

# LP SERIES | MODEL LP35

## LOW PROFILE PROGRAMMABLE ENCODER



### Features

- Low profile package saves space
- Excellent resistance to shock and vibration
- 30mm standard through shaft, PEEK reduction hub available
- High protection level of IP66
- High performance in temperatures from -40°C to +100°C
- Resolutions up to 10,000 PPR, incremental or 16 BITS absolute
- Terminal box, M12 or cable output terminations
- Encapsulated electronics
- TTL and HTL electronics
- Reinforced electrical output available on some incremental and absolute models
  - Wiring fault tolerant with terminal box connection
  - Long cable drive capability

### SPECIFICATIONS

#### Mechanical

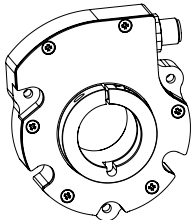
<b>Housing Size</b>	<b>Standard:</b> Ø 90mm X 26mm deep <b>Terminal Box:</b> 128mm tall X 116mm wide X 25mm deep. (See dimensional drawings for detail)
<b>Shaft Size</b>	<b>Hollow Shaft:</b> Ø 1/2" to Ø 1" blind or through <b>Solid Shaft:</b> Ø12 mm x 20 mm with keyway, Ø 3/8" x 7/8" with flat <b>Hollow Shaft w/ Integrated Coupling:</b> 14mm, 20mm, 1/2", 3/4"
<b>Permissible Shaft Loads</b>	<b>Axial:</b> 40 N <b>Radial:</b> 80 N
<b>Shaft Runout</b>	<b>Hollow Shaft:</b> 0.1 mm [0.004"] TIR <b>Solid Shaft:</b> 0.02 mm [0.001"] TIR <b>Hollow Shaft w/ Integrated Coupling:</b> N/A
<b>Static/ Dynamic Torque</b>	30 / 300 mN.m [4.2/ 42 oz-in] @ 25°C
<b>Bearings</b>	6807 - Sealed
<b>Material</b>	<b>Cover:</b> Clear anodized aluminum <b>Body:</b> Clear anodized aluminum <b>Shaft:</b> AISI 303 stainless steel
<b>Bearing Life <math>L_{10h}</math> (Theoretical Mechanical Lifetime)</b>	> 18.10 <sup>9</sup> turns / 100000 hours
<b>Continuous Max. Speed</b>	6000 RPM, (Reference Chart 1. Speed vs Temperature)
<b>Shaft Moment of Inertia</b>	< 84000 g.mm <sup>2</sup> [11.9 x 10 <sup>-3</sup> oz*in*sec <sup>2</sup> ]
<b>Weight (approx.)</b>	<b>Terminal Box:</b> 790g <b>M12 or cable:</b> 450g

# Chart 1. Speed vs Temperature

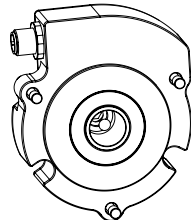
(Temperature on this chart to be added to ambient temperature. Do not exceed maximum temperature on datasheet.)



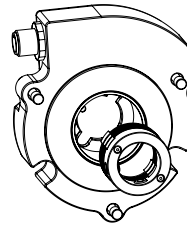
## Cable or M12 Connection Shaft Options



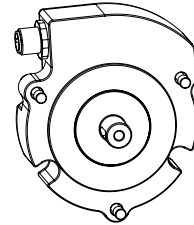
Through Hollow Shaft



Blind Hollow Shaft



Shaft with Integrated coupling



Solid Shaft

## Electrical

	Absolute	Incremental
<b>Output Format</b>	SSI compatible (RS422)	Two channels in quadrature + index and complements
<b>Resolution</b>	Up to 16 BITS	Up to 10,000 CPT
<b>Encoder Accuracy</b>	±0.1°	
<b>Supply Voltage Vcl</b>	5-30 Vdc	<b>Cable or M12:</b> 5-30V (28/V) and 4.75-30V (28/5) <b>Terminal Box:</b> 11-30V (28/VR), 5-30V (28/V) and 4.75-30V (28/5)
<b>Supply Current (No Loads)</b>	75mA Typ	<b>Cable or M12:</b> 75mA <b>Terminal Box:</b> 100mA (28/VR), 75mA (28/V and 28/5)
<b>Current Per Channel Pair</b>	40mA max	<b>Cable or M12:</b> 40mA <b>Terminal Box:</b> 60mA (28/VR), 40mA (28/V and 28/5)
<b>Voltage / Output</b>	<b>28/SI:</b> SSI RS485 w/o parity <b>28/SR:</b> SSI RS485 reinforced w/o parity Terminal Box version only	<b>28/V:</b> Line driver 5-30 V In/Out; PushPull <b>28/5:</b> Line driver with 5 V (TTL) regulated output <b>28/VR:</b> Push Pull 11-30V reinforced. Terminal Box version only
<b>Short Circuit Proof</b>	<b>28/SI:</b> Yes (except to V+) <b>28/SR:</b> Yes	<b>Cable or M12:</b> Yes (28/V) and Yes (except to Vcl) (28/5) <b>Terminal Box:</b> Yes (28/VR), (28/V) and (28/5) except to Vcl
<b>Reverse Polarity Tolerant</b>	Yes	
<b>Wiring Fault Tolerant &amp; Overvoltage Prot.</b>	<b>28/SI:</b> No <b>28/SR:</b> Yes	<b>Cable or M12:</b> No <b>Terminal Box:</b> Yes Up to 60Vdc (28/VR) and No (28/V and 28/5)
<b>Frequency Response</b>	<b>Cable or M12:</b> Up to 1MHz <b>Terminal Box:</b> Up to 300kHz (28/VR), Up to 1MHz (28/V and 28/5)	
<b>Output Terminations</b>	Cable, M12 or Terminal Box	
<b>EMC</b>	EN 61000-6-2 : 2005, see user manual for details EN 61000-6-4 : 2017 + A1 : 2011, see user manual for details	
<b>Isolation</b>	1000V	

## Environmental

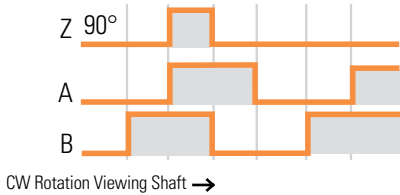
<b>Protection Class (sealing)</b>	IP66	
<b>Temperature Range</b>	<b>Cable or M12:</b> -40°C +100°C <b>Terminal Box:</b> -40°C +85°C (28/VR), -40°C +100°C (28/V and 28/5)	
<b>Mechanical Resistance</b>	<b>Shock</b>	(EN60068-2-27): $\leq 3000\text{m.s}^{-2}$ (5 ms, half sine) (300 G's)
	<b>Vibration</b>	(EN60068-2-6): $\leq 200\text{m.s}^{-2}$ (55 ... 2 000 Hz) (20 G's)
<b>Humidity</b>	98% RH without condensation	

