, 681, 689, 7272, 4469 etc) and you literally have more than 1000 models. Dynapar is not that different. This presents a major challenge to the user community, particularly plants that have equipment coming from different machine manufacturers. **Plant stock room has to carry a large inventory and it is not uncommon to not have the one you need in an emergency.**

To solve this problem, BEI has recently introduced its Omnicoder™ series. The problem with Omnicoder is two fold:
1. You have to unplug the output connector/cable, it takes a computer software and special cable to program it and hence it can only be done on the bench.
2. It is too expensive.

Smart-Encoder™, solves both these problems. you can program the counts/rev while it is installed on the machine, without any laptop, special USB cable or software. It has an LED display to be able to check its operation on the spot as it shows counts and RPM. On top of all this, Smart-Encoder™ costs less than the current industry stand fixed count encoders from BEI and Dynapar.

As can be seen from its specification, its mechanical as well as electrical specifications are at par, if not better, than these other encoders.

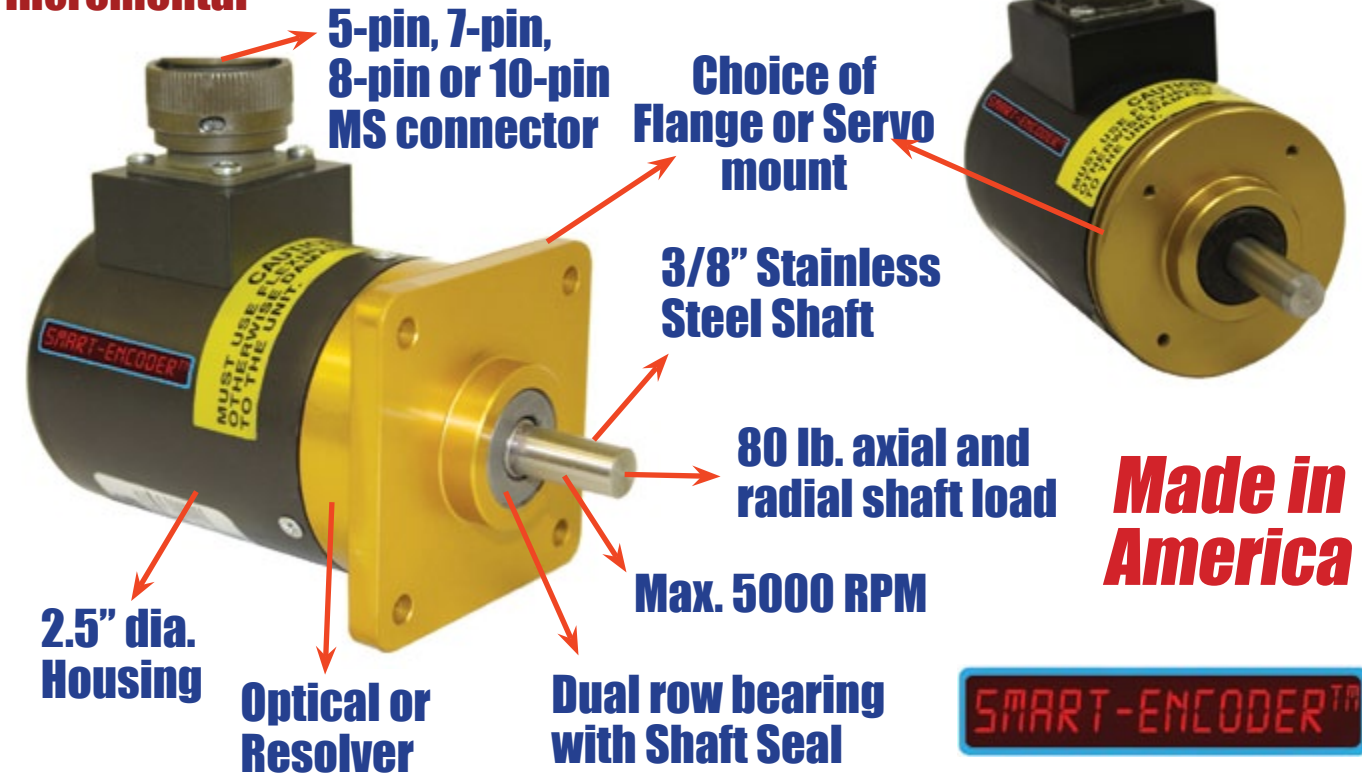
SMART-ENCODER™

Size 25 Drop-in Replacement for BEI/Dynapar (Mechanical & Electrical Form Fit & Function)


Robust, NEMA 4, Class I, DIV II, Conformal Coated boards, Aluminum or Stainless Steel Housing

**A25-PI
Optical
Incremental**

**A25-RI
Resolver
Incremental**



Made in America




10-pin, 17-pin, or 19-pin MS connector

12 bit, 1 to 4096 programmable resolution, binary, BCD, gray code, SSI, DeviceNet, Profibus or Ethernet (Rockwell Ethernet IP, Modbus TCP/IP, Utopic IP, GE SRTP protocols)

**A25-RA
Resolver Absolute**

Programming Absolute Encoder attributes



SMART-ENCODER™

Intuitive, Simple to Program without PC or Software, Shows Position/RPM on 4 digit LED Display



Field Programmable All-in-One

Incremental: 1 to 1024 counts per revolution

4096 Pulse Transitions with Quadrature 4x

Absolute: 1 to 4096 counts per revolution

Binary, BCD, Gray code Field Programmable Options

Programming Absolute Encoder attributes



Position/RPM Display

A40-RI Resolver Incremental

A40-RA Resolver Absolute



Program in seconds while installed and connected

- NO laptop
- NO Special Cable
- NO Software
- NO Unplugging/plugging connectors

Simple as 1-2-3



SSI, DeviceNet, Profibus or Ethernet
(Rockwell Ethernet IP, Modbus TCP/IP, Utopic IP, GE SRTP protocols)

Smart-Encoder Absolute models are available with high level networking capability such as SSI protocol, DeviceNet, Profibus or even Ethernet with multiple protocols such as Rockwell's Ethernet IP, Modbus TCP/IP, Utopic IP and GE SRTP.

First Encoder with built-in Ethernet

SMART-ENCODER™

Size 40 The Most Rugged Construction, 250,000+ in operation

Robust, NEMA 4, Class I, DIV II, Conformal Coated boards, Aluminum or Stainless Steel Housing

5-pin, 7-pin, 8-pin, 10-pin, 17-pin or 19-pin MS connectors *compatible with BEI and Dynapar Encoders*

Made in America



4.0" dia. Housing

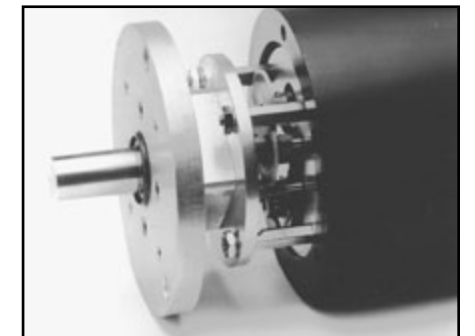
Optical or Resolver

Dual row bearing with Shaft Seal

5/8" Stainless Steel Shaft

120 lb. axial and radial shaft load

Max. 5000 RPM



Optional built-in gear train

SMART-ENCODER™

Choice of Stainless Steel, Water Submersible or Explosion Proof

Size 40 Smart Encoders, both Incremental as well as Absolute, are available in stainless steel, water submersible housing as well as an Fm approved explosion proof housing. where as the water submersible model has a visible display and programming buttons. The explosion proof unit needs to have its back end housing unscrewed to allow field programming

Stainless Steel Water Submersible



Explosion Proof

SMART-ENCODER™ Part Numbers and Specifications

How to select Part Numbers and Order ?

