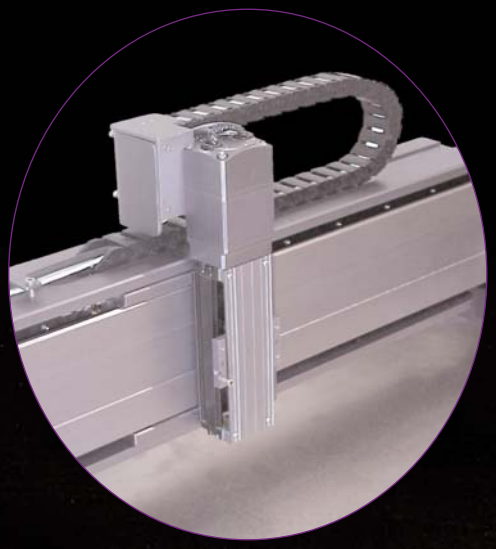
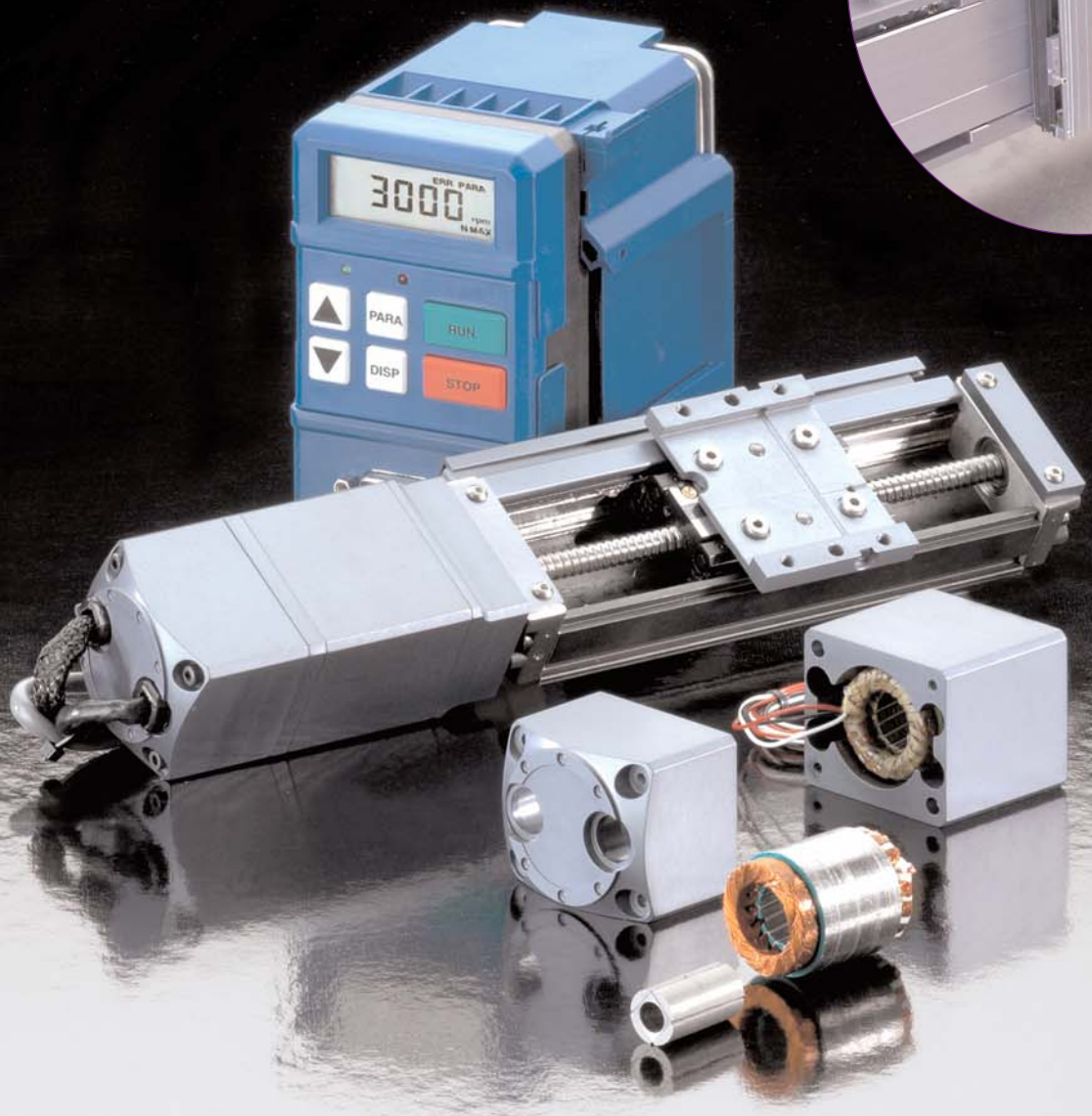
Mini-Luge BPSK Series:
Direct Drive Precision Modules

Advanced Mini Stages for Linear Motion:
The Mini Luge is a ready-to-mount precision module offering outstanding performance within a compact envelope. The steel frame construction provides a rigid assembly. The tight ball screw tolerances and zero backlash nut system yield a high precision module. It is also unique due to the integrated brushless servo motor that provides superior dynamic performance and a smaller foot print compared to conventional motor mounting designs.





Mini-Luge BPSK Series:
Overview

3

One Piece Construction Bearing Block and Ball Screw

the Rexroth Integrated Ball Rail® System and precision ball screw assembly provides optimum running properties:

- High Load Capacities
- High Stiffness
- High Precision

4

Extruded Aluminum Cover

to minimize pinch points and protect the precision ball screw

2

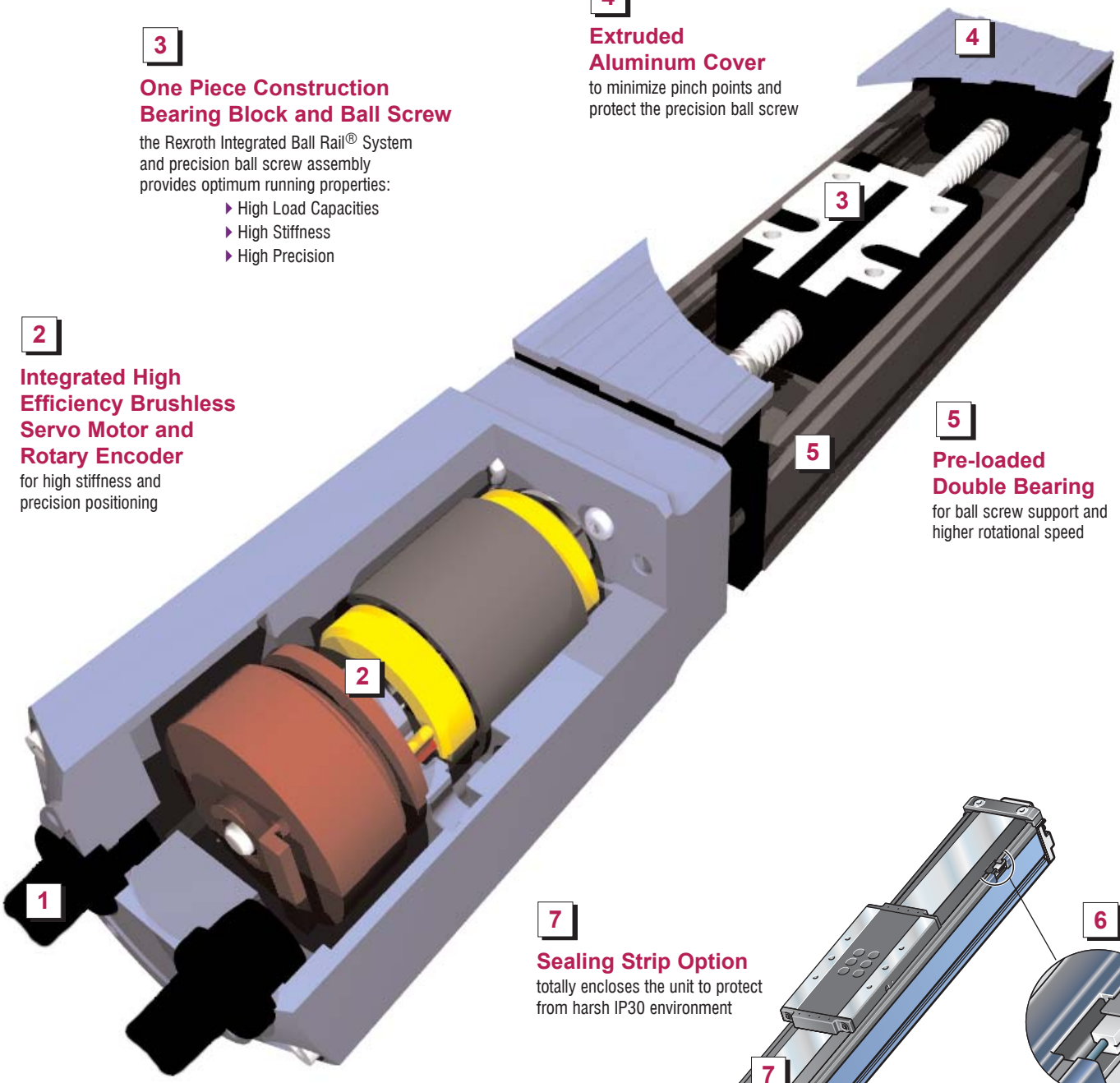
Integrated High Efficiency Brushless Servo Motor and Rotary Encoder

for high stiffness and precision positioning

5

Pre-loaded Double Bearing

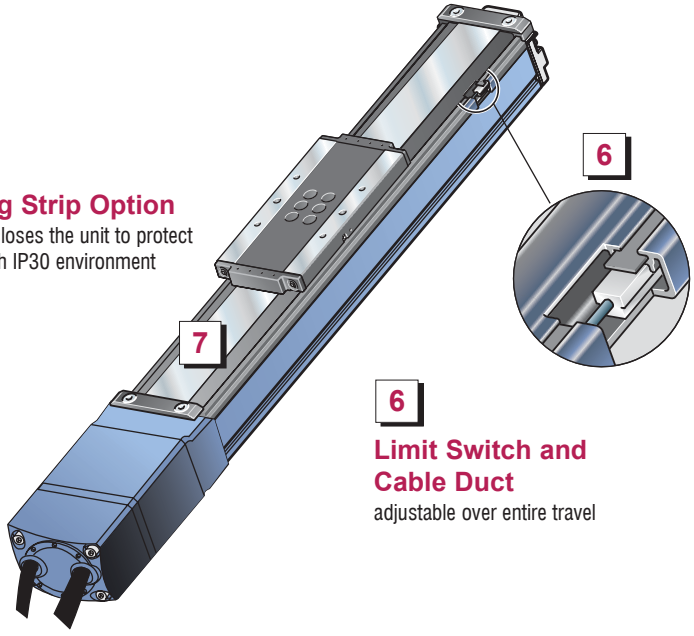
for ball screw support and higher rotational speed



7

Sealing Strip Option

totally encloses the unit to protect from harsh IP30 environment



1

Flying Lead Cable

for flexible termination of the wires and ease of connectivity

6

Limit Switch and Cable Duct

adjustable over entire travel

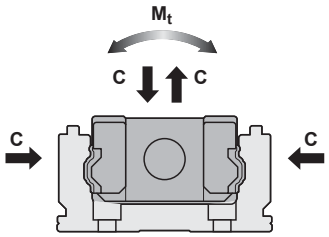
Rexroth
Bosch Group

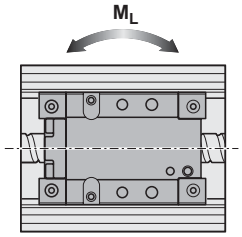
Mini-Luge BPSK Series:
Direct Drive Precision Modules

Performance Specifications (For 100,000m Travel)

Model No.	Ball Screw Lead	Dynamic Load		Dynamic Axial Load		Dynamic Moments M_t		M_L	
	(mm)	C (N)	C (lb)	C (N)	C (lb)	(Nm)	(lb)	(Nm)	(lb)
BPSK50	**2.5**	**7,300**	1,606	**2,200**	484	**150**	1,327	**35**	310
BPSK60	**5**	**7,300**	1,606	**3,800**	854	**170**	1,504	**35**	310
BPSK60	**10**	**7,300**	1,606	**2,500**	462	**170**	1,504	**35**	310

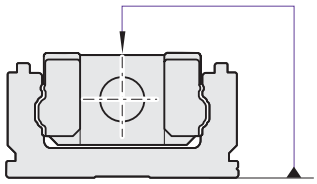
Note: For 50,000 m travel multiply value C, M_T and M_L by 1.26





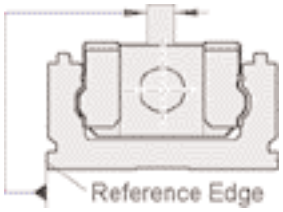
Model No.	Length (1) L		Ball Screw Lead	Maximum Velocity		Maximum Acceleration With Cover Plate		With Sealing Strip	
	(mm)	(in)	(mm)	(mm/sec)	(in/sec)	(m/sec^2)	(in/sec^2)	(m/sec^2)	(in/sec^2)
BPSK50	**150**	5.91	**2.5**	**300**	12	**124**	4,900	**N/A**	N/A
BPSK50	**200**	7.87	**2.5**	**300**	12	**109**	4,300	**109**	4,300
BPSK50	**250**	9.84	**2.5**	**300**	12	**96**	3,800	**96**	3,800
BPSK50	**300**	11.81	**2.5**	**300**	12	**86**	3,400	**86**	3,400
BPSK60	**200**	7.87	**5**	**600**	24	**68**	2,700	**N/A**	N/A
BPSK60	**300**	11.81	**5**	**600**	24	**48**	1,900	**48**	1,900
BPSK60	**400**	15.75	**5**	**600**	24	**38**	1,500	**38**	1,500
BPSK60	**500**	19.69	**5**	**600**	24	**30**	1,200	**30**	1,200
BPSK60	**600**	23.62	**5**	**600**	24	**25**	1,000	**25**	1,000
BPSK60	**200**	7.87	**10**	**1,200**	48	**124**	4,900	**N/A**	N/A
BPSK60	**300**	11.81	**10**	**1,200**	48	**91**	3,600	**89**	3,500
BPSK60	**400**	15.75	**10**	**1,200**	48	**71**	2,800	**71**	2,800
BPSK60	**500**	19.69	**10**	**1,200**	48	**58**	2,300	**58**	2,300
BPSK60	**600**	23.62	**10**	**1,200**	48	**51**	2,000	**48**	1,900