## OUTPUT WAVEFORMS

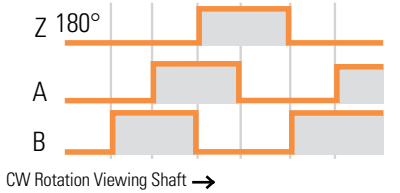
Waveform AA/ BB/ 00/ Channel B before A Clockwise (US convention is A leads B CCW)

### Incremental Waveform

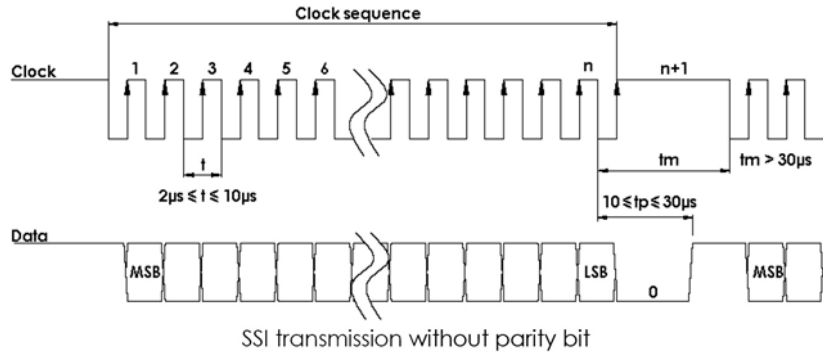
#### INDEX GATED WITH A & B HIGH (CODE Q28)



#### INDEX GATED WITH B LOW (CODE Q29)



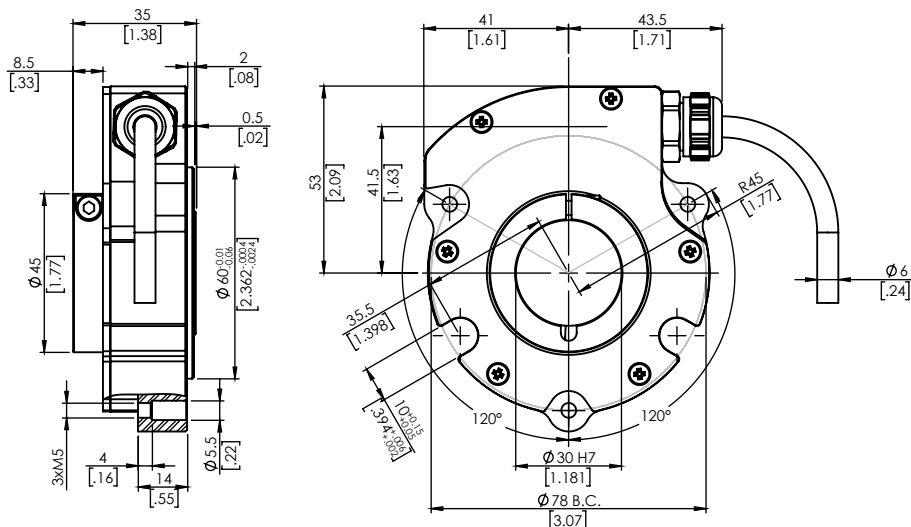
### Absolute SSI Waveform



## DIMENSIONS(A)

All dimensions are in millimeters [inches]

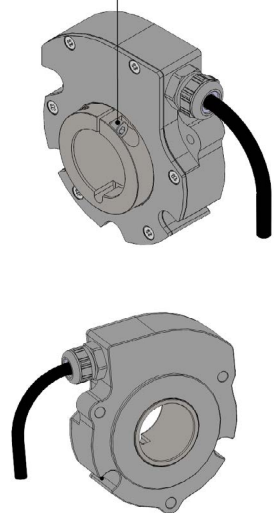
### Through hollow shaft



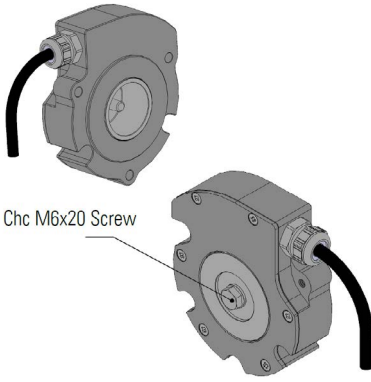
**NOTE:**

CHc : Hexagonal Socket head cap screws HC : Hexagonal socket set screws

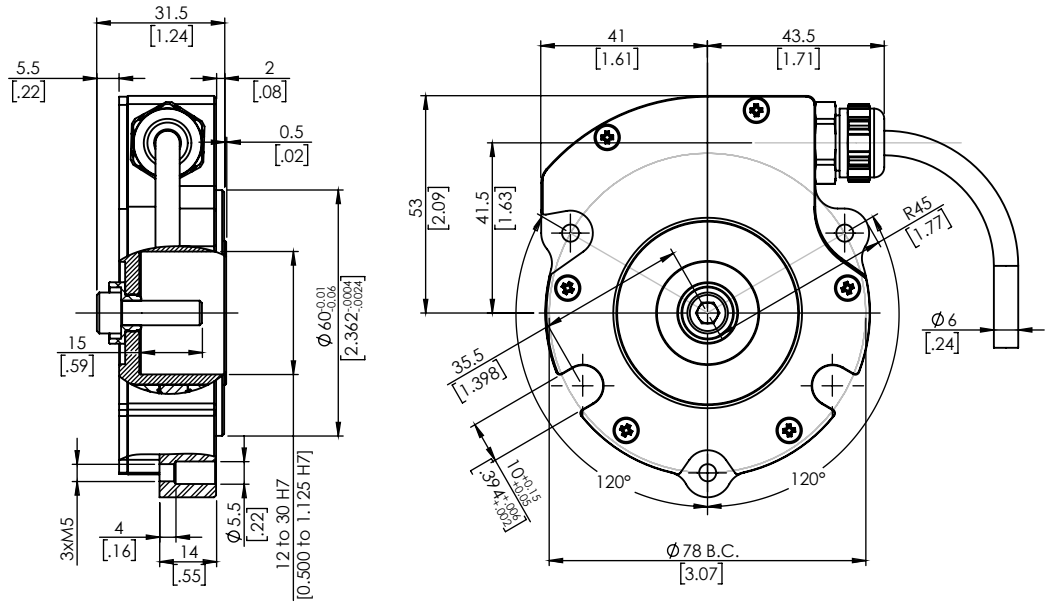
CHc M4 Screw (SW3)