The primary selection here is the mechanical configuration and MS connector compatibility with BEI and Dynapar. Electrical parameters are mostly field programmable.

AXX - XX - X - XXXX - X - XXXX - XX - XXX
 1 2 3 4 5 6 7 8

- Choice of Size:**
 25 for size 25 or 2.5 dia
 40 for size 40 or 4.0 dia
- Choice of Incremental/Absolute/Optical/Resolver:**
 PI for Optical Incremental
 RI for Resolver Incremental
 RA for Resolver Absolute
- Mounting:**
 F for Flange Mount (A25)
 S for Servo Mount (A25)
 A for A40 Models
- Input power/Output driver (ET7272):**
 30V/V - Output follows power voltage (all models)
 30V/5 - Output voltage 5V, TTL compatible (all models)
 30V/N - Sinking (absolute models only)
- Output connector location:**
 E for End mount
 S for Side mount
- Output MS connector/Network connector:**
 05SL - 5pin Single line Incremental
 07SL - 7pin Single line Incremental
 07DL - 7pin Differential Incremental
 08SL - 8pin Single line Incremental
 08DL - 8pin Differential Incremental
 10DL - 10pin Differential M18 Incremental
 10DM - 10pin Differential M12 Incremental
 17SL - 17pin Single line Absolute
 19SL - 19pin Single line Absolute
 NWDN - DeviceNet connector Absolute
 NWPB - Profibus connector Absolute
 SSIC - SSI connector Absolute
 NWET - Ethernet connector Absolute

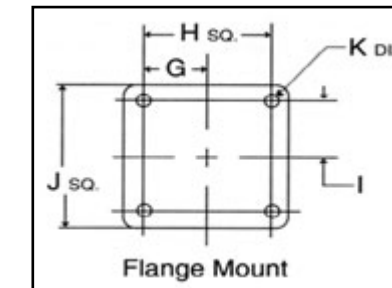
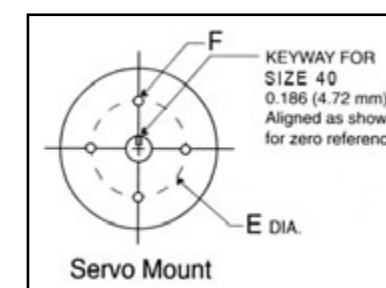
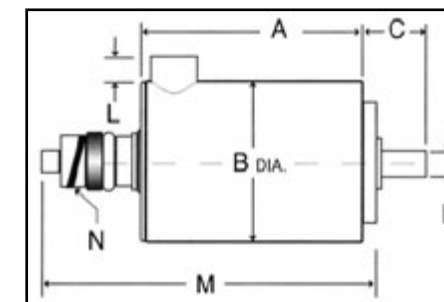
- Special Construction**
 SS - Stainless steel, Water submersible, size 25 or size 40
 EX - Explosion Proof, size 40
 AL - Standard Aluminum case, size 25 or size 40
- Gear Trains (Applicable only for size 40 encoders):**
 002 - 2:1 003 - 3:1 004 - 4:1
 005 - 5:1 008 - 8:1 010 - 10:1
 012 - 12:1 016 - 16:1 020 - 20:1
 024 - 24:1 032 - 32:1 038 - 38:1
 040 - 40:1 048 - 48:1 060 - 60:1
 064 - 64:1 080 - 80:1 100 - 100:1

Electrical Specifications:
 Input power voltage: Optical models 10VDC - 30VDC
 Resolver models 18VDC - 32VDC
 Input power current: Optical 100mA exclusive of load
 Resolver 250mA exclusive of load
 Reverse voltage protection: YES
Encoder Output Signals:
 Max. voltage 30VDC, max. current/output: 40mA
 Line driver device: ET7272
 "N" model: Sinking side of ET7272, no pull-up needed
 High voltage: Vcc -0.5V @20mA source current
 Low voltage: 0.5V @ 20mA sink current
Encoder Input Signals:
 High voltage: Min. 2.4VDC TTL compatible
 Low voltage: Max. 0.4VDC TTL compatible
Temperature Specifications:
 Operating: -10°C - 70°C
 Storage: -40°C - 85°C

Housing	Size 40 4.0" dia.	Size 40 explosion-proof 4.0" dia.	Size 25 2.5" dia.
Max. Starting Torque @ 25 °C (oz. in.)	8 (576.1)	8 (576.1)	5 (360.04)
Moment of Inertia (oz*in ²)	6.4 x 10 ⁻⁴	6.4 x 10 ⁻⁴	4 x 10 ⁻⁴
Max. Slew Speed (RPM)	5000	5000	5000
Shaft Size	5/8"	5/8"	3/8"
Max. Shaft Loading Axial and Radial:	120 lb.	120 lb.	80 lb.
Bearing Life at Max. Mfr. Spec. (Rev.)	2 x 10 ⁹	2 x 10 ⁹	2 x 10 ⁹
Shock		150 g for 11 ms	100 g for 11 ms
Vibration		20 g to 2000 Hz	20 g to 2000 Hz
Enclosure	NEMA 4/IP 66	NEMA 4X (Div. I, Class 1, Groups B, C, and D)	NEMA 4/IP 66

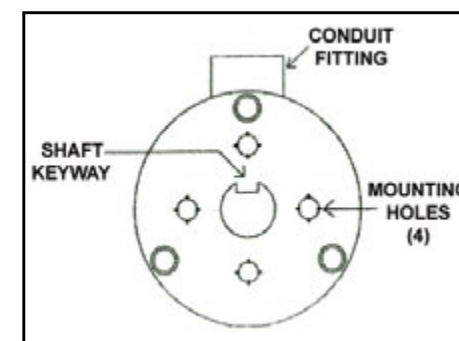
Smart-Encoder™ Dimensions & Mounting Table

Encoder Mounting Table				
Encoder Models	Size 40	Size 40 Explosion proof	Size 25 Resolver	Size 25 Optical
MEASUREMENTS (inches & mm)				
A	5.50 (139.7)	8.56 (217.5)	3.87 (98.3)	3.57 (90.7)
B (dia.)	4.0 (101.6)		2.50 (63.5)	
C	Servo Mount	*1.25 (31.8)	1.18 (30.0)	
	Flange Mount	—		
D (dia.)	0.625 (15.9)		0.38 (9.5)	
E (dia.)	2.50 (63.5)		2.0 (50.8)	
F	10-32 UNF		4-40 UNC	
G	—		1.03 (26.2)	
H (sq.)	—		2.06 (52.3)	
I	—		1.33 (33.8)	
J (sq.)	—		2.65 (67.6)	
K	—		0.22 (5.54)	
L	0.625 (15.9)		???????	
M	7.60 (193.0)	—	—	

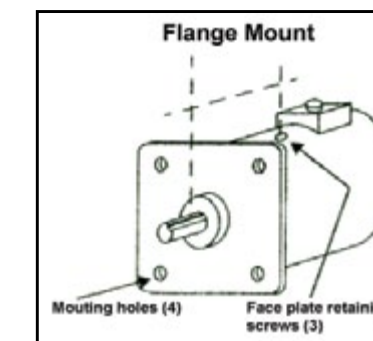
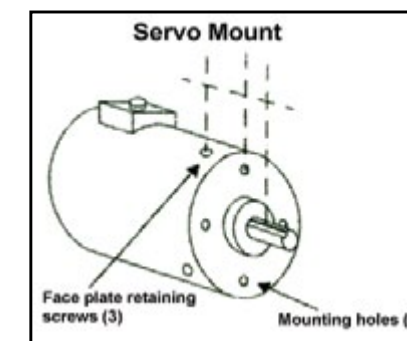