(1) See Dimension drawing



Flatness

(2) Flatness measured at the carriage center



Straightness

(3) Straightness measured with respect to reference edge

Accuracy Specifications

Model No.	Travel		Straightness[2]		Flatness[3]		Accuracy		Repeatability	
	(mm)	(in)	(microns)	(in)	(microns)	(in)	(microns)	(in)	(microns)	(in)
BPSK50 with Cover Plate	70	2.76	6	0.00020	5	0.00019	12.1	0.00047	1.2	0.00005
	120	4.72	6.7	0.00026	5	0.00019	20.8	0.00081	2.1	0.00005
	170	6.69	7.5	0.00029	5.2	0.00020	29.5	0.00116	2.9	0.00011
	220	8.66	8.5	0.00033	5.8	0.00022	38.1	0.00149	3.8	0.00015
BPSK50 with Sealing Strip	630.	2.48	6.7	0.00026	5	0.00019	10.9	0.00042	1.1	0.00004
	113	4.45	7.5	0.00029	5	0.00019	19.6	0.00077	2.0	0.00008
	163	6.41	8.5	0.00033	5.2	0.00020	28.3	0.00111	2.8	0.00031
BPSK60 with Cover Plate	110	4.33	6.7	0.00026	5	0.00019	19.1	0.00075	1.9	0.00007
	210	8.27	8.5	0.00033	5.6	0.0002	36.4	0.00143	3.6	0.00014
	310	12.20	10	0.00039	6.5	0.00025	53.7	0.00211	5.4	0.00021
	410	16.14	11.3	0.00044	7.2	0.00028	71.1	0.00275	7.1	0.00028
	510	20.08	12.6	0.0005	8	0.00031	88.4	0.00348	8.8	0.00035
BPSK60 with Sealing Strip	120	4.72	8.5	0.00033	5.8	0.00022	20.8	0.00081	2.1	0.0008
	220	8.66	10	0.00039	6.5	0.00025	38.1	0.00149	3.8	0.00015
	320	12.60	11.3	0.00044	7.2	0.00028	55.5	0.00218	5.5	0.00022
	420	16.54	12.6	0.0005	8	0.00031	72.8	0.00286	7.3	0.00029
BPSK60 with Cover Plate	90	3.54	6.7	0.00026	5	0.00019	15.6	0.00061	1.6	0.00006
	190	7.48	8.5	0.00033	5.6	0.00020	32.9	0.00129	3.3	0.00013
	290	11.42	10	0.00039	6.5	0.00025	50.3	0.00198	5.0	0.00020
	390	15.35	11.3	0.00044	7.2	0.00028	67.6	0.00266	6.8	0.00268
	490	19.29	12 .6	0.0005	8	0.00031	84.9	0.00334	8.5	0.00033
BPSK60 with Sealing Strip	100	3.94	8.5	0.00033	5.8	0.00022	17.3	0.00068	1.7	0.00007
	200	7.87	10	0.00039	6.5	0.00025	34.7	0.00136	3.5	0.00014
	300	11.81	11.3	0.00044	7.2	0.00028	52.0	0.00204	5.2	0.00020
	400	15.75	12.8	0.0005	8	0.00031	69.3	0.00272	6.9	0.00027

Mini-Luge BPSK Series:
Direct Drive Precision Modules

Inertia with Cover Plate

Model No.	Length		Travel		Inertia Ball Screw 8d x 2.5 lead	
	(mm)	(in)	(mm)	(in)	(gm cm sec²)	(oz in sec²)
BPSK50	150	5.91	70	2.76	0.0049	0.000068
BPSK50	200	7.87	120	4.72	0.0066	0.000091
BPSK50	250	9.84	170	6.69	0.0082	0.000114
BPSK50	300	11.81	220	8.66	0.0099	0.000137

Model No.	Length		Travel		Inertia Ball Screw 12d x 5 lead	
	(mm)	(in)	(mm)	(in)	(gm cm sec²)	(oz in sec²)
BPSK60	200	7.87	110	4.33	0.0333	0.000462
BPSK60	300	11.81	210	8.27	0.0499	0.000693
BPSK60	400	15.75	310	12.20	0.0665	0.000924
BPSK60	500	19.69	410	16.14	0.0831	0.001155
BPSK60	600	23.62	510	20.08	0.0998	0.001386

Model No.	Length		Travel		Inertia Ball Screw 12d x 10 lead	
	(mm)	(in)	(mm)	(in)	(gm cm sec²)	(oz in sec²)
BPSK60	200	7.87	90	3.54	0.0333	0.000462
BPSK60	300	11.81	190	7.48	0.0499	0.000693
BPSK60	400	15.75	290	11.42	0.0665	0.000924
BPSK60	500	19.69	390	15.35	0.0831	0.001155
BPSK60	600	23.62	490	19.29	0.0998	0.001386

Inertia with Sealing Strip

Model No.	Length		Travel		Inertia Ball Screw 8d x 2.5 lead	
	(mm)	(in)	(mm)	(in)	(gm cm sec²)	(oz in sec²)
BPSK50	200	7.87	63	2.48	0.0066	0.00091
BPSK50	250	9.84	113	4.45	0.0082	0.000114
BPSK50	300	11.81	163	6.42	0.0099	0.000137

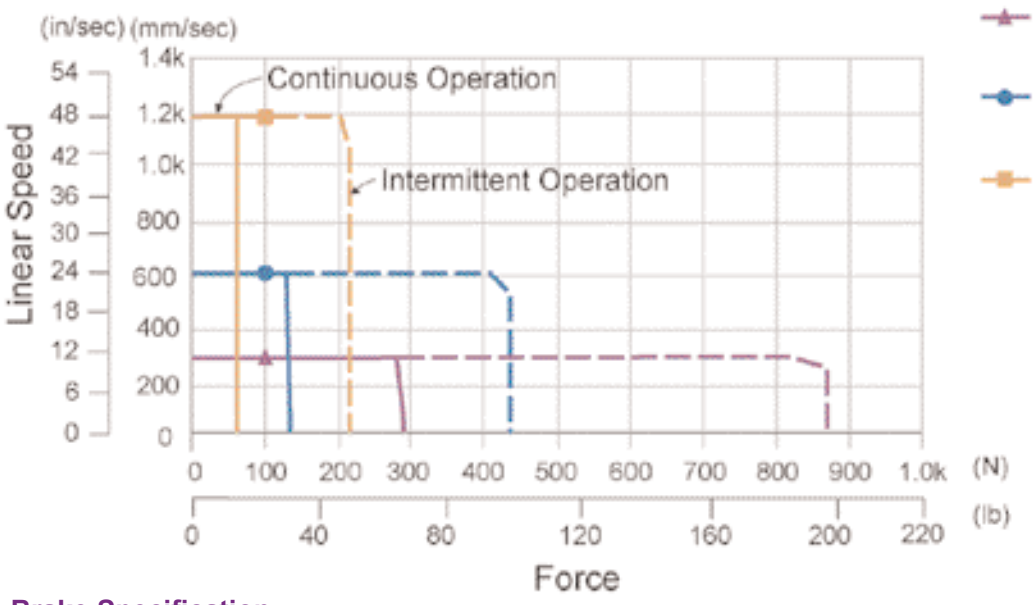
Model No.	Length		Travel		Inertia Ball Screw 12d x 5 lead	
	(mm)	(in)	(mm)	(in)	(gm cm sec²)	(oz in sec²)
BPSK60	300	11.81	120	4.72	0.0499	0.000693
BPSK60	400	15.75	220	8.66	0.0665	0.000924
BPSK60	500	19.69	320	12.60	0.0831	0.001155
BPSK60	600	23.62	420	16.54	0.0998	0.001386

