



## LP SERIES | MODEL LP35

LOW PROFILE INCREMENTAL OR ABSOLUTE 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



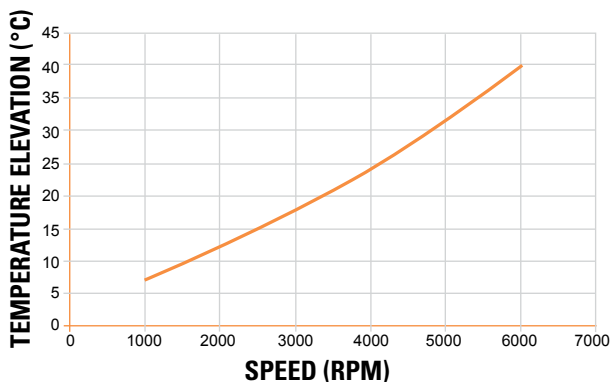
### SPECIFICATIONS

#### Mechanical

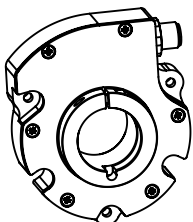
<b>Housing Size</b>	<b>Standard:</b> Ø 90mm X 26mm deep <b>Terminal Box:</b> 128mm tall X 116mm wide X 25mm deep. (See dimensional drawings for detail)
<b>Shaft Size</b>	<b>Hollow Shaft:</b> Ø 1/2" to Ø 1" blind or through <b>Solid Shaft:</b> Ø12 mm x 20 mm with keyway, Ø 3/8"x 7/8" with flat <b>Hollow 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

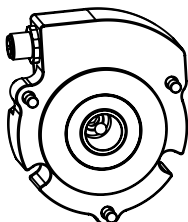
(Temperature on this chart to be added to ambient temperature. Do not exceed maximum temperature on datasheet.)



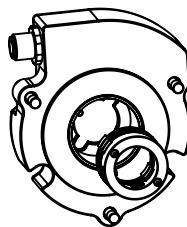
## Cable or M12 Connection Shaft Options



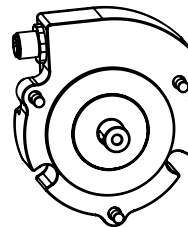
Through Hollow Shaft



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

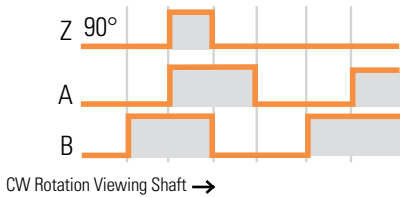
<b>Protection Class (sealing)</b>	IP66	
<b>Temperature Range</b>	<b>Cable or M12:</b> -40°C +100°C <b>Terminal Box:</b> -40°C +85°C (28/VR), -40°C +100°C (28/V and 28/5)	
<b>Mechanical Resistance</b>	<b>Shock</b>	(EN60068-2-27): $\leq 3000\text{m.s}^{-2}$ (5 ms, half sine) (300 G's)
	<b>Vibration</b>	(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

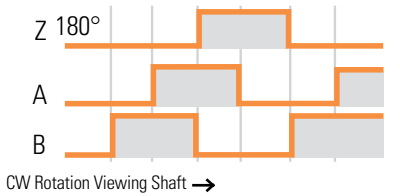
Waveform AA/ BB/ 00/ Channel B before A Clockwise (US convention is A leads B CCW)

### Incremental Waveform

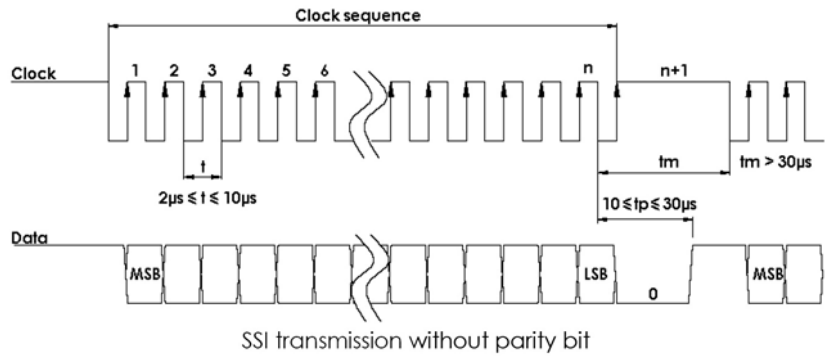
#### INDEX GATED WITH A & B HIGH (CODE Q28)



