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

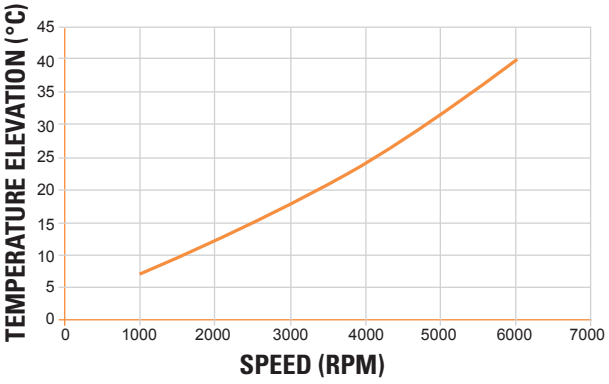
SPECIFICATIONS

Mechanical

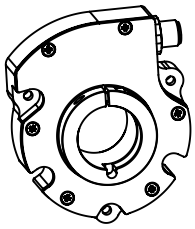
Housing Size	**Standard:** Ø 90mm X 26mm deep **Terminal Box:** 128mm tall X 116mm wide X 25mm deep. (See dimensional drawings for detail)
Shaft Size	**Hollow Shaft:** Ø 1/2" to Ø 1" blind or through **Solid Shaft:** Ø12 mm x 20 mm with keyway, Ø 3/8"x 7/8" with flat **Hollow Shaft w/ Integrated Coupling:**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

Chart 1. Speed vs Temperature

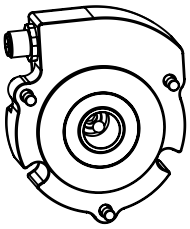
(Temperature on this chart to be added to ambient temperature. Do not exceede maximum temperature on datasheet.)



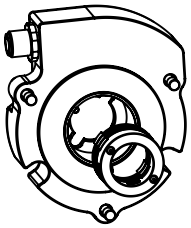
Cable or M12 Connection Shaft Options



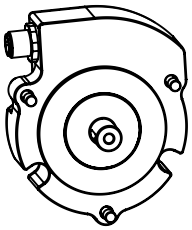
Through Hollow Shaft



Blind Hollow Shaft



Shaft with Integrated coupling



Solid Shaft

Electrical

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

Environmental

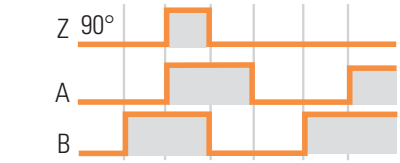
Protection Class (sealing)	IP66	
Temperature Range	**Cable or M12**: -40°C +100°C **Terminal Box**: -40°C +85°C (28/VR), -40°C +100°C (28/V and 28/5)	
Mechanical Resistance	**Shock**	(EN60068-2-27): ≤ 3000m.s^{-2} (5 ms, half sine) (300 G's)
	Vibration	(EN60068-2-6): ≤ 200m.s^{-2} (55 … 2 000 Hz) (20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

OUTPUT WAVEFORMS

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

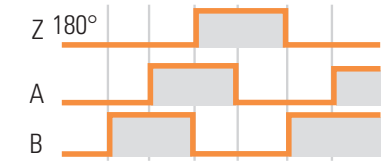
Incremental Waveform

INDEX GATED WITH A & B HIGH (CODE Q28)



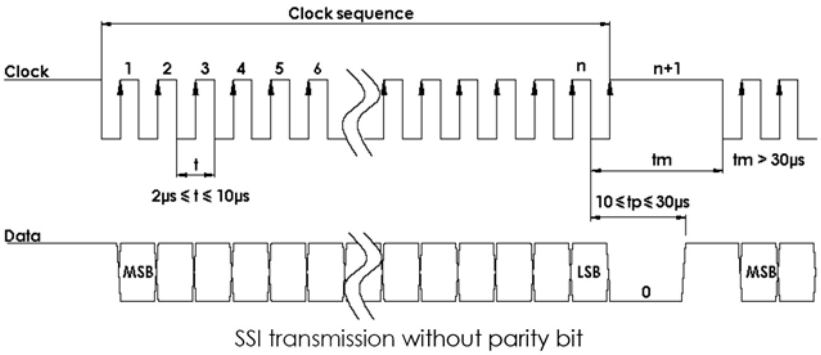
CW Rotation Viewing Shaft →

INDEX GATED WITH B LOW (CODE Q29)



