

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), set the position to any value or reset it, change the direction of increasing counts, and set a password to protect any unauthorized changes. The EtherNet/IP & Modbus TCP/IP Smart-Encoder has been optimized to achieve the quickest set-up and configuration times.

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.

2. Specifications

ELECTRICAL

INPUT POWER

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

OUTPUT DRIVERS

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

OUTPUT FORMAT:

- Gray Code:** Programmable up to 4096
- Binary:** Programmable up to 4096
- BCD:** Programmable up to 1999

TRANSMISSION RATE: 10/100MBit

DATA SYNCHRONIZATION

The Smart-Encoder's position data is continuously updated. Since the device is Level triggered, the Encoder position is latched on as long as the Data Transfer command from the Programmable Controller is OFF i.e. the Level is "Low". It can be then read back by the Programmable Controller. At the same time, the data constantly updates itself if the level of the data Command is "High".

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.

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*in ²)	6.4 x 10 ⁻⁴	6.4 x 10 ⁻⁴	4.0 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.	2 x 10 ⁹	2 x 10 ⁹	2 x 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

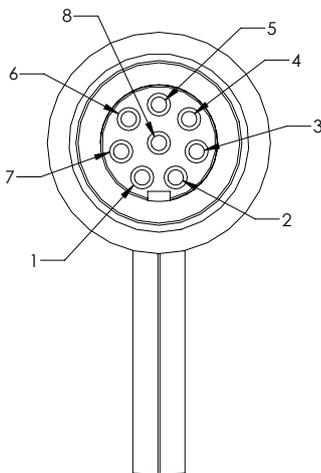
1. The shielded ethernet cable should be routed in its own conduit and kept separate from other high voltages/high inductance wiring.
2. Follow the wiring diagram below:

CAUTION:

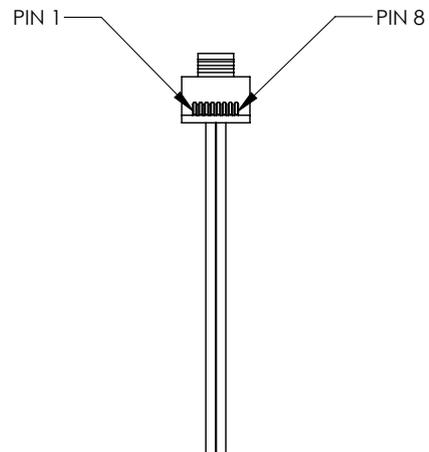
- Upon power-up the outputs are tri-stated for up to 100mSec.
- Check the cable wiring before applying power to the Smart-Encoder.

8 PIN CIRCULAR CONNECTOR PIN #	SIGNAL	CAT 5 COLOR CODE	RJ45 PIN NUMBER
3	Tx +	Green/ White	1
4	TX -	Green	2
5	Rx +	Orange/ White	3
6	Rx -	Orange	6
2	V +	Red	N/C
7	V -	Black	N/C
1	N/C	N/C	N/C
8	N/C	N/C	N/C