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



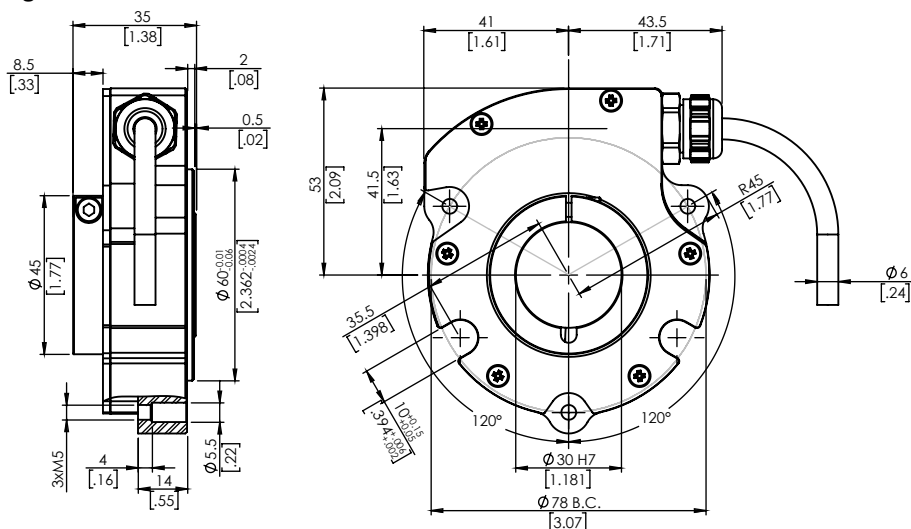
### Absolute SSI Waveform



## DIMENSIONS<sup>(A)</sup>

All dimensions are in millimeters [inches]

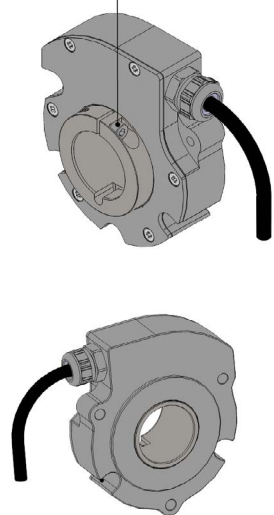
### Through hollow shaft



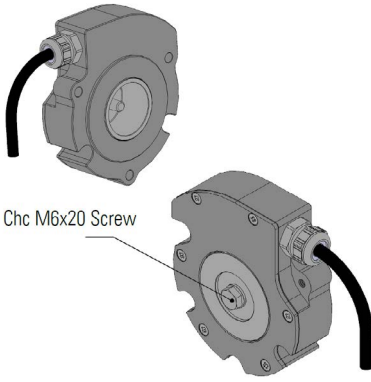
**NOTE:**

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

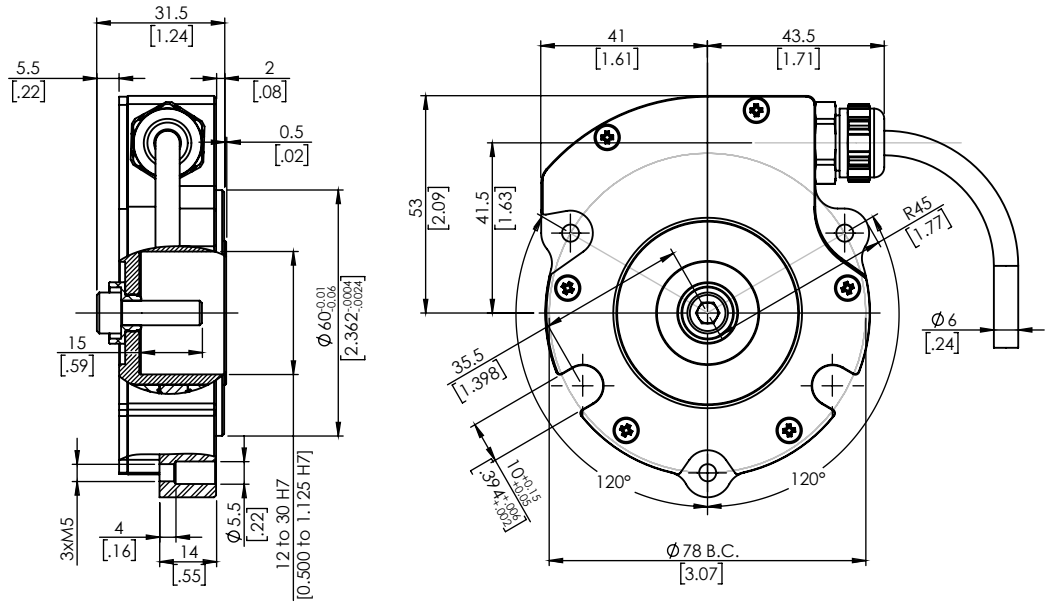
CHc M4 Screw (SW3)