Model No.	Length		Travel		Inertia Ball Screw 12d x 10 lead	
	(mm)	(in)	(mm)	(in)	(gm cm sec²)	(oz in sec²)
BPSK60	300	11.81	100	3.94	0.0499	0.000693
BPSK60	400	15.75	200	7.87	0.0665	0.000924
BPSK60	500	19.69	300	11.81	0.0831	0.001155
BPSK60	600	23.62	400	15.75	0.0998	0.001386

Moving Slide Weight

Model No.	with Cover Plate (kg)	with Cover Plate (lb)	with Sealing Strip (kg)	with Sealing Strip (lb)
BPSK50	**0.19**	0.42	**0.20**	0.44
BPSK60	**0.25**	**0.55**	**0.33**	**0.73**

Linear Speed vs. Force Analysis



These curves show the continuous and peak forces available to drive and accelerate a load to the maximum speed shown. There are several other factors which must be considered when sizing an application. Please see "Bayside Motor and Drive Selection" in the Servo Motor & Drive section.

Brake Specification

Model No.	Static Holding Torque (Nm)	Static Holding Torque (in lb)	Voltage (V)	Current (amps)	Resistance (ohms)	Brake Inertia (gm cm sec^2)	Brake Inertia (oz in sec^2)
BPSK50	**0.11**	1	24 Vdc	0.17	138	1.0 x 10^{-9}	1.4 x 10^{-11}
BPSK60	**0.11**	1	24 Vdc	0.17	138	1.0 x 10^{-9}	1.4 x 10^{-11}

Motor Specifications
(sinusoidal comm)

KO32 Frameless Motor with: Voltage		160V	300V
K_{EL-L}	(Vpk/kRPM)	11.5	23.2
K_{TL-L}	**(Nm/amp RMS)** (oz in/amp RMS)	**0.134** 18.91	**0.26** 38.7
Continuous Current	Arms	1.0	0.5
Peak Current	Arms	3.0	1.5
R_{L-L}	(ohms)	16.5	6.6
L_{L-L}	(mH)	8.1	33
Pole	#	4	4
Rotor Inertia	**(gm cm sec^2)** (oz in sec^2)	**0.0064** 0.000089	**0.0064** 0.000089

Rotary Encoder Specifications

Resolution:
1,000 LPR
with internal commutation signal

Electrical Input:
5 Vdc, 260 ma maximum

Encoder Output:
Dual channel quadrature
Differential, TTL compatible
Frequency Response 500 KHz

Mini-Luge BPSK Series:
Vertical Motion Application Data

In many applications, the slide must operate in a vertical orientation (the Z axis), moving the load against and with the effect of gravity.

The worst case operation in this mode is when the load is being accelerated in the UP direction or when it is being decelerated in the DOWN direction.

In addition, when the load is at a condition of constant velocity (either slew velocity or zero velocity), a constant force must be supplied by the motor and/or a brake to balance the gravity effect.

The following data will determine which slide model will be appropriate for a particular application.

Static

The following table shows the maximum load weights that can be supported at constant velocity, based on either the continuous torque rating of the motor or the rating of the brake (0.021 Nm / 3 oz in of friction torque is included).

Model No	Motor Rating (kg)	Motor Rating (lb)	Brake Rating (kg)	Brake Rating (lb)
BPSK50 (Lead 2.5)	**40**	89	**32**	73
BPSK60 (Lead 5)	**20**	45	**16**	37
BPSK60 (Lead 10)	**10**	22	**8**	18

Acceleration

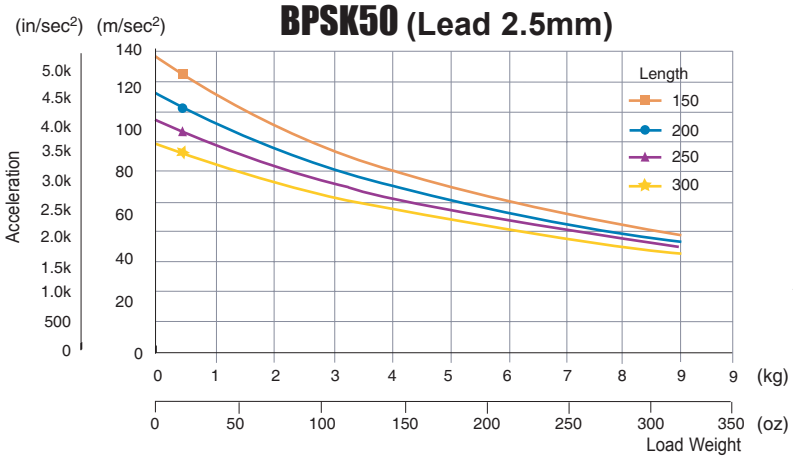
The following curves show the worst case acceleration capability of the slides as a function of load weight, for each of the slide lengths. These curves include the inertia of the screw and the motor rotor plus the reflected inertia of the moving carriage. To determine the acceleration for weights greater than shown, use the formula next to each curve. Select the appropriate screw inertia from the table. Motor and carriage inertia are included in the formula constants.

Screw Inertia

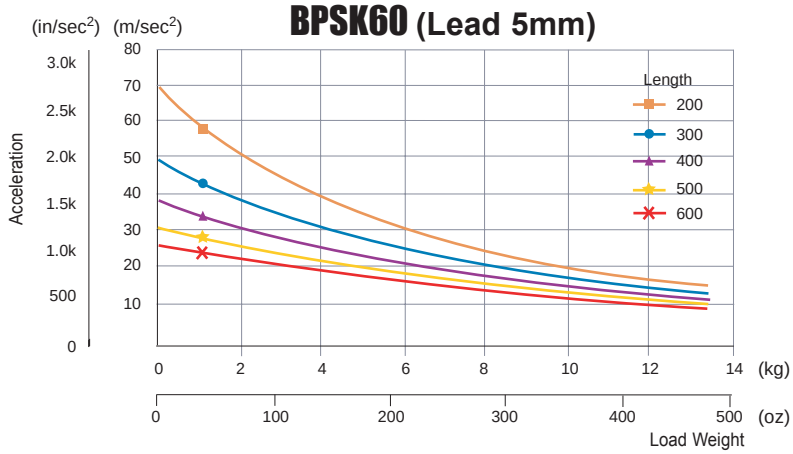
Model No	Length (mm)	Length (in)	Inertia ($gm\ cm\ sec^2$)	Inertia ($oz\ in\ sec^2$)
BPSK50	**150**	5.91	**0.0049**	0.00007
	200	7.87	**0.0066**	0.00009
	250	9.84	**0.0082**	0.00012
	300	11.81	**0.0099**	0.00014
BPSK60	**200**	7.87	**0.0330**	0.00046
	300	11.81	**0.0050**	0.00064
	400	15.75	**0.0670**	0.00092
	500	19.69	**0.0830**	0.00116
	600	23.62	**0.1000**	0.00139

