L25
INCREMENTAL OPTICAL ENCODER



Introduction

The L25 is a lighter duty version of BEI's H25 optical encoder Incorporating the same high quality optics and electronics as the H25, the L25 also offers low starting torque. Other features include ABEC 5 bearings, EMI shielding, a 1/4" diameter stainless steel shaft and a drawn aluminum cover. Typical applications include use with light machine tools, test and laboratory instrumentation, the biomedical industry and flow metering.

MECHANICAL SPECIFICATIONS

Shaft Diameter	1/4" nominal
Flat On Shaft	0.80 long x 0.03 deep
Shaft Loading	up to 5 lbs. axial and 8 lbs. radial
Shaft Runout	.0005 T.I.R. maximum
Starting Torque at 25°C	0.07 in-oz typical, 0.12 in-oz maximum without sealed bearings; 0.50 in-oz typical, 1.0 in-oz maximum with sealed bearings
Bearings	Class ABEC 5
Shaft Material	416 stainless steel
Bearing Housing	Die cast aluminum with iridite finish
Cover	Drawn aluminum, 0.060" wall, protective finish standard. Die cast aluminum with protective finish for EM, SM, ECS and SCS terminations
Bearing Life	1 X 10^9 revs (6,700 hrs at 2500 RPM)
Maximum RPM	10,000 RPM
Moment of Inertia	4.1 x 10^{-4} oz-in-sec^2
Weight	13 oz. typical

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ELECTRICAL SPECIFICATIONS

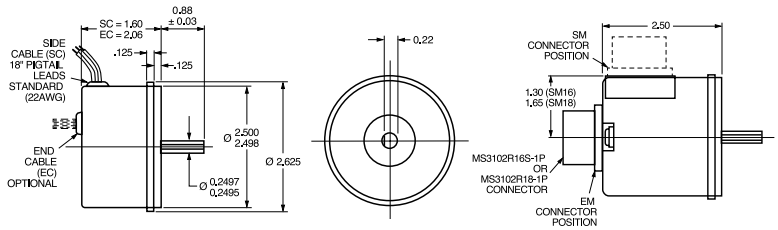
Code	Incremental
Cycles per Shaft Turn	1 to 28,800
Voltage/ Output	(see note 5) 15V/V: Line Driver, 5–15 VDC in, V_{out} = Vin 28V/V: Line Driver, 5–28 VDC in, V_{out} = Vin 28V/5V: Line Driver, 5–28 VDC in, V_{out} = 5 VDC 28V/OC: Open collector, 5–28 VDC in, OC_{out}
Current Requirements	TTL: 175 mA maximum 125 mA typical
Output Format	2 channels in quadrature = 27° electrical typical. Optional index is typically gated 1/2 cycle wide (see figure 1)
Protection Level	Reverse, overvoltage and output short circuit (4469, 7272 only)
Frequency Response	100 KHz (see note 7), up to 800 KHz with interpolation option
Output Terminations	(See Table 1)

ENVIRONMENTAL SPECIFICATIONS

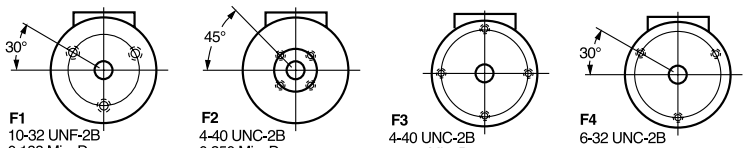
Enclosure Rating	NEMA 2 (IP43)
Temperature	Operating, 0° to 70° C; extended temperature testing available (see note 8); storage; -25° to 90° C
Shock	50 g's for 11 msec duration
Vibration	5 to 2000 Hz @ 20 G's
Humidity	98% RH without condensation

DIMENSIONS

L25G - M16 or M18



Optional Face Mounts



F1
10-32 UNF-2B
0.188 Min. Deep
3 places equally spaced
on a Ø 1.875. bolt circle.

F2
4-40 UNC-2B
0.250 Min. Deep
4 places equally spaced
on a Ø 1.272 bolt circle.
(0.900 square, Ref.)

F3
4-40 UNC-2B
0.250 Min. Deep
4 places equally spaced
on a Ø 2.00 bolt circle.

F4
6-32 UNC-2B
0.250 Min. Deep
3 places equally spaced
on a Ø 2.00 bolt circle.

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TABLES

Table 1–Incremental Output Terminations

The connector style will determine pinouts. For example, an encoder with ABC channels and an M18 connector uses the table to the right.

