SANMOTION

DC SERVO SYSTEMS

T

DC SERVO SYSTEMS

SANYO DENKI

E

ENGLISH

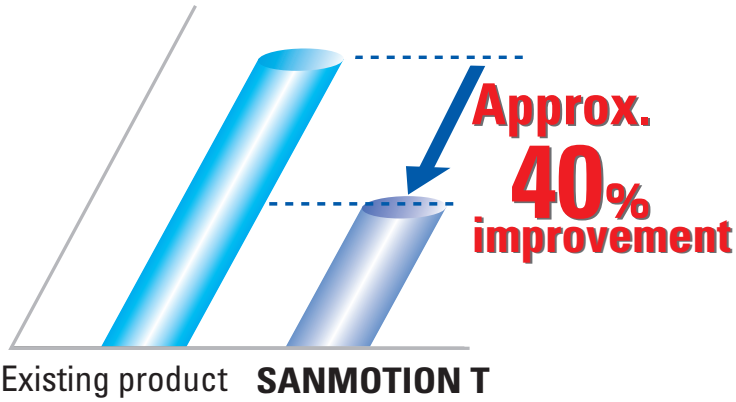
Characteristics

1. Equipment precision can be enhanced.

●High-resolution encoder (45,000 P/R) can be mounted.

2. Smooth drive is enabled.

●Improved performance with small-torque ripple



3. Worldwide usefulness is secured.

●Conformity to CE Marking and UL Standards

Explanation of model number

Examplifierle) The model number is as follows when 200W rated output, 76mm outer diameter, incremental encoder (500P/R), a brake, tachometer generator gear (1/15 gear ratio), and 75V series voltage specification are selected for "SANMOTION T" servo motor:

T7 20 B T G6 — 01 2 EL7

Model	Outer diameter of motor	Rated output	
T4	φ41 (1.61)	02	23W
T4	φ41 (1.61)	04	40W
T4	φ41 (1.61)	06	60W
T5	φ51 (2.0079)	06	60W
T5	φ51 (2.0079)	11	110W
T7	φ76 (2.9921)	20	200W
T7	φ76 (2.9921)	30	300W
T8	φ87.5 (3.4449)	40	400W
T8	φ87.5 (3.4449)	50	500W

Unit : mm(inch)

Brake	
B	Equipped
Blank	Not equipped

Tacho-generator	
T	Equipped
Blank	Not equipped

Tachometer generator	
1	24V series
2	75V series

Specification identification	
01	Standard
Other	Option

Gear		
Motor model	Model No.	Gear ratio
T4 type	GA	1/12.5
	GB	1/25
	GC	1/50
T5 type	G1	1/15
	G2	1/30
	G3	1/60
	G4	1/90
T7 type	G6	1/15
	G7	1/30
	G8	1/60
	G9	1/90

☆No indication: No gear

Encoder				
Motor model	Open collector		Line driver	
T4, T5, T7, and T8 types	E16	200P/R	EL6	200P/R
	E17	500P/R	EL7	500P/R
	E18	1000P/R	EL8	1000P/R
			EL0	2000P/R
			E59	2500P/R

☆No indication: No encoder

※T4 type can be equipped with either tacho-generator or encoder only. It cannot be equipped with brake oil seal

※The 24V-voltage series is provided for T402-011 only.

■Specifications of combined amplifier, motor and sensor

Series			Resolution		Mounted motor dimension	
			Single rotation	Multiple rotations	Dimension	Remarks
PP031 series	Optical detection system	Incremental type	2048P／R	—	Min.40mm (1.57inch)sq.	
PP038 series			32768P／R	—	Min.42mm (1.65inch)sq.	
PP062 series			10000P／R	—	Min.100mm (3.94inch)sq.	
PA035 series	Optical detection system	Absolute type	11bit (2048 divisions)	13bit (8192 rotations)	Min.42mm (1.65inch)sq.	Incremental output
PA035 series			17bit (131072 divisions)	16bit (65536 rotations)	Min.42mm (1.65inch)sq.	Bi-directional serial (2.5Mbps)

Capacity

23 to 500W (9 types)

Features

Small and lightmass

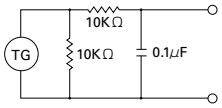
Uses

Machines for precision machining
Lathes
Milling machines
Transfer machines
Machines for industrial industries

Standard specifications

Type					T4 type	
Model					T402-011	T404-012
		Condition	Symbol	Unit (SI)		
Motor	Rated output	☆☆	PR	W	23	40
	Rated armature voltage	☆☆	VR	V	20	72
	Rated torque	☆☆	TR	N·m (lb·in)	0.074 (0.65)	0.13 (1.15)
	Rated armature current	☆☆	IR	A	1.9	1.0
	Rated rotating speed	☆☆	NR	min^{-1}	3000	
	Continuous stall torque	☆☆	TS	N·m (lb·in)	0.08 (0.71)	0.14 (1.24)
	Instantaneous maximum torque	☆☆	TP (N)	N·m (lb·in)	0.42 (3.72)	0.76 (6.73)
	Stall armature current	☆☆	IS	A	1.9	0.9
	Instantaneous maximum armature current	☆☆	IP (N)	A	10	4.7
	Maximum rotating speed		Nmax	min^{-1}	5000	
	Friction torque	☆	Tf	N·m (lb·in)	0.015 (0.13)	0.019 (0.17)
	Rated power rate	☆☆	QR	kW/S	1.2	2.1
	Instantaneous maximum angular acceleration	☆☆	αP	rad/s^2	89.4×10^3	90.5×10^3
	Viscous braking constant	☆	Fd	N · m/min^{-1}	0.003×10^{-3}	0.006×10^{-3}
	Torque constant	☆	KT	N · m/A	0.047	0.174
	Voltage constant	☆	KE	V/min^{-1}	4.9×10^{-3}	18.2×10^{-3}
	Rotor inertia		JM	$kg·m^2$ ($GD^2/4$) ($lb·in^2$)	0.0047×10^{-3} (16.06×10^{-3})	0.0084×10^{-3} (28.70×10^{-3})
	Armature winding resistance	☆	Ra	Ω	3.2	18.6
	Armature inductance	☆	Ja	mH	1.1	6.6
	Mechanical time constant	☆	tm	ms	7.1	4.8
	Electrical time constant	☆	te	ms	0.35	0.35
	Thermal time constant	☆☆	tθ	min	15	20
	Thermal resistance	☆☆	Rθ	K/W	4.9	3.6
	Heatup limit	☆☆	θ	K	105	
	Mass		W/M	kg (lbs)	0.3 (0.66)	0.4 (0.88)
Tachometer generator	Coefficient of voltage generated	☆	KEG	V/min^{-1}	$3\times10^{-3}\pm10\%$	
	Effective (rms) ripple	☆	εs	%	2	
	Peak-to-peak ripple	☆	εs	%	5	
	Linearity	☆	δL	%	1	
	Armature winding resistance	☆	Ri	Ω	37	
	Armature inductance	☆	Li	mH	5	
	Minimum load resistance	☆	RL	kΩ	10	
	Rotor inertia		JTG	$kg·m^2$ ($GD^2/4$) ($lb·in^2$)	0.0011×10^{-3} (3.76×10^{-3})	
	Mass		WT	kg (lbs)	0.09 (0.020)	
Holding brake	Holding torque	☆☆	TB	N·m (lb·in)	———	
	Voltage	☆	VB	V DC	———	
	Current	☆	IB	A	———	
	Resistance	☆	RB	Ω	———	
	Inertia		JB	$kg·m^2$ ($GD^2/4$) ($lb·in^2$)	———	
	Mass		WB	kg (lbs)	———	
Optical encoder		Open collector			200 500 1000 P/R	
		Line driver			200 500 1000 2000 2500 P/R	
Gear					1/12.5 1/25 1/50	
Oil seal					———	
Basic model number of applicable servo amplifier					—	DA0D020

Note 1) The mark ☆ in the "Condition" column is a value that applies when the ambient temperature and armature winding temperature are 25℃.The mark ☆☆ is a value that applies when the temperature has risen to the limit.
2) The figures in the above table apply when a smooth DC power supply is used at an ambient temperature of no more than 40℃.
3) The characteristics of the tachogenerator are based on the use of a test circuit illustrated below.
4) The values in the above table were measured when a specific device was mounted on an aluminum plate. T4 type (250 × 250 × 6mm thick), T5 and T7 and T8 type (305 × 305 × 12mm thick).
5) No encoder can be installed on a T4 type equipped with a tachogenerator.
6) Do not use a holding brake for quick braking.
7) The T404 and T406 and T506 series are compatible with products having a rated voltage ER of 24V.
8) The brake can be of the 24V type (optional).
9) Our servo amplifiers can be used with the 1000P/R line driver and the 2000P/R motor with encoder.



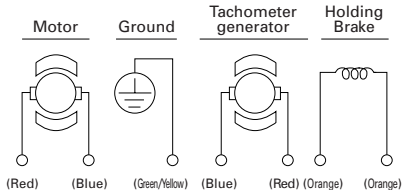
Gear Rating

Model No.	Motor nameplate marking			GA	GB	GC		G1	G2	G3
	Gear model			G6-12	G6-25	G6-50		G8-15	G8-30	G8-60
Reduction ratio (nominal)			G6 gear	1/12.5	1/25	1/50	G8 gear	1/15	1/30	1/60
Reduction ratio (detailed)				1/12.5	1/25	1/50		1/15.004	1/31.155	1/60.227
Rated torque	TRG	N·m (lb·in)		0.5 (4.43)	1.0 (8.85)	2.0 (17.70)		1.0 (8.85)	2.0 (17.70)	4.0 (35.40)
Instantaneous maximum torque	TPG	N·m (lb·in)		1.5 (13.28)	3.0 (26.55)	6.0 (53.10)		3.0 (26.55)	6.0 (53.10)	12.0 (106.21)
Mass	WG	kg (lbs)		0.4 (0.88)				0.6 (1.32)		
Applicable motor				T4 type				T5 type		

Note 1) Do not apply any value exceeding the appropriate rated torque or instantaneous maximum torque.
2) Applying a value exceeding the appropriate instantaneous maximum torque causes an abnormal thrust load, perhaps resulting in affecting the encoder and other equipment.

	T4 type	T5 type		T7 type		T8 type		Symbol
	T406-012	T506-012	T511-012	T720-012	T730-012	T840-012	T850-012	
	60	60	110	200	300	400	500	PR
	70	75		80	75	85	80	VR
	0.19 (1.68)	0.19 (1.68)	0.34 (3.01)	0.64 (5.66)	1.18 (10.44)	1.57 (13.90)	1.96 (17.35)	TR
	1.4	1.2	2.0	3.4	5.2	5.8	7.6	IR
	3000	3000		3000	2500	2500		NR
	0.20 (1.77)	0.24 (2.12)	0.42 (3.72)	0.77 (6.81)	1.43 (12.66)	1.70 (15.05)	2.16 (19.12)	TS
	1.2 (10.62)	1.8 (15.93)	3.4 (30.09)	5.4 (47.79)	9.8 (86.73)	12.0 (106.21)	16.7 (147.80)	TP (N)
	1.4	1.3	2.2	3.7	5.5	6.0	7.6	IS
	7.6	10	18	25	40	40	62	IP (N)
	5000	5000		5000	4000	4000	3000	Nmax
	0.020 (0.18)	0.020 (0.18)	0.022 (0.19)	0.04 (0.35)	0.05 (0.44)	0.06 (0.53)	0.07 (0.62)	Tf
	3.2	1.7	3.2	2.7	5.1	5.0	6.4	QR
	111×10^{3}	81.8×10^{3}	91.9×10^{3}	36.7×10^{3}	38.4×10^{3}	24×10^{3}	27.8×10^{3}	αP
	0.008×10^{-3}	0.009×10^{-3}	0.013×10^{-3}	0.020×10^{-3}	0.039×10^{-3}	0.045×10^{-3}	0.058×10^{-3}	Fd
	0.177	0.183	0.21	0.23	0.273	0.314	0.287	KT
	18.5×10^{-3}	19.1×10^{-3}	21.8×10^{-3}	24.2×10^{-3}	28.6×10^{-3}	32.9×10^{-3}	30.0×10^{-3}	KE
	0.0108×10^{-3} (36.91×10^{-3})	0.022×10^{-3} (75.18×10^{-3})	0.037×10^{-3} (126.44×10^{-3})	0.147×10^{-3} (502.32×10^{-3})	0.270×10^{-3} (922.64×10^{-3})	0.50×10^{-3} (1708.59×10^{-3})	0.60×10^{-3} (2050.30×10^{-3})	JM
	11.8	12.1	5.1	2.8	1.1	0.95	0.56	Ra
	4.4	5.7	3.2	3.0	1.6	1.9	1.1	Ja
	4.1	7.4	4.3	7.8	4.0	5.2	4.1	tm
	0.37	0.47	0.63	1.1	1.5	2.0	1.9	te
	25	20	30	30	30	30	40	tθ
	3.0	2.8	2.4	1.2		1.1	1.0	Rθ
	105	105		105		105		θ
	0.5 (1.1)	0.65 (1.43)	0.95 (2.09)	1.8 (3.96)	2.5 (5.5)	3.4 (7.5)	4.0 (8.8)	W/M
	$3\times10^{-3}\pm10\%$	$7\times10^{-3}\pm10\%$						KEG
	2	1						εs
	5	3						εs
		1						δL
	37	26						Ri
	5	4.1						Li
		10						RL
	0.0011×10^{-3} (3.76×10^{-3})	0.012×10^{-3} (41.01×10^{-3})						JTG
	0.09 (0.020)	0.26 (0.057)		0.35 (0.077)		0.45 (0.099)		WT
	—	0.29 (2.57)		1.47 (13.01)		1.96 (17.35)		TB
	—	90		90		90		VB
	—	0.06		0.11		0.11		IB
	—	1600		820		820		RB
	—	0.001×10^{-3} (3.42×10^{-3})		0.009×10^{-3} (30.75×10^{-3})		0.02×10^{-3} (68.34×10^{-3})		JB
	—	0.26 (0.057)		0.59 (0.13)		0.79 (0.17)		WB
				200 500 1000 P/R				
		200 500 1000 2000 2500P/R				—		
	1/12.5 1/25 1/50	1/15 1/30 1/60 1/90						
	—	Installable						
	DA0D020				DA0D030			

■Connection method



How to run the motor
Counterclockwise as viewed from the output axis when (red) + (blue)

Tachogenerator polarity
(Red) + (blue) in counterclockwise rotation as viewed from the output axis

	G4		G6	G7	G8	G9
	G8-90		G10-15	G10-30	G10-60	G10-90
	1/90	G10 gear	1/15	1/30	1/60	1/90
	1/89.588		1/15.303	1/30.066	1/60.132	1/90.198
	4.0 (35.40)		3.8 (33.63)	7.5 (66.38)	15.0 (132.76)	15.0 (132.76)
	12.0 (106.21)		12.0 (106.21)	23.0 (203.56)	45.0 (398.27)	45.0 (398.27)
	0.6 (1.32)		1.5 (3.3)			
	T5 type		T7 type			

■Common specifications

Rating	Continuous ("S1")
Heat resistance class	F
Excitation system	Permanent magnet
Insulation resistance	10MΩ or more (with a 500 VDC megger)
Dielectric strength	50Hz or 60Hz, 1,500 VAC (600V for 24V and TG types, 1 minute (but do not perform an insulation test between the system and encoder.)
Rotation method	Normal/reverse rotations possible
Ambient temperature	0 to 40°C
Humidity	20 to 90%RH (non-condensing)
Paint color	Black
Protection system	Fully closed (IP43)
Lead wire length	1000mm (39.37inch)

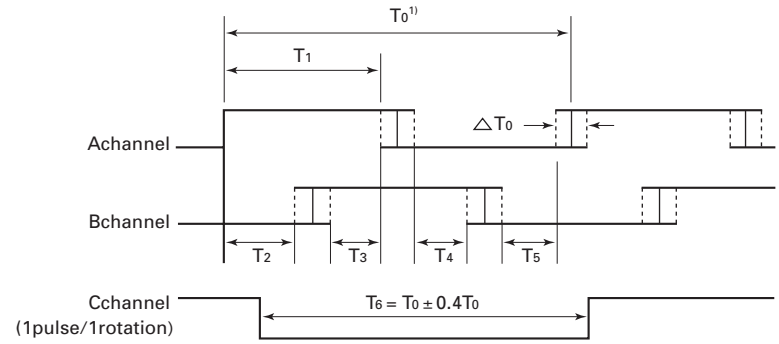
Built-in optical encoder

■Standard specifications

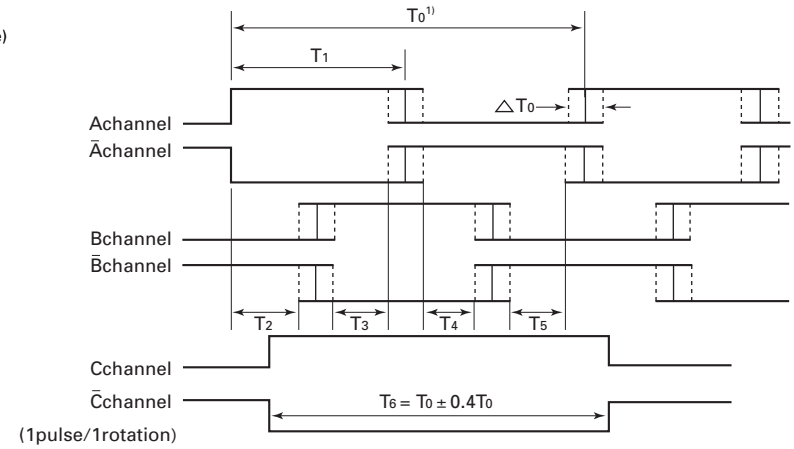
Applicable motor type		T4・T5・T7・T8 type	
Output pulse number	P/R	200,500,1000	200,500,1000,2000,2500
Output circuit system		Open collector	Line driver
Channel number		3	
Input voltage	V.DC	+5±10%	
Power demand	mA	70max	160mA max
Output circuit voltage	V.DC	+30max (When output transistor off)	V_{OH}=2.4min,V_{OL}=0.5max at I_O=±20mA
Output circuit current	mA	20max	20max
Response frequency	kHz	0～300	0～300
Pulse duty cycle		$T_1=1/2T_0\pm1/8T_0$	
Output mutual phase difference		$T_{2\sim5}=1/4T_0\pm1/8T_0$	
Flutter		$(T_{0max}-T_{0min})/T_0\leqq0.08$	
Working temperature		−10℃～+85℃ (at encoder atmosphere)	
Light emitting element		Infrared light emitting diode	
Light receiving element		Photo diode	
Inertia	kg・m²(GD²/4) (lb・in²)	200P/R : 0.0003×10^{-4} (102.52×10^{-4}), 500・1000・1024・2000・2500P/R : 0.0008×10^{-4} (27.34×10^{-4})	
Weight	Kg (lbs)	0.25 (0.55)	

■Output waveform

● Open collector output (When the encoder rotates counterclockwise viewed from the motor output shaft side)



● Line driver output (When the encoder rotates counterclockwise viewed from the motor output shaft side)



1)"T_0" is the average value of each cycle during one encoder rotation at a constant speed.
T_0 : 360-degree electrical angle.

■External leads

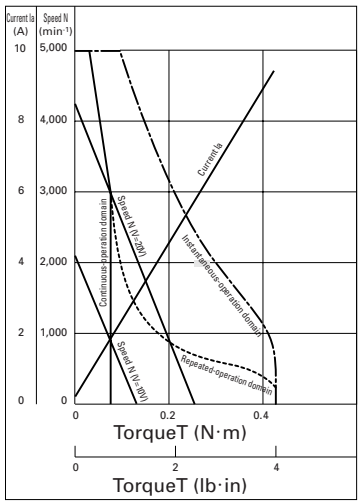
Lead color	Open collector	Line driver
Red	+DC5V	+DC5V
Black	GND(0V)	GND(0V)
Shield	Case earth	Case earth
Blue	A channel output	A channel output
Brown	—	$\overline{A}$ channel output
Green	B channel output	B channel output
Purple	—	$\overline{B}$ channel output
White	—	C channel output
Yellow	C channel output	$\overline{C}$ channel output

Notice

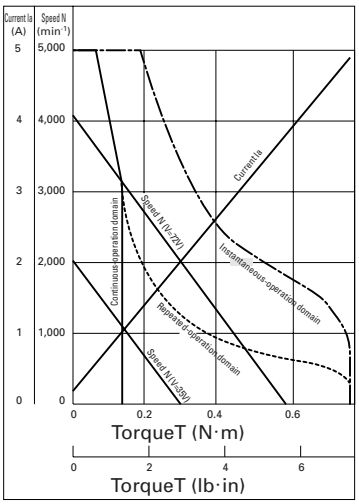
1) Never apply shock in the thrust direction when handling the encoder.
2) Do not test encoder insulation resistance and dielectric strength to avoid damaging the electronic circuits.

Characteristic curve

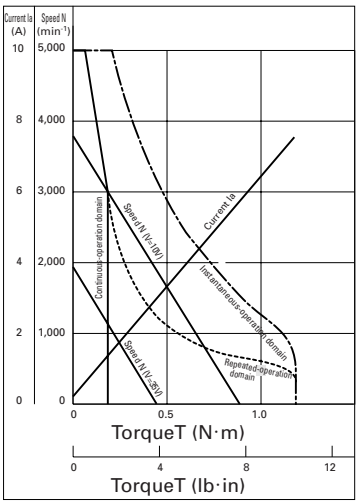
T402-011



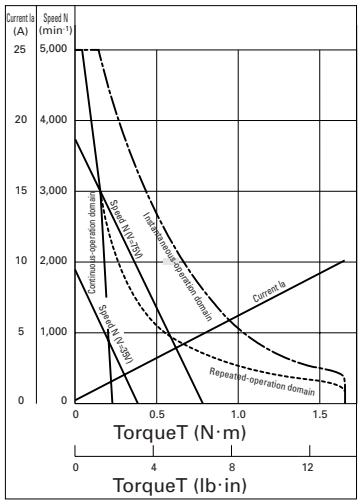
T404-012



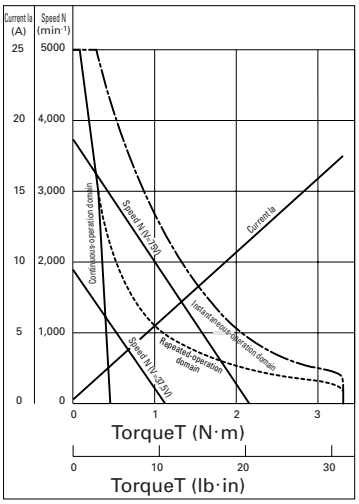
T406-012



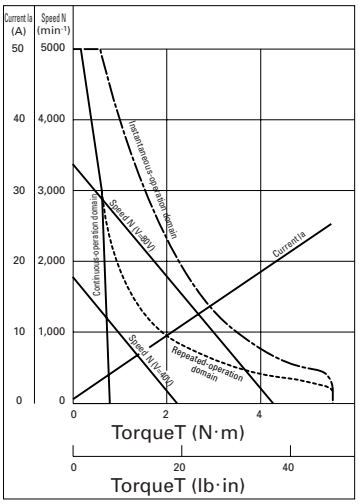
T506-012



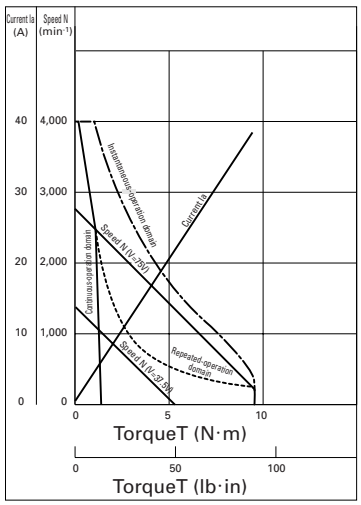
T511-012



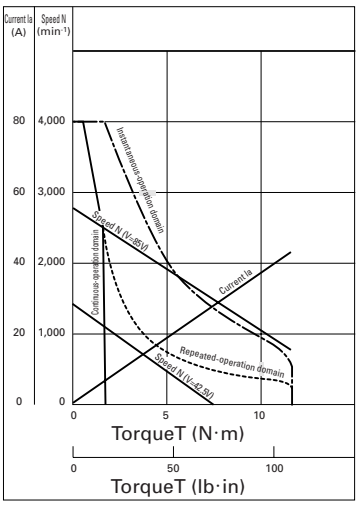
T720-012



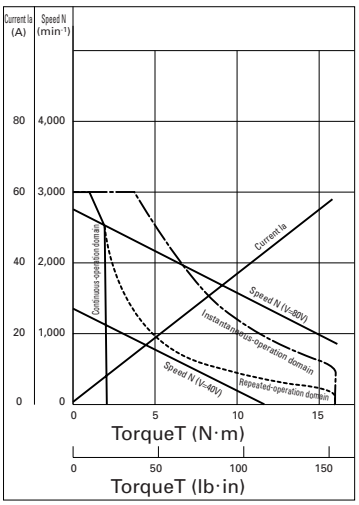
T730-012



T840-012

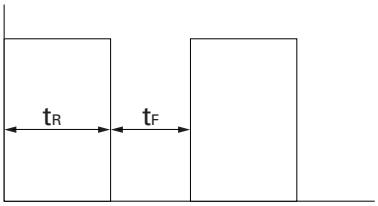


T850-012



Characteristics of overload duty cycle

When repeatedly driving "SANMOTION T" under an overload as illustrated in the right-hand figure, calculate the operable time t_R on the basis of the characteristic curve of overload duty cycle.



TS：Continuous stall torque
TL：Load torque
tR：Load time (minutes)
tF：Rest time (minutes)

$$\text{Load factor} = \frac{T_L}{T_S} \times 100 = \frac{\text{Armature current}}{\text{Stall armature current}} \times 100$$

$$\text{Load time factor, \%ED} = \frac{t_R}{t_R + t_F} \times 100$$

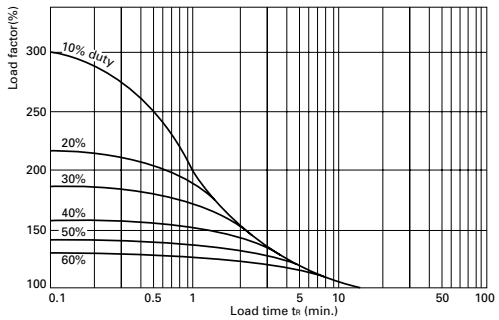
$$\text{Rest time } t_F = t_R \left(\frac{100}{\%ED} - 1 \right)$$

Typical calculations（T850-012）
Supposing that the load factor is 150% and the percentage of ED is 40%, the load time tR = 3 (minutes), from the characteristic curve of overload duty cycle. Therefore,

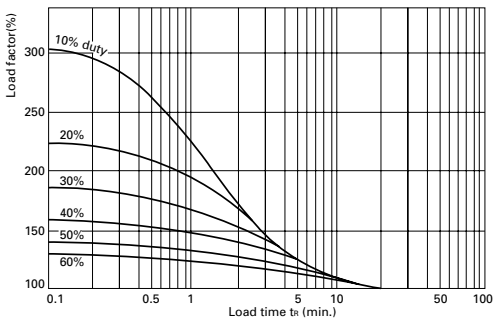
$$\text{Rest time } t_F = t_R \left(\frac{100}{\%ED} - 1 \right) = 3 \left(\frac{100}{40} - 1 \right) = 4.5 \text{(minutes)}$$

This means that, if you run the system at an overload of 150% with regard to the continuous stall torque for three minutes, you need a rest time of 4.5 minutes.

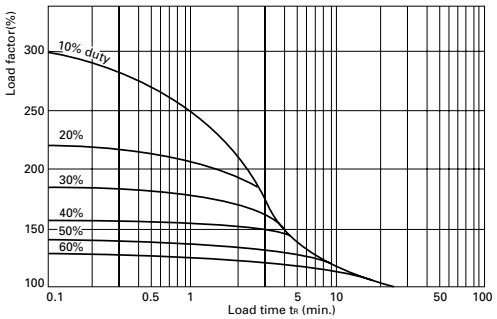
T402



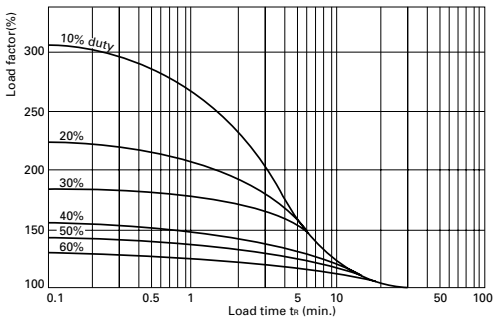
T404,T506



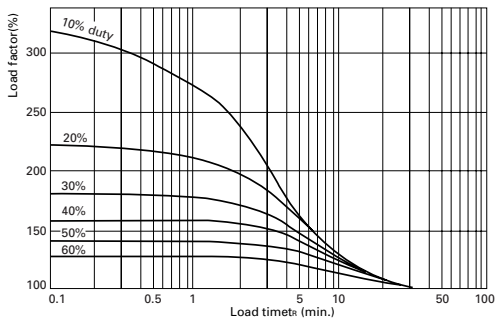
T406



T511,T720,T730,T840

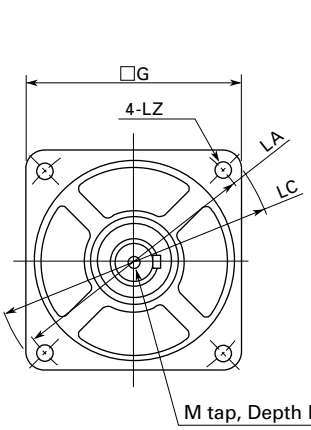


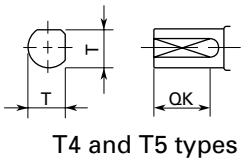
T850



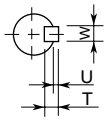
Motor dimensions

■Motors

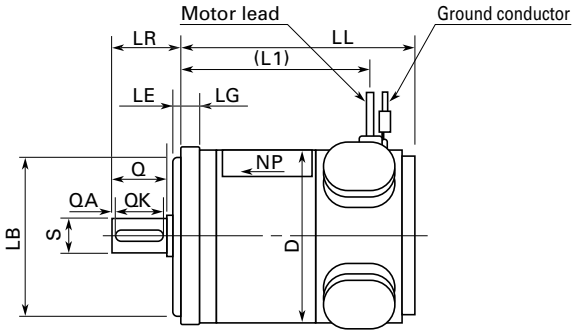




T4 and T5 types



T7 and T8 types



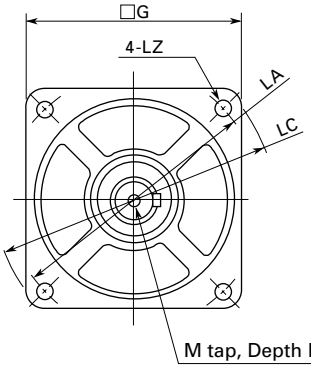
Model	LL	LG	L1	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T402	55.5	5	42	48±0.2	0 34-0.025	2	56	42	3.5	24±0.5	41	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T404	68.5		55											—					—	—
T406	81.5		68											—					—	—
T506	80.5	5	67	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	100.5		87											—					—	—
T720	100.5	8	83	90±0.3	0 70-0.030	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	124.5		107																	
T840	132	8	113	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	10
T850	147		128																	

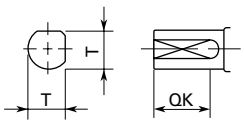
(Unit : mm)

Model	LL	LG	L1	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T402	2.19	0.20	1.65	1.89±0.008	0 1.34-0.0009	0.079	2.205	1.654	0.138	0.94±0.02	1.61	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T404	2.70		2.17											—					—	—
T406	3.21		2.68											—					—	—
T506	3.17	0.20	2.64	2.36±0.012	0 1.97-0.0009	0.098	2.717	2.126	0.177	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	3.96		3.43											—					—	—
T720	3.96	0.31	3.27	3.54±0.012	0 2.76-0.001	0.118	3.937	2.992	0.217	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.79	0.197	0.197	0.079	M5	0.315
T730	4.90		4.21																	
T840	5.20	0.31	4.45	3.94±0.012	0 3.15-0.001	0.118	4.409	3.465	0.260	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.197	0.197	0.079	M6	0.39
T850	5.79		5.04																	

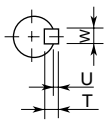
(Unit : inch)

■Encoder-equipped motors

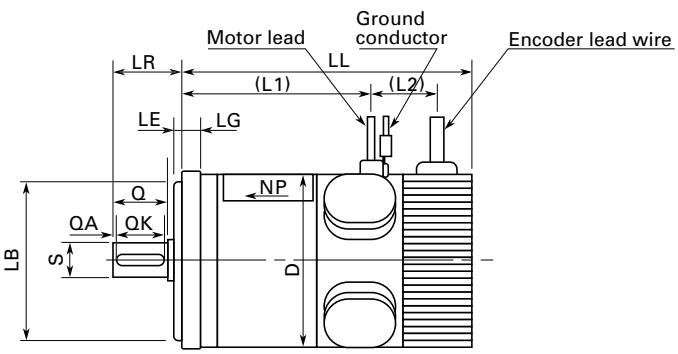




T4 and T5 types



T7 and T8 types



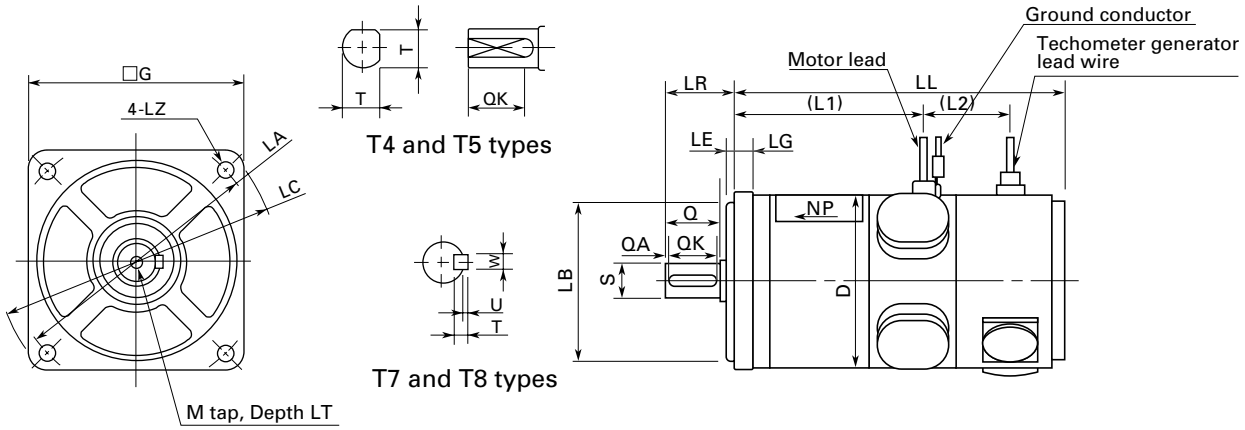
Model	LL	LG	L1	L2	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T402	83	5	42	18	48±0.2	0 34-0.025	2	56	42	3.5	24±0.5	41	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T404	96		55												—					—	—
T406	109		68												—					—	—
T506	110	5	67	22	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	130		87												—					—	—
T720	134.5	8	83	36	90±0.3	0 70-0.030	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	158.5		107																		
T840	166	8	113	38	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	10
T850	181		128																		

(Unit : mm)

Model	LL	LG	L1	L2	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T402	3.27	0.20	1.65	0.71	1.89±0.008	0 1.34-0.0009	0.08	2.20	1.65	0.14	0.94±0.02	1.61	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T404	3.78		2.17												—					—	—
T406	4.29		2.68												—					—	—
T506	4.33	0.20	2.64	0.87	2.36±0.012	0 1.97-0.0009	0.10	2.72	2.13	0.18	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	5.12		3.43												—					—	—
T720	5.30	0.31	3.27	1.42	3.54±0.012	0 2.76-0.001	0.12	3.94	2.99	0.22	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.79	0.20	0.20	0.08	M5	0.31
T730	6.24		4.21																		
T840	6.54	0.31	4.45	1.50	3.94±0.012	0 3.15-0.001	0.12	4.41	3.46	0.26	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.20	0.20	0.08	M6	0.39
T850	7.13		5.04																		

(Unit : inch)

■Tachometer generator-equipped motors



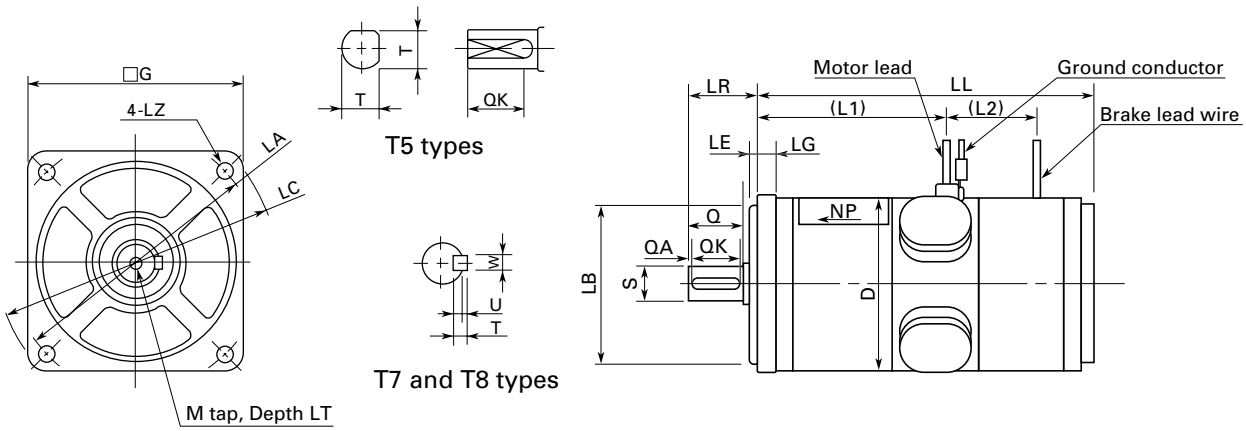
Model	LL	LG	L1	L2	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T402	88.5	5	42	33	48±0.2	0 34-0.025	2	56	42	3.5	24±0.5	41	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T404	101.5		55												—					—	—
T406	114.5		68												—					—	—
T506	123.5	5	67	38	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	143.5		87												—					—	—
T720	142	8	83	38	90±0.3	0 70-0.030	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	166		107																		
T840	174.5	8	113	38	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	10
T850	189.5		128																		

(Unit : mm)

Model	LL	LG	L1	L2	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T402	3.48	0.20	1.65	1.30	1.89±0.008	0 1.34-0.0009	0.08	2.20	1.65	0.14	0.94±0.02	1.61	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T404	4.00		2.17												—					—	—
T406	4.51		2.68												—					—	—
T506	4.86	0.20	2.64	1.50	2.36±0.012	0 1.97-0.0009	0.10	2.72	2.13	0.18	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	5.65		3.43												—					—	—
T720	5.59	0.31	3.27	1.5	3.54±0.012	0 2.76-0.001	0.12	3.94	2.99	0.22	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.79	0.20	0.20	0.08	M5	0.31
T730	6.54		4.21																		
T840	6.87	0.31	4.45	1.5	3.94±0.012	0 3.15-0.001	0.12	4.41	3.46	0.26	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.20	0.20	0.08	M6	0.39
T850	7.46		5.04																		

(Unit : inch)

■Brake-equipped motors



Model	LL	LG	L1	L2	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	117	5	67	36	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	137		87												—					—	—
T720	138.5	8	83	40	90±0.3	0 70-0.025	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	162.5		107																		
T840	169	8	113	40	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	10
T850	184		128																		

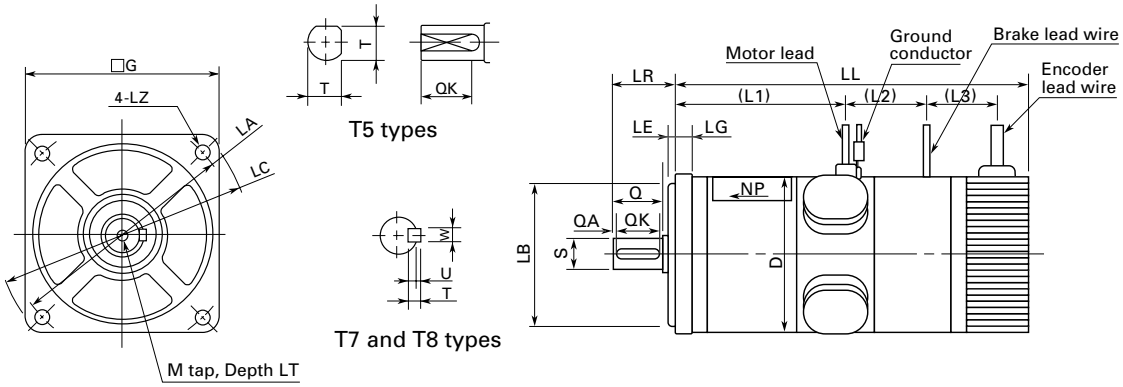
(Unit : mm)

Model	LL	LG	L1	L2	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	4.61	0.20	2.64	1.42	2.36±0.012	0 1.97-0.0009	0.10	2.72	2.13	0.18	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	5.39		3.43												—					—	—
T720	5.45	0.31	3.27	1.57	3.54±0.012	0 2.76-0.001	0.12	3.94	2.99	0.22	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.80	0.20	0.20	0.08	M5	0.31
T730	6.40		4.21																		
T840	6.65	0.31	4.45	1.57	3.94±0.012	0 3.15-0.001	0.12	4.41	3.46	0.26	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.20	0.20	0.08	M6	0.39
T850	7.24		5.04																		

(Unit : inch)

Motor dimensions

■Encoder brake-equipped motors



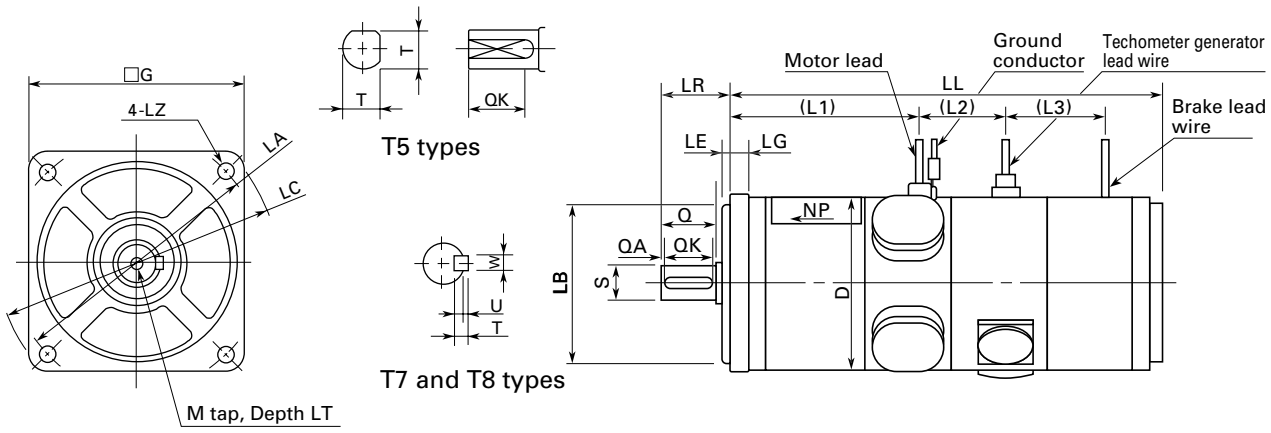
Model	LL	LG	L1	L2	L3	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	146.5	5	67	36	22	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	166.5		87													—					—	—
T720	172.5	8	83	38	35	90±0.3	0 70-0.025	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	196.5		107																			
T840	203	8	113	40	35	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	8
T850	218		128																			

(Unit : mm)

Model	LL	LG	L1	L2	L3	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	5.77	0.20	2.64	1.42	0.87	2.36±0.012	0 1.97-0.0009	0.10	2.72	2.13	0.18	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	6.56		3.43													—					—	—
T720	6.79	0.31	3.27	1.5	1.38	3.54±0.012	0 2.76-0.001	0.12	3.94	2.99	0.22	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.79	0.20	0.20	0.08	M5	0.31
T730	7.74		4.21																			
T840	7.99	0.31	4.45	1.57	1.38	3.94±0.012	0 3.15-0.001	0.12	4.41	3.46	0.26	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.20	0.20	0.08	M6	0.31
T850	8.58		5.04																			

(Unit : inch)

■Techometer generator brake-equipped motors



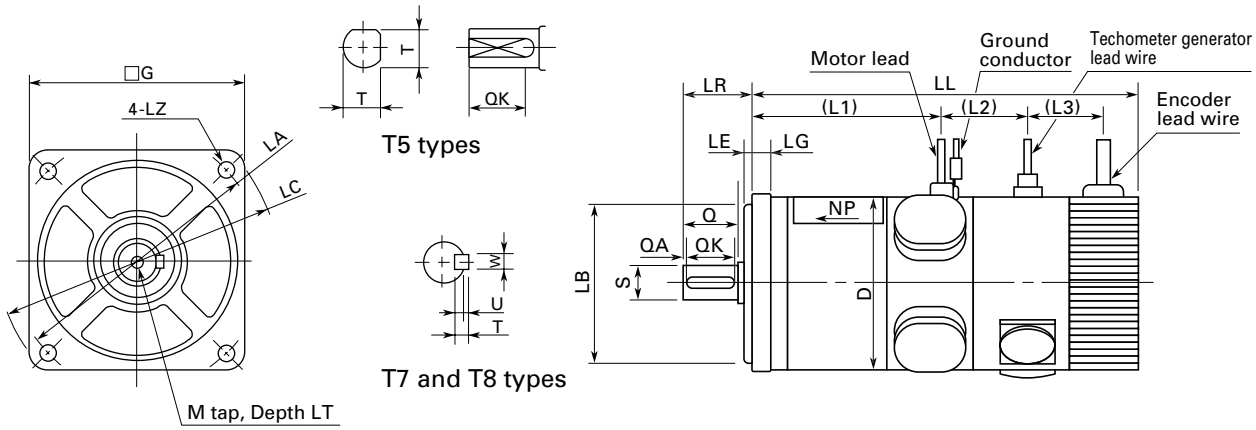
Model	LL	LG	L1	L2	L3	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	160	5	67	38	42	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	180		87													—					—	—
T720	180	8	83	40	44	90±0.3	0 70-0.025	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	204		107																			
T840	211.5	8	113	38	44	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	8
T850	226.5		128																			

(Unit : mm)

Model	LL	LG	L1	L2	L3	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	6.3	0.20	2.64	1.50	1.65	2.36±0.012	0 1.97-0.0009	0.10	2.72	2.13	0.18	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	7.09		3.43													—					—	—
T720	7.09	0.31	3.27	1.57	1.73	3.54±0.012	0 2.76-0.001	0.12	3.94	2.99	0.22	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.79	0.20	0.20	0.08	M5	0.31
T730	8.03		4.21																			
T840	8.33	0.31	4.45	1.50	1.73	3.94±0.012	0 3.15-0.001	0.12	4.41	3.46	0.26	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.20	0.20	0.08	M6	0.31
T850	8.92		5.04																			

(Unit : inch)

■Motors with encoder and techometer generator



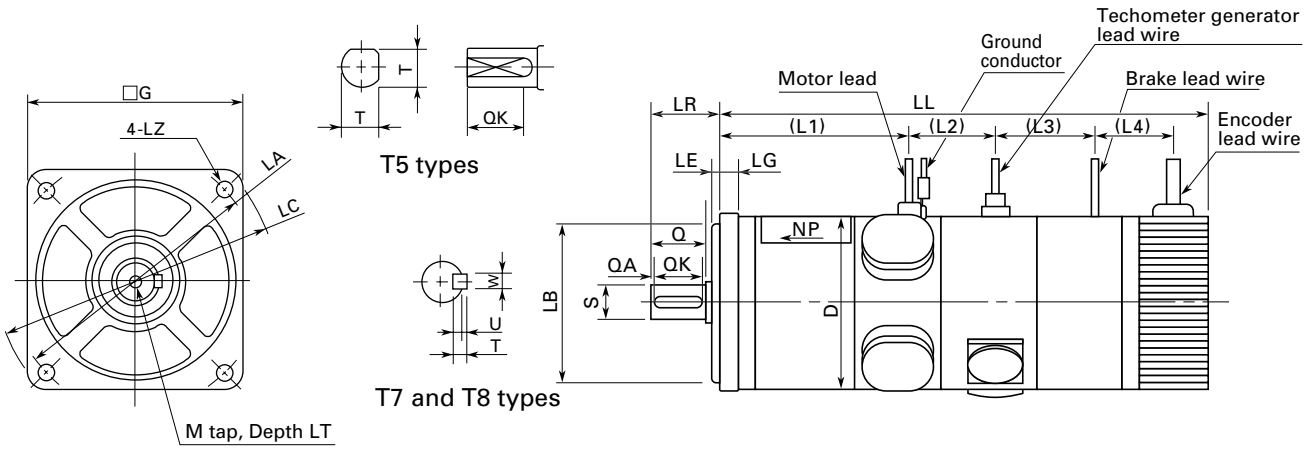
Model	LL	LG	L1	L2	L3	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	153	5	67	38	27	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	173		87													—					—	—
T720	176	8	83	38	40	90±0.3	0 70-0.030	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	200		107																			
T840	208.5	8	113	38	42	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	8
T850	223.5		128																			

(Unit : mm)

Model	LL	LG	L1	L2	L3	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	6.02	0.20	2.64	1.50	1.06	2.36±0.012	0 1.97-0.0009	0.10	2.72	2.13	0.18	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	6.81		3.43													—					—	—
T720	6.93	0.31	3.27	1.50	1.57	3.54±0.012	0 2.76-0.001	0.12	3.94	2.99	0.22	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.79	0.2	0.20	0.08	M5	0.31
T730	7.87		4.21																			
T840	8.21	0.31	4.45	1.50	1.65	3.94±0.012	0 3.15-0.001	0.12	4.41	3.46	0.26	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.2	0.20	0.08	M6	0.31
T850	8.80		5.04																			

(Unit : inch)

■Motors with encoder, techometer generator, and brake



Model	LL	LG	L1	L2	L3	L4	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	189.5	5	67	38	42	22	60±0.3	0 50-0.025	2.5	69	54	4.5	24±0.5	51	0 7-0.009	20	—	15	w/ 2 slots, 6.5			—	—
T511	209.5		87														—					—	—
T720	214	8	83	38	44	35	90±0.3	0 70-0.030	3	100	76	5.5	30±0.8	76	0 14-0.011	25	2	20	5	5	2	M5	8
T730	238		107																				
T840	245.5	8	113	38	44	35	100±0.3	0 80-0.030	3	112	88	6.6	35±0.8	87.5	0 16-0.011	30	2	25	5	5	2	M6	8
T850	260.5		128																				

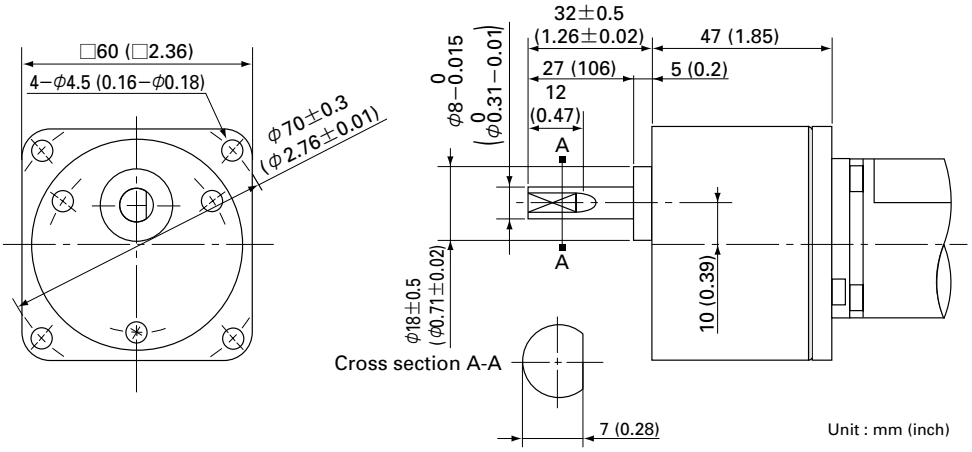
(Unit : mm)

Model	LL	LG	L1	L2	L3	L4	LA	LB	LE	LC	G	LZ	LR	D	S	Q	QA	QK	W	T	U	M	LT
T506	7.46	0.20	2.64	1.50	1.65	0.87	2.36±0.012	0 1.97-0.0009	0.10	2.72	2.13	0.18	0.94±0.02	2.01	0 0.28-0.00035	0.79	—	0.59	w/ 2 slots, 6.5			—	—
T511	8.25		3.43														—					—	—
T720	8.43	0.31	3.27	1.50	1.73	1.38	3.54±0.012	0 2.76-0.001	0.12	3.94	2.99	0.22	1.18±0.03	2.99	0 0.55-0.0004	0.98	0.08	0.79	0.20	0.20	0.08	M5	0.31
T730	9.37		4.21																				
T840	9.67	0.31	4.45	1.50	1.73	1.38	3.94±0.012	0 3.15-0.001	0.12	4.41	3.46	0.26	1.38±0.03	3.44	0 0.63-0.0004	1.18	0.08	0.98	0.20	0.20	0.08	M6	0.31
T850	10.26		5.04																				

(Unit : inch)

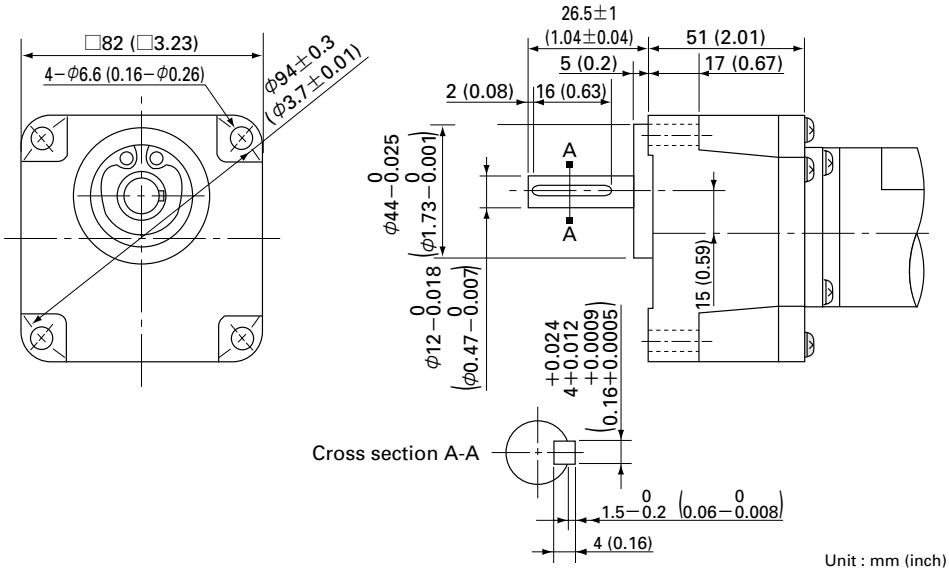
Gear dimensions

■Dimensions of a typical gear for T4



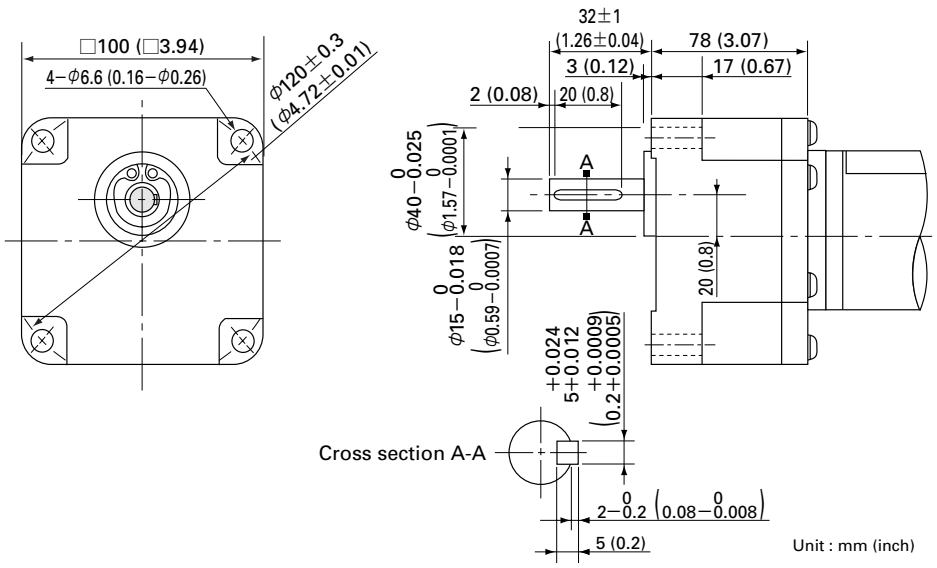
Unit : mm (inch)

■Dimensions of a typical gear for T5



Unit : mm (inch)

■Dimensions of a typical gear for T7



Unit : mm (inch)

Precautions to select motors

1. The mark ☆☆ in the standard specifications (pages 3 and 4) are values that apply when the temperature has risen to the limit. The conditions therefore differ from those that apply when it is cold. Be careful of this when comparing these models with products manufactured by other manufacturers.

2. The values in the characteristics table apply to a pure DC power supply. Use lower values than the ratings according to the type of power supply you are actually using.

(Typical rating reduction ratios)
Single-phase, full-wave : 50 to 60%
3-phase, half-wave : 70 to 80%
3-phase, full-wave : 90 to 95%
Transistor : 90 to 98%

(Typical motor ratings calculated)
Effective motor torque = rated motor torque × rating reduction ratio

$$\text{Rating reduction ratio} = \frac{1}{\text{Form factor}} = \frac{\text{Average current}}{\text{Effective current}}$$

3. The instantaneous maximum armature currents are set at maximum current waveform values (including instantaneous surges). Set the system so that its maximum value remains equal to or below a specified level whatever happens. Any instantaneous value exceeding a specified one demagnetizes the permanent magnet, thus normal characteristics can no longer be obtained.

4. Monitor the drive mode of the system, calculate the effective torque in the mode which seems to be the most severe, and make sure that it is within the continuous rated domain range of the motor.

5. The brake is a holding brake. It does not serve for braking. It is a negative-action-type brake for spring operations and open excitation. The operation time varies according to the type of discharge circuit. Check the specifications before selecting a model.

Maintenance and handling precautions

1. Do not disassemble the motor or apply shock to it to avoid malfuction.

2. For a motor with an encoder, never apply shock, especially in the thrust direction.

3. The motor is shipped after the encoder insulation resistance has been sufficiently checked during product inspection. So,users are requested not to test it.
(Since a noise-suppressing capacitor has been installed,improper measurement may damage the electronic circuits.)

4. For safety precautions and other details, refer to the operation manual.

Option

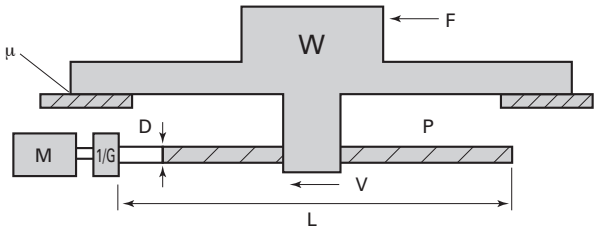
The following optional.

Oil seal
24V.DC rating brake

Servomotor selection guide

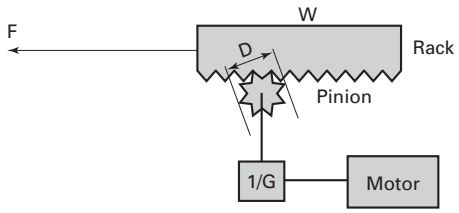
1 : What driving method are you employing?

Ball screw



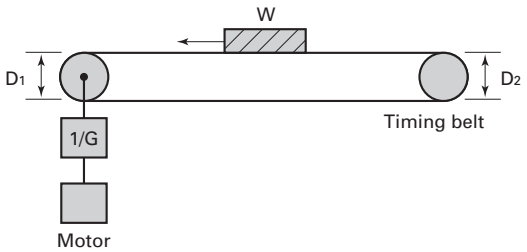
· Mass of moving part	W	kg
· Coefficient of friction	μ	
· External force	F	kg
· ball screw pitch	P	cm
· ball screw diameter	D	cm
· ball screw length	L	cm
· transfer efficiency	η	
· Specific gravity of "W"	ρ	kg/cm³
· Reduction gear ratio	1/G	

Rack and pinion



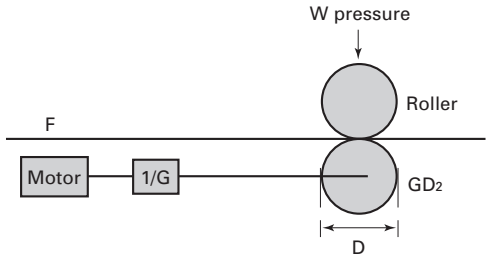
· Mass of moving part	W	kg
· Coefficient of friction	μ	
· Pinion pitch	P	cm
· Pinion diameter	D	cm
· Pinion thickness	t	cm
· Transfer efficiency	η	
· Specific gravity of "W"	ρ	kg/cm³
· Reduction gear ratio	1/G	

Timing belt



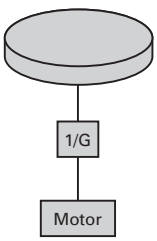
· Mass of moving part	W	kg
· Coefficient of friction	μ	
· Pulley pitch	P	cm
· Pulley diameter (motor side)	D1	cm
· Pulley diameter (load side)	D2	cm
· Pulley thickness(motor side)	t1	cm
· Pulley thickness(load side)	t2	cm
· Transfer efficiency	η	cm
· Specific gravity of "W"	ρ	kg/cm³
· Reduction gear ratio	1/G	

Roll feed



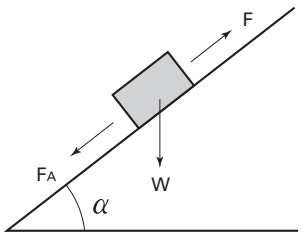
· Load	GD²	kg · m²
· Coefficient of friction	μ	
· Tension	F	N
· Pressure	W	N
· Diameter of roller	D	cm
· Transfer efficiency	η	
· Reduction gear ratio	1/G	

Rotary object



· Load	GD²	kg·m²
· Load torque	TL	N·m
· Transfer efficiency	η	
· Reduction gear ratio	1/G	

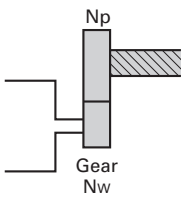
Note) 1) Thrust force on the slope



Calculate the thrust(F) on the slope.

$F = F_A + W(\sin\alpha + \mu\cos\alpha)$

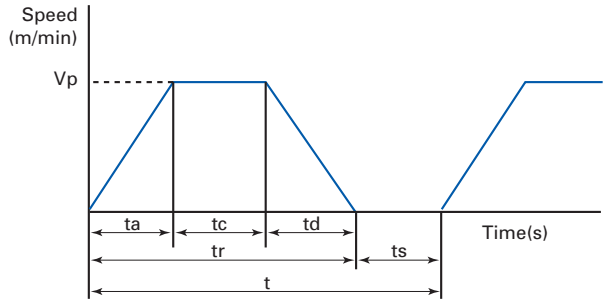
2) Gear ratio



Calculate the gear ratio(G)

$$\frac{Np}{Nw} = \frac{1}{G}$$

2 : Sketch the operation pattern.



・Speed for positioning (Np) [min^{-1}]
Calculate the maximum feed speed (Vp) [m/min.] from the positioning distance(Lp) [mm] and the positioning time (tr) [sec] .
According to the operation pattern diagram on the left:

$$\frac{Vp\times10^3}{60}\times\frac{2tr}{3}=Lp\text{(Provided that ta=tb=tr/3)}$$

$$\therefore Vp=Lp\times\frac{3}{2tr}\times\frac{60}{10^3}\ [\text{m/min}]$$

$$Np=\frac{Vp\times10^3}{P}\times\frac{G}{1}\ [min^{-1}]$$

3 : Calculate the motor shaft equivalent load torque(TL).

$$TL=\frac{(F+\mu W)}{\eta}\cdot\frac{D}{2}\cdot\frac{1}{G}\times\frac{9.8}{100}\ [N\cdot m]$$

Note) When using the ball screw

$$\frac{D}{2}=\frac{P}{2\pi}$$

4 : Calculate the motor shaft equivalent load inertia(JL).

$J_L=J_B+J_W$
＊Gear inertia is negligible.

・Inertia of the moving part(JB)

$$J_B=\left(\frac{1}{G}\right)^2\cdot\frac{\pi\rho D^4A}{32\times10^4}\ [kg\cdot m^2]$$

・