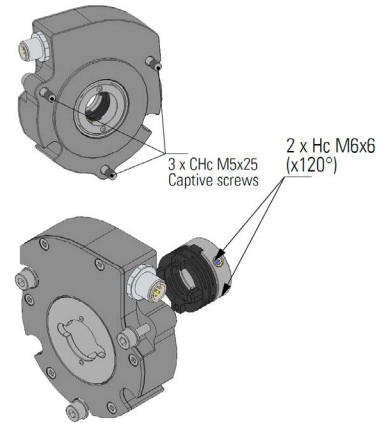
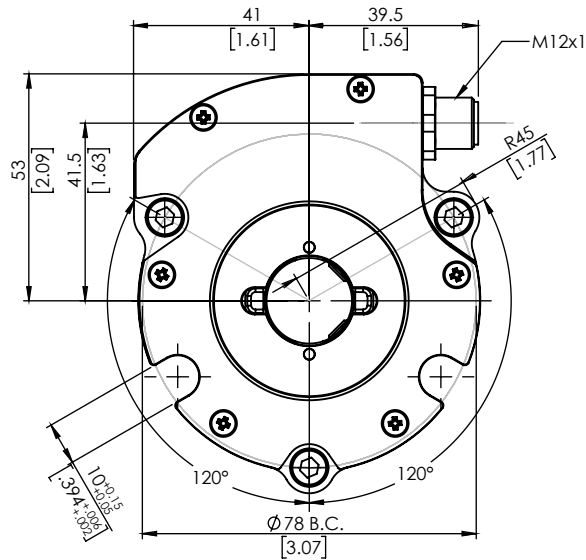
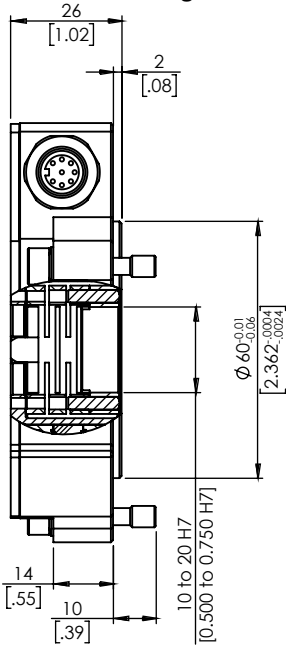
## Blind hollow shaft



Chc M6x20 Screw

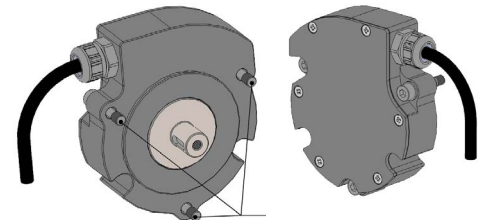
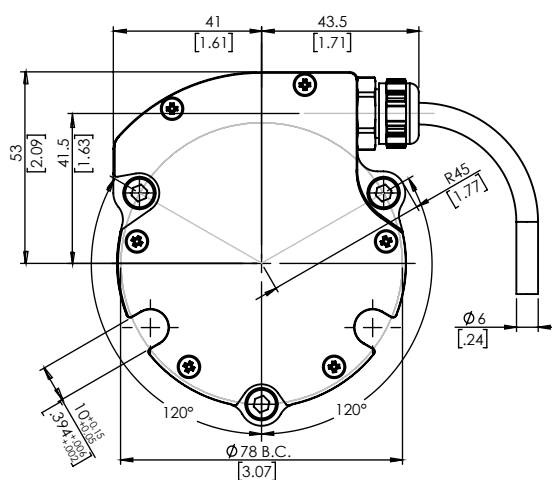
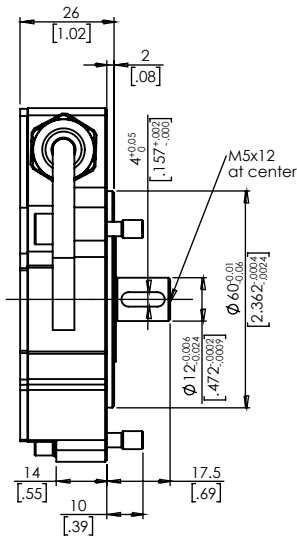


## Shaft with integrated coupling

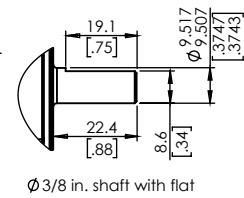


3 x Chc M5x25 Captive screws  
2 x Hc M6x6 (x120°)