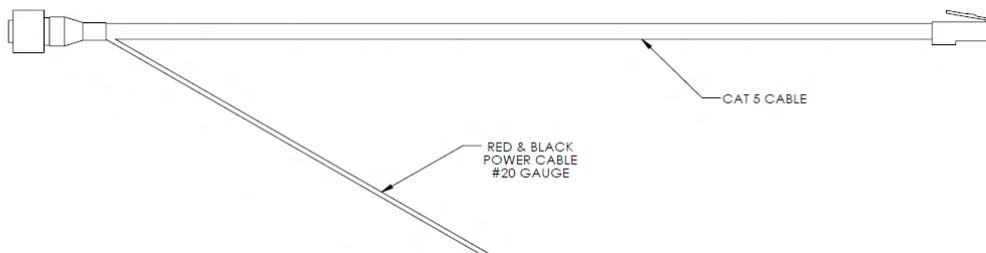
8 Pin Circular Connector



RJ45 Connector



Ethernet Cable Assembly



Smart-Encoder™: EtherNet/IP & Modbus TCP/IP

4. Mounting

Types of Mounting

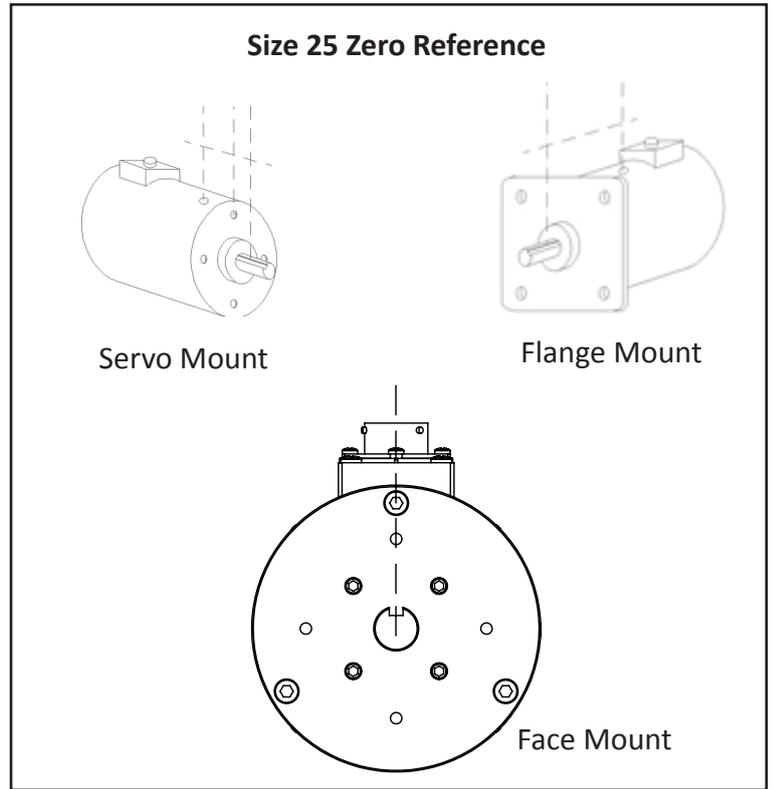
1. Servo- Mount

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.

Zero Reference ($\pm 5^\circ$): The position at which the flat on the shaft lines up with the screw in the case and the two mounting holes on the Smart-Encoder's face plate.

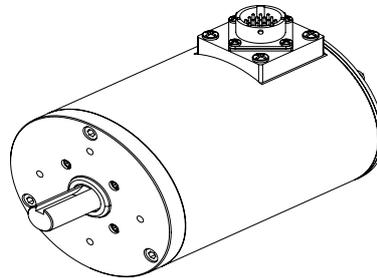
2. Flange-Mount

The Smart-Encoder can be mounted using the four mounting holes on the square face plate. *Zero Reference ($\pm 5^\circ$):* The position at which the flat on the shaft lines up with the screw on the housing along with the mounting hole on the Smart-Encoder's face plate.