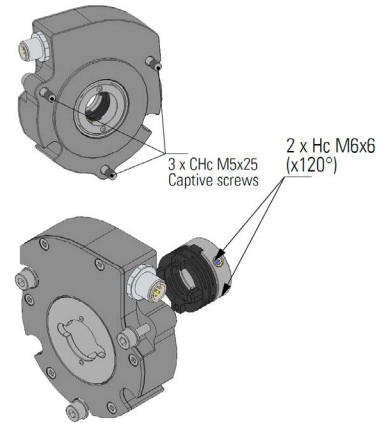
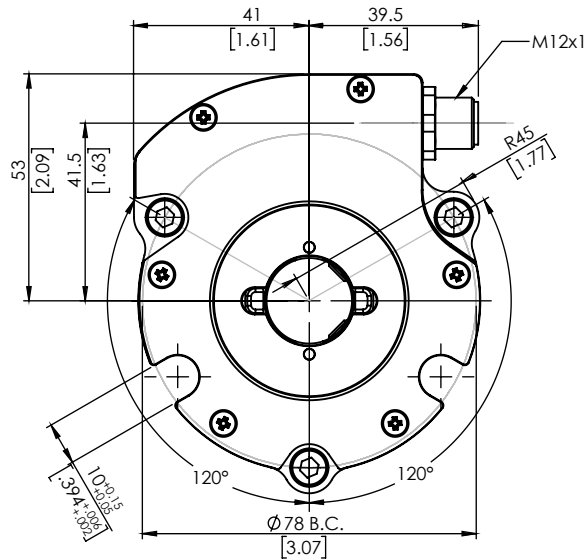
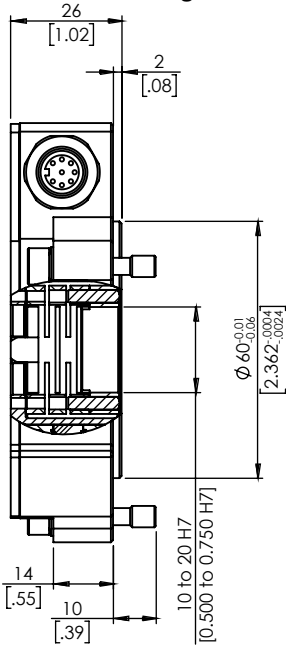
## Blind hollow shaft



Chc M6x20 Screw

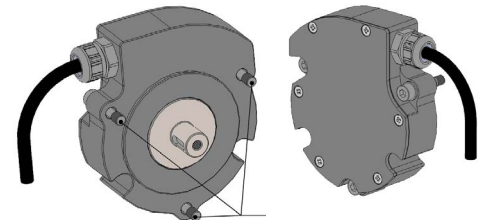
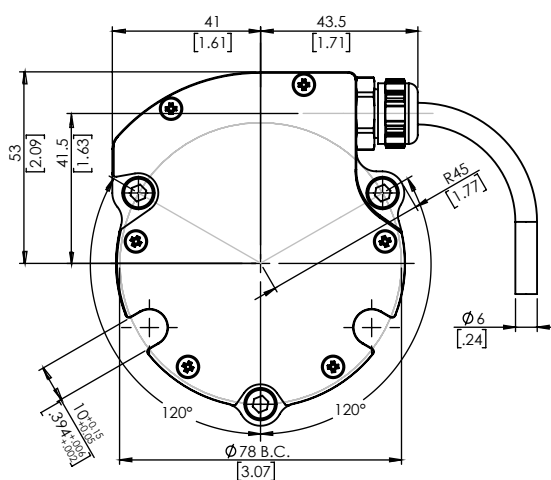
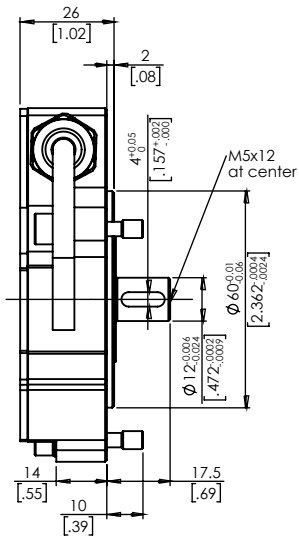