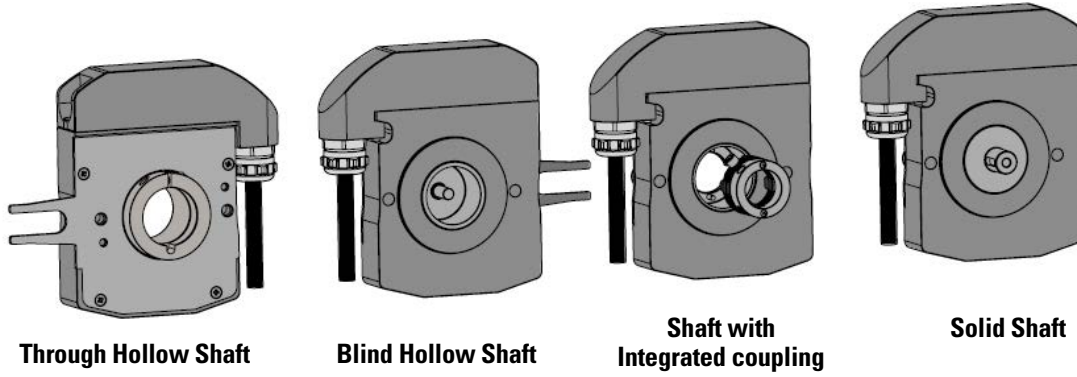
## Solid shaft



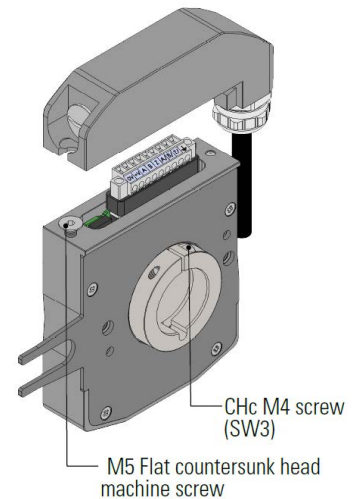
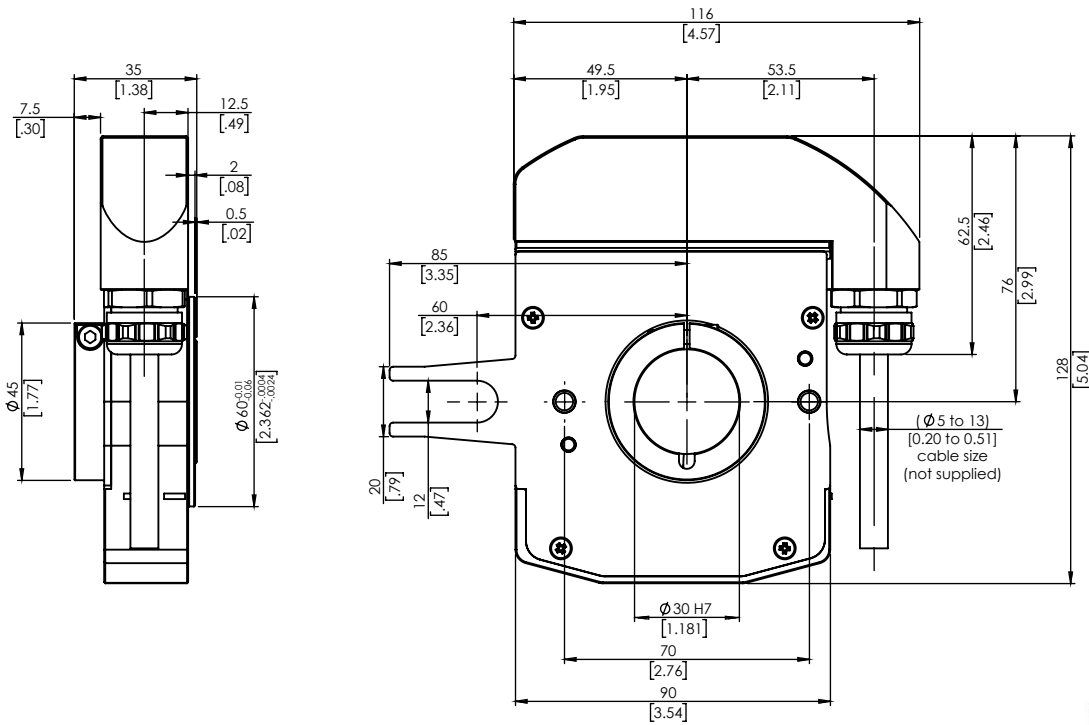
3x Chc M5x25 Captive screws



$\phi 3/8$  in. shaft with flat

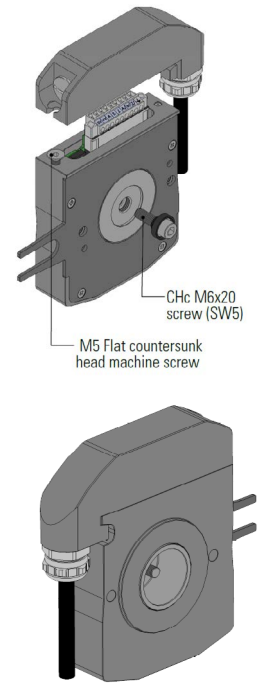
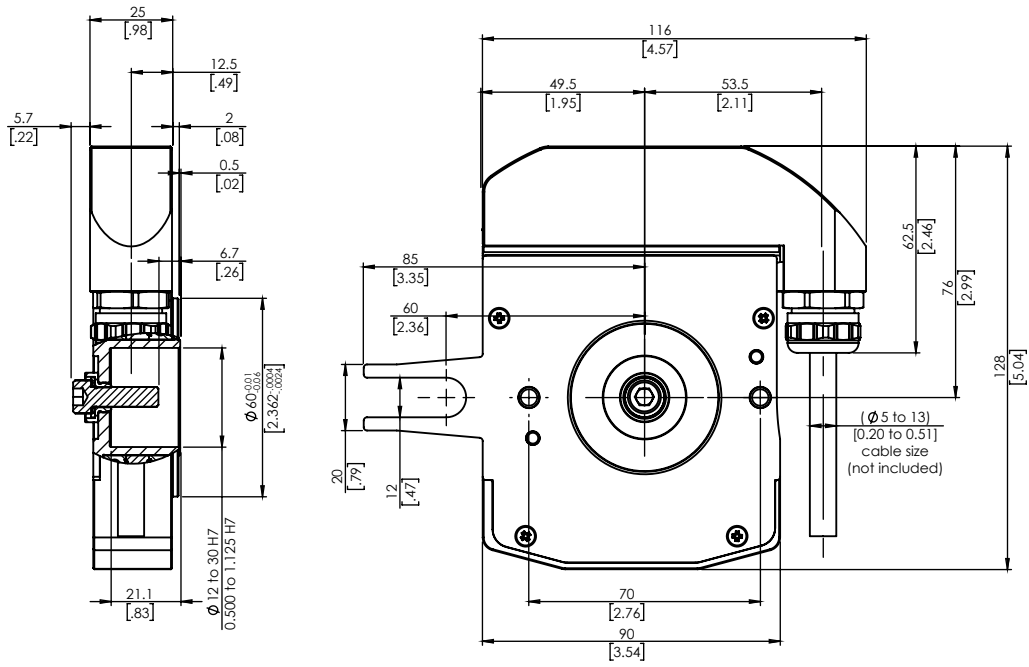


