Smart-Encoder™ : Resolver Incremental

1. Introduction

The Smart-Encoder effectively eliminates multiple encoder part numbers by bringing intelligence and security to its design. In seconds, a four-digit LED display with two push-buttons enables the Smart-Encoder to change its resolution (pulses per revolution) and set a password to protect unauthorized changes. Our intuitive design eliminates the need for PCs or external devices for programming to ease set-up.

Additional features of the Smart-Encoder include reverse voltage protection of the inputs in addition to, short-circuit protection of the outputs. It is designed to operate within a wide range of industrial applications under harsh environmental conditions such as mechanical shock, vibrations, extreme temperature and humidity changes, oil mists, coolants and solvents. Nema 4 and 4x rated, submersible and explosion proof, Class 1, Div 1 models are also offered to suit a virtually limitless number of applications. The Smart-Encoder is available with the most common connectors found on the market thus making it a universal drop-in replacement.

2. Specifications

ELECTRICAL

INPUT
Voltage: 18-30 VDC
Current: 250 mA @ 24VDC exclusive of load
High Voltage: Min. 2.4 VDC TTL Compatible
Low Voltage: Max. 0.4 VDC TTL Compatible

PROTECTION
Reverse Voltage Protected Inputs
Short Circuit Protected Outputs

POWER-ON SETTLING TIME
Upon power-up the outputs are tri-stated for up to 100mSec.

OUTPUT FORMAT:
Incremental
Programmable up to 1024 Pulses Per Rev.

OUTPUT DRIVERS
Line driver device: ET7272
Voltage: 30V/V = 18-30VDC (V_{in} = V_{out})
$\qquad$ 30V/5= 5VDC
Max Output Current: 40mA
High Voltage: 30 VDC@ 20mA source current
Low Voltage: 5 VDC @ 20mA sink current

ENVIRONMENTAL

| Housing	Size 40 (4.0" dia.)	Size 40 explosion proof	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*in²)	6.4×10^{-4}	6.4×10^{-4}	4.0×10^{-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.	2×10^{9}	2×10^{9}	2×10^{9}
Shock	150g for 11ms		100g for 11ms
Vibration	20g to 2000Hz		20g to 2000Hz
Enclosure	NEMA 4/IP 66	NEMA 4x (Div1 , Class 1, Group B,C,D)	NEMA 4/IP 66
Operating Temperature	-10°C to 70° C		
Storage Temperature	-40°C to 85°C		

3. Wiring

1. The shielded interconnecting cable should be routed in its own conduit and kept separate from other high voltages/high inductance wiring. The shield drain wire should be connected to earth ground at both ends of cable.

2. Use appropriate mating connector (5 pin, 7 pin, 8 pin or 10 pin). Diagrams for these connectors are found below.
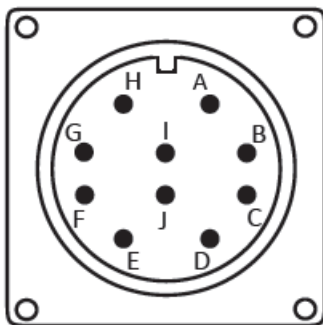
CAUTION:
- Upon power-up the outputs are tri-stated for up to 100 mSec.
- Check the cable wiring before applying power to the Smart-Encoder.

Mating Connector: Autotech 's ECM-10REC-BEI

Cable: CBD-10T22-MXXX
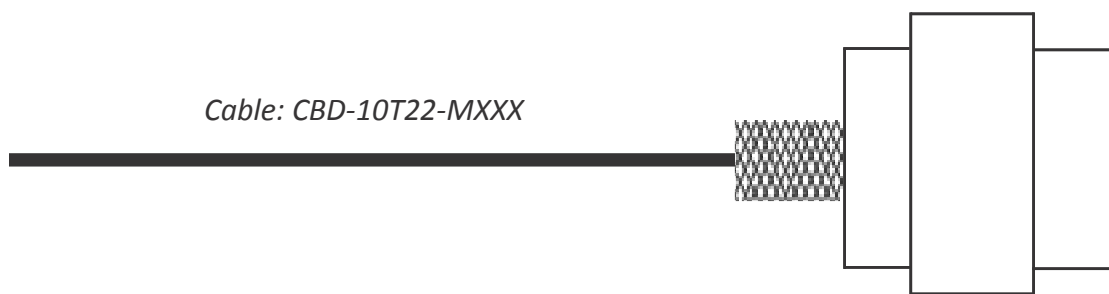
10- Pin MS Connector Pin Out