CW Rotation Viewing Shaft →

Absolute SSI Waveform

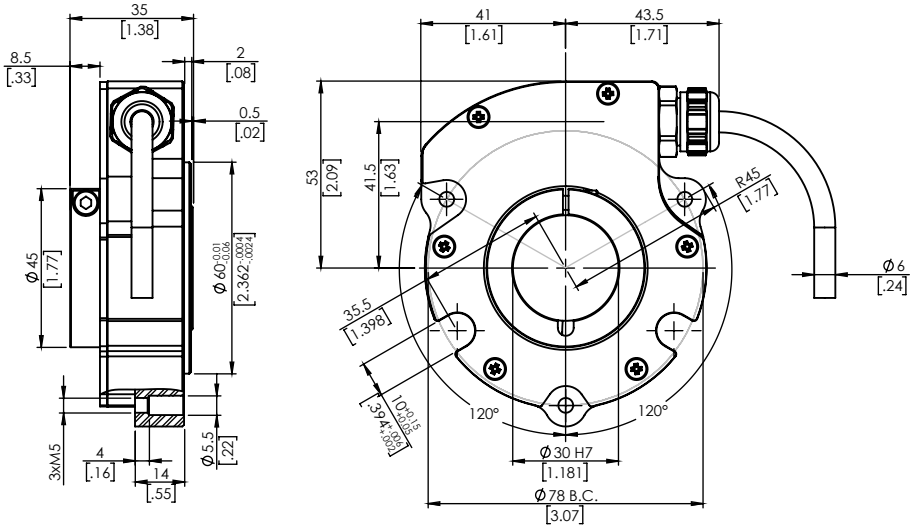


SSI transmission without parity bit

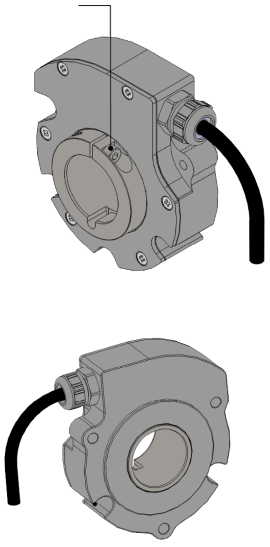
DIMENSIONS(A)

All dimensions are in millimeters [inches]

Through hollow shaft

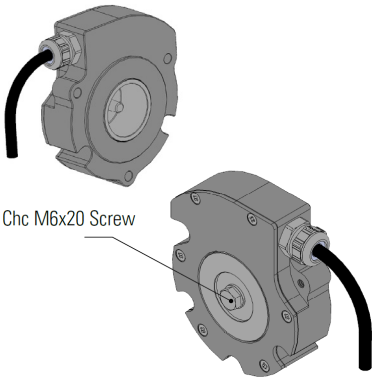


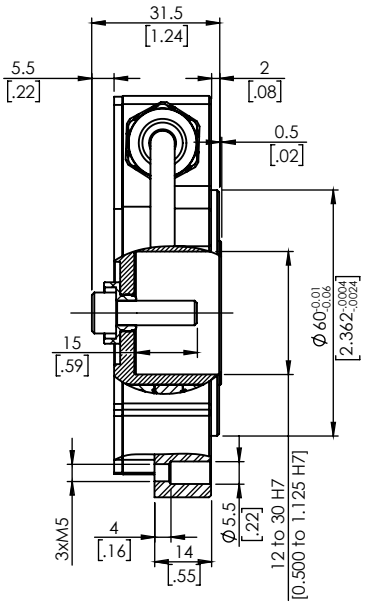
CHc M4 Screw (SW3)