M14 CONNECTOR	M16 CONNECTOR	CHANNELS DESIGNATED IN MODEL NO.	
PIN	PIN	ABZ	ABC
E	A	A	A
D	B	B	B
C	C	Z	$\overline{A}$
B	D	+V (SUPPLY VOLTAGE)	
F	E	-	$\overline{B}$
A	F	0 V (CIRCUIT COMMON)	
	G	CASE GROUND (CG) (except H20)	

M18 Connector	
PIN	Channel
A	A
B	B
C	Z
D	+V
E	-
F	0V
G	CG
H	$\overline{A}$
I	$\overline{B}$
J	$\overline{Z}$

WIRE COLOR	DA 15P CONNECTOR	CHANNELS DESIGNATED IN MODEL NO.		
		ABZ	ABC	ABZC
YEL	13	A	A	A
BLUE	14	B	B	B
ORN	15	Z	-	Z
W-YEL	10	-	$\overline{A}$	$\overline{A}$
W-BLU	11	-	$\overline{B}$	$\overline{B}$
W-OM	12	-	-	$\overline{Z}$
RED	6	+V (SUPPLY VOLTAGE)		
BLK	1	0 V (CIRCUIT COMMON)		
GRN	9	CASE GROUND (CG) (except H20)		
WHITE		SHIELD DRAIN (Shielded Cable Only)		

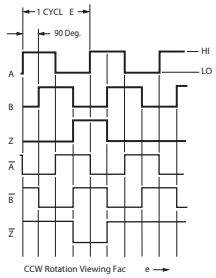
M12 Connector	
PIN	Channel
A	A
B	B
C	Z
D	+V
E	-
F	0V
G	CG
H	$\overline{A}$
J	$\overline{Z}$
K	$\overline{Z}$

Table 2–Disc Resolutions for Incremental Encoder Model L25

1, 2, 3, 5, 6, 7, 8, 10, 13, 16, 20, 24, 25, 26, 30, 32, 33, 34, 36, 37, 40, 45, 48, 50, 51, 56*, 60, 64, 66, 72, 75, 80, 86, 88, 90, 100, 102, 120, 122,125, 127, 128, 132, 144, 148, 150, 158, 160, 175, 176, 180, 187, 192, 200, 202, 204*, 217, 220, 240, 250, 254, 255, 256, 264*, 274, 280, 283, 288, 292, 300, 312, 320, 321, 325, 360, 366, 372, 375, 377, 380, 381, 384, 385, 393, 400, 430, 432, 450, 462, 480, 490, 500, 502, 508, 512, 522, 530, 550, 560*, 576, 598, 600, 604, 625, 628, 635, 638, 640, 660, 672, 676, 680, 687, 690, 700, 720, 725, 735, 740, 744, 748, 750, 762, 768, 780, 785, 800, 812, 825, 850, 864, 878, 888, 900, 912, 914, 938, 942, 955, 960, 1000, 1016, 1024, 1030, 1035, 1036, 1040, 1054, 1056, 1074, 1076, 1080,1088, 1100, 1101, 1125, 1136, 1200, 1237, 1250, 1257, 1270, 1280, 1300, 1314, 1332, 1333, 1390, 1400, 1414, 1427, 1440, 1484, 1500, 1562, 1570, 1596, 1600, 1650, 1666, 1718, 1745, 1774, 1800, 1840*, 1850, 1855, 1875, 1894, 1920, 1952, 1968, 1979, 1995, 2000, 2048, 2080, 2094, 2100, 2160, 2164, 2199, 2200, 2250, 2356, 2400, 2485, 2500, 2514, 2519, 2540, 3000, 3125, 3600, 4000, 4096, 5000

Output Waveform

Figure 1



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ORDERING OPTIONS

Example : L25G-F3-SB-2000-ABZC-28V/V-SC18

Use this diagram, working from left to right to construct your model number

L25 G - - - - - - - - -

Type

L = Heavy Duty
25 = 2.500" Dia.

Housing Config. Letter

G = 2.62 Dia. Servo Mount
See dimensions

Optional Face Mounts

F1, F2, F3, or F4
Blank = None

Shaft Seal Config.

SB = Seal Integral with Bearing
Blank = Shielded Bearing

Cycles per Turn

(Enter Cycles) See table 2

No. of Channels

A = Single Channel
AB = Dual Quad. Ch.
ABZ = Dual with Index
AZ = Single with Index
See note 3

Complements

C = Complementary Outputs
Blank = None
See note 4

Voltage/Output

15V/V = 5-15 $V_{in/out}$
28V/V = 5-28$V_{in/out}$
28V/5 = 5-28V_{in}/5V_{out}
M18 = 5-28V_{in}/OC_{out}
See note 5

Output Termination Location

E = End
S = Side

Output Termination

M16 = MS3102R16S-1P
D15 = DA15P
C = Pigtail Cable
CS = Cable with Seal Cable length specified in inches
(i.e. C18 = Pigtail 18" long)
See table 1 & note 9

Special Features

S = Special features specified on purchase order (consult factory)
See table 6

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NOTES

1. Mounting is usually done either using the D-style square flange mount, E- or G-style servo mounts, or one of the standard face mounts, F1 for example. Consult factory for additional face mount options.
2.The shaft seal is recommended in virtually all installations. The most common exceptions are applications requiring a very low starting torque or those requiring operation at both high temperature and high speed.
3. Non-standard index widths and multiple indices are available by special order. Consult factory.
4. Complementary outputs are recommended for use with line driver type (source/ sink) outputs. When used with differential receivers, this combination provides a high degree of noise immunity.
5. Output IC's: Output IC's are available as either Line Driver (LD) or NPN Open Collector (OC) types. Open Collectors require pull-up resistors, resulting in higher output source impedance (sink impedance is similar to that of line drivers). In general, use of a Line Driver style output is recommended. Line Drivers source or sink current and their lower impedance mean better noise immunity and faster switching times. **Warning**: Do not connect any line driver outputs directly to circuit common/0V, which may damage the driver. Unused outputs should be isolated and left floating. Our applications specialists would be pleased to discuss your system requirements and the compatibility of your receiving electronics with Line Driver type outputs. **28V/V:** Multi-voltage Line Driver (7272*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard (Note: Vout = Vin). This driver is TTL compatible when used with 5 volt supply. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 120 mA typical (plus load current). This is the recommended replacement for 3904R and 7406R open collector outputs with internal pullup resistors. It is also a direct replacement for any 4469, 88C30, 8830 or 26LS31 line driver **28V/5:** Multi-voltage Line Driver (7272*): 100 mA source/sink. Input voltage 5 to 28 VDC +/- 5% standard, internally regulated with 5V (TTL compatible) logic out. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 90 mA typical (plus load current). **Note:** Limit encoder load to 2.5W max at ambient. Example at 12 VDC: 2.5W/(+12VDC minus +5VDC) = 357 mA total allowed current. Consult factory for your specific requirements. **15V/V:** Multi-voltage Line Driver (4469*): 100 mA source/sink. Input voltage 5 to 15 VDC +/- 5% standard (Note: Vout = Vin). TTL compatible when used with 5 volt supply. Supply lines are protected against overvoltage to 60 volts and reverse voltage. Outputs are short circuit protected for one minute. Supply current is 90 mA typical (plus load current). This is a direct replacement for the 4469 Line Driver. **28V/OC:** NPN Open Collector (3904*, 7273*). Current sink of 80 mA max. Current sourced by external pull- up resistor. Output can be pulled up to voltage other than supply voltage (30 V max). Input voltage 5 to 28 VDC +/- 5% standard. Supply current is 120 mA typical. This replaces prior IC's with designations of 3904, 7406, 3302, 681 and 689. **5V/OCR, 15V/OCR, 24V/ OCR:** Open Collector (3904R*, 7406R*, 7273R*): Current sink of 70 mA max. Includes internal pull-ups sized at approximately 100 ohms/volt. Max current source is 10 mA. Supply current is 100 mA typical, 120 mA with internal pullups. The 5V/OCR, 15V/OCR and 24V/OCR are often replaced by the 28V/V in system upgrades. **3904, 3904R, 4469, 5V/V, 5V/OC, 5V/OCR, 9V/OC:** Intrinsically safe line driver and open collector outputs. These drivers are specific to intrinsically safe encoders, and are installed per the appropriate control drawings listed in Table 2.on this page.
6. Special –S at the end of the model number is used to define a variety of non-standard features such as special shaft lengths, voltage options, or special testing. Please consult the factory to discuss your special requirements.
7. Higher frequency response may be available. Please consult with the factory.
8. Extended temperature ratings are available in the following ranges: -40 to 70°C, -40 to 85°C, –20 to 105°C and –40 to 105°C depending on the particular model. Some models can operate down to -55°C. Extended temperature ranges can affect other performance factors. Consult with factory for more specific information.
9. Mating straight plug receptacles may be ordered from the factory:
For M12 use MS3116F12-10S, For M14 use MS3106F14S-6S
For M14/19 use MS3116J14-19S, For M16 use MS3106F16S-1S
For M18 use MS3106F18-1S, For M20 use MS3106F20-29S

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02004-001 Rev: 05/03/2018