5- Pin M12 Connector Pin Out
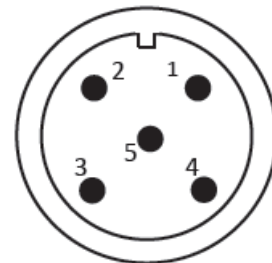
Table 1: 10DL and 10DM (10 Pin Differential)		
Connector Pin	**Function**	**Cable Color Code**
A	Signal A	Red
B	Signal B	Yellow
C	Signal Z	Green
D	Power Source (+V)	White
E	Not Connected	-
F	Com (-V)	White/Black
G	Case Ground	-
H	Signal $\overline{A}$	Red/Black
I	Signal $\overline{B}$	Yellow/Black
J	Signal $\overline{Z}$	Green/Black

Table 2: 05SL (5 Pin Single Ended)		
Pin	**Function**	**Wire Color**
1	Power Source (+V)	White
2	Signal B	Yellow
3	Com (-V)	White/Black
4	Signal A	Red
5	Signal Z	Green

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8- Pin M12 Connector Pin Out
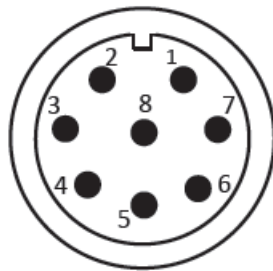
Table 3: 08DL (8 Pin Differential)		
Pin	**Function**	**Wire Color**
1	Signal A	Red
2	Power Source (+V)	White
3	Signal $\overline{A}$	Red/Black
4	Signal B	Yellow
5	Signal $\overline{B}$	Yellow/Black
6	Signal Z	Green
7	Com (-V)	White/Black
8	Signal $\overline{Z}$	Green/Black

Table 4: 08SL (8 Pin Single Ended)		
Pin	**Function**	**Wire Color**
1	Signal A	Red
2	Power Source (+V)	White
3	Not Connected	-
4	Signal B	Yellow
5	Not Connected	-
6	Signal Z	Green
7	Com (-V)	White/Black
8	Not Connected	-

7- Pin M12 Connector Pin Out
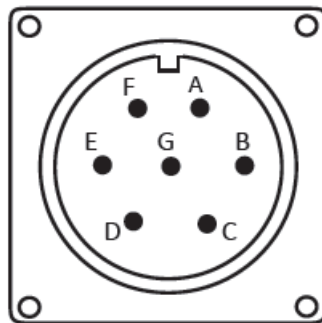
Table 5: 07DL (7 Pin Differential)		
Pin	**Function**	**Wire Color**
A	Signal A	Red
B	Signal B	Yellow
C	Signal $\overline{A}$	Red/Black
D	Power Source (+V)	White
E	Signal $\overline{B}$	Yellow/Black
F	Com (-V)	White/Black
G	Case Ground	-

Table 6: 07SL (7 pin Single Ended)		
Pin	**Function**	**Wire Color**
A	Signal A	Red
B	Signal B	Yellow
C	Signal Z	Green
D	Power Source (+V)	White
E	Not connected	-
F	Com (-V)	White/Black
G	Case Ground	-