Mini-Luge BPSK Series:
Vertical Motion Acceleration vs Load

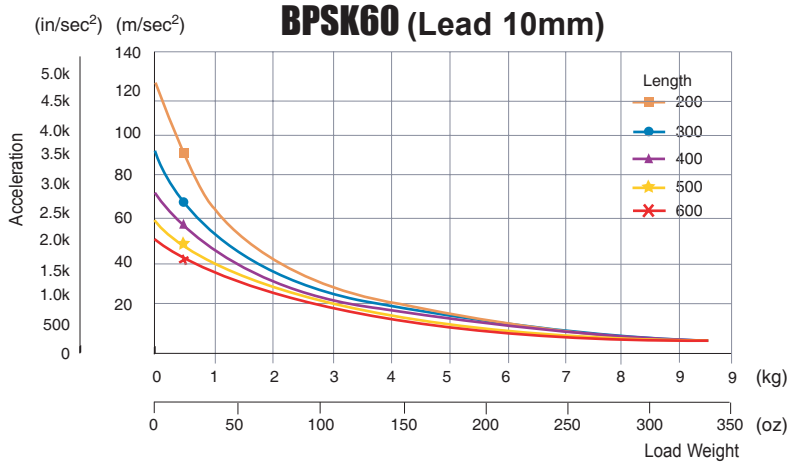
BPSK50 (Lead 2.5mm)



BPSK60 (Lead 5mm)



BPSK60 (Lead 10mm)



To calculate acceleration for a given weight use the following formula.

$$\text{Acc } (\text{m/sec}^2) = \left[\frac{36.4 - 0.398W}{10\,(J_{screw} + 0.00673 + 0.00161W)}\right]\left[0.398\right]$$

W in (kg)

J_{screw} in (gm cm sec^2)

$$\text{Acc } (\text{in/sec}^2) = \left[\frac{50.6 - 0.0157W}{J_{screw} + 0.0000935 + 0.000000638W)}\right]\left[0.0157\right]$$

W in (oz)

J_{screw} in (oz in sec^2)

$$\text{Acc } (\text{m/sec}^2) = \left[\frac{36.4 - 0.796W}{10\,(J_{screw} + 0.00857 + 0.00645W)}\right]\left[0.796\right]$$

W in (kg)

J_{screw} in (gm cm sec^2)

$$\text{Acc } (\text{in/sec}^2) = \left[\frac{50.6 - 0.0313W}{J_{screw} + 0.000119 + 0.00000254W)}\right]\left[0.0313\right]$$

W in (oz)

J_{screw} in (oz in sec^2)

$$\text{Acc } (\text{m/sec}^2) = \left[\frac{36.4 - 1.59W}{10\,(J_{screw} + 0.0149 + 0.0258W)}\right]\left[1.59\right]$$

W in (kg)

J_{screw} in (gm cm sec^2)

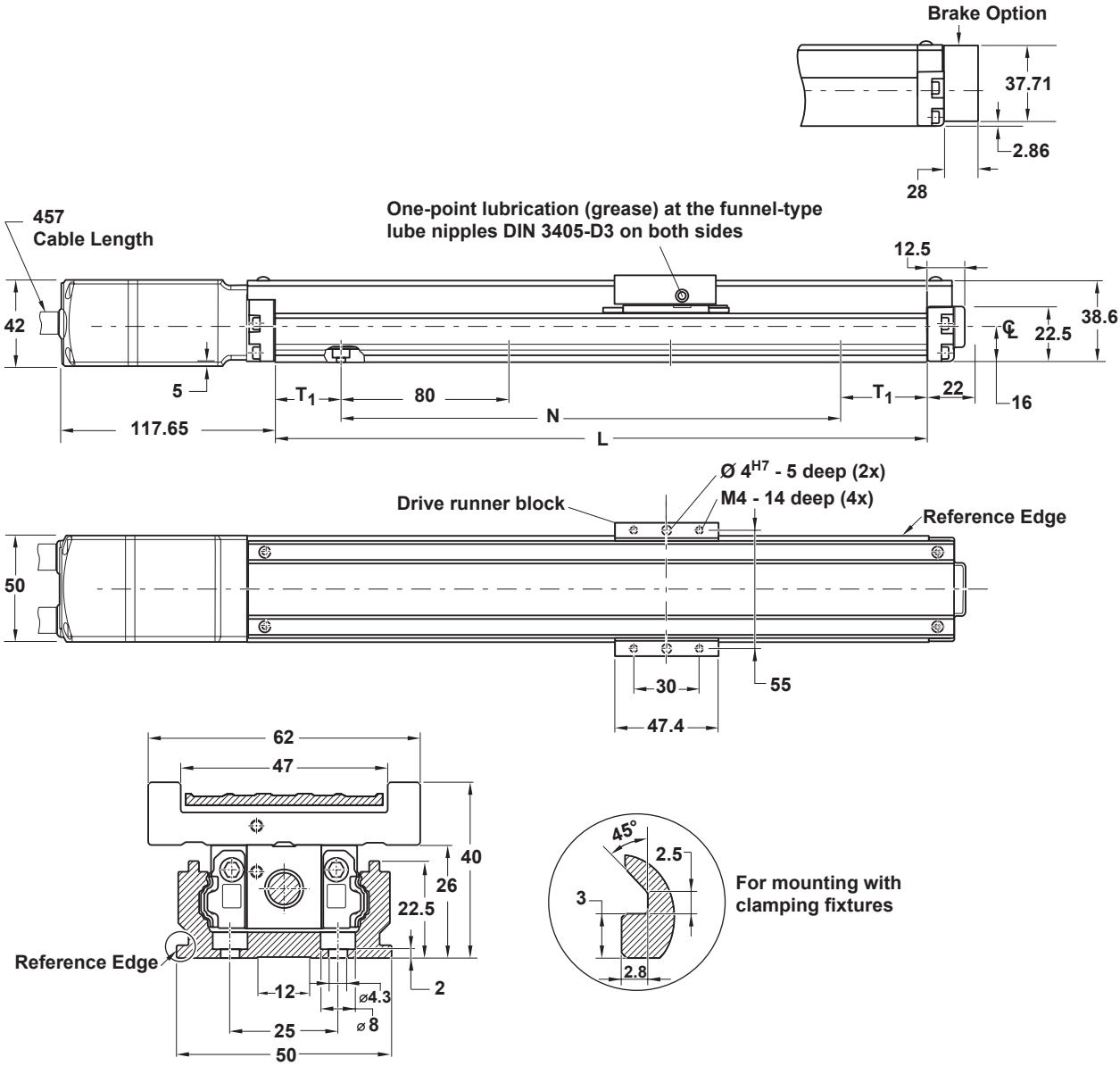
$$\text{Acc } (\text{in/sec}^2) = \left[\frac{50.6 - 0.0627W}{J_{screw} + 0.000207 + 0.0000102W)}\right]\left[0.0627\right]$$

W in (oz)

J_{screw} in (oz in sec^2)