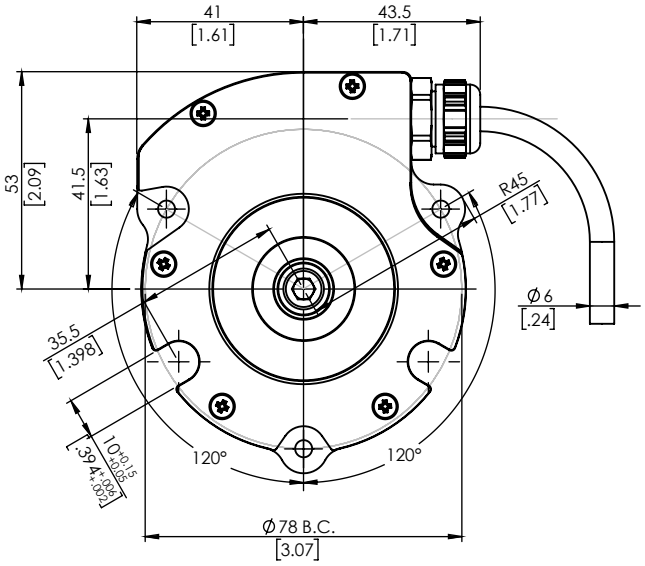


NOTE:
CHc : Hexagonal Socket head cap screws HC : Hexagonal socket set screws

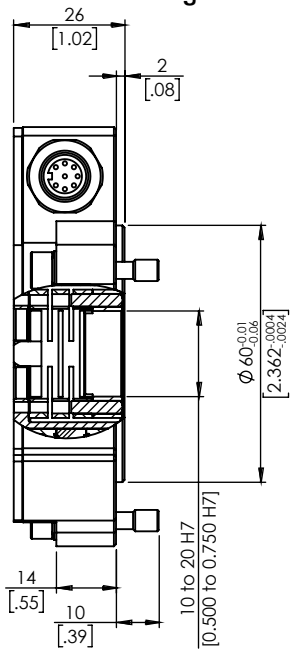
Blind hollow shaft

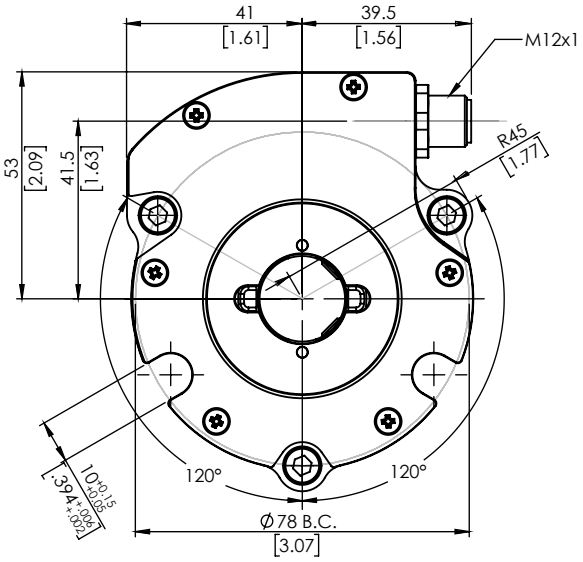


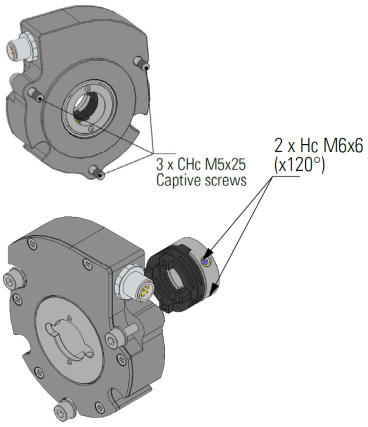




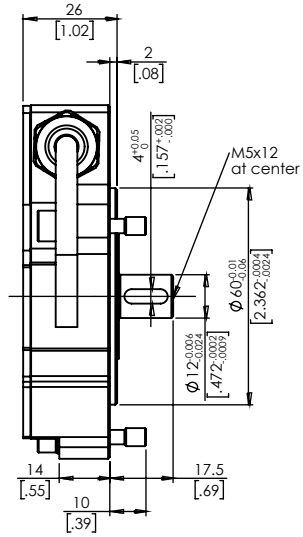
Shaft with integrated coupling

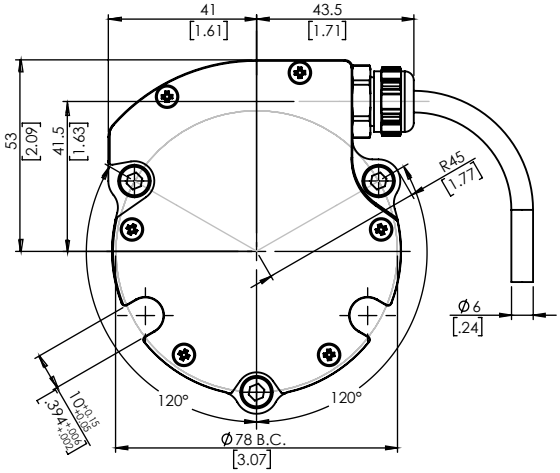