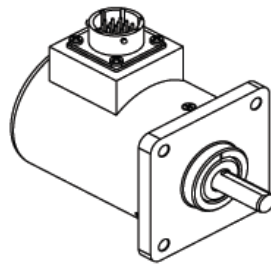## 4. Mounting

Types of Mounting

1.   Servo- Mount

The Smart-Encoder can be either mounted with traditional servo-clamps or through the four 6-32 mounting holes on the face of the resolver.
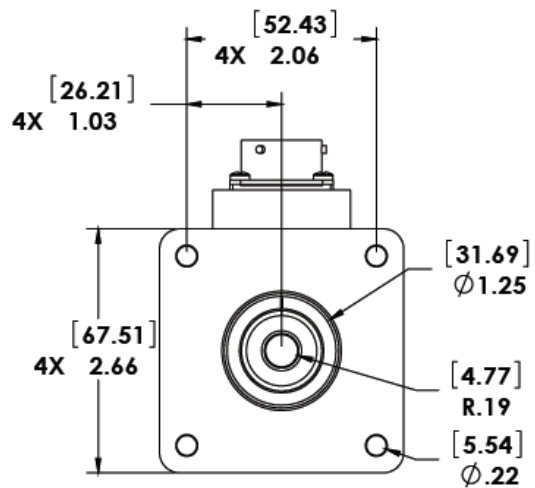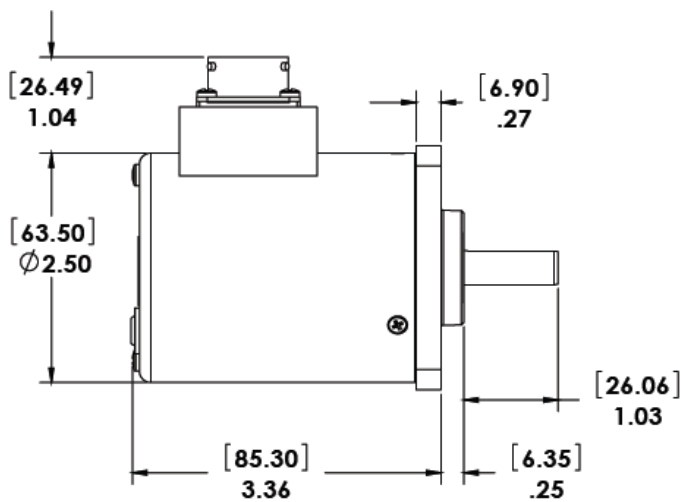
2.   Flange-Mount

The Smart-Encoder can be mounted using the four mounting holes on the square face plate.