**Through hollow shaft**

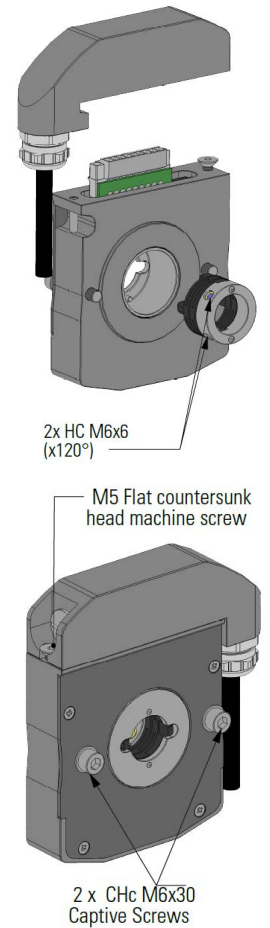
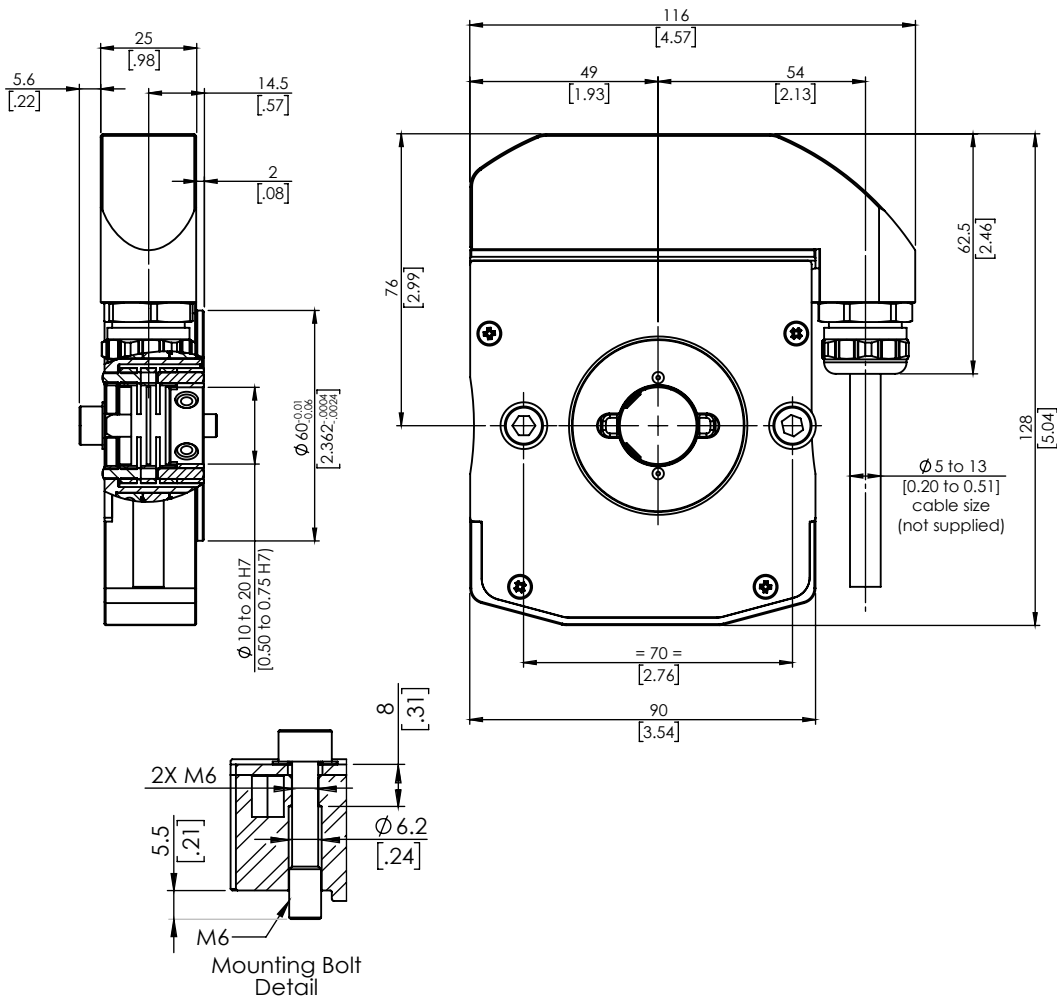