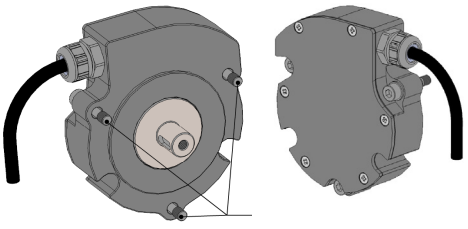


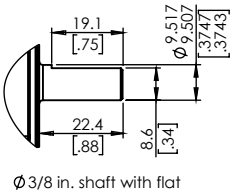


Solid shaft



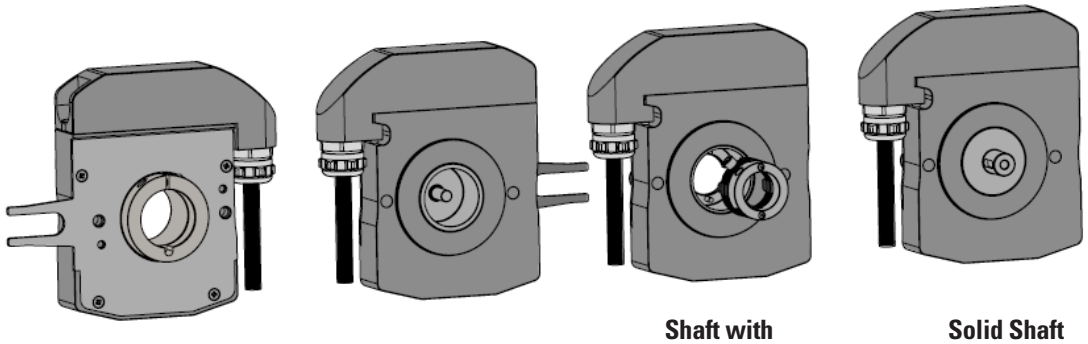






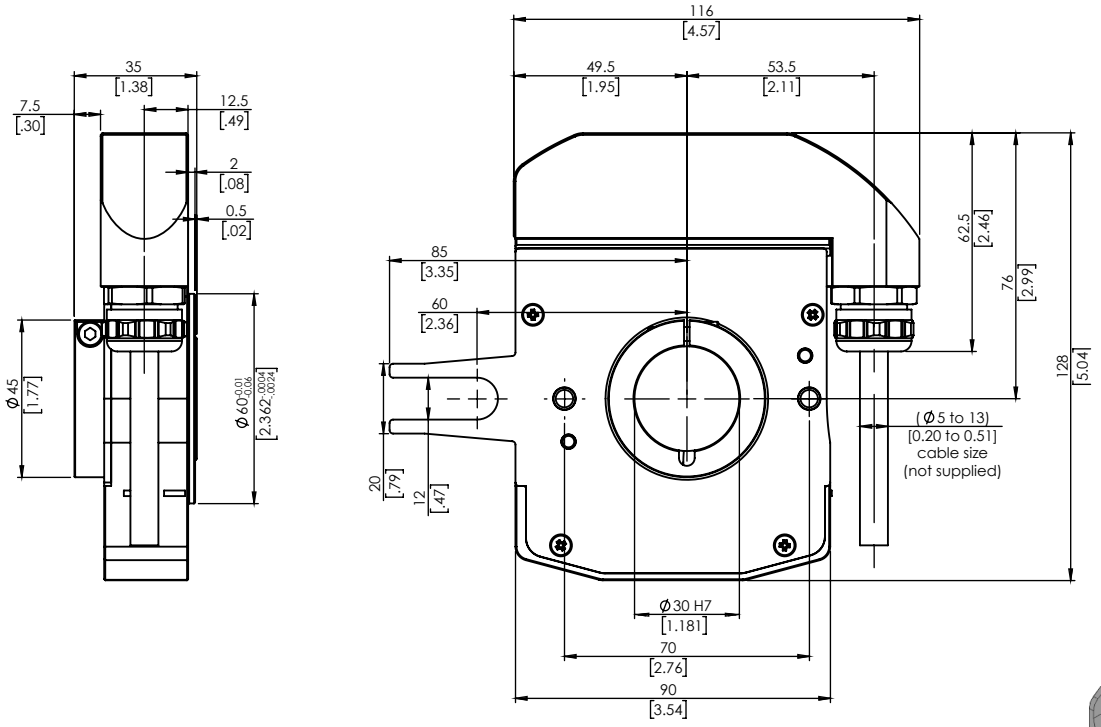
Ø3/8 in. shaft with flat

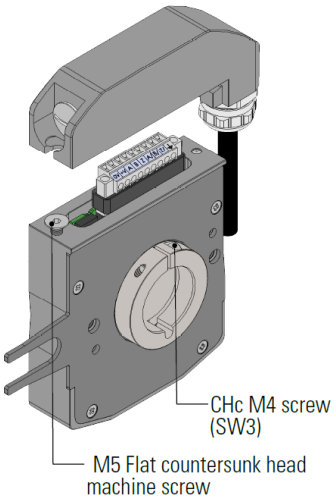
TERMINAL BOX SHAFT OPTIONS



Through Hollow Shaft | **Blind Hollow Shaft** | **Shaft with Integrated coupling** | **Solid Shaft**