## Shaft with integrated coupling

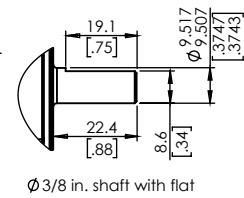


3 x Chc M5x25 Captive screws  
2 x Hc M6x6 (x120°)

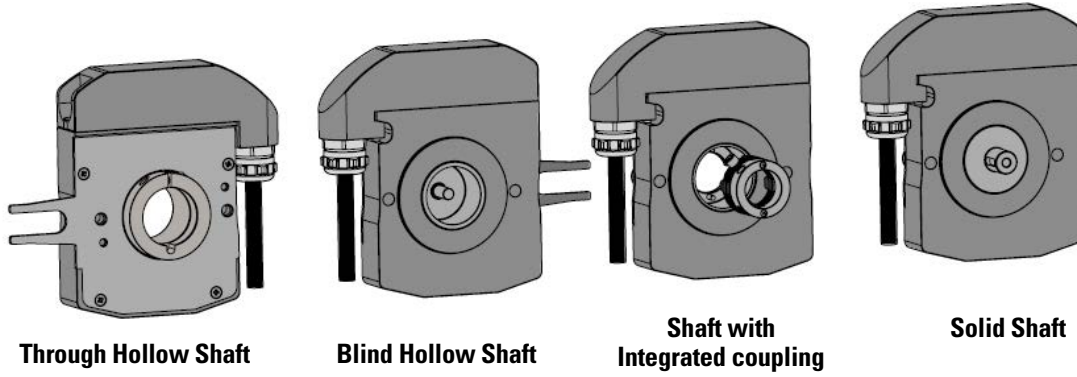
## Solid shaft



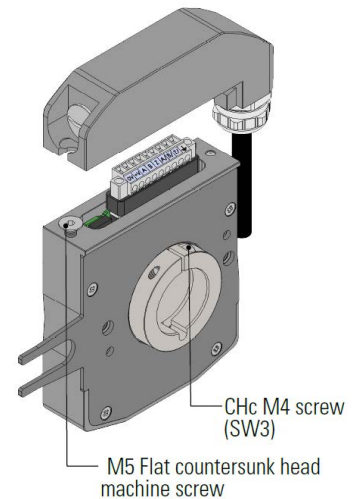
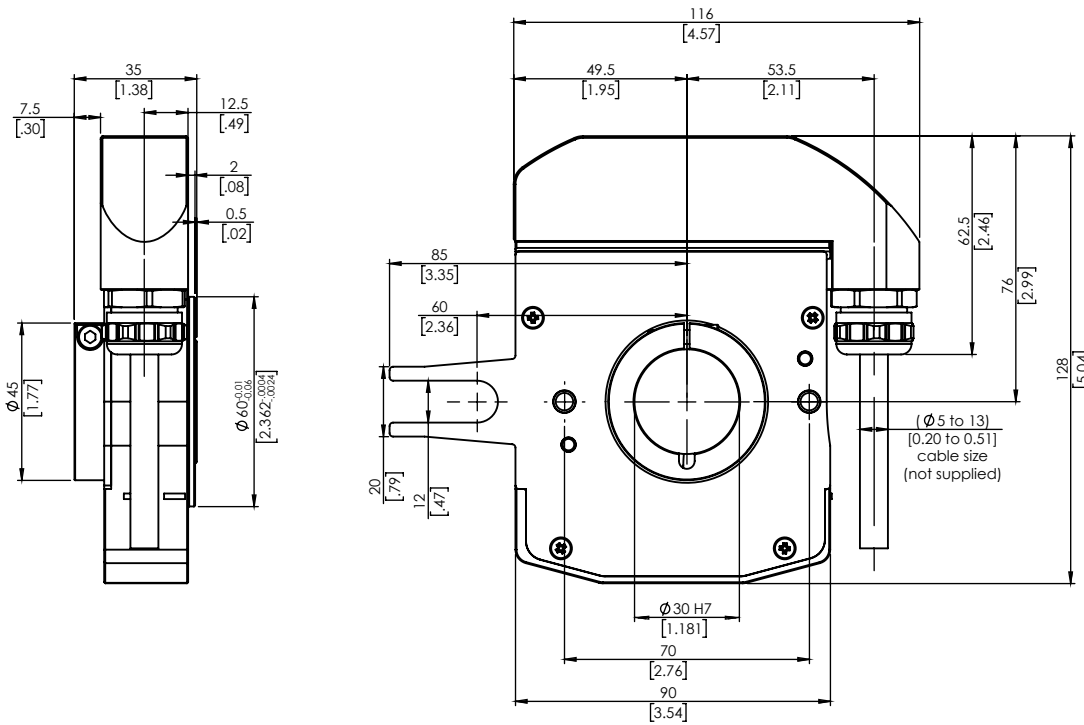
3x Chc M5x25 Captive screws



