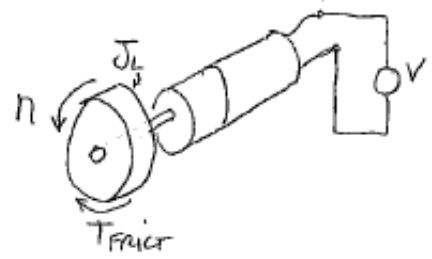
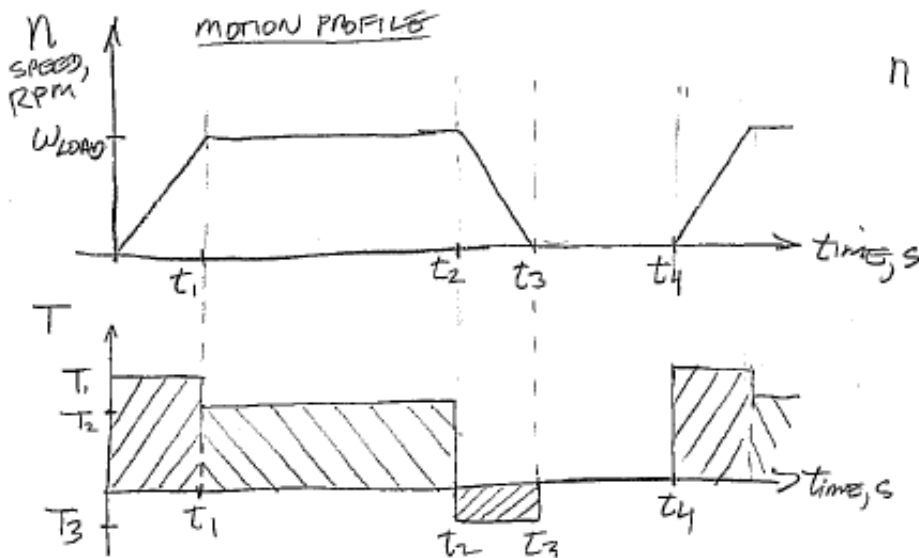


# Motor Sizing Example

From Maxon 2002/03 Catalog (<http://www.maxonmotorusa.com/>)

## MOTOR SIZING EXAMPLE 18OCT2010



$W_{LOAD} = 60 \text{ RPM}$       MAXIMUM SPEED OF LOAD

$J_L = 0.012 \text{ Kg-m}^2$       INERTIA OF LOAD

$T_{fric} = 300 \times 10^{-3} \text{ N-m}$       FRICTION TORQUE

$T_{ext} = 0$

POWER SUPPLY CAN DELIVER 5A AT 24V

$t_1 = 0.5 \text{ sec}$

$t_2 = 2.5 \text{ sec}$

$t_3 = 3.0 \text{ sec}$

$t_4 = 3.7 \text{ sec}$

$$T_{RMS} \triangleq \sqrt{\frac{1}{t_{total}} \int_{t_1}^{t_2} T^2 dt}$$

$$= \sqrt{\frac{1}{t_4} [t_{accel} T_{peak}^2 + t_{slow} T_{slow}^2 + t_{dec} T_{dec}^2 + t_{dwell} T_{dwell}^2]}$$

$t_{accel} =$

$\alpha_{LOAD} =$

$t_{slow} =$

$T_{PEAK} =$

$t_{dec} =$

$T_1 =$

$t_{dwell} =$

$T_2 =$

$T_{RMS} =$

$T_3 =$

# MOTOR SIZING EXAMPLES CONT.

## GEAR SELECTION

FIND GEARING THAT CAN HANDLE THE PEAK TORQUE AND CONTINUOUS TORQUE.

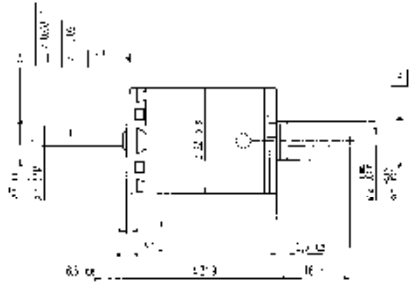
## MOTOR TYPE SELECTION

NEED TO "REFLECT" THE TORQUE AND SPEED REQUIREMENTS AT THE LOAD BACK THROUGH THE GEARING TO SPECIFY WHAT THE MOTOR AT ITS OUTPUT SHAFT MUST PRODUCE.

## SELECTION OF THE WINDING

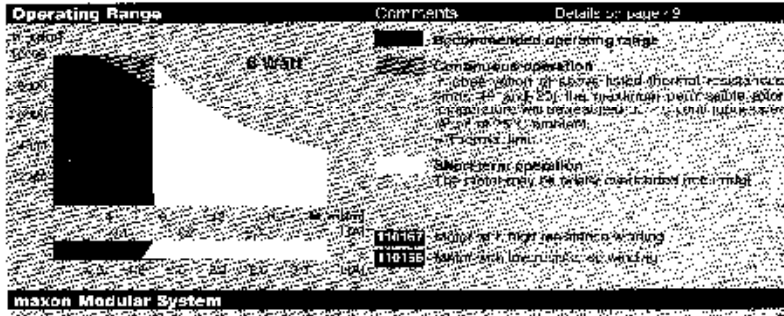
FIND THE WINDING SUCH THAT THE SPEED-TORQUE LINE WILL RUN ABOVE ALL WORKING POINTS PLOTTED IN THE SPEED-TORQUE QUADRANT.