* Size 40 is not Servo mount

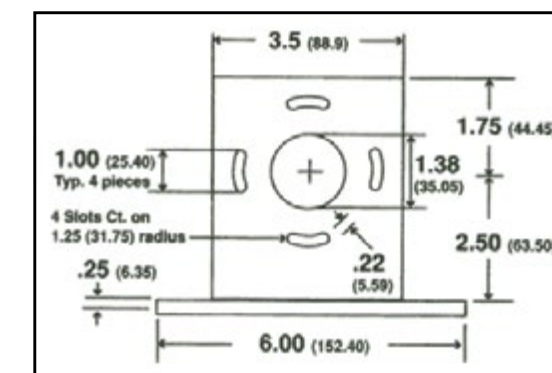
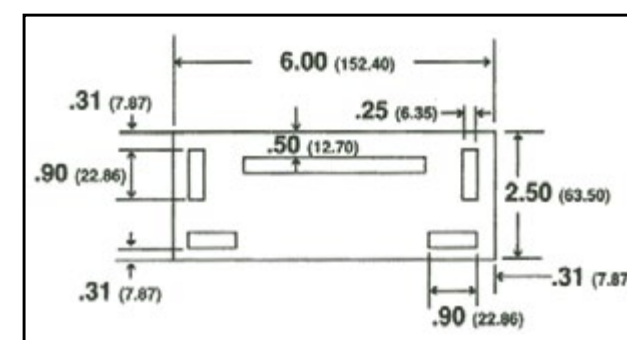
Zero Reference-Size 40 Encoders



Zero Reference-Size 25 Encoders

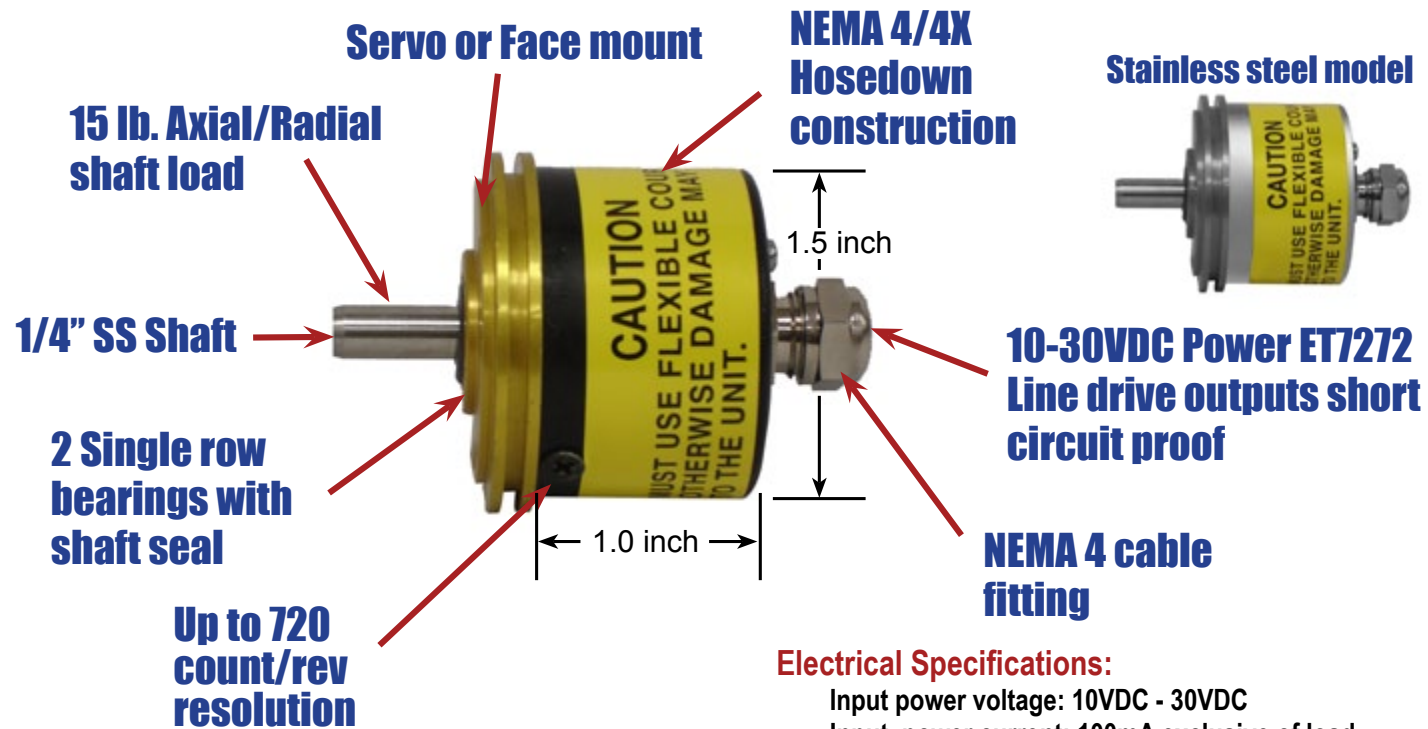


Size 40 Mounting Bracket Dimensions



Mini-Encoder™ Jewel of an Encoder

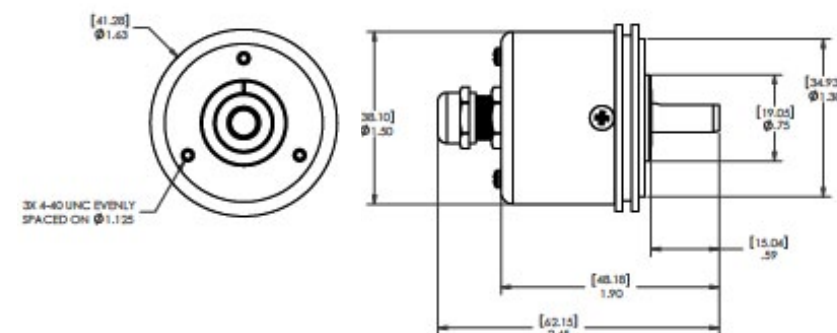
World's Smallest NEMA4, Heavy Duty Encoder



Mechanical & Environmental Specifications

Housing	Size 15 1.5" dia.
Max. Starting Torque @ 25 °C (oz. in.)	2
Moment of Inertia (oz*in ²)	2 x 10 ⁻⁴
Max. Slew Speed (RPM)	5000
Shaft Size	1/4"
Max. Shaft Loading Axial and Radial:	15 lb.
Bearing Life at Max. Mfr. Spec. (Rev.)	2 x 10 ⁹
Shock	100 g for 11 ms
Vibration	20 g to 2000 Hz
Enclosure	NEMA 4/IP 66

Mechanical Dimensions



Electrical Specifications:

Input power voltage: 10VDC - 30VDC
 Input power current: 100mA exclusive of load
 Reverse voltage protection: YES

Encoder Output Signals:

Max. voltage 30VDC, max. current/output: 40mA
 Line driver device: ET7272
 "N" model: Sinking side of ET7272, no pull-up needed
 High voltage: Vcc -0.5V @20mA source current
 Low voltage: 0.5V @ 20mA sink current

Temperature Specifications:

Operating: -10°C - 70°C
 Storage: -40°C - 85°C

How to Order

A15-XXXX-XX-XX-XXX
 1 2 3 4

1. Input power/Output driver (ET7272):

- a) 30V/V - Output voltage follows power input voltage
- b) 30V/5 - Output voltage 5V, TTL compatible

2. Special Construction

- a) SS - Stainless steel, Water submersible
- b) AL - Standard Aluminum case

3. Cable Type:

- a) C4 - 4 conductor shielded
- b) C6 - 6 conductor shielded

4. Cable Length: (in ft.)

- 1.5, 003, 005, 010, 020,
- 030,050,100

DigiSolver No.1 Absolute Resolver Encoder for Rough Environments such as the Tire Industry, Automotive, Brick Presses, and others.