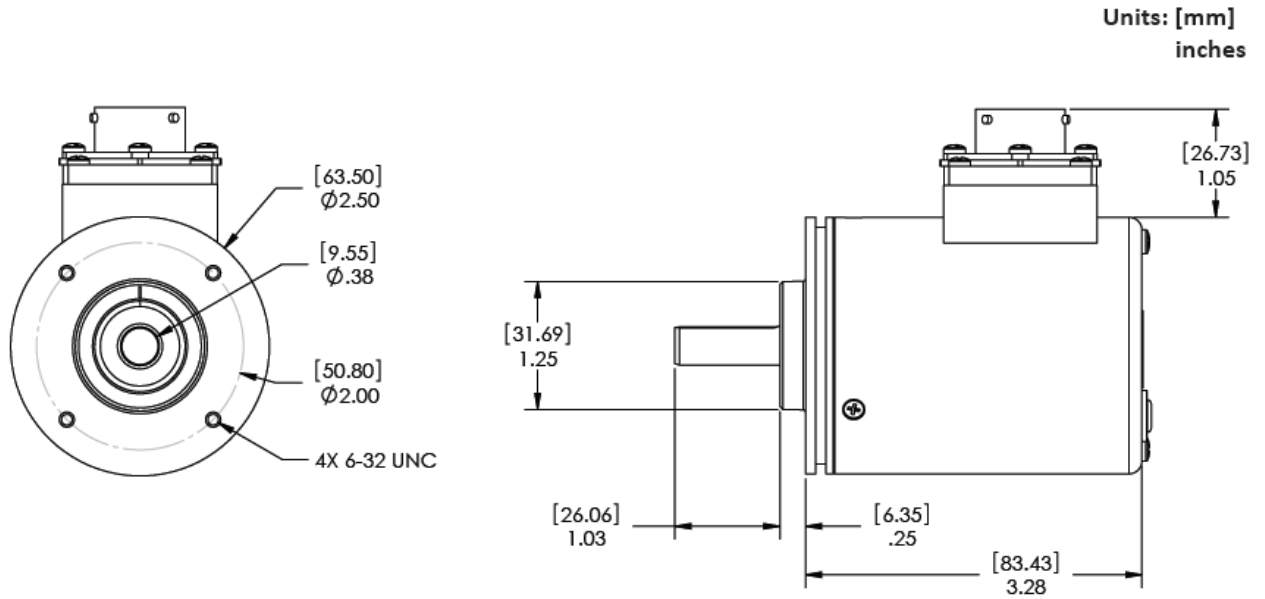### Mounting Dimensions
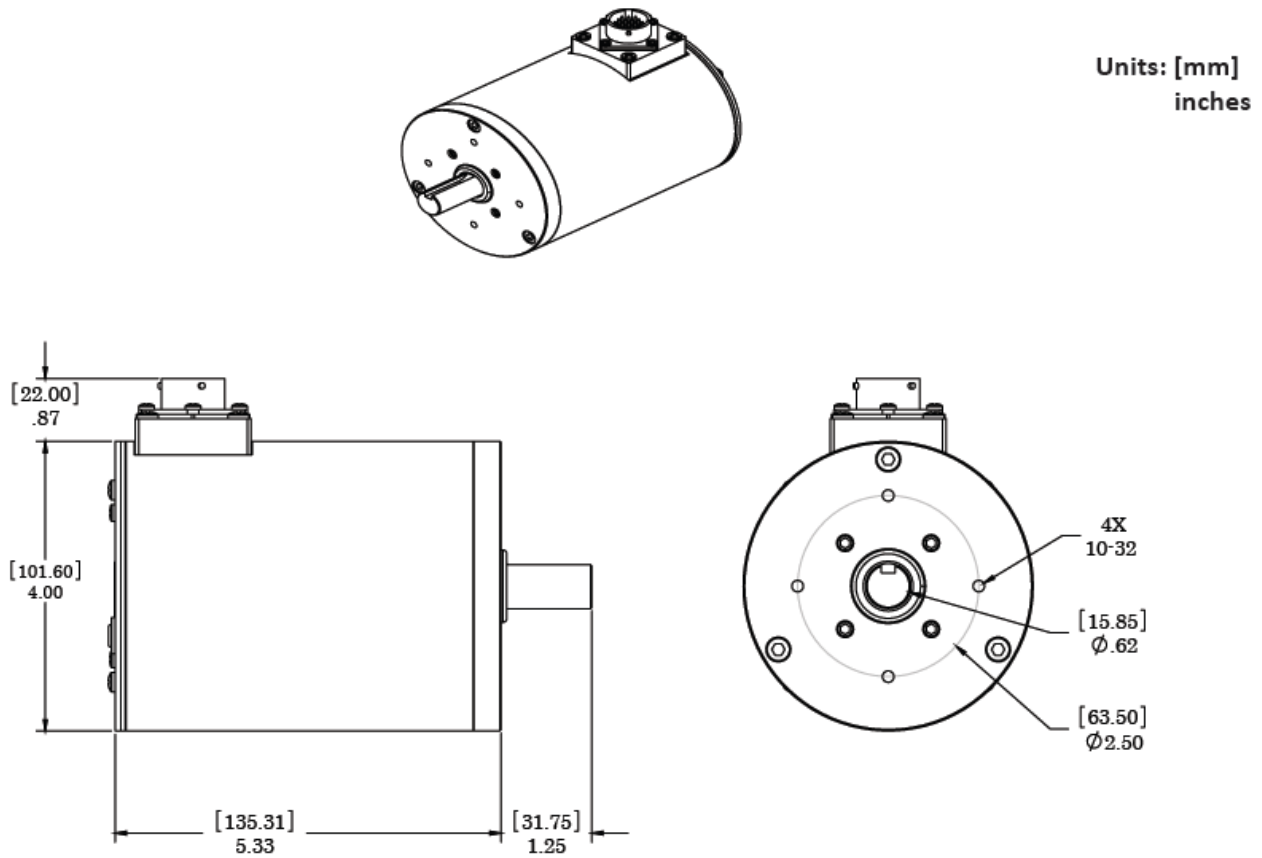
1. Size 25 (Flange Mount)