**NOTE:**  
CHc : Hexagonal Socket head cap screws    HC : Hexagonal socket set screws

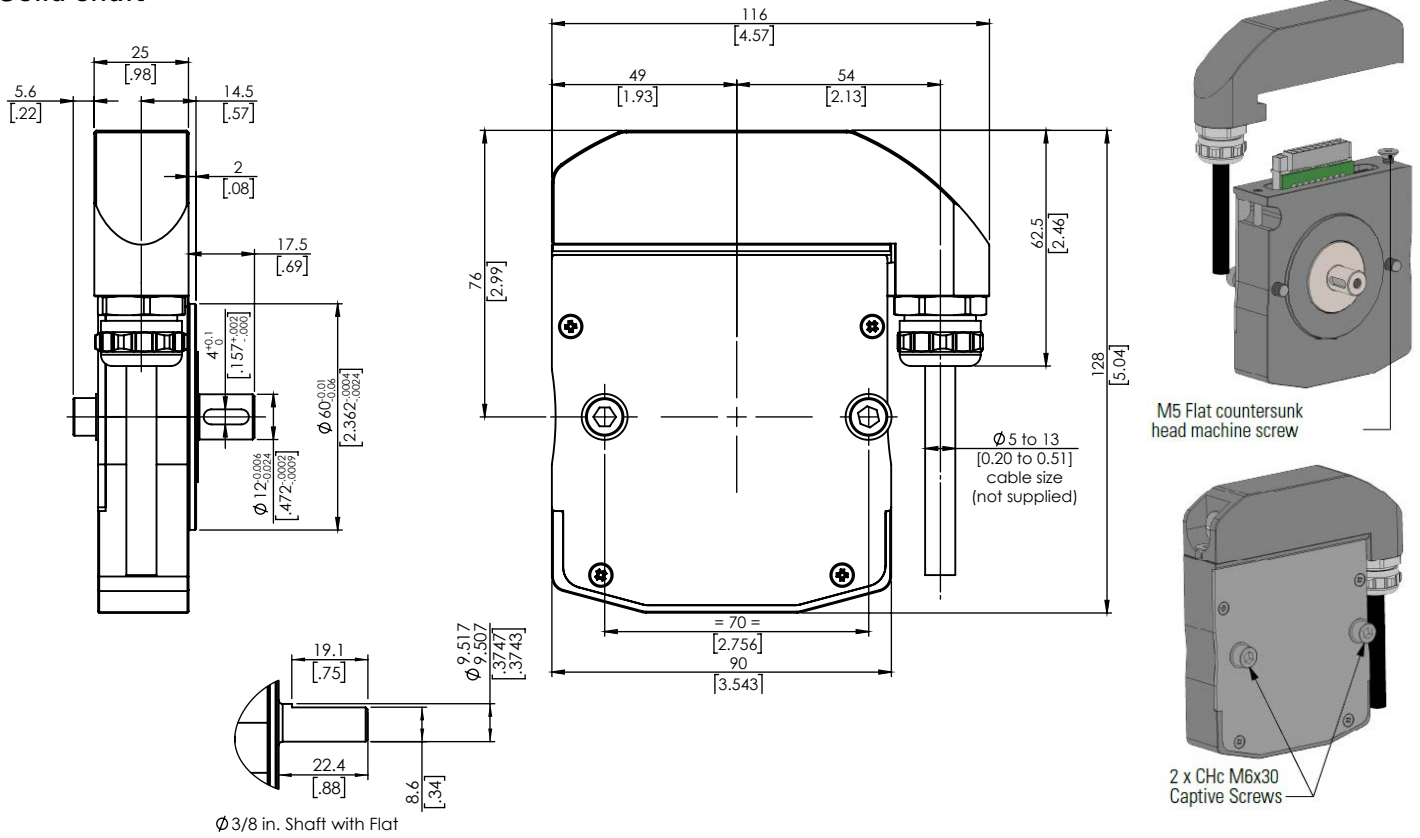
## Blind hollow shaft



## Shaft with integrated coupling

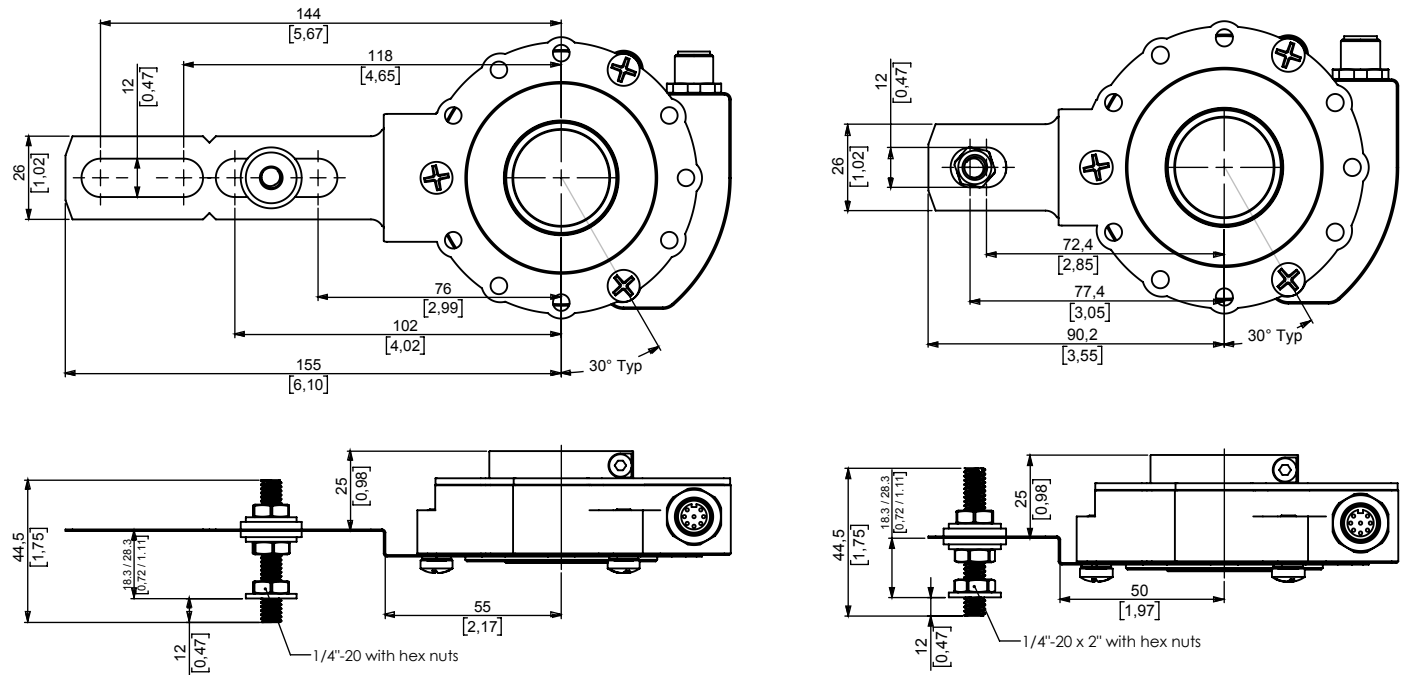


## Solid shaft



## TETHER OPTIONS FOR STANDARD CABLE OR M12 CONNECTOR

Other options available, consult factory. Tethers come with all the hardware shown.

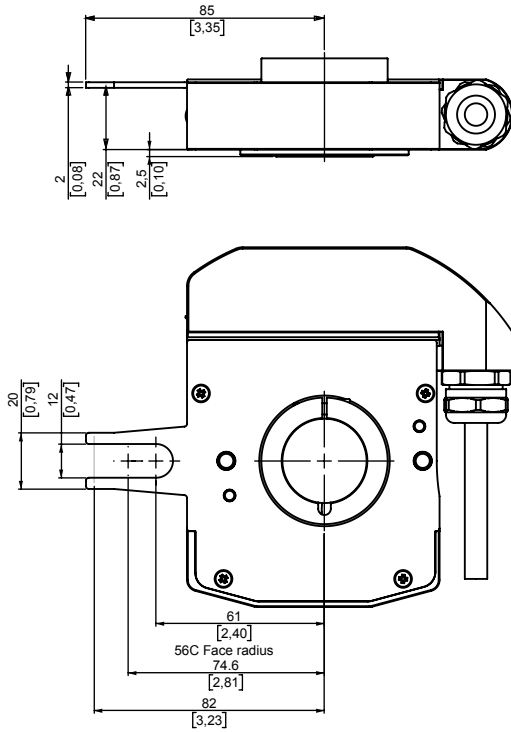


T2- Long tether arm with 1/4"-20 adj. hardware – M9445/053-02

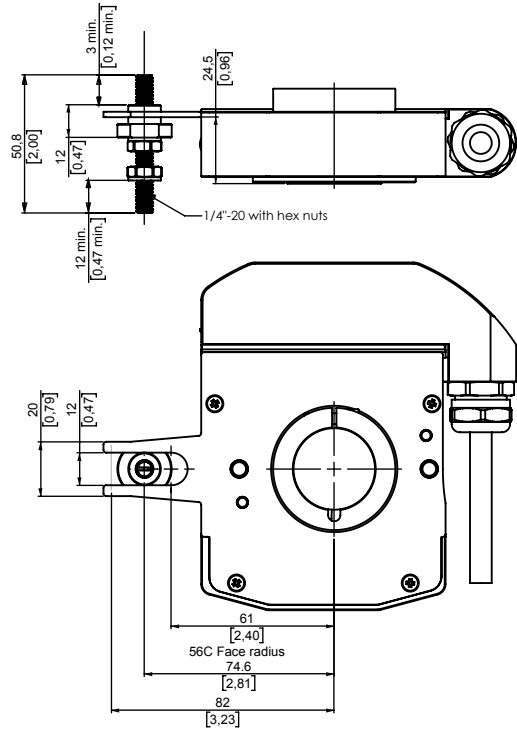
T3-Short tether arm with 1/4"-20 adj. hardware (fits 56C) – M9445/058-02