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



**Through hollow shaft**



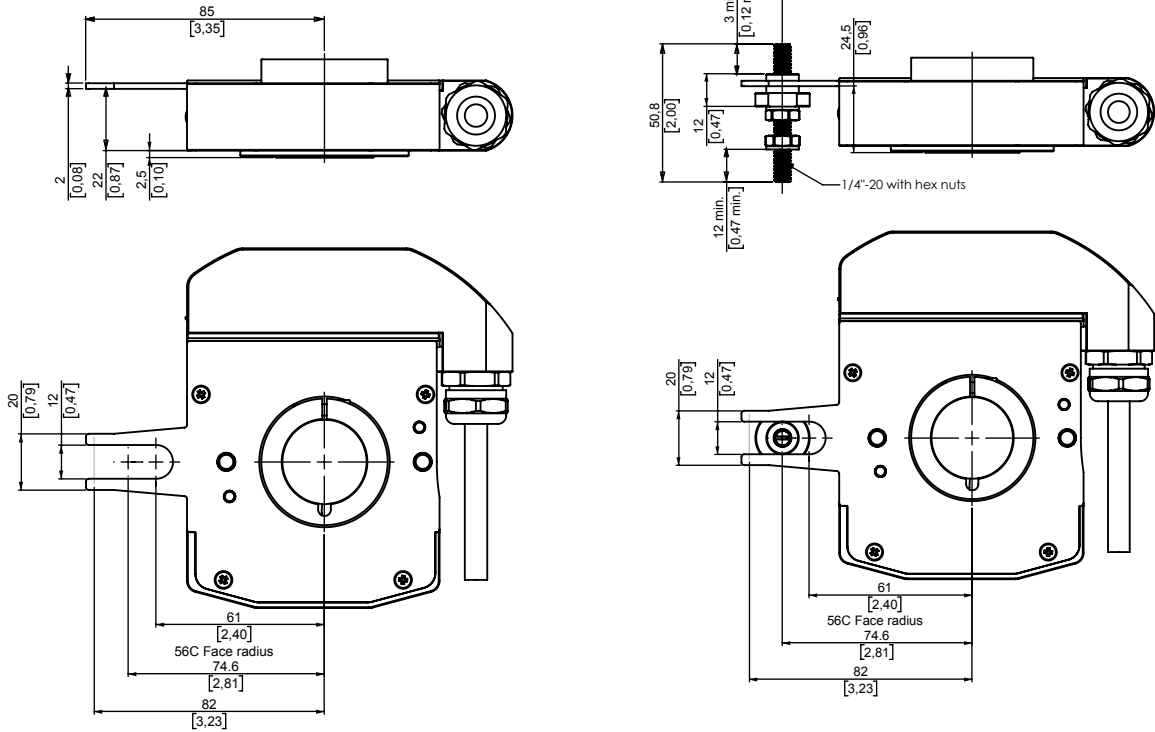
**NOTE:**  
CHc : Hexagonal Socket head cap screws    HC : Hexagonal socket set screws