Units: [mm]
inches

[26.49] 1.04

[6.90] .27

[63.50] Ø2.50

[85.30] 3.36

[6.35] .25

[26.06] 1.03

[52.43] 4X   2.06

[26.21] 4X   1.03

[31.69] Ø1.25

[67.51] 4X   2.66

[4.77] R.19

[5.54] Ø.22

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2. Size 25 (Servo Mount)

Units: [mm]
inches

[63.50]
Ø2.50

[9.55]
Ø.38

[50.80]
Ø2.00

4X 6-32 UNC

[26.73]
1.05

[31.69]
1.25

[26.06]
1.03

[6.35]
.25

[83.43]
3.28

3. Size 40 Resolver Based (Face Mount)

Units: [mm]
inches

[22.00]
.87

[101.60]
4.00

[135.31]
5.33

[31.75]
1.25

4X
10-32

[15.85]
Ø.62

[63.50]
Ø2.50

5. How to Order

AXX – RI – X – XXXX – S – XXXX – XX – XXX
1   2   3   4   5   6   7   8

1. **Size**
   25 2.5" Diameter
   40 4.0" Diameter

2. **Output Format**
   RI Resolver Incremental

3. **Mounting**
   F Flange Mount, (Size 25)
   S Servo Mount, (Size 25)
   A Face Mount, (Size 40)

4. **Input Power/ Output Driver (ET7272)**
   30V/V 18-30Vin , Vin=Vout
   30V/5 18-30Vin , Vout =5V (TTL compatible)

5. **Output Connector Location**
   S Side mount

6. **Output Connector Type**
   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

7. **Construction/ Housing**
   AL Aluminum
   EX Explosion Proof (Size 40 Only)
   SS Stainless Steel, Water Submersible

8. **Gear Trains** *(Applicable only for size 40)*

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

Product Number Example: A25 – RI – F – 30V/5 – S – 10DL – AL

2.5" Diameter Encoder, Resolver Based Incremental Type output, 5V Output Voltage, 10 pin Differential Side Connector, Aluminum Housing.

Cable

CBD-10S22-Mxxx	**Communication Cable with a 10-pin connector attached (10DL and 10DM)**
CBL-05SL-Mxxx	**Communication Cable with a 5-pin connector attached (Single-line)**
CBL-07SL-Mxxx	**Communication Cable with a 7-pin connector attached (Single-line)**
CBL-07DL-Mxxx	**Communication Cable with a 7-pin connector attached (Differential)**
CBL-08SL-Mxxx	**Communication Cable with an 8-pin connector attached (Single-line)**
CBL-08DL-Mxxx	**Communication Cable with an 8-pin connector attached (Differential)**

6. Programming

The Smart-Encoder has a 7-segment LED Display (shown below) which can be used for programming the user parameters.
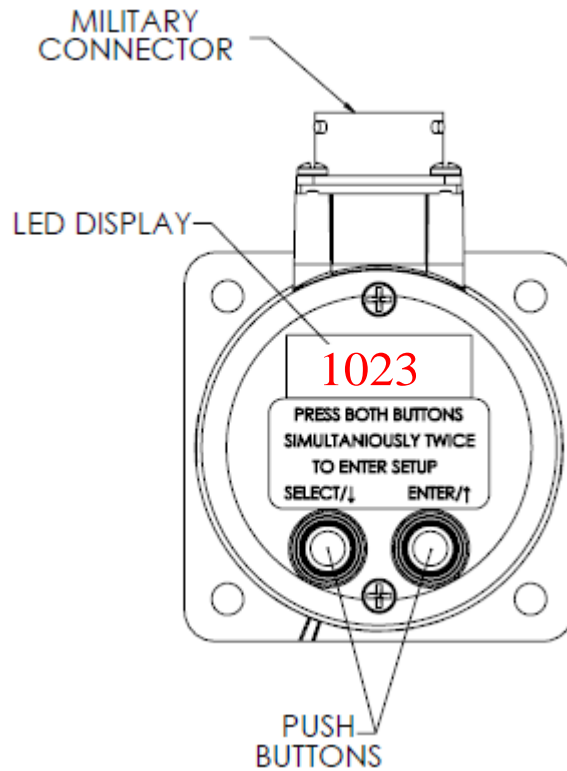
The Smart-Encoder has two (2) modes of operation **Run Mode** and **Programming Mode**.