## TETHER OPTIONS FOR TERMINAL BOX OUTPUT



T4- Standard Fork is provided for all blind or through hollow shaft versions



T5- M9445/059-01 Standard Fork + 56C Face Pin



## TERMINATIONS

### Connection Incremental

Termination	Connection Ordering Code	Description	-	+	A	B	Z	A/	B/	Z/	Case Ground
M12	M12	EUR M12 - 8 pins	1	2	3	4	5	6	7	8	Connector Body
Standard Cable	SG	PVC Jacket	BLK	RED	YEL	BLU	ORN	WHT/ YEL	WHT/ BLU	WHT/ ORN	GRN
Terminal Box	T	Terminal box - 9 pins	1	2	3	4	5	6	7	8	9

Other cable types available- Consult factory

### Connection Absolute SSI

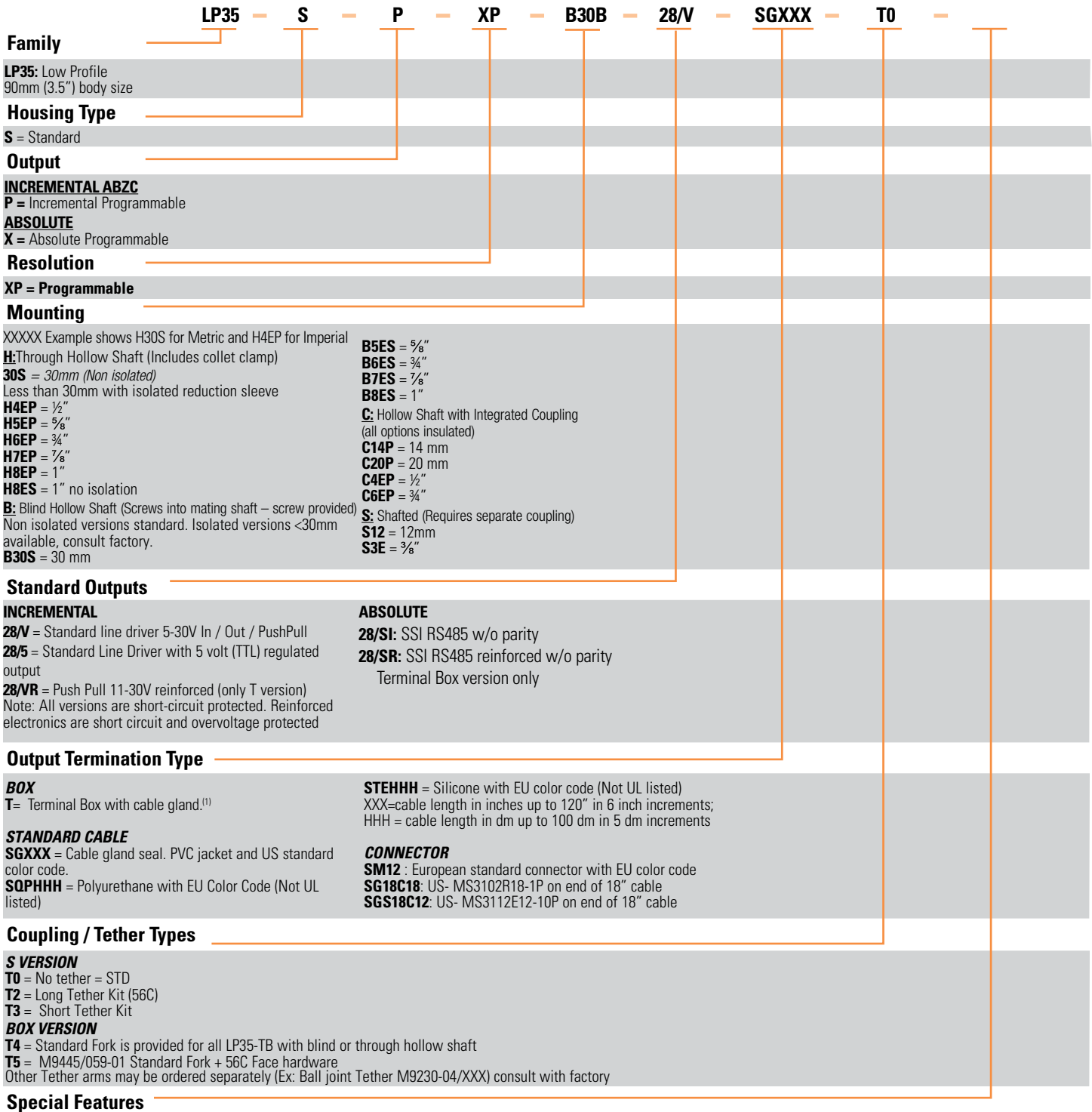
Termination	Connection Ordering Code	Description	-	+	Clk+	Clk-	Data+	Data-	Reset	NC	Case Ground
M12	M12	EUR M12 - 8 pins	1	2	3	4	5	6	7	N/A	Connector Body
Standard Cable	SG	PVC Jacket	BLK	RED	BLU	WHT/ BLU	YEL	WHT/ YEL	ORN	N/A	GRN
Terminal Box	T	Terminal box - 9 pins	1	2	3	4	5	6	7	8	9





# ORDERING OPTIONS - NORTH AMERICAN LP35 MODELS

Use this diagram, working from left to right to construct your model number (Example : LP35-S-P-XP-B30B-28/V-SGXXX-T0)



**NOTE:** <sup>(1)</sup>"T" Code changes the form from approximately 90mm (3.5") round to a rectangle that is approximately 128mm (5") high by 116mm wide (4.5")



## HOW TO USE THE PROGRAMMABLE FEATURE



- Download the software and drivers on BEI Sensors website <http://www.beisensors.com/programmable-encoders.html> Choose the « LP Series : Programmable Resolution Incremental and Absolute Encoders »
- Prior to using the software programming cable, the USB programming tool must be installed on the PC. OS requirements: Windows XP or higher.
- Administrator rights may be required for driver software installation.