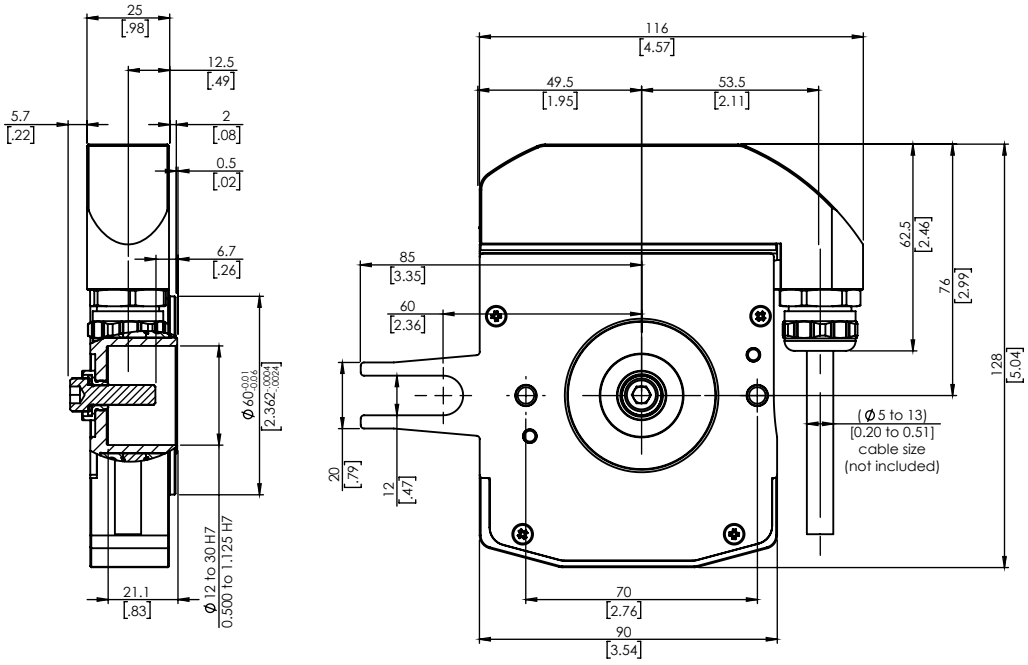
Through hollow shaft

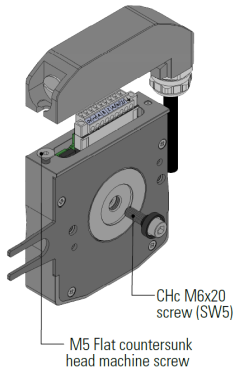


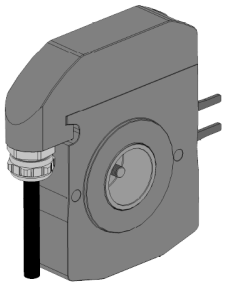


NOTE:
CHc : Hexagonal Socket head cap screws HC : Hexagonal socket set screws

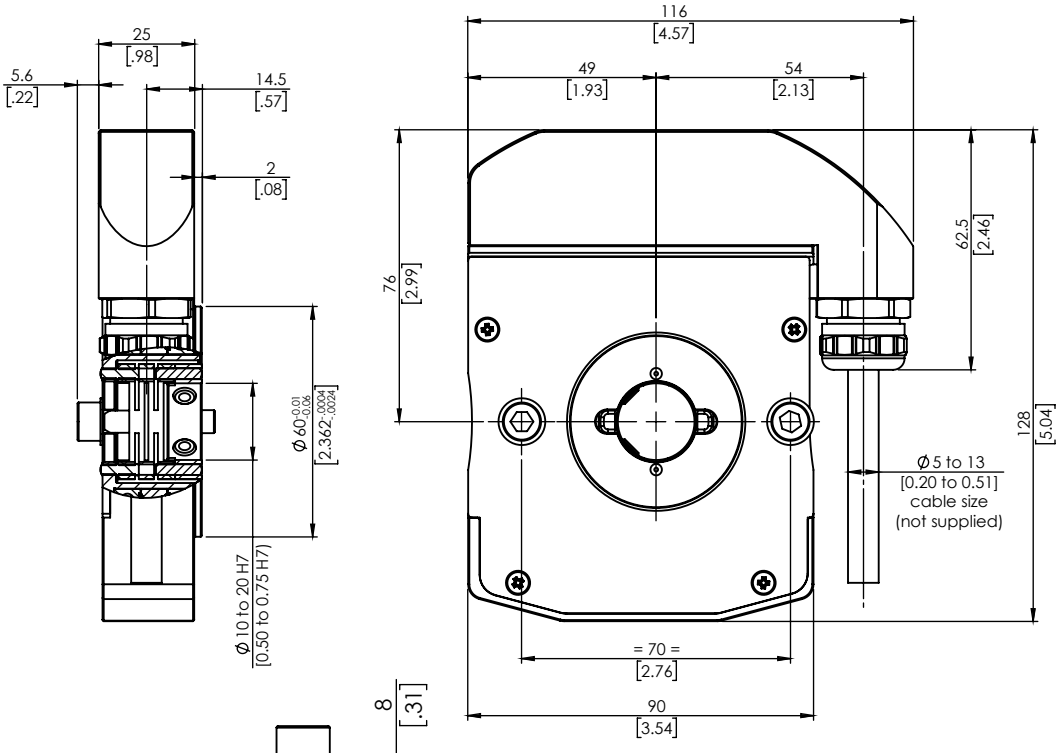
Blind hollow shaft

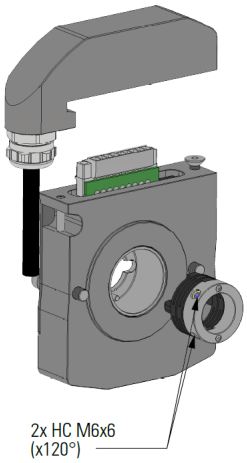