1. Run Mode:

When in Run Mode the encoder will display the position or RPM (Revolutions Per Minute). To differentiate between the two parameters, the Resolver includes a decimal point following the right-most digit while displaying the RPM.

Left Pushbutton:
Pressing the Left Push button in run mode toggles between the position and RPM display.

Right Pushbutton:
Pressing the Right Push button in the run mode provides the user with a quick overview of the Encoder's Resolution setting and the Firmware Version. After automatically scrolling through the values, the display returns to the Run Mode. These parameters are:

RUN MODE	EXAMPLE
Position	2473
RPM	0311.

uEr - Firmware Version
PSEt - Position Set
rES - Resolution
tYPE - Type of code
dir - Direction of rotation

2. Programming Mode

- To enter the programming mode press both of the push buttons simultaneously twice.
- Use the left push button to navigate through the parameters to be set.
- Use the right push button to select the parameter to be programmed.
- Use left push button to decrement and the right to increment values.
- Press both of the push buttons simultaneously to save the changes, program the flash and return to "Programming Mode" (all done in one step).
- After 10 sec. of inactivity in Programming Mode, the Encoder will discard the changes and go back to Run mode.

The following parameters may be programmed on the Smart- Encoder:

Main Menu		
1	Resolution	rE5
2	Password	PA55

* If a password has been previously set, upon entering the programming mode the user is immediately prompted to enter the password. The LED display shows PA55 momentarily and then 0000. The left push button decreases the value while the right push button increases it. Once the desired value is set press both pushbuttons simultaneously to enter the password.

- If an incorrect password is entered, the display prompts for the password once more.
- If an incorrect password is entered again, the display shows bAd briefly and then returns to Run Mode.

The two (2) programmable parameters are discussed in the section to the right.

Resolution

In rE5 mode, the encoder displays the current resolution (counts per turn). The programmable resolution range is 2- 1024 Pulses Per Revolution. To decrease the resolution use the left push button and to increase use the right push button. Pressing both push buttons simultaneously saves the current resolution and brings the Smart-Encoder back to the Programming menu.

Password

In PA55 mode, the encoder displays On to indicate a password has been set or off to indicate password feature is disabled.

Pressing any one of the push buttons toggles between password "on" and "off". To disable password feature choose off and press both push buttons simultaneously. The encoder will then return to Run Mode. To enable password protection choose On. The encoder then shows the current password stored in memory. The right push button increases the value while left push button decreases it. When the desired value has been selected, pressing both the push buttons simultaneously saves the new password, and returns the Smart-Encoder to Run Mode.

*For instructions on resetting the password please consult the factory.
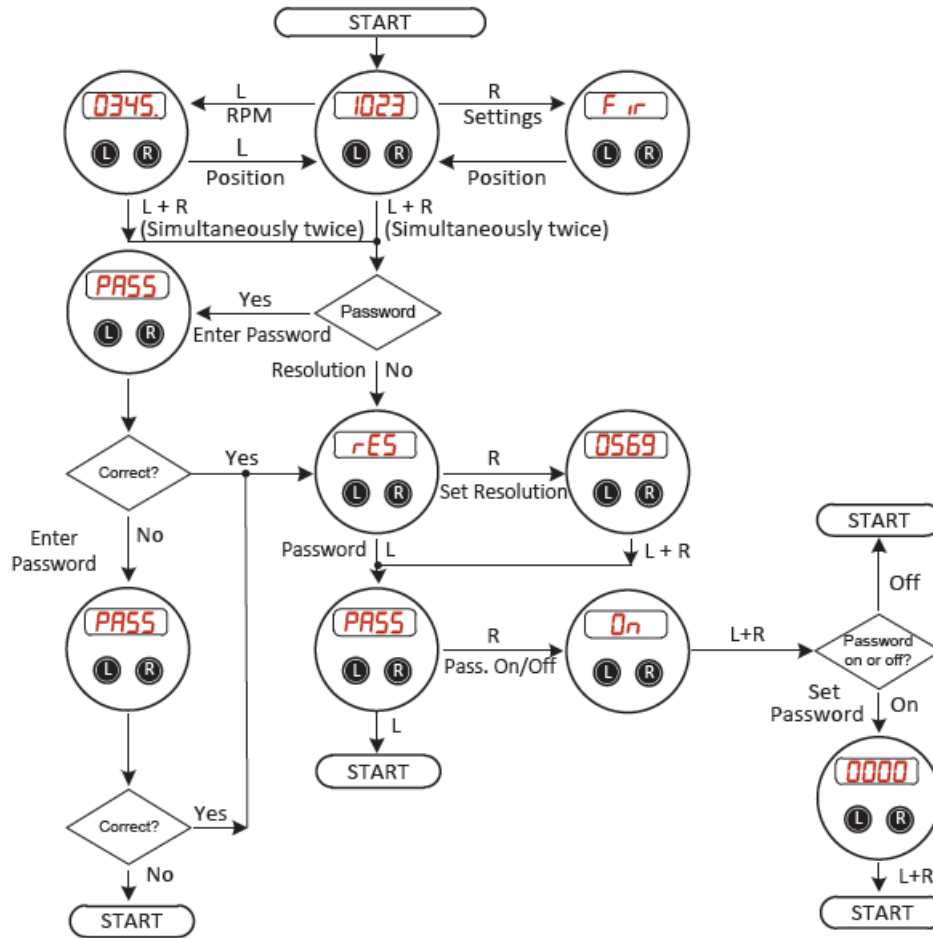
3. Programming Example

This example will illustrate how to program the encoder with the following parameters: a resolution of 360 pulses per revolution and a password set to "1111".

a. Wire the encoder according to the wiring instructions on page 2 and supply the appropriate power.

b. The encoder is now in Run Mode. Press the left push button to see the RPM while rotating the shaft of the encoder.

c. Press both push buttons twice simultaneously to enter Programming Mode. The LCD display will now show rES.

d. Press the right push button to enter resolution set mode and use the left and right push button to decrement and increment (respectively) the counts per turn. Once you reach 0360, press both push button simultaneously to save the setting.

e. The encoder should now display the next programming option, the password: PASS. Press the right push button to enter password set mode.

f. Use the left or right push buttons to toggle the password to On. Now press both of the push buttons simultaneously to save the setting.

g. The screen should now display 0000. Using the right push button, increment the password to 1111. Press both push buttons to save the password.

h. The encoder should now return to resolution mode. Since we are done programming, press both push buttons simultaneously to go back to Run Mode.

This completes the programming example. You may check the resolution by pressing the right push button while in run mode. It will be evident the password is set when you enter programming mode.

*For instructions on resetting the password, please consult the factory.

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363 St. Paul Blvd. Carol Stream, IL 60188

4. Programming Flowchart

NOTES
- Press "L + R" Simultaneously twice to enter programming mode.
- Use "L" (left push button) to decrease value, advance to next programming mode, or toggle settings.
- Use "R" (right push button) to increase value, select the current setting to be programmed, or toggle settings.
- While setting a parameter press "**L+R**" **once to save changes** and advance to the next mode.
- While navigating, **press "L+R" once to return to Run Mode** (Position or RPM Display)
- While in programming mode, after 10 sec. of inactivity the encoder will return to Run Mode.