Potted Electronics

- Multi-turn, 18-bit Binary or 15-bit BCD and Gray Code absolute output.

- Short-circuit-proof outputs.

- No optics, MIL-grade Resolver and Potted Electronics.

- 8-30 VDC voltage range.



- Choice of mounting styles and enclosures.

-20 °C to 85 °C Operating Temperature

- Single-turn, 13-bit Binary, Gray Code, or BCD absolute output.

- Flexible options of counts-per-turn.

- Built-in Synchronization for PLCs.

Digisolver Specifications

Electrical

Input Power:

Voltage: 5 VDC ±5%, or 8-30 VDC
 Current: 0.55 A, Single-turn; 0.75 A, Multi-turn

Power-on Settling Time:

For 130 ms after power is turned ON, the encoder output is frozen as follows: T & N: all zeros, P & C: all ones
 After 130 ms, the DigiSolver reads the TRUE position.

Position Output

Output Format and Number of Words/Counts:

- a) Single-turn and Geared Single-turn Units:
 Gray Code (G): 256, 512, 1024, 4096, and 8192
 Binary (B): 1024, 4096, and 8192
 BCD (D): 360, 1000, and 3600
 (Custom Counts available consult factory)
 Analog (A): 4-20 mA (sinking or sourcing) or 0-10 VDC output, 0.1% Repeatability, 1% Accuracy of full scale.
 (Consult factory for higher accuracy models)
 Built-in Gear Ratios: 2:1, 3:1, 4:1, 8:1, 12:1, 16:1, 20:1, 24:1, 32:1, 36:1, 40:1, 48:1, 60:1, 64:1, 80:1, 100:1
- b) Multi-turn Units:
 18-bit Binary over 64 turns, 12-bit per revolution, 6-bits for 64 turns. 15-bit BCD or Gray Code over 32 turns, 10-bits per revolution, 5-bits for 32 turns, Built-in gear train of 64:1 or 32:1

Output Drivers

- T: Tristate (Multiplexing): TTL (74LS 645), high Logic TRUE
 Logic True: 2V @ 15 mA, 20 mA leakage when tristated
 Logic False: 0.35 V @ 24 mA, 0.4 mA leakage when tristated
 MUX input: Low active, TTL level
- P: Source Transistor: Vmax = 30 V, high Logic TRUE (Sprague UDN-2981A)
 Logic TRUE: Transistor ON, 1.7 V drop @ 100 Ma

Logic FALSE: Transistor OFF, 0.2 mA leak. @ 50 V.

On ES the P-type outputs are short-circuit-proof and are rated 20 mA @ 50 VDC

N: Sink Transistor: Vmax = 30 V, low Logic TRUE (Sprague ULN-2803A)

Logic TRUE: Transistor ON, 1.1 V drop @ 100 mA
 Logic FALSE: Transistor OFF, 0.1 mA leak. @ 50 V.

C: Sink Transistor: Vmax = 30 V, high Logic TRUE (Sprague ULN-2803A)

Logic TRUE: Transistor OFF, 0.1 mA leak. @ 50 V
 Logic FALSE: Transistor ON, 1.1 V drop @ 100 mA.

Output Timing

P: PLC Synchronization Option: Encoder position data is latched 50 µs to 3 ms (factory set at 3 ms, field-adjustable) after either transition edge of data transfer command from PLC. (Nonretriggerable during timing period)

O: Transparent/Microfreeze Option: Encoder position data is continuously updated at full speed. The data is frozen (Microfreeze) for 100 ±10% µs within 10 µs of either transition edge of data transfer command. Data transfer command is not required if Microfreeze is not needed.

Data Transfer Command:
 TTL compatible, 2.2 K½ internal pull-up to 5 V, high Logic TRUE, edge-triggered.
 High level: 3.5 to 30 VDC, Low level: 0 to 1 VDC
 Pulse width: Minimum 10 µs

Optional Outputs

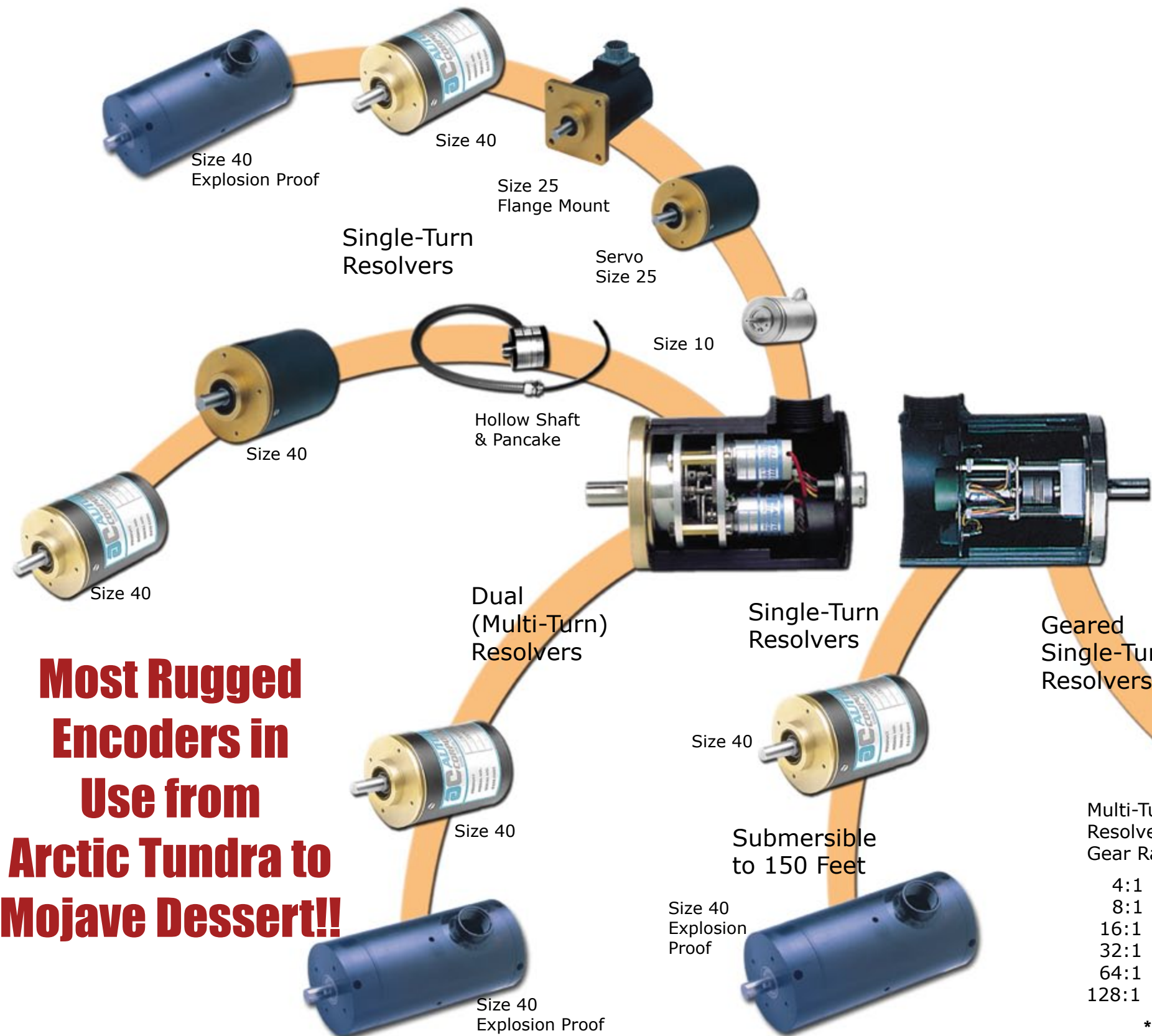
Analog Tach Output: 100 RPM/Volt for 0 to +10 VDC (0 Volt = 0 RPM) or 100 RPM/1.6 mA for 4-20 mA (4 mA = 0 RPM).
 Direction Output: TTL, HIGH = CCW, LOW = CW
 Revolution Count (Marker Pulse): Negative pulse, TTL, pulse width 0.3, 3.0 µs