## TETHER OPTIONS FOR TERMINAL BOX OUTPUT



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

T5- M9445/059-02 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



## STANDARD RESOLUTIONS

### Incremental

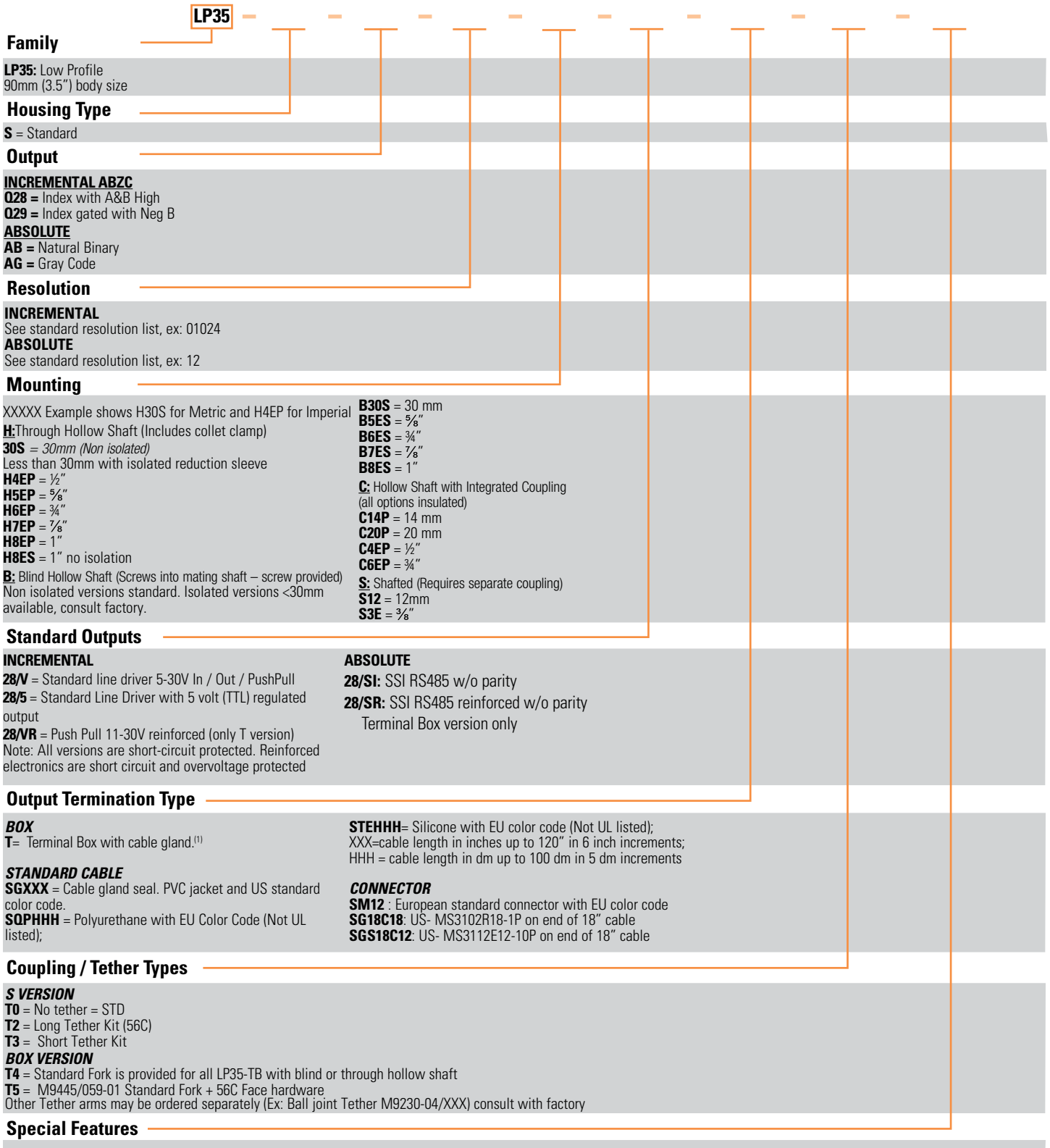
32	64	100	128	250	256	360	500	512
600	720	1000	1024	1200	1250	1440	1500	2000
2048	2500	2880	3600	4096	5000	7200	8192	10000

### Absolute

BITS	5	6	7	8	9	10	11	12	13	14	15	16
Counts	32	64	128	256	512	1024	2048	4096	8192	16384	32768	65536

