

# 920, 930, 940 SERIES

## Precision Motor Potentiometers

BI Motor Potentiometers use a precision potentiometer connected to a DC motor by a gear box and clutch. There are eight potentiometer types and 15 gear ratios available combined with a 10,700 RPM motor.

In addition, motor potentiometers with special features such as center-taps, multi-taps, special shafts, and special gear ratios, etc., can be provided on special orders. Several potentiometer sections can be ganged on a single rotor potentiometer shaft.



### SPECIFICATIONS

Motor Potentiometer Model	922	927	929	931
Potentiometer Model	6671	8146	8211	A
# of Turns	1	10	1	10
Element Type	Conductive Plastic	Hybrid	Hybrid	Wirewound
Potentiometer Mounting Style	Bushing	Bushing	Bushing	Bushing
Resistance Range, Ohms	1K-300K	1K-100K	1K-25K	10-500K
Diameter	2"	7/8"	2"	1 - 13/16"
Linearity	±0.25%	±0.25%	±0.5%	<300Ω: ±0.5% ≥300Ω: ±0.25%
No. of Gangs, Max.	3	2	3	3

Motor Potentiometer Model	933	936	937	949
Potentiometer Model	C	7283	7286	5611
# of Turns	3	10	10	1
Element Type	Wirewound	Wirewound	Wirewound	Wirewound
Potentiometer Mounting Style	Bushing	Servo	Bushing	Bushing
Resistance Range, Ohms	100-100K	100-100K	100-100K	1K - 50K
Diameter	1-13/16"	7/8"	7/8"	2"
Linearity	±0.5% ≥1KΩ: 0.20%	≤75Ω: ±0.50%	±0.25%	<50Ω: ±1.0% ≥50Ω: ±0.5%
No. of Gangs, Max.	3	2	2	3

Specifications subject to change without notice.  
Refer to potentiometer data sheet for complete specifications.

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### MOTOR SPECIFICATIONS

Rotor Temperature, °C	22
Input Voltage Range, Vdc	Vis to 9.0
Input Voltage, Nominal, Vdc	6.0*
Power Input @ Stall (6 Vdc), Watts	1.8
No Load Current, mA	≤7
Armature Resistance, Ohms	20
No Load Speed @ Max. Volts, RPM	16,000
No Load Speed (6.0 Vdc, RPM)	10,700
Mechanical Time constant @ Max. Supply Voltage, Sec.	0.032
Starting Voltage, Vdc	0.3
Torque Constant, oz.-in.	0.749
Torque Stall (6.0 Vdc), oz.-in. Max.	0.22
Torque Continuous Duty (Gear Box), oz.-in. Max.	3
Moment of Inertia, oz.-in. /Sec <sup>2</sup>	5.6 x 10 <sup>-6</sup>
Motor Pot Life Expectancy @ Rated Torque, Hours	5,000
Slip Friction Setting, oz.-in., Nominal	12
Life Reduction per Load Torque Beyond Rating, Estimated Hours	643 (T <sub>L</sub> <sup>-3</sup> )

\*Input voltage in continuous stall and 22°C ambient.

### GEAR RATIO SPECIFICATIONS

Gear Ratio (N)	Output Speed (RPM)	Efficiency (e)	Backlash Max. (B)	Direction(D)**
41:1†	261	.73	4°	CW
76:1	141	.66	4°	CCW
141:1†	76	.66	4°	CCW
262:1†	41	.59	4°	CW
485:1	22	.59	4°	CW
900:1	12	.53	4°	CCW
1,670:1	6.4	.53	4°	CCW
3,101:1	3.5	.48	4°	CW
5,752:1	1.9	.48	4°	CW
10,683:1	1.0	.43	4°	CW
19,813:1	0.54	.43	4°	CCW
36,796:1	0.29	.39	4°	CW
68,245:1	0.17	.39	4°	CW
126,741:1	0.08	.35	4°	CCW
235,067:1	0.05	.35	4°	CCW

\*\* Direction of shaft rotation with "+" voltage to red lead.

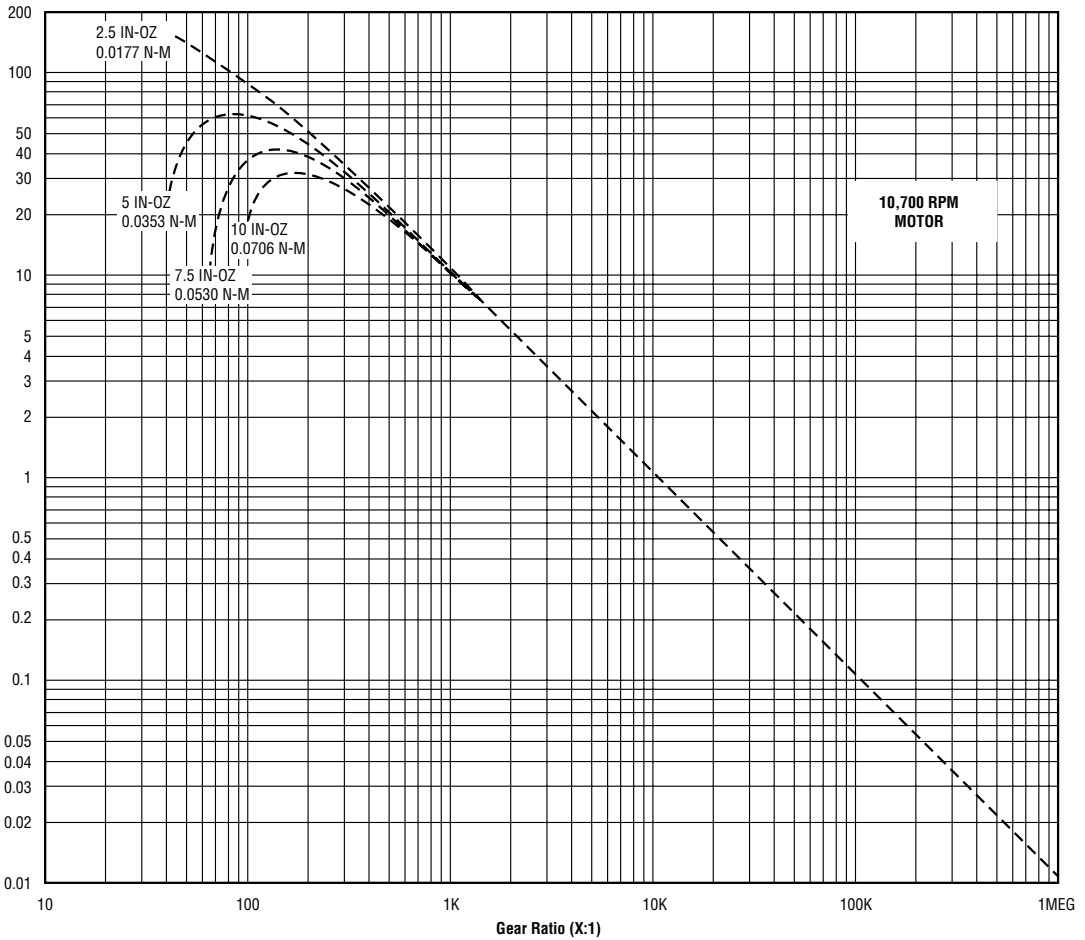
† Stocked ratios.



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## PERFORMANCE

Output Speed vs. Gear Ratio at various Load Torques



41	76	141	262	485	900	1670	3120	5750	10.7K	19.8K	37K	68.2K	127K	235K
(.73)	(.66)	(.66)	(.59)	(.59)	(.53)	(.53)	(.48)	(.48)	(.43)	(.43)	(.39)	(.39)	(.35)	(.35)

Specific Ratios (Efficiency)

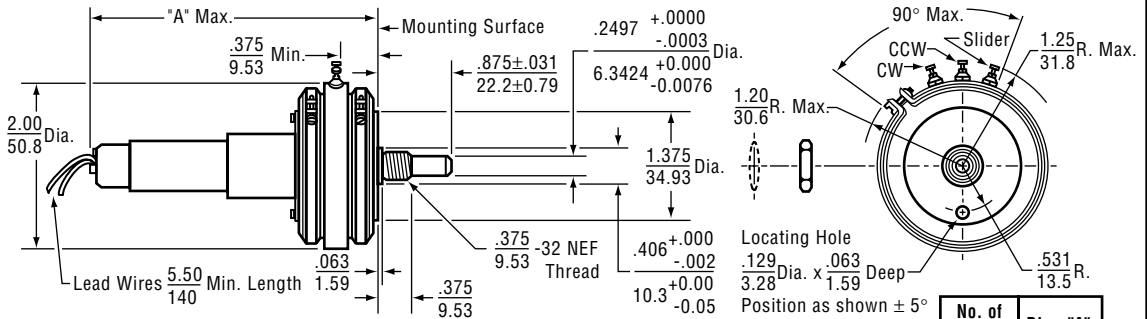


# Model 920, 930, 940 Series

## OUTLINE DIMENSIONS (Inch/mm)

### Models 922, 929 & 949

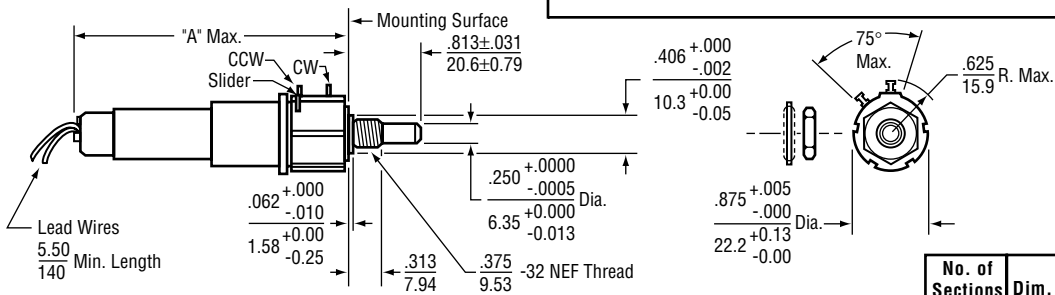
(Potentiometer Models 6671 & 5611)



No. of Sections	Dim. "A"
1	3.55 90.2
2	4.11 104
3	4.68 119

### Models 927 & 937

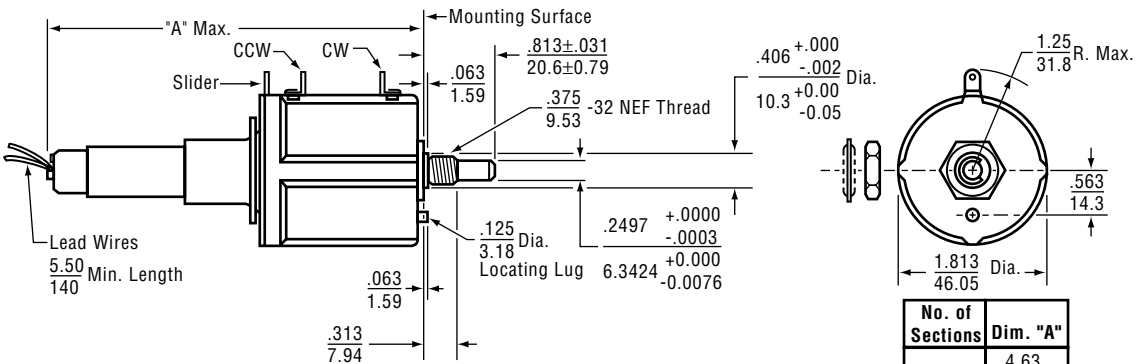
(Potentiometer Models 8146 & 7286)



No. of Sections	Dim. "A"
1	3.55 90.2
2	4.11 104

### Model 931

(Potentiometer Model A)



No. of Sections	Dim. "A"
1	4.63 118
2	6.83 174
3	8.73 222



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## MOTOR POT AND LOAD PERFORMANCE CALCULATIONS

e	=	Gear ratio Efficiency
J <sub>l</sub>	=	Load inertia (oz. in.-sec <sup>2</sup> )
J <sub>m</sub>	=	Motor inertia (oz. in.-sec <sup>2</sup> )
J <sub>t</sub>	=	Total inertia at motor shaft (oz. in.-sec <sup>2</sup> )
K <sub>t</sub>	=	Motor torque constant (oz. in./A)
N	=	Gear ratio (N:1)
R <sub>a</sub>	=	Armature d-c resistance (ohms)
S <sub>ni</sub>	=	No load motor speed at rated voltage (RPM)
S <sub>o</sub>	=	Slew velocity (RPM)
t	=	Travel time (seconds)
T <sub>l</sub>	=	Load torque (oz. in.) Must include pot
t <sub>m</sub>	=	Mechanical time constant (seconds)
T <sub>s</sub>	=	Motor stall torque at rated voltage (oz. in.)
V <sub>s</sub>	=	Motor no load starting voltage (Vdc)
V <sub>ls</sub>	=	Start torque of motor and load Vdc
V <sub>t</sub>	=	Terminal voltage (Vdc)
θ	=	Degrees traveled

1. To determine motor and load starting voltage:

$$V_{is} = V_s + \frac{6T_l}{eNT_s}$$

2. To determine slew velocity at terminal voltage:

$$S_o = \frac{SnlV_t}{6TsN} \left( T_s - \frac{T_l}{eN} \right)$$

3. To determine gear ratio:

$$N = \frac{Snl}{2S_o} \left( 1 + \sqrt{1 - \frac{4T_l S_o}{T_s Snl}} \right)$$

4. To determine degrees traveled:

$$\theta = 6S_o [t - tm(1 + 2.72^{-t/tm})]$$

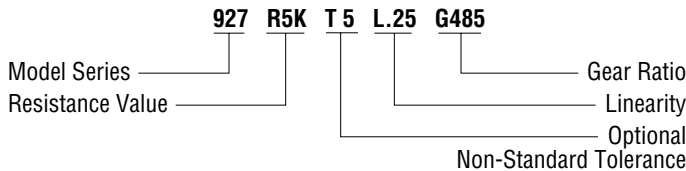
5. To determine mechanical time constant:

$$tm = \frac{RaJt}{7 \times 10^{-3} Kt^2}$$

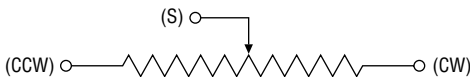
Where:

$$Jt = Jm + \frac{Jl}{N^2}$$

## ORDERING INFORMATION



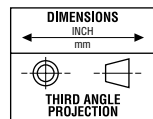
## CIRCUIT DIAGRAM



## NOTES

Metric equivalents, based on 1 inch = 25.4mm are rounded to the same number of significant figures as in the original English units and are provided for general information only.

Tolerances unless otherwise specified:  
 Linear = ± .01 inches  
 (.25mm)  
 Angular = ± 2 degrees



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