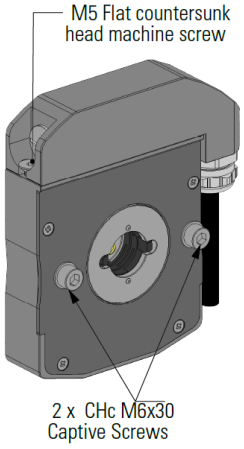




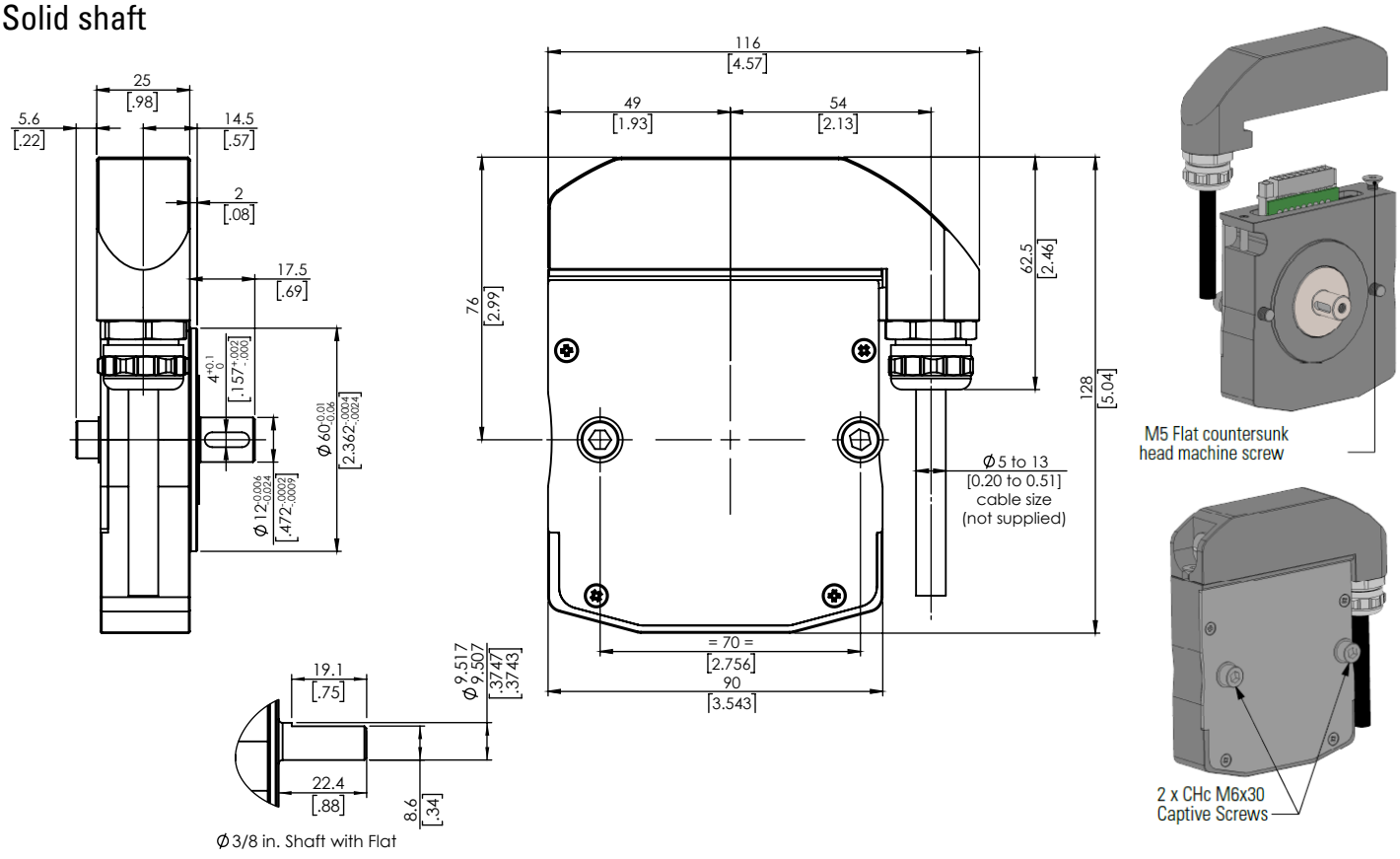
Shaft with integrated coupling





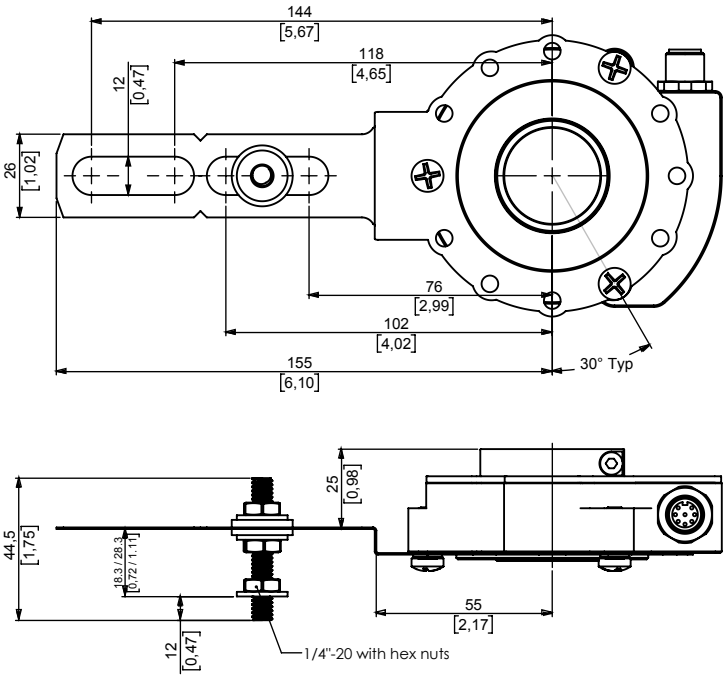


Solid shaft

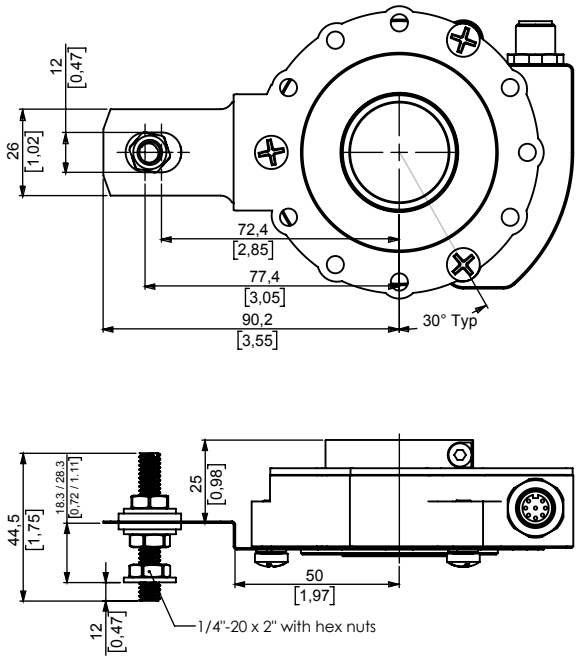


TETHER OPTIONS FOR STANDARD CABLE OR M12 CONNECTOR

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

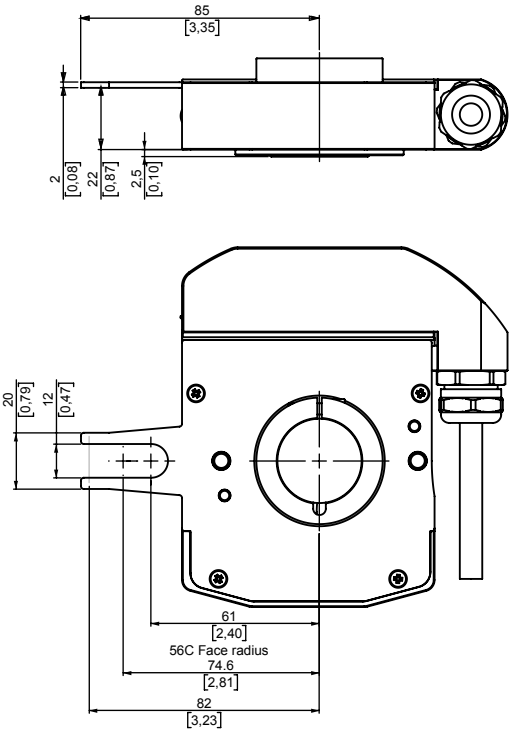