***Refer to Autotech Encoder price book on How to Order**



Resolvers with Remote Decoder Work in Boiling Water!

-55°C to 120°C, 200g Shock, Submersible under water, can be 2500 ft. away from Decoder



**Most Rugged
Encoders in
Use from
Arctic Tundra to
Mojave Dessert!!**

Resolver Specifications

Mechanical:				
Resolver	SAC-RL100 SAC-RL210	E8R-RL101 E8R-RL210-xxxMC	E7R-RL101	SAC-RL101
Housing	Size 40 4.0" dia. (101.6 mm)	Size 40 explosion- proof 4.0" dia. (101.6 mm)	Size 25 2.5" dia. (63.5 mm)	Size 11 1.1" dia. (27.94 mm)
Max. Starting Torque oz. in. @ 77 °F: (gm/cm @ 25 °C):	8 (576.1)	8 (576.1)	5 (360.04)	0.07 (5.04)
Moment of Inertia (gm/cm ²):	45	45	45	3.3
Max. Slew Speed: (RPM)	5000	5000	5000	5000
Shaft Size:	5/8" (15.88 mm)	5/8" (15.88 mm)	3/8" (9.53 mm)	0.120" (3.05 mm)
Max. Shaft Loading Axial :	50 lb. (22.68 kg)	50 lb. (22.68 kg)	40 lb. (18.14 kg)	0.3 lb. 0.7 lb.(0.32 kg)
Radial:	100 lb. (45.36 kg)	100 lb. (45.36 kg)	36 lb. (16.33 kg)	
Bearing Life at Max. Mfr. Spec. (Rev.)	2 x 10 ⁹	2 x 10 ⁹	2 x 10 ⁹	2 x 10 ⁹
Approx. Weight:	6 lb. (2.72 kg)	8 lb. (3.62 kg)	1 lb. (0.45 kg)	0.25 lb. (0.11 kg)
Environmental				
Shock:	200 g for 11 ms		50 g for 11 ms	
Vibration:	20 g to 2000 Hz		15 g to 2000 Hz	
Temperature:				
Operating:	-67 °F to +248 °F (-55 °C to +120 °C)			
Storage:	-85 °F to +302 °F (-65 °C to +150 °C)			
Enclosure:	NEMA 13	NEMA 4X (Div. I, Class 1, Groups B, C, and D)	NEMA 13	NEMA 1

Single-Turn Gear Ratios	2:1 3:1 4:1 5:1 8:1 10:1 12:1 16:1 20:1 24:1 32:1 38:1 40:1 48:1 60:1 64:1 80:1 100:1
Multi-Turn Resolver Gear Ratios	4:1 8:1 16:1 32:1 64:1 128:1

*Refer to Autotech Encoder price book on How to Order

Single-Turn, Single-Channel: The Most Versatile Small Footprint Resolver-to-Digital Decoder

Extremely rugged and reliable resolver as position transducer

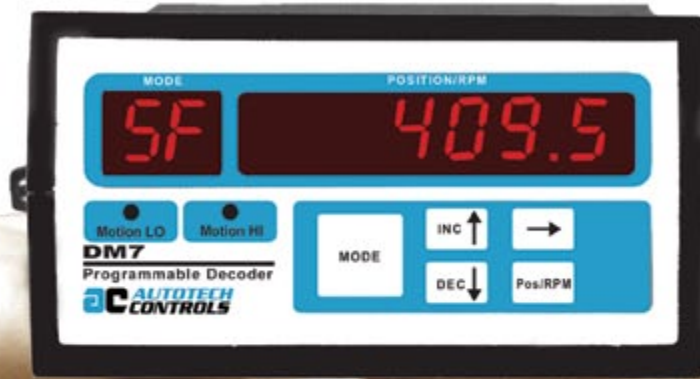
Incredibly small size; only 9 square-inch panel space

Full-scale programmable zero offset for easy setup and programmable resolution; 20-16384 counts-per-turn

Direction output and zero marker plus

Built-in PC synch circuit permits interface to any PLC along with built-in digital tach and over/under-speed switch

1/8" DIN Package



NEW

SSI, DeviceNet, Profibus, Interbus or Ethernet options (Rockwell Ethernet IP, Modbus TCP/IP, Utopic IP, GE SRTP protocols)

16384 Counts Per Turn, Absolute Ratiometric Decoder Highest Immunity to Electrical Noise, All Inputs/Outputs Optically isolated

Fully absolute position means no loss of position under any situation

Highly noise-immune ratiometric tracking converter

Optically isolated outputs and Self-Diagnostics with fault output

Front panel selectable output formats: BCD, Binary, or Gray Code

Short Circuit proof resolver wiring with broken wire detector

DM7 Specifications

Input Power:

AC: 105 to 135 VAC, 7 VA; Optional 220, 240 VAC
 DC: 11 to 28 VDC, 100 mA (typical) exclusive of load
 Operating Temperature: -10 °F to +130 °F (-23 °C to +55 °C)
 Position Transducer: AVG Automation's series RL100, E7R, E8R, or RL101 resolvers
 Signal Resolution: 4096 counts/turn, 16384 optional
 Scale Factor: 20 to 4096, programmable
 Output Update Rate: 200µs
 Programmable Offset: Full revolution
 Decimal Point: Programmable after any digit
 Resolver Cable Length: 2500 ft. (762 m) max., shielded

Outputs:

(All outputs have to be the same)
 Type of Outputs:
 Output Interface: T, P, N, or C
 T: LS TTL (74LS645):
 Logic TRUE: 2 VDC @ 15 mA, 20 mA leakage when tristated
 Logic FALSE: 0.35 V @ 24 mA, 0.4 mA leakage when tristated
 MUX Input: Low active TTL level
 Logic TRUE: 0-0.8 V
 Logic FALSE: 2-5 V
 P: PNP source transistor:
 Logic TRUE: Transistor ON, 1.7 V drop @ 100 mA
 Logic FALSE: Transistor OFF, 0.2 mA leakage @ 50 V
 N: NPN sink transistor:
 Logic TRUE: Transistor ON, 1.1 V max @ 100 mA
 Logic FALSE: Transistor OFF, 0.1 mA leakage @ 50 V
 C: NPN sink transistor:
 Logic TRUE: Transistor OFF, 0.1 mA leakage @ 50 V
 Logic FALSE: Transistor ON, 1.1 V max @ 100 mA
 Position Output Format: Front Panel selectable BCD, Gray Code, Binary
 Motion Outputs: Two; Over-speed & Under-speed; active high
 Direction Output: Logic TRUE for increasing position
 Marker Pulse: Zero crossing pulse 200µs min. to 1.0 ms max.
 Output Isolation: All outputs optically isolated up to 2500 Volts