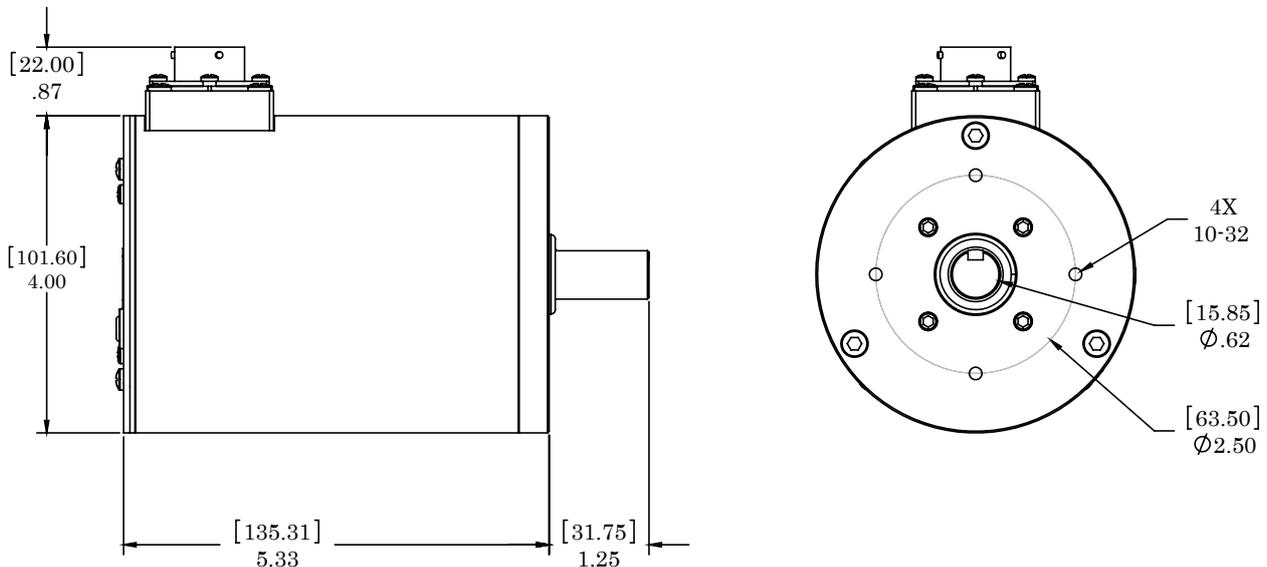


Mounting Dimensions

1. Size 40 Resolver Based (Face Mount)

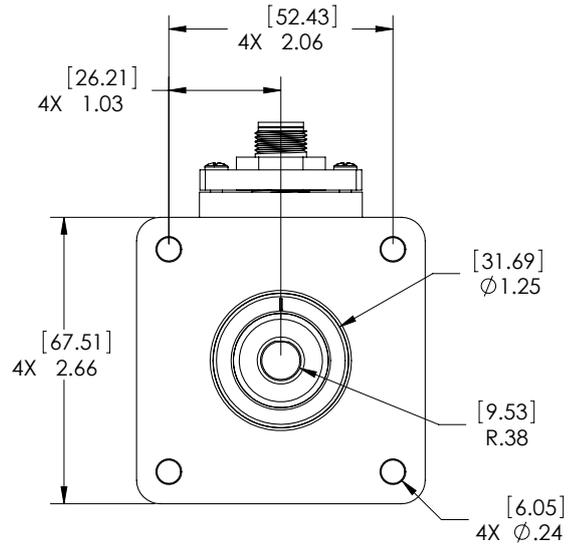
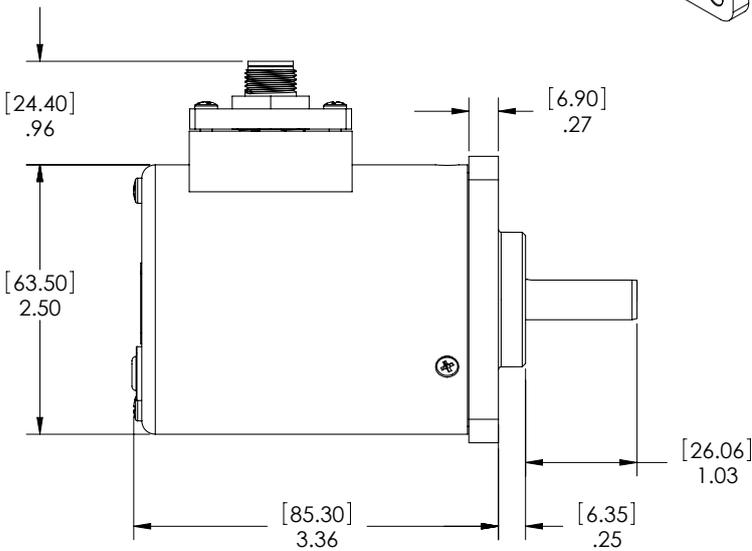
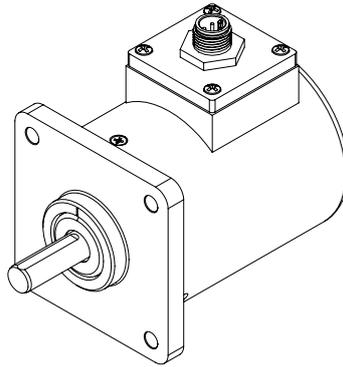


**Units: [mm]
inches**

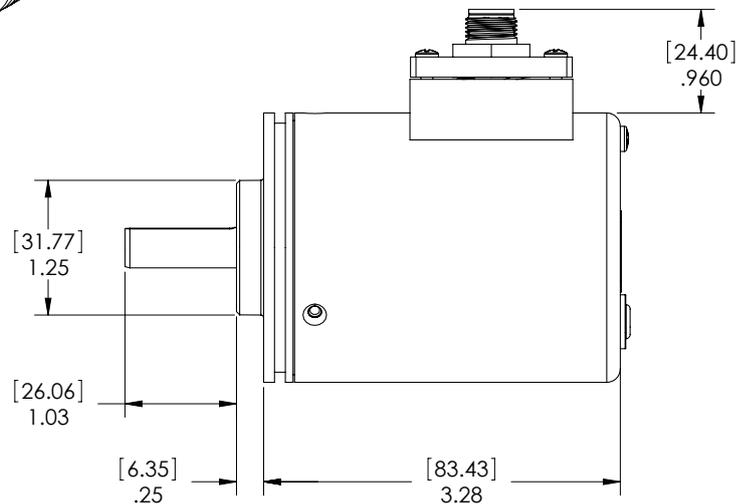
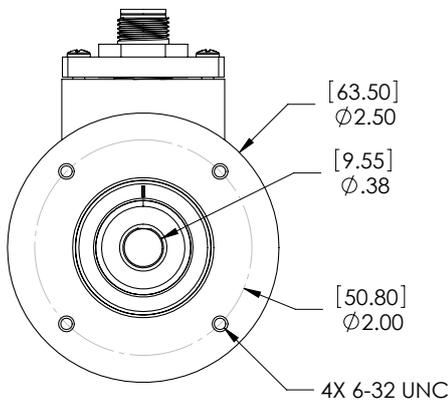
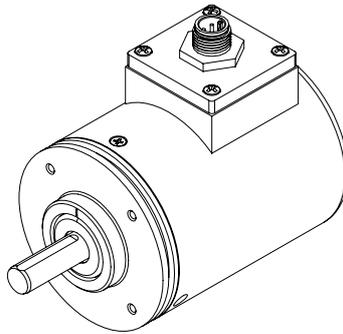


3. Size 25 Ethernet Encoder (Flange Mount)

Units: [mm]
inches



3. Size 25 Resolver (Servo Mount)



5. How to Order

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

- 1. **Size**
25 2.5" Diameter
40 4.0" Diameter
- 2. **Output Format**
RA Resolver Absolute
- 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 10-30Vin , Vin=Vout
30V/5 10-30Vin , Vout =5V (TTL compatible)
30V/N Single ended N type (current sinking)
- 5. **Output Connector Location**
S Side mount
- 6. **Output Connector Type**
NWET Ethernet Connector Absolute
- 7. **Construction/ Housing**
AL Aluminum
EX Explosion Proof (Size 40 Only)
SS Stainless Steel, Water Submersible
- 8. **Gear Trains (Size 40 only)**
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 – RA – F – 30V/5 – S – NWET – AL

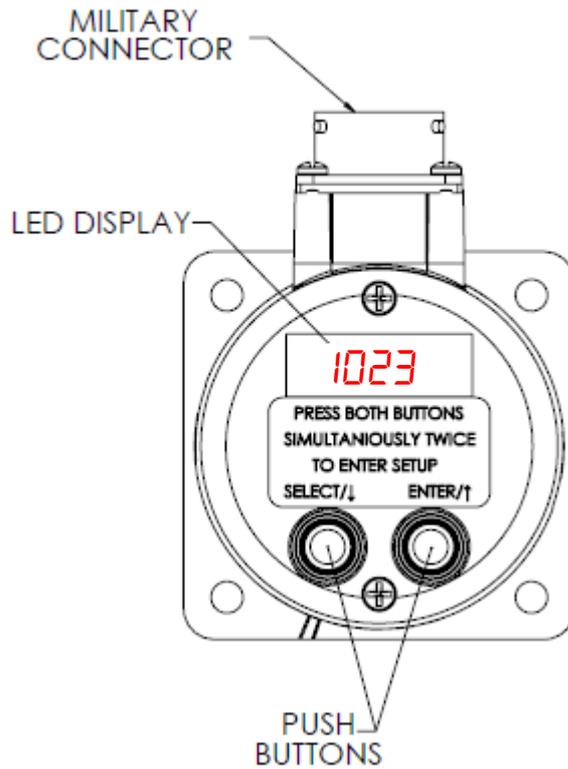
2.5" Diameter Encoder, Resolver Based Absolute, 5V Output Voltage, Ethernet Connector Absolute, Aluminum Housing.

Cable

CBL-ENC8P-Exx 8 PIN M12 Connector on one end and RJ45 on other end. Two (2) conductors for power separated from the ethernet cable on the M12 connector side (see page 2). xxx = length of the cable in feet.

6. Programming

The 7-segment LED Display (shown below) can be used for viewing user programmed 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.

RUN MODE	EXAMPLE
Position	2473
RPM	0311.

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:

- uEr* - Firmware Version
- PSEt* - Position Set
- rES* - Resolution
- tYPE* - Type of code
- di r* - 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	Reset	rESt
2	Position Set	PSEt
3	Resolution	rES
4	Output Format	tYPE
5	Direction	dIr
6	Password Set	PASS

* 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 **PASS** 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 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.

Reset

In **rESt** mode, the display flashes the actual (scaled) offset and then displays **ZEro**. Pressing both push buttons at this time will set the current position of encoder to zero, and brings the Smart-Encoder back to the Programming menu.

Position

In **PSEt** mode, the LED display shows the actual (scaled) position. The left push button decrease the value while the right push button increases the value. Pressing both push buttons simultaneously saves the current position value and bring the Smart-Encoder back to the Programming menu.

Resolution

In **rES** mode, the encoder displays the current resolution (counts per turn). The left push button decrease the value while the right push button increases the value. Pressing both push buttons simultaneously saves the current resolution and brings the Smart-Encoder back to the Programming menu.

Note: For Binary and Gray Code the maximum programmable resolution is 4096. For BCD, the Resolution can be programmed up to 1999.

Output Format

In **tYPE** mode, the encoder displays the current type of output format. There are three types of outputs to choose from:

- bin** = Binary
- bcd** = BCD
- grY** = Gray Code

Pressing any one of the push buttons cycles thru the available output formats. Pressing both push buttons simultaneously saves the current output format and proceeds to **rES** mode. Refer to “Resolution” programming above to set the desired counts per turn.

Direction

In *dir* mode, the encoder display the current direction of ascending count: *CU* (clockwise) or *CCW* (counter clockwise). Pressing both push buttons simultaneously saves the direction and brings the Smart-Encoder back to the Programming menu.

Password

In *PASS* 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.

3. Programming Example

This example will illustrate how to program the encoder with the following parameters: a resolution of 360 pulses per revolution, binary type outputs, counter clockwise direction for ascending count, 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. You may 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 the first programming screen: *rESt*.
- d. To set the resolution press the left push button two (2) times so that *rES* shows on the display. Press the right push button to enter resolution set mode. The current resolution will now be displayed. Using the left push button decrement the count to *0360*. Press both push buttons simultaneously to save.

e. The display will now show *TYPE*. Press the right push button to enter the Output Type set mode. Press the left button until you see *bin*. Now press both push buttons simultaneously to save.

f. The screen will now display *dir*. Press the right push button to enter set mode for the direction. Using either push button toggle the direction to *CCW* and then press Left and Right push button simultaneously to save.

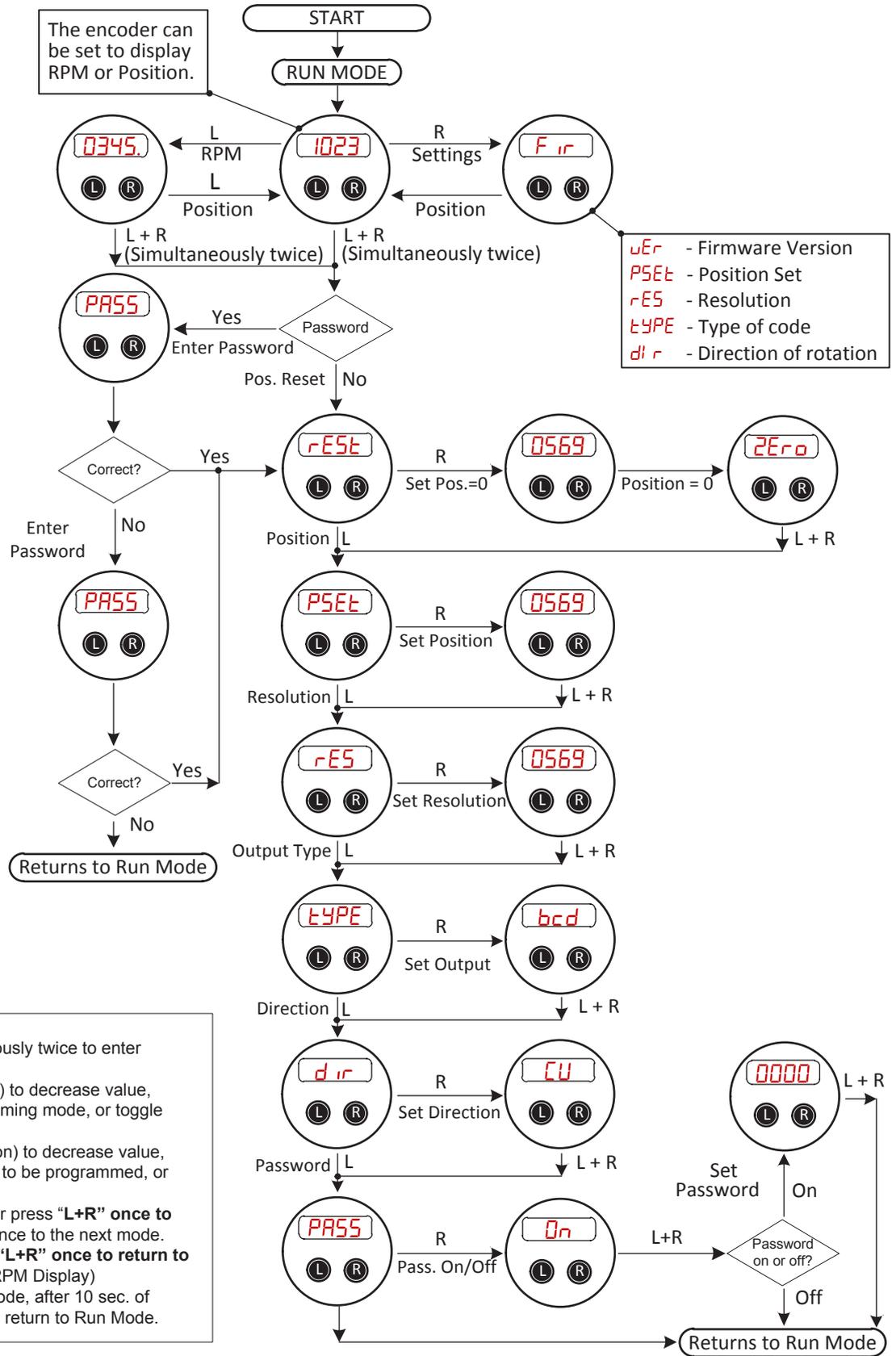
i. The screen will now display *0000*. Using the left push button increment the password to *1111*. Press both push buttons to save the password.

h. The encoder will now return to Run Mode.

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

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

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 decrease 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.

7. Initial Setup and Configuration

1. Overview

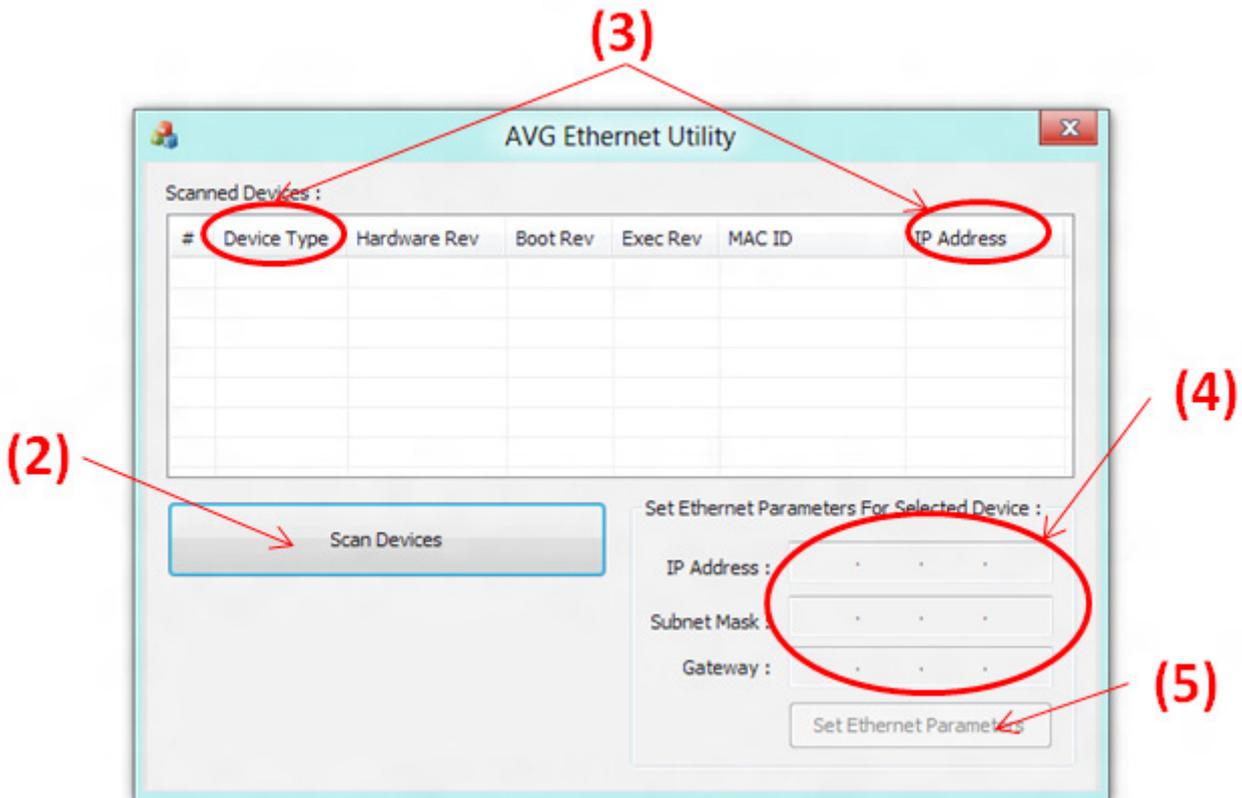
The AVG Ethernet Utility along with the AVG Programmable Absolute Encoder utility are available for download by going to autotechcontrols.net/SmartEncoderUtility. You must download both files to set-up and configure the Smart Encoder.

2. AVG Ethernet Utility

This software can perform a scan of all AVG devices connected on the network and allow configuration of the ethernet parameters for the selected device. Follow the outline below for instructions on setting the ethernet parameters for the Smart-Encoder.

1. Run the installation file by double clicking the “AVG IP Config Setup “ and follow the on-screen installation instruction.
2. After the encoder has been properly connected to the network open the AVG Ethernet Utility and press “Scan Devices”.
3. Locate the device by looking up the device type and IP address.
4. Select the device and enter the desired parameters in the fields in the bottom right hand corner.
5. Click “Set Ethernet Parameters” and exit the utility.

*If you are unable to identify the Smart-Encoder, connect the ethernet cable from the encoder directly to the PC and click “Scan Devices”.

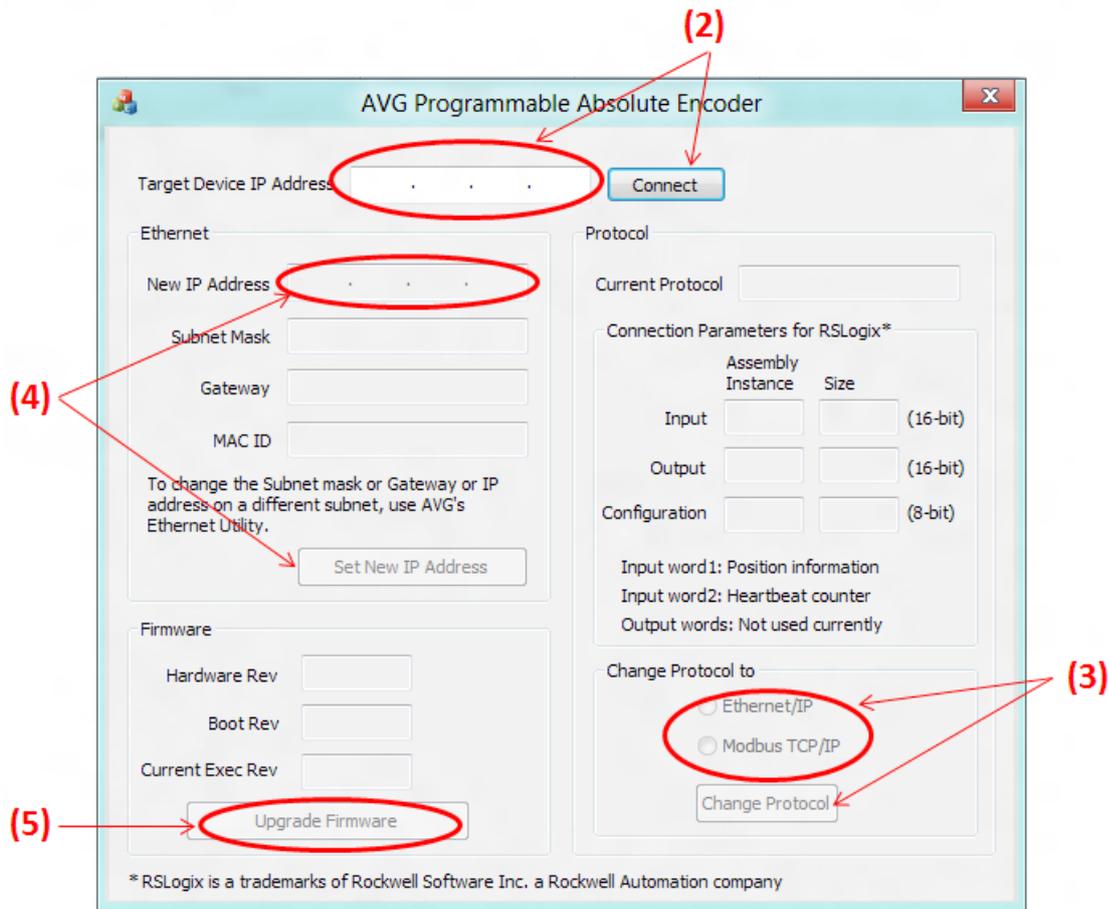


*AVG Ethernet Utility is available for download at <http://autotechcontrols.net/SmartEncoderUtility>

2. AVG Programmable Absolute Encoder

We can now use the AVG Programmable Absolute Encoder utility to set the communication protocols and parameters. This software also supports changing the IP address of the unit, but only after the encoder has already been configured to the same Subnet Mask.

1. Open the installation file by double clicking the “AVG Programmable Absolute Encoder Setup “ and follow the on-screen installation instruction.
2. Type the IP Address for the Smart-Encoder that was configured in part 1 and click “Connect”.
3. Choose the desired communication protocol by selecting either Ethernet /IP or Modbus TCP/IP in the “Change Protocol to” Section located in the bottom right hand corner of the utility and click “Change Protocol”.
4. Note the “Connection Parameters For RSLogix” as these will be necessary to set up communication. Change the Ip address of the unit by typing in the New IP address in the “Ethernet” section and then by clicking “Set New IP Address”.
5. Any future firmware revisions may be performed by clicking on “Upgrade Firmware” and then selecting the appropriate firmware file from your PC.



*AVG Programmable Absolute Encoder utility is available for download at <http://autotechcontrols.net/SmartEncoderUtility>

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