T2- Long tether arm with ¼"-20 adj. hardware – M9445/053-02

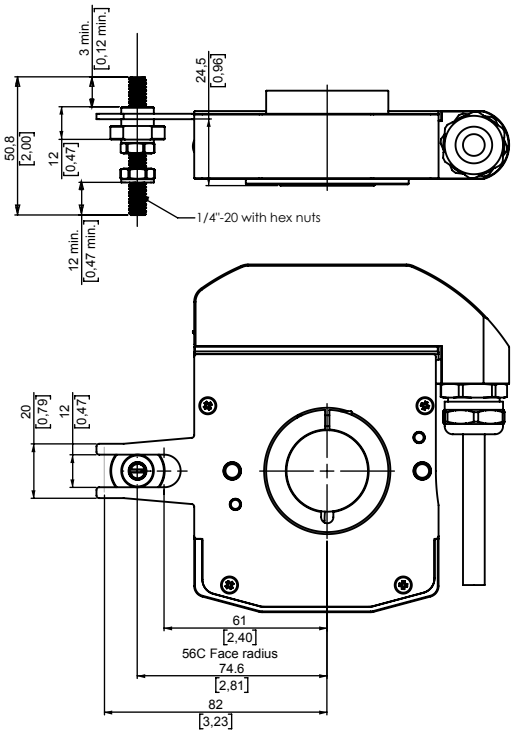


T3-Short tether arm with ¼"-20 adj, hardware (fits 56C) – M9445/058-02

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
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
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-H30S-28/V-SGXXX- T0)