Inputs:

Program Enable, Output Enable, and Data Transfer Logic of inputs determined by output option.
 For P-type units:
 Enable or TRUE: 11.0 to 28.0 VDC @ mA max. or tied to Vs+
 Disable or FALSE: 2.0 VDC @ 0.2 mA max. or open circuit
 For N-type units:
 Enable or TRUE: 1.0 VDC @ -3.0 mA max. or tie to Vs-
 Disable or FALSE: 3.8 VDC to 28 VDC Max @ -0.2 mA max. or open circuit.
 Data Transfer Input:
 0-24 VDC logic: Edge-triggered (i.e., data transfer on both rising and falling edges)
 Low-Level: 0 to 0.8 V @ 3.2 mA
 High-Level: 2.4 V @ 0.4 mA
 Minimum pulse width: 30µs
 Timing: Depends upon the PC synch option selected from keyboard:
 PC Synchronization mode: Updates position output within 150µs of a transition edge (LOW-to-HIGH, or HIGH-to-LOW) at data transfer input.
 Transparent Mode/Microfreeze: Output data is continuously updated at full speed. The data is latched for 100µs +/- 10% within 10µs of a transition (HIGH-to-LOW or LOW-to-HIGH) at data transfer input.

*Refer to Autotech Encoder price book on How to Order

Programmable Decoder for Multi-Turn Resolvers Includes three Programmable Limit Outputs

M10 Model: Programmable semi-absolute position encoder, resolver input, and 6-digit output.

M10A Model: Fully Absolute, dual resolver input, 6-digit output.

Prescalable, Presetable, and Solid-state replacement for electromagnetical Selsyn systems.

Simple, front panel programming of counts-per-turn, no mechanical gear trains. **M10A Model:** Very easy-to-calibrate, no calculations required for gear ratios.

Two built-in PLS outputs and Motion output.

No batteries, nonvolatile EEROM memory as well as PC-handshake for PLC synchronization.

Extremely small 1/8" DIN package, reliable under extreme environments, splash-proof oil-tight front plate.

Tachometer and Self-Diagnostics.

Optically-isolated outputs provide high system integrity under noise conditions and System Security to prevent program tampering.

19-bit Resolution

Snap Track Mount Models DM2-STRAK-xxxx and DS2-STRAK-xxxx

Decoder for single or dual resolvers.

PNP sourcing, NPN sinking or TTL outputs. P and N outputs short-circuit-proof.

11 - 28 VDC Power.

Gear Ratio, output code, output update method DIP switch selectable on dual Resolver model.

Master or Slave units.

Complimentary quadrature pulse train output on single Resolver model.

Broken resolver cable indication and short-circuit-proof resolver interface.

*Refer to Autotech Encoder price book on How to Order

Putting Resolvers on a Device-Level Network Increases Reliability, Adds Diagnostics, and Lowers Installed Costs

- Gear Single-Turn Ratios
- 2:1
- 3:1
- 4:1
- 5:1
- 8:1
- 10:1
- 12:1
- 16:1
- 20:1
- 24:1
- 32:1
- 36:1
- 38:1
- 40:1
- 48:1
- 60:1
- 64:1
- 80:1
- 100:1



Attributes Programmable over Network

Device-Level Networks reduce the complexity of the control system in terms of hardware outlay. PLC I/O hardware requirements are substantially reduced = cost savings!

DeviceNet Resolvers (slave) powered from Network. 5 Pin DeviceNet miniconnector. 125K, 250K, or 500K Baud Rates. Strobe, Polling, and COS modes. Programmable counts per turn over Network.

Network Programmable DeviceNet Resolvers formats (Binary, BCD, Gray Code). Single and Geared Models. 12 Bit (4096) resolution up to 2500 RPM. 2 Frame sizes 25 (2.5" diameter) & 40 (4" diameter).

Profibus Resolvers (DP slave). Network Programmable formats Binary, BCD, and Gray Code. Single and Geared models. 12 Bit (4096) resolution up to 2500 RPM. Two Frame sizes 25 (2.5" diameter) and 40 (4" diameter). 9.6 kbps to 12 Mbps transmission speeds. Programmable counts per turn over Network. 16-32 VDC Power.

Interbus Resolvers Network Programmable formats Binary, BCD, and Gray Code. Single and Geared models. 12 Bit (4096) resolution up to 2500 RPM. Two Frame sizes 25 (2.5" diameter) and 40 (4" diameter). Programmable counts per turn over Network. 10-30 VDC Power

Interbus Multi-turn Resolver 128:1 Dual-gear Resolvers. 17-Bit, 128-Turn, 1024 counts/turn Gray Code output. 10-30 VDC Power.

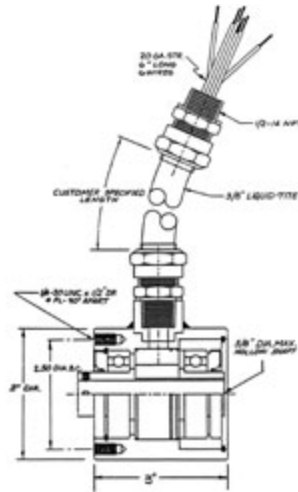
Modbus Plus Resolver Redundant Single-Turn Dual Resolver Output format binary 360 only. One resolver analog output (mil connector). Second resolver Modbus Plus Output. Size 40 frame only. 16-28 VDC Power.

Network Resolvers are a slave on the network so they do not effect network speed.

*Check for availability of Multi-Turn DeviceNet and Profibus resolvers.

RL500 Hollow Shaft Resolver

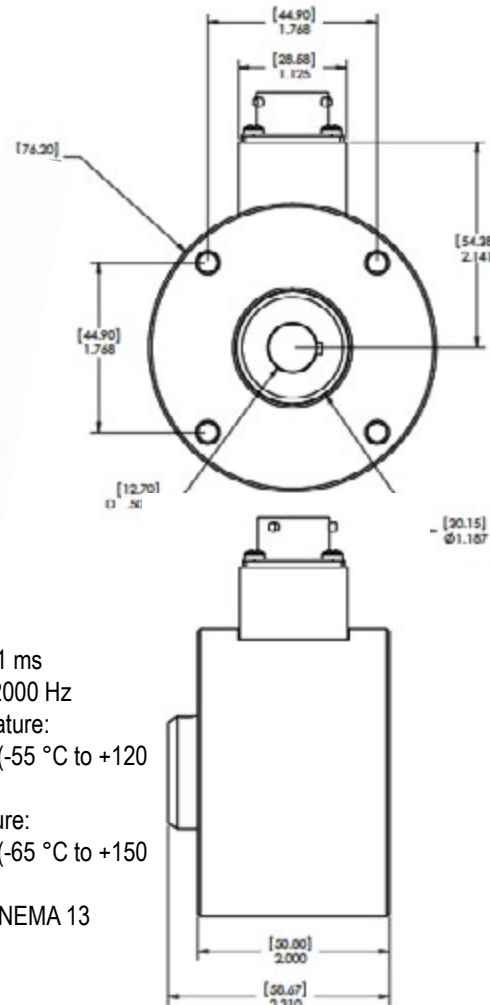
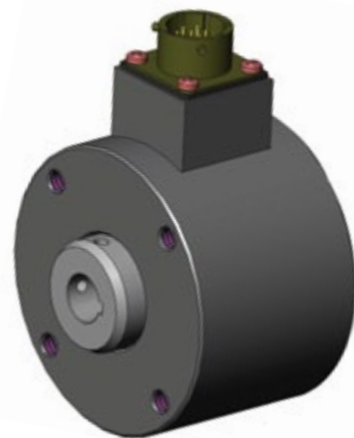
The RL500 Hollow Shaft Resolver is intended for those applications where there is a projecting 5/8" (15.88 mm) diameter shaft (machine shaft, double-ended motor shaft, etc.) available at the point where the user wishes to take rotational readings. Instead of having to make provisions to install a traditional resolver, which has to be installed with a bracket and coupled to a shaft on the machine, as long as there is a 3" (76.2 mm) shaft projection, the RL500 can be mounted directly to the machine.