# Motor Sizing Example

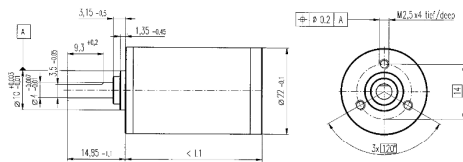


Motor Data	Order Number												
	110156	110158	110159	110160	110161	110162	110163	110164	110165	110166	110167	110168	
1 Nominal voltage	Volt	6.0	6.0	6.0	12.0	12.0	12.0	12.0	24.0	24.0	24.0	24.0	24.0
2 Nominal speed	rpm	1500	1500	1500	3000	3000	3000	3000	1500	1500	1500	1500	1500
4 Stal torque	mNm	15.8	2.7	18.0	22.0	19.7	21.3	7.4	29.4	14.8	21.1	18.1	17.7
5 Speed-torque constant	rpm/A	89	111	83	68	146	142	167	48	103	88	121	176
6 No load current	mA	89	68	60	43	41	36	20	21	18	4	10	0
7 Standstill current	mA	123	111	102	73	70	63	34	41	36	7	18	0
8 Terminal resistance	Ohm	2.27	8.31	4.81	5.92	7.38	9.49	14.4	21.0	55.5	59.1	22	147
9 Max. average input power	mW	222	367	500	345	360	360	360	360	360	360	360	360
10 Max. continuous current	mA	1530	841	758	880	618	580	480	480	287	211	51	107
11 Max. continuous torque	mNm	15.8	2.7	18.0	22.0	19.7	21.3	7.4	29.4	14.8	21.1	18.1	17.7
12 Max. power output at nominal voltage	mW	3180	1740	3920	5810	4550	5550	5340	6300	4070	6210	4520	3790
13 Max. torque	mNm/A	89	111	83	68	146	142	167	48	103	88	121	176
14 Torque constant	mNm/A	89	111	83	68	146	142	167	48	103	88	121	176
15 Torque constant	mNm/A	89	111	83	68	146	142	167	48	103	88	121	176
16 Mechanical time constant	ms	25	22	21	20	20	20	20	19	18	18	18	18
17 Heating time constant	ms	25	22	21	20	20	20	20	19	18	18	18	18
18 Terminal inductance	mH	0.1	0.22	0.29	0.38	0.5	0.58	0.89	1.7	2.10	3.80	2.0	4.95
19 Thermal resistance motor housing	K/W	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
20 Thermal resistance motor winding	K/W	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
21 Motor life	h	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
22 Motor life	h	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000

- Specifications**
- Axial play: C.G. - 0.15 mm
  - Max. sleeve bearing loads:
    - axial (dynamic): 100 N
    - radial (5 mm from flange): 2.8 N
    - press-fit force (static): 20 N
    - isotropic (static supported): 400 N
  - Max. ball bearing loads:
    - axial (dynamic): 30 N
    - radial (5 mm from flange): 45 N
    - press-fit force (static): 440 N
    - (static, shaft supported)
  - Radial play sleeve bearing: 0.012 mm
  - Radial play ball bearing: 0.025 mm
  - Ambient temperature range: -30 / +55 °C
  - Max. rotor temperature: -125 °C
  - Number of commutator segments: 9
  - Weight of motor: 4 g
  - Values listed in the table are nominal



## Planetary Gearhead GP 22 A Ø22 mm, 0.5 - 1.0 Nm Metalversion



**Technical Data**

Planetary Gearhead	straight teeth
Output shaft	stainless steel, hardened
Bearing at output	ball bearings*
Radial play, 10 mm from flange	max. 0.2 mm
Axial play	max. 0.2 mm
Max. perm. radial load, 10 mm from flange	70 N
Max. permissible axial load	100 N
Max. permissible force for press fits	100 N
Recommended input speed	< 6000 rpm
Recommended temperature range	-15 / +80 °C

\*Sleeve bearings on request

- Stock program
- Standard program
- Special program (on request!)

Gearhead Data	Order Number											
	134156	134158	134163	134168	134172	110340	134183	134186	134190	134195	134203	
1 Reduction												
2 Reduction absolute	1539/219	185193/219			2777895/471	124859/482		4186825/111	15000833/111	335793/111		
3 Number of stages	1	2	1	1	1	1	1	1	1	1	1	1
4 Max. continuous torque at gear output	Nm	0.5	0.5	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5 Intermittently permissible torque at gear output	Nm	0.8	0.8	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5
6 Sense of rotation, drive to output		=	=	=	=	=	=	=	=	=	=	=
7 Max. efficiency	%	64	70	69	69	49	49	49	42	42	42	42
8 Weight	g	40	55	68	68	61	61	61	94	94	94	94
9 Average backlash no load	arc min	0.5	0.6	0.8	0.8	1.0	1.0	1.0	3.0	3.0	1.0	1.0
10 Mass inertia	gcm <sup>2</sup>	0.5	0.4	0.4	0.4	11.4	0.4	0.4	0.4	0.4	11.4	0.4
11 Gearhead length L1	mm	25.4	32.2	39.0	39.0	45.8	45.8	45.8	52.6	52.6	52.6	52.6