### Overview of General Programming Procedure

Connect the terminal box, M12 connector or encoder wires from the encoder to the programming tool.



#### CAUTION

Double check wiring before inserting USB plug into PC.

Connect the programming tool to a PC.

Launch LP series PC programming tool software.

The software detects the encoder type and then gives access to the relevant encoder parameters

Change the encoder parameters as needed

End the programming sequence by clicking on the Program button.

Disconnect the encoder

### Incremental

• Once the program has recognized a valid connection between the programming tool and the computer, then the encoder and the programming tool, two green check marks will appear in the upper right hand corner.

• Select the resolution – this is the number of cycles per turn that the encoder will generate.

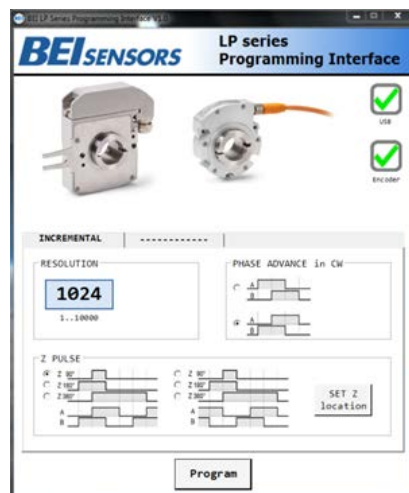
Also sometimes referred to as counts or CPT.

• Phase advance determines whether the encoder sequence of the data channels: whether A leads B Clockwise (CW) or Counterclockwise (CCW).

• You have a choice of three different index track widths: 90° (1/4 cycle), 180° (1/2 cycle) or 360° (Full Cycle)

• You can also choose the relationship between the index and the other data tracks.

Once you have the encoder set the way you want it, end the programming sequence by a click on the Program button.



### Absolute

• Once the program has recognized a valid connection between the programming tool and the computer, then the encoder and the programming tool, two green check marks will appear in the upper right hand corner.

• Select the resolution – this is the number of counts per turn, expressed as Bits, that the encoder will generate. For example 10 = 10 Bits = 1024 counts, 12 = 12 Bits = 4096 counts

• Evolution code determines whether the encoder will increase or decrease counts when turned in the clockwise CW direction

• You will also have a choice of whether to count in Natural Binary or Gray Code. For most common applications Gray Code is preferred as it is more immune to noise and propagation delays.

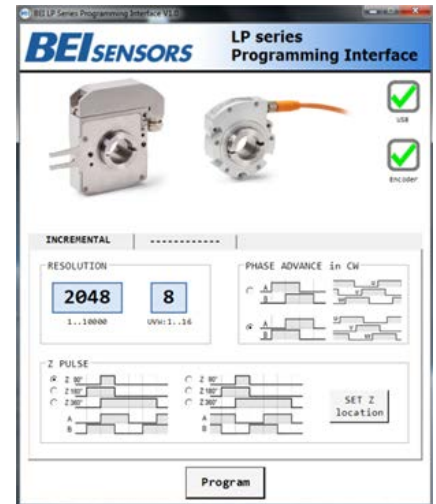
• You also have an opportunity to set the “zero” or starting point at the current location of the encoder by clicking the RESET button.

• Once you have the encoder set the way you want it, end the programming sequence by a click on the Program button.



## Incremental with Commutation Track Version

- Once the program has recognized a valid connection between the programming tool and the computer, then the encoder and the programming tool, two green check marks will appear in the upper right hand corner.
  - Select the resolution – this is the number of cycles per turn that the encoder will generate. Also sometimes referred to as counts or CPT.
  - Next, choose the number of commutation pair poles from one to 16
  - Phase advance determines whether the encoder sequence of the data channels: whether A leads B Clockwise (CW) or Counterclockwise (CCW). This also affects the direction of the commutation cycles as well.
  - You have a choice of three different index track widths: 90° (1/4 cycle), 180° (1/2 cycle) or 360° (Full Cycle)
  - You can also choose the relationship between the index and the other data tracks.
- Once you have the encoder set the way you want it, end the programming sequence by a click on the Program button.



## AGENCY APPROVALS & CERTIFICATIONS

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Proc. Cont. Eq.  
E477663



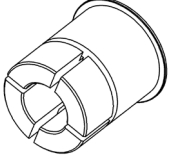
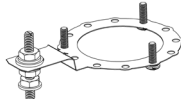
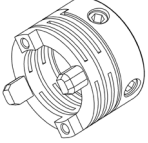
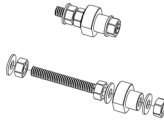
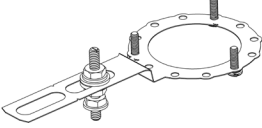

## GENERAL NOTES

<sup>(A)</sup> For detailed installation instructions and recommend screw torques refer to the User's Manual



## ACCESSORIES

The following accessories are included with your LP series encoder and defined by your part number selection.

 <p><b>Bore Reduction Sleeve</b></p>	<p>9418/H20 = 20 mm bore  9418/H8E = 1 in. bore  9418/H7E = 7/8 in. bore  9418/H6E = 3/4 in. bore  9418/H5E = 5/8 in. bore  9418/H4E = 1/2 in. bore  9418/H3E = 2/8 in. bore</p>	 <p><b>Short Tether Arm Kit</b></p>	<p>M9455/058 = short tether, 8 x 1 mm rod  M9455/058-01 = short tether, 3/8"-16 rod  M9445/053-02 = short tether, 1/4"-20 rod</p>
 <p><b>Integrated Coupling Kit</b> (includes flex, hub and set screws)</p>	<p>M9410/009-14 = 14 mm  M9410/009-20 = 20 mm  M9410/009-E3 = 1/4 in.  M9410/009-E4 = 1/2 in.  M9410/009-E6 = 5/8 in.</p>	 <p><b>Tether Pin Kit</b></p>	<p>M9445/059 = 10 x 1.5 mm rod and hardware  M9445/059-01 = 3/8"-16 rod and hardware  M9445/059-02 = 1/4"-20 rod and hardware</p>
 <p><b>Long Tether Arm Kit</b></p>	<p>M9445/053 = long tether, 8 x 1 mm rod  M9445/053-01 = long tether, 3/8"-16 rod  M9445/053-02 = long tether, 1/4"-20 rod</p>	 <p><b>Key for 12mm slot</b></p>	<p>9435/006 = 4X4X12 mm key</p>

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