- | | |
|-------------------------------------|--|
| Electrical: | Mechanical: |
| Frequency: 2250 Hz | Max. Slew Speed: 5000 RPM |
| Input Voltage: 1.88 V | Max. Shaft Loading: |
| Input Current: 6 mA | Axial: 50 lb. (22.68 kg) |
| Input Power: 6.5 mW | Radial: 100 lb. (45.36 kg) |
| Open Circuit Zro: 180+j256 1/2 | Bearing Life at Max. Mfr. Spec. (Rev): 2 x 109 |
| DC Resistance(Rotor): 18.3 1/2 | Approx. Weight: 7 lb. (3.18 kg) |
| Output Voltage (Stator): 2.63 V ±5% | Diameter: 3" (76.2 mm) |
| Transformation Ratio: 1.400:1 | Height: 3" (76.2 mm) |
| | Internal Diameter: 0.708"(18.0 mm) |

RL501 "Pancake" Resolver

The RL501 Pancake Resolver is intended for those applications where there is a projecting 1/2" (12.7 mm) diameter shaft (machine shaft, double-ended motor shaft, etc.) available at the point where the user wishes to take rotational readings. Only 1" (25.4 mm) thick, the RL501 can be installed in applications where space is very constricted. Instead of having to make provisions to install a traditional resolver which has to couple to a shaft on the machine, as long as there is a 1" (25.4 mm) shaft projection, the RL501 can be mounted directly to the machine.

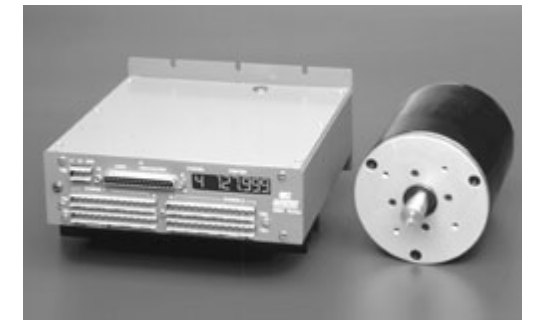


- | | |
|-------------------------------------|--|
| Electrical: | Mechanical: |
| Frequency: 2250 Hz | Max. Slew Speed: 5000 RPM |
| Input Voltage: 1.88 V | Max. Shaft Loading: |
| Input Current: 6 mA | Axial: 50 lb. (22.68 kg) |
| Input Power: 6.5 mW | Radial: 100 lb. (45.36 kg) |
| Open Circuit Zro: 180+j256 1/2 | Bearing Life at Max. Mfr. Spec. (Rev): 2 x 109 |
| DC Resistance (Rotor): 18.3 1/2 | Approx. Weight: 7 lb. (3.18 kg) |
| Output Voltage (Stator): 2.63 V ±5% | Diameter: 2.062" (52.37 mm) |
| Transformation Ratio: 1.400:1 | Height: 1.062" (26.97 mm) |
| | Internal Diameter: 0.500" (12.7 mm) |

- | |
|--|
| Environmental: |
| Shock: 200 g for 11 ms |
| Vibration: 20 g to 2000 Hz |
| Operating Temperature: -67 °F to +248 °F (-55 °C to +120 °C) |
| Storage Temperature: -85 °F to +302 °F (-65 °C to +150 °C) |
| Enclosure Rating: NEMA 13 |

DMS/DMM Multi-Axis Single/Multi-Turn Cost Effective Resolver Decoders

8 Resolvers for Single-Turn and 4 Dual Resolvers for Multi-Turn Decoders



Principle of Operation

The DMS/DMM decoders are available with either output or input multiplexing. The resolver analog signals are converted to the output digital format by a tracking resolver-to-digital converter. With input multiplexing, the analog signals are multiplexed to a single digital converter. In output multiplexing, multiple decoders are multiplexed to the parallel digital output port. The binary code at the input selects a particular resolver for output, as well as the gear ratio for the selected resolver. Output multiplexing allows for a fast response and is recommended for high-speed operations. In the input multiplexing versions, there is a 100 msec settling time after a change in resolver selection before the data is stable. The output multiplexing has only 15 µs settling time.

- 8-axis single-turn & 4-axis multi-turn, for up to eight resolver inputs
- Reduce cost and save space by interfacing multiple axes to one controller
- Optically isolated outputs available
- High-resolution: Up to 4096 counts/turn
- Position display for easy setup and troubleshooting
- Variety of outputs and PC-handshake allow interface to any PLC or embedded controller, BCD, Binary, or Gray Code output formats
- Fast: Operation to 1800 rpm
- Decoder sharing for multiple resolvers reduces cost

Input Power:

AC: 105-135 V or 210-270 V, 50/60 Hz, 5 W
 DC: 8 -30 VDC @ 0.25 A, exclusive of load (without using optical isolation, an external power supply is needed only for PNP outputs)

Operating Temperature: -10 °F to +130 °F (-2 °C to +55 °C)

Position Transducer: AVG Automation's RL100, E7R, E8R, or RL101 single-turn resolvers.

Maximum Cable Length between Resolver and DMS: 2500 ft (762 m), shielded twisted-pair

Output Format and Resolution:

BCD: 360, 1000, or 3600 counts-per-turn
 Natural Binary: 1000, 1024, 3600 or 4096 counts-per-turn
 Gray code: 256, 360, 512, 1000, 1024, 3600, or 4096 counts-per-turn

Resolver shaft speed: 3600 RPM (max.)