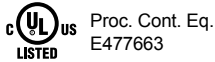
For non-standard and resolutions above 10000 PPR, please contact factory





**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")

# AGENCY APPROVALS & CERTIFICATIONS



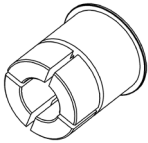

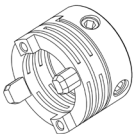
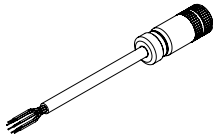
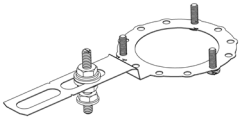
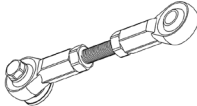
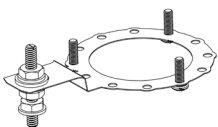
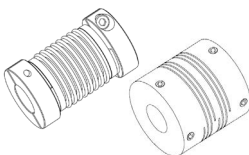
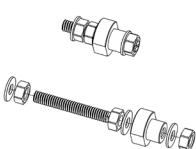
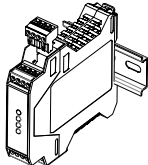
These commodities, technology or software if exported from the United States must be in accordance with the Bureau of Industry and Security, Export Administration regulations. Diversion contrary to U.S. Law is prohibited.

# 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/HXX series: range is from 1/2" through 1" in 1/8 inch increments</p>	<p><b>Key for 12mm slot</b></p> 	<p>9435/006 = 4X4X12 mm key</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-E5 = 5/8 in. M9410/009-E6 = 1 in.</p>	<p><b>Cable Assemblies</b></p> 	<table border="1"> <thead> <tr> <th>Length</th> <th>Model Number</th> <th>Part Number</th> </tr> </thead> <tbody> <tr> <td>0.5m</td> <td>9416/111-8230/200-GM-005</td> <td>RAL-005-002</td> </tr> <tr> <td>1m</td> <td>9416/111-8230/200-GM-010</td> <td>RAL-010-012</td> </tr> <tr> <td>2m</td> <td>9416/111-8230/200-GM-020</td> <td>RAL-020-035</td> </tr> <tr> <td>5m</td> <td>9416/111-8230/200-GM-050</td> <td>RAL-050-045</td> </tr> <tr> <td>10m</td> <td>9416/111-8230/200-GM-100</td> <td>RAL-100-047</td> </tr> </tbody> </table>	Length	Model Number	Part Number	0.5m	9416/111-8230/200-GM-005	RAL-005-002	1m	9416/111-8230/200-GM-010	RAL-010-012	2m	9416/111-8230/200-GM-020	RAL-020-035	5m	9416/111-8230/200-GM-050	RAL-050-045	10m	9416/111-8230/200-GM-100	RAL-100-047
Length	Model Number	Part Number																			
0.5m	9416/111-8230/200-GM-005	RAL-005-002																			
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5m	9416/111-8230/200-GM-050	RAL-050-045																			
10m	9416/111-8230/200-GM-100	RAL-100-047																			
<p><b>Long Tether Arm Kit</b></p> 	<p>M9445/053 = long tether, M8x1 rod M9445/053-01 = long tether, 3/8"-16 rod M9445/053-02 = long tether, 1/4"-20 rod</p>	<p><b>Ball End Tether</b></p> 	<p>M9230-04/XXX</p>																		
<p><b>Short Tether Arm Kit</b></p> 	<p>M9455/058 = short tether, M8x1 rod M9455/058-01 = short tether, 3/8"-16 rod M9445/058-02 = short tether, 1/4"-20 rod</p>	<p><b>Flexible Couplings</b></p> 	<p>Bellows Type 9404/S/12-12 = for use with a 12mm shaft</p> <p>Triple Beam Type 39074-12-12 = for use with a 3/8" shaft</p>																		
<p><b>Tether Pin Kit</b></p> 	<p>M9445/059 = M10x1.5 rod and hardware M9445/059-01 = 3/8"-16 rod and hardware M9445/059-02 = 1/4"-20 rod and hardware</p>	<p><b>Intrinsic Safety Barrier</b></p> 	<p>This galvanically isolated barrier provides both power and signal isolation for an incremental encoder. With differential line driver outputs, it can carry signals up to 500 feet with a bandwidth of up to 250 kHz. For detailed ordering options, refer to accessory specification sheet.</p>																		