LP35 – – – – – – – – – – – –

Family

LP35: Low Profile
90mm (3.5") body size

Housing Type

S = Standard

Output

INCREMENTAL ABZC
P = Incremental Programmable
ABSOLUTE
X = Absolute Programmable

Resolution

XP = Programmable

Mounting

XXXXX example H30SM in Metric and H50P if Imperial
H:Through Hollow Shaft (Includes collet clamp)
30S = *30mm (Non isolated)*
Less than 30mm with isolated reduction sleeve
H4EP = ½"
H5EP = ⅝"
H6EP = ¾"
H7EP = ⅞"
H8EP = 1"
H8ES = 1" no isolation
B: Blind Hollow Shaft (Screws into mating shaft – screw provided)
Non isolated versions standard. Isolated versions <30mm available, consult factory.
B30S = 30 mm
B5ES = ⅝"
B6ES = ¾"
B7ES = ⅞"
B8ES = 1"
C: Hollow Shaft with Integrated Coupling (all options insulated)
C14P = 14 mm
C20P = 20 mm
C4EP = ½"
C6EP = ¾"
S: Shafted (Requires separate coupling)
S12 = 12mm
S3E = ⅜"

Standard Outputs

INCREMENTAL
28/V = Standard line driver 5-30V In / Out / PushPull
28/5 = Standard Line Driver with 5 volt (TTL) regulated output
28/VR = Push Pull 11-30V reinforced (only T version)
Note: All versions are short-circuit protected. Reinforced electronics are short circuit and overvoltage protected

ABSOLUTE
28/SI: SSI RS485 w/o parity
28/SR: SSI RS485 reinforced w/o parity
Terminal Box version only

Output Termination Type

BOX
T= Terminal Box with cable gland.[1]
STANDARD CABLE
SGXXX = Cable gland seal with cable length in inches up to 120" in 6 inch increments. PVC jacket and US standard color code.
SQPXXX = Polyurethane with EU Color Code (Not UL listed); for length in M use XXM
STEXXX = Silicone with EU color code (Not UL listed); for length in M use XXM

CONNECTOR
SM12 : European standard connector with EU color code
SG18C18: US- MS3102R18-1P on end of 18" cable
SGS18C12: US- MS3112E12-10P on end of 18" cable

Coupling / Tether Types

S VERSION
T0 = No tether = STD
T2 = Long Tether Kit (56C)
T3 = Short Tether Kit
BOX VERSION
T4 = Standard Fork is provided for all LP35-TB with blind or through hollow shaft
T5 = M9445/059-01 Standard Fork + 56C Face hardware
Other Tether arms may be ordered separately (Ex: Ball joint Tether M9230-04/XXX) consult with factory

Special Features

NOTE: [1]"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.

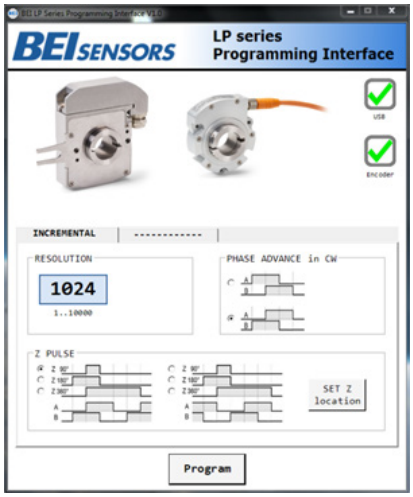
Overview of General Programming Procedure

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.

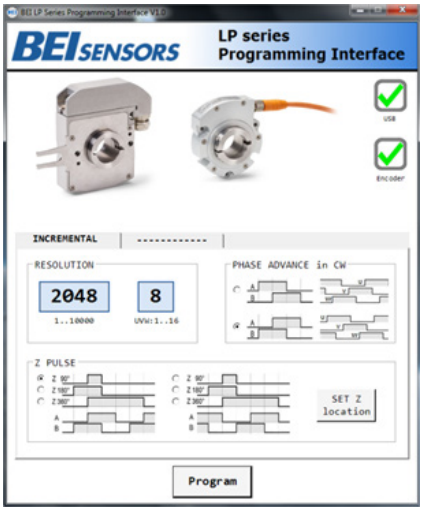
• Next, choose the number of commutation pair poles from one to 16

• 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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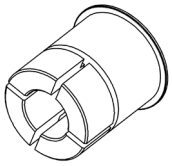
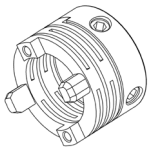
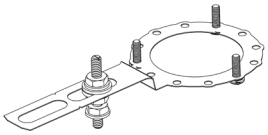
Proc. Cont. Eq.
E477663

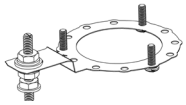
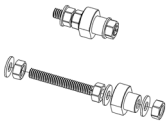
GENERAL NOTES

(A) 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.

Bore Reduction Sleeve 	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
Integrated Coupling Kit (includes flex, hub and set screws) 	M9410/009-14 = 14 mm M9410/009-20 = 20 mm M9410/009-E3 =1/4 in. M9410/009-E4 = ½ in. M9410/009-E6 = 5/8 in.
Long Tether Arm Kit 	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

Short Tether Arm Kit 	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
Tether Pin Kit 	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
Key for 12mm slot 	9435/006 = 4X4X12 mm key

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