Resolver-to-digital decoder tracking speed: 1800RPM

Display: 3 or 4 digits, 0.25" (6.35 mm) LEDs

Optical Isolation (Optional): 2500 Volts, on all I/Os except resolver

Input Logic (Channel Select, PLC Sync; Gear Select):

28 VDC Max:

N-type:	C-type:
Logic FALSE: 3.8 V @ 0.4 mA;	Logic FALSE: 0 to 0.8 V @ 3.2 mA;
Logic TRUE: 0 to 0.8 V @ 3.2 mA	Logic TRUE: 3.8 V @ 0.4 mA

0 to 5 VDC Logic:

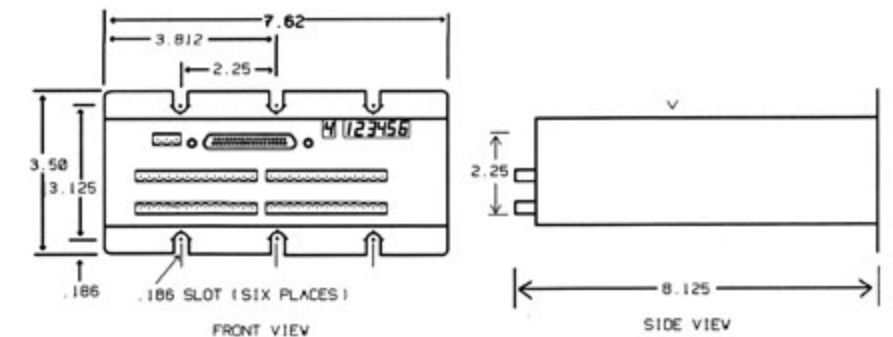
T-type:	P-type:
Logic FALSE: 0 to 0.8 V @ 3.2mA;	Logic FALSE: 0 to 0.8 V @ 4 mA;
Logic TRUE: 2.4 V @ 0.4 mA	Logic TRUE: 2.4 V @ 3.2 mA

Channel Select Timing:

Input Multiplexing: 100 ms from channel select

Output Multiplexing: 15 µs from channel select

Gear Select Timing: 15 µs from gear ratio select input



Output Type	T:TTL * (74LS645)	P: PNP Source Transistor (Sprague UDN-2981A)	N: NPN Sink Transistor Low TRUE (Sprague ULN-2803A)	C: NPN Sink Transistor High TRUE (Sprague ULN-2803A)
Logic TRUE	2 VDC @ 15 mA 2.4 V @ 3 mA (20 µA leakage when Tristated)	Transistor ON 1.7 V drop @ 100 mA	Transistor ON 1.1 V @ 100 mA	Collector Open 0.1 mA leakage @ 50 VDC
Logic FALSE	0.35 V @ 24 mA (0.4 mA leakage when Tristated)	Transistor OFF 0.2 mA leakage @ 50 VDC	Collector Open 0.1 mA leakage @ 50 VDC	Transistor ON 1.1 V @ 100 mA

* Note: Multiplexing or Tristating Input = Low active TTL level (i.e., Logic TRUE: 0-0.8 V; Logic FALSE: 2 VDC)

Summary of Encoder Specifications

	Smart-Encoder™ optical	Smart-Encoder™ Resolver	Mini-Encoder™ Resolver	DM7, M1150-M10, M1150-M10A	DigiSolver	Network Resolver	DMS/DMM
Application:	Incremental	Incremental or Absolute	Incremental	Single-Turn, Resolver for DM7 & M1150-M10, Dual Multi-Turn Resolver for M1150-M10A	Single- or Multi-Turn Resolver	Dual Multi-Turn Resolver for Interbus, Single-Turn for all Others	Single-Turn Resolver for DMS, Dual Multi-Turn for DMM
Position Input Device:	Optical	Resolver	Optical	Resolver	Resolver	Resolver	Resolver
Absolute: Fully Absolute	Incremental	Absolute	Incremental	Absolute for DM7 and M1150-M10A, Absolute as long as shaft does not move over 1/2 turn with power off for M1150-M10	Absolute	Absolute	Absolute
Output up-date rate:	<10 µs	<10 µs, depends on Network speed when using this option	<10 µs	200 µs for DM7, 1.4ms for M1150-M10/M1150-M10A	<1 µs, hardwired	Depends on Network speed	<1 µs for normal operation, Switching: 100ms for input mux, 15 µs for output mux
Resolution: (counts/turn)	Programmable 1024 4096 with X4	Programmable Incr: 1024 4096 with X4 Absolute: 4096	Up to 720 2880 with X4	Programmable 4096 per turn	Up to 8192 (13 bits) 18 bits (multi-turn)	Programmable 10-4096	Up to 4096 per turn
Display	4-digit LED	4-digit LED	No	Yes, Up to 8 digit	No	No	Yes, 5 digit for DMM & 7 digit for DMS
Output Format:	Quadrature	Incr: Quadrature, Absolute: BCD, Binay, Gray or Network format	Quadrature	BCD, Binary, Gray or Network format	BCD, Binary, Gray Code, or Analog, 0-10 V or 4-20 mA	Network format	BCD, Binary, or Gray
Output Type:	ET7272	ET7272 or Network format	ET7272	TTL, PNP, & NPN	TTL, PNP, or NPN	TTL, PNP, or NPN	TTL, PNP, or NPN
Optical Isolation	No	No	No	Yes	No	Yes	No
Integral/Remote Decoder:	Integral	Integral	Integral	Remote	Integral	Integral	Remote
PC-Synchronization:	NA	latch Control	NA	Yes, Programmable	Yes, optional	Yes, programmable	Yes, optional
Networking:	NA	Optional	NA	Optional	NO	YES	NO
NEMA Rating:	NEMA 4/4X	NEMA 4/4X	NEMA 4/4X	NEMA 12 face plate, NEMA 13 for Resolver	NEMA 13 or explosion-proof	NEMA 13	NEMA 1 for Decoder, NEMA13 for Resolver
Physical Size, in. Height: Width: Depth:	Size 25, 2.5" dia., depth <3.1", Size 40 4" dia. depth model dependant	Size 25, 2.5" dia., depth <4", Size 40 4" dia. depth model dependant	Size 15, 1.5" dia., depth <1" excluding cable connector	2.19", 4.11", 6.12"	Size 40-4" dia. or Size 25-2.5" dia., depth model dependant	Size 40-4" dia. or Size 25-2.5" dia., depth model dependant	3.5" 7.62" 8.125"
Max shaft load: Axial/Radial:	80 Size 25, 120 Size 40	80 Size 25, 120 Size 40	15	80 Size 25, 120 Size 40	80 Size 25, 120 Size 40	80 Size 25, 120 Size 40	80 Size 25, 120 Size 40
Shaft size	3/8", 5/8"	3/8", 5/8"	1/4"	3/8", 5/8"	3/8", 5/8"	3/8", 5/8"	3/8", 5/8"
Encoder Shock Rating:	150g for size 40 100g for size 25, 11ms	150g for size 40 100g for size 25, 11ms	50g 11ms	200g 11ms	200g 11ms	200g 11ms	150g for size 40 100g for size 25, 11ms
Encoder Vibration Rating:	20g to 2000 Hz						
Encoder Operating temp. Ambient	-10°C to 70°C	-10°C to 70°C	-10°C to 70°C	-55°C to 120°C	-20°C to 85°C	-10°C to 70°C	-55°C to 120°C
Field-Selectable CW/CCW	NA	YES	NA	YES	YES	YES	YES
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Accessories

Connectors and Cables



Mateing connectors with or without cable for all encoders in this catalog are available in various cable lengths. Please consult the Encoder price book for details.

Flexible Couplings



1/4", 3/8", 5/8" flexible helical couplings for all Encoders in this catalog are available in different sizes. Please consult the Encoder price book for details.

Mounting Bracket



Mounting brackets for size 40 Encoders in this catalog are available. Please consult the Encoder price book for details.

Custom Accessories

Autotech will be glad to provide you with any custom accessory needs. Pease consult the factory or your local distributor.

Smart-Power™



24V DC, 30W, 60W and 90W Din mount compact switch mode power supplies from Autotech feature adjustable voltage, a 3-digit voltage display, a 2-digit current display and an alarm signal. These smart power supplies also display hours of operation as well as expected life expectancy. See price book for details.

Smart-Counter™



8-digit Smart-Counter™ features two encoder inputs and multiple operating modes for most common encoder applications in the industry. Smart counter can be configured using PC and a simple computer software or it can also be programmed using two push buttons and an alphanumeric display. Programming both ways is as easy as 1-2-3

AUTOTECH
Your Encoder Company



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