Mini-Luge BPSK Series:
BPSK50 Cover Plate

Dimensions



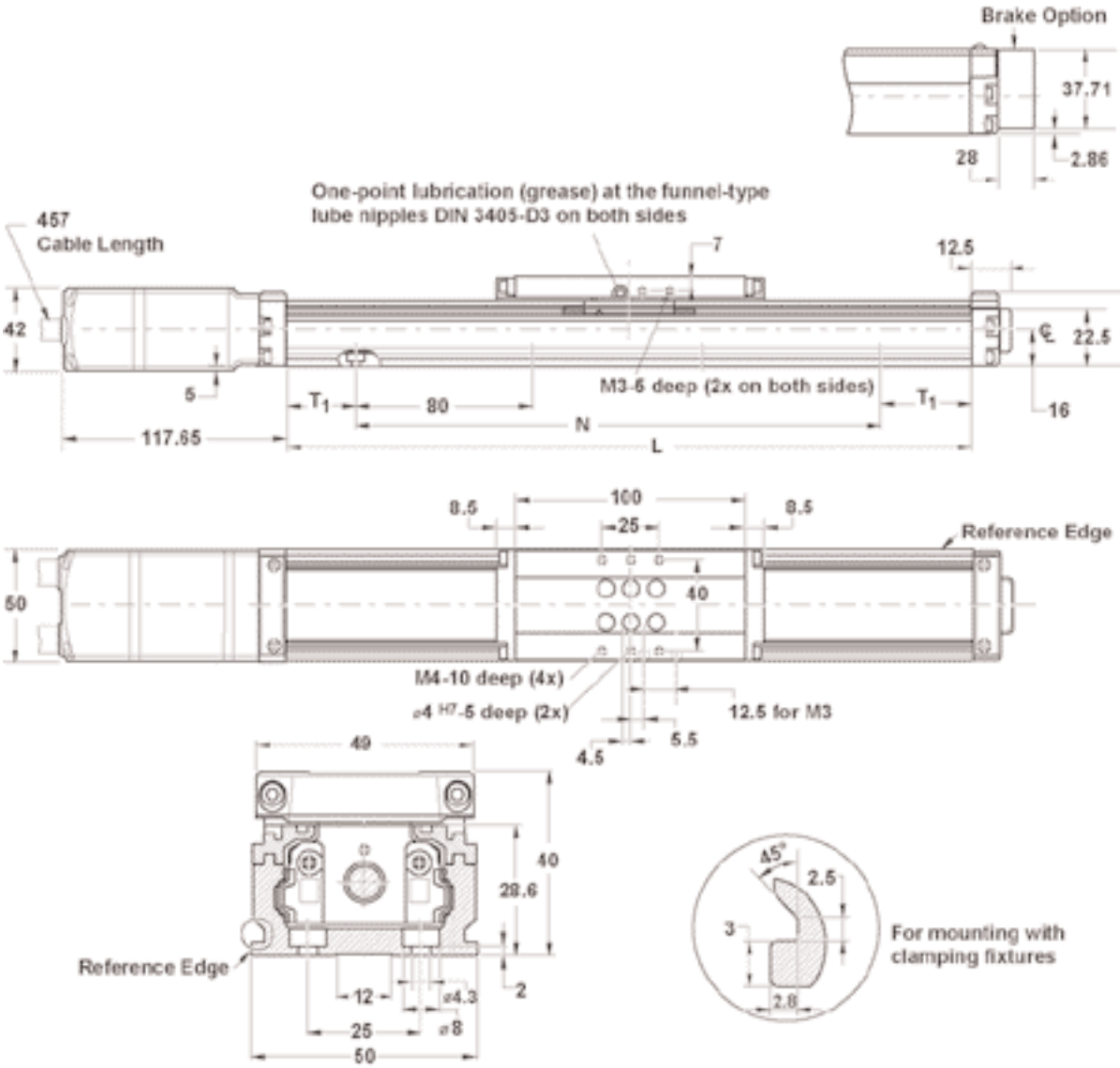
L		Travel (1)		# of Holes	T_1 Edge Space		Stage Weight	
(mm)	(in)	**(mm)**	(in)	**N**	**(mm)**	(in)	**(kg)**	(lb)
150	5.90	**70**	2.76	2	**35**	1.377	**1.42**	3.12
200	7.874	**120**	4.724	3	**20**	0.787	**1.62**	3.57
250	9.842	**170**	6.692	3	**45**	1.771	**1.83**	4.03
300	11.811	**220**	8.661	4	**30**	1.181	**2.03**	4.48

(1) There is an additional 10mm over travel.

Mini-Luge BPSK Series:

BPSK50 Sealing Strip

Dimensions

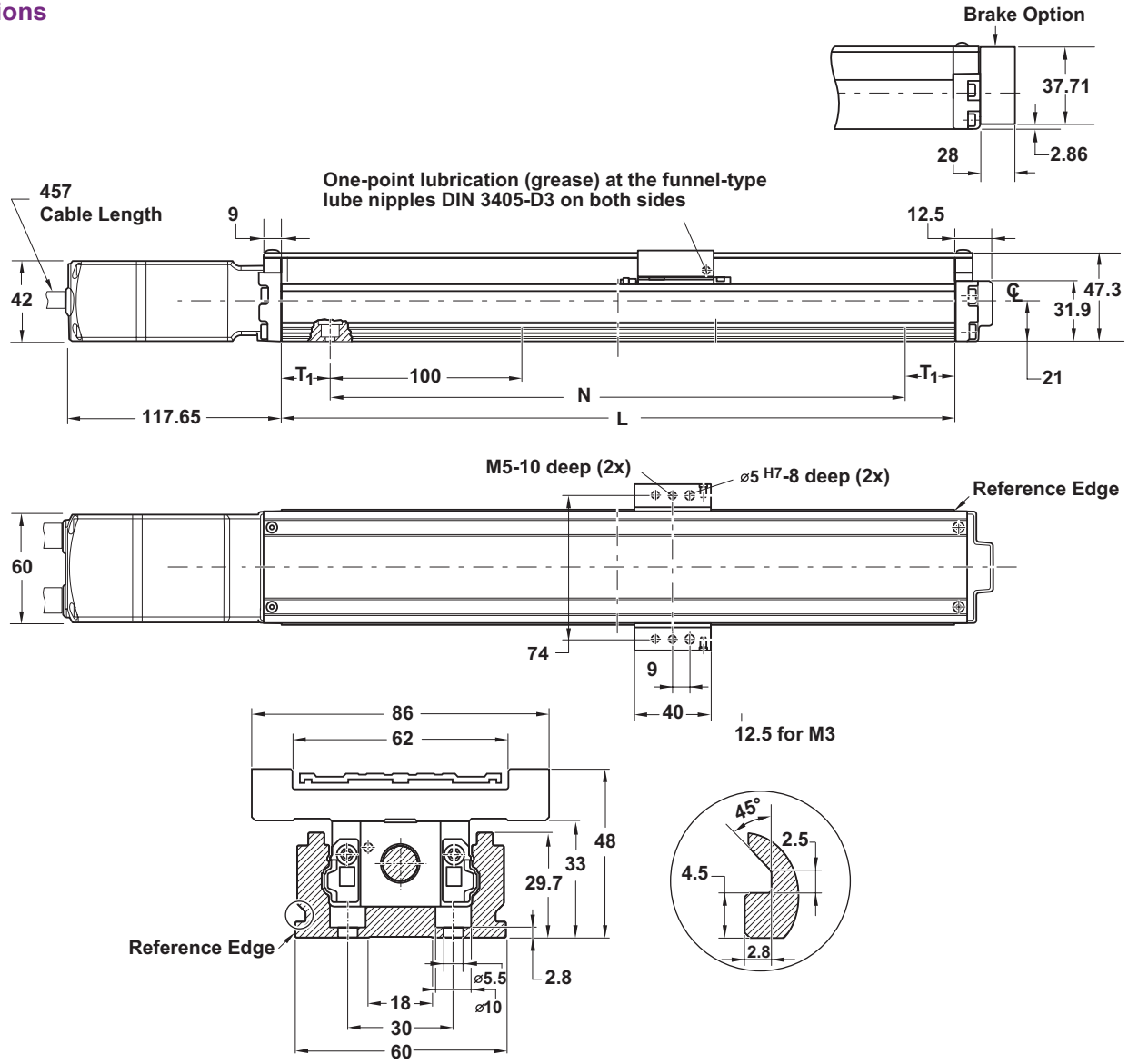


L		Travel (1)		# of Holes	T_1 Edge Space		Stage Weight	
(mm)	(in)	**(mm)**	(in)	**N**	**(mm)**	(in)	**(kg)**	(lb)
200	7.874	**63**	2.480	3	**20**	0.787	**1.66**	3.65
250	9.842	**113**	4.448	3	**45**	1.771	**1.87**	4.11
300	11.811	**163**	6.417	4	**30**	1.181	**2.08**	4.57

(1) There is an additional 10mm over travel.

Mini-Luge BPSK Series:
BPSK60 Cover Plate

Dimensions



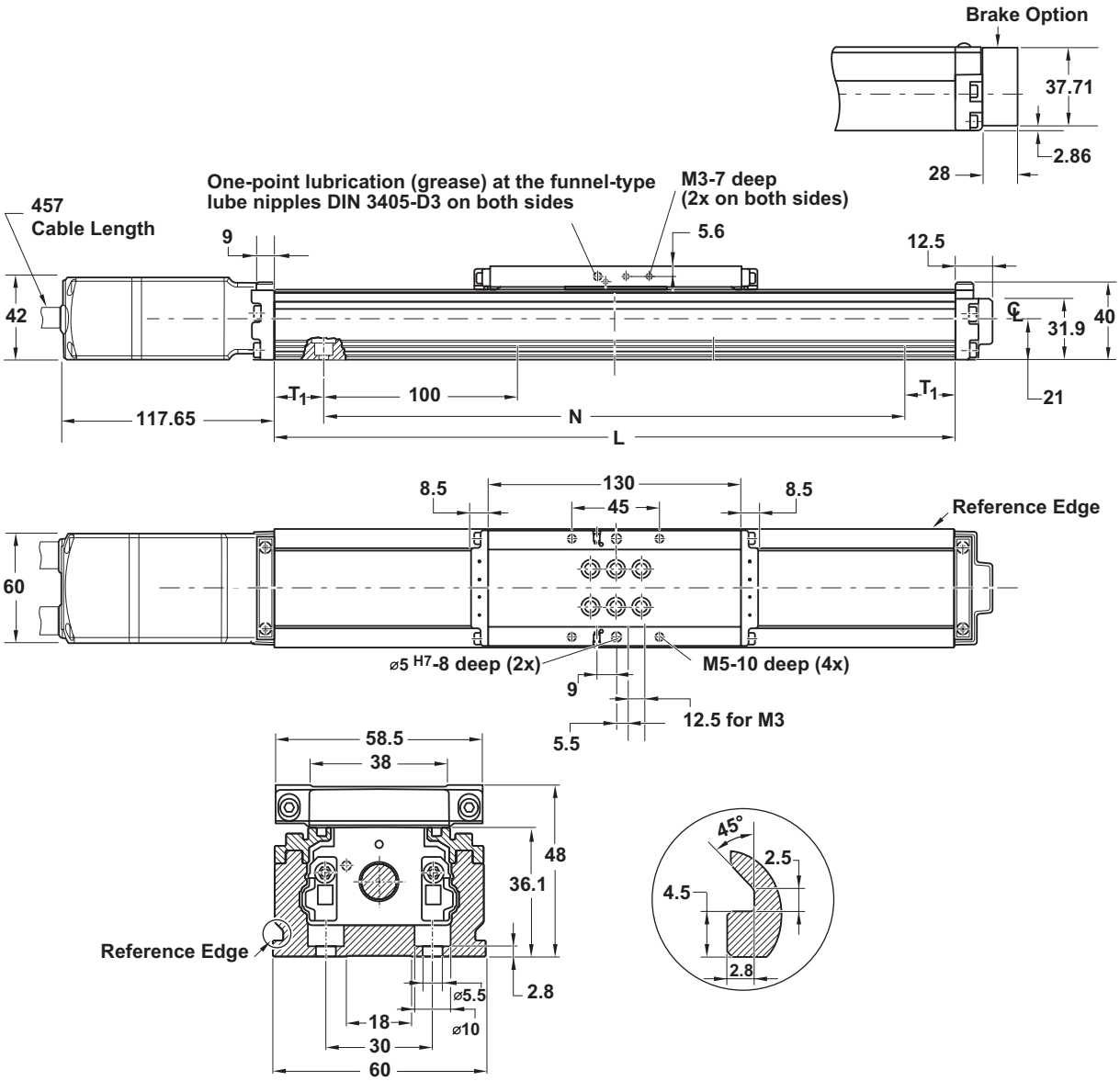
L		Travel				# of Holes	T_1 Edge Space		Stage Weight	
		Ball Screw 12d x 5 Lead (1)		Ball Screw 12d x 10 Lead (2)						
(mm)	(in)	(mm)	(in)	(mm)	(in)	N	(mm)	(in)	(kg)	(lb)
200	7.874	**110**	4.330	**90**	3.543	2	**40**	1.574	**2.06**	4.54
300	11.811	**210**	8.268	**190**	7.480	3	**40**	1.574	**2.78**	6.12
400	15.748	**310**	12.204	**290**	11.417	4	**40**	1.574	**3.50**	7.71
500	19.685	**410**	16.141	**390**	15.354	5	**40**	1.574	**4.22**	9.29
600	23.622	**510**	20.078	**490**	19.291	6	**40**	1.574	**4.94**	10.88

(1) With the 5mm Lead there is an additional 20mm over travel.
(2) With the 10mm Lead there is an additional 40mm over travel.

Mini-Luge BPSK Series:

BPSK60 Sealing Strip

Dimensions

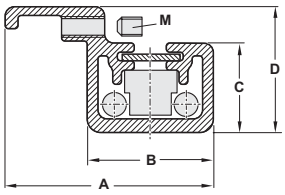


L		Travel				# of Holes	T_1 Edge Space		Stage Weight	
		Ball Screw 12d x 5 Lead (1)		Ball Screw 12d x 10 Lead (2)						
(mm)	(in)	(mm)	(in)	(mm)	(in)	N	(mm)	(in)	(kg)	(lb)
300	11.811	**120**	4.724	**100**	3.937	3	**40**	1.574	**2.83**	6.22
400	15.748	**220**	8.661	**200**	7.874	4	**40**	1.574	**3.86**	7.82
500	19.685	**320**	12.598	**300**	11.811	5	**40**	1.574	**4.29**	9.45
600	23.622	**420**	16.535	**400**	15.748	6	**40**	1.574	**5.02**	11.83

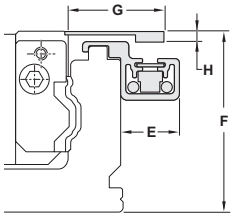
(1) With the 5mm Lead there is an additional 20mm over travel.
(2) With the 10mm Lead there is an additional 40mm over travel.

Mini-Luge BPSK Series:
Cable Duct & Switch Mounting Configuration

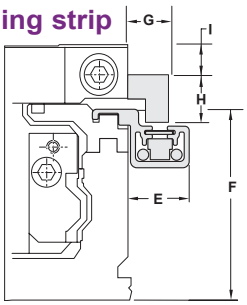
Dimensions



with cover plate



with sealing strip



Part Number	A (mm)	A (in)	B (mm)	B (in)	C (mm)	C (in)	D (mm)	D (in)	M
BPSK50	21.7	0.854	15.0	0.590	11.5	0.452	16.5	0.650	M2
BPSK60	25.2	0.992	15.0	0.590	11.5	0.452	16.5	0.650	M2.5

Cover Plate

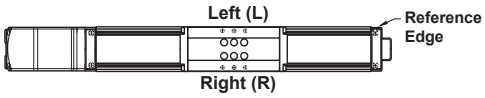
Part Number	E (mm)	E (in)	F (mm)	F (in)	G (mm)	G (in)	H (mm)	H (in)
BPSK50	15.2	0.598	28.5	1.122	18.6	0.732	6.0	0.236
BPSK60	18.5	0.728	32.8	1.291	21.6	0.850	6.0	0.236

Sealing Strip

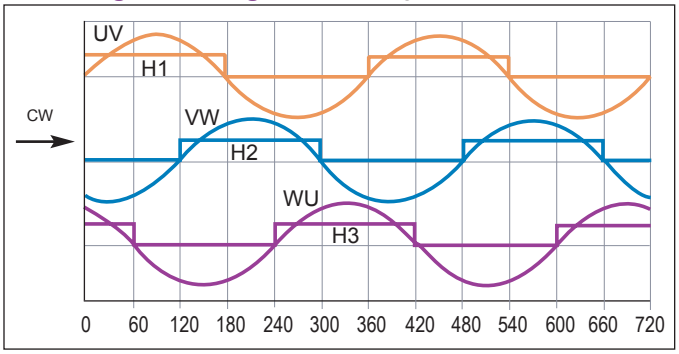
Part Number	E (mm)	E (in)	F (mm)	F (in)	G (mm)	G (in)	H (mm)	H (in)	I (mm)	I (in)
BPSK50	15.2	0.598	38.0	1.496	11.2	0.440	12.5	0.492	4.3	0.165
BPSK60	15.8	0.622	30.7	1.209	12.0	0.472	14.0	0.551	1.9	0.750

Hall Sensor

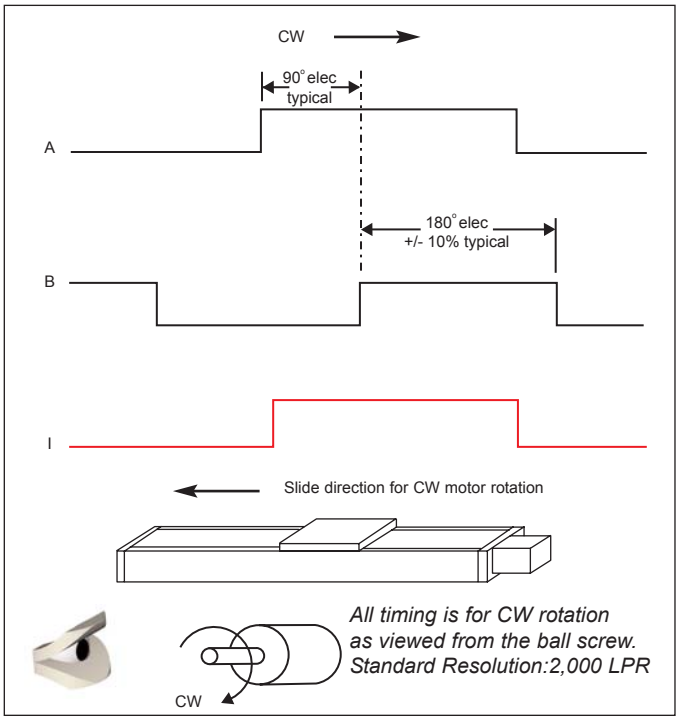
Transistor Type	NPN (Logic low for normal operation)
Service voltage	5 to 24 Vdc
Sinking current	max. 20 mA
Cable length	3,000 mm/switch



Motor Signal Timing (C/D winding) at motor connector



Encoder Timing



All timing is for CW rotation as viewed from the ball screw. Standard Resolution:2,000 LPR

Mini-Luge BPSK Series:
How to Order

Model

BPSK	50	1465-200-00	150	MF01	01	01	31	02	01	02	0
	A		B	C	D	E	F	G	H	J	K

A Model

50	50 mm wide
60	60 mm wide

B Length

Length (mm)	Travel	Model	Ball Screw Lead
150	70 mm with Cover Plate	BPSK50	2.5
200	120 mm with Cover Plate 63 mm with Sealing Strip	BPSK50	2.5
	110 mm with Cover Plate	BPSK60	5
	90 mm with Cover Plate	BPSK60	10
250	170 mm with Cover Plate 113 mm with Sealing Strip	BPSK50	2.5
300	220 mm with Cover Plate 163 mm with Sealing Strip	BPSK50	2.5
	210 mm with Cover Plate 120 mm with Sealing Strip	BPSK60	5
	190 mm with Cover Plate 100 mm with Sealing Strip	BPSK60	10
400	310 mm with Cover Plate 220 mm with Sealing Strip	BPSK60	5
	290 mm with Cover Plate 200 mm with Sealing Strip	BPSK60	10
500	410 mm with Cover Plate 320 mm with Sealing Strip	BPSK60	5
	390 mm with Cover Plate 300 mm with Sealing Strip	BPSK60	10
600	510 mm with Cover Plate 420 mm with Sealing Strip	BPSK60	5
	490 mm with Cover Plate 400 mm with Sealing Strip	BPSK60	10

C Type

MF01	Factory number

D Guideway

01	Standard

E Drive Unit

		Model
01	Ball screw 8 d x 2.5 lead	BPSK50
02	Ball screw 12 d x 5 lead	BPSK60
03	Ball screw 12 d x 10 lead	BPSK60

F Moving Slide

31	With cover plate
40	With sealing strip

G Motor & Encoder

02	Direct Drive Motor 160V, 1,000 LPR
03	Direct Drive Motor 300V, 1,000 LPR

H Cover Type

01	With Cover Plate
02	With Sealing Strip

J Limit Switches & Mounting

01	Without Limit Switches
02	NPN NC (5 ~ 24 VDC, sinking 20mA Max) on Ref Edge
03	NPN NC (5 ~ 24 VDC, sinking 20mA Max) non Ref Edge

K Brake

0	No Brake
1	With Brake

NOTE:

Part Number follows the Rexroth Bosch part number code.

Specifications are subject to change without notice.

How to Order

Mini Luge BPSK stages are supported by a worldwide network of offices and local distributors.
Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor.
Information can also be obtained at **www.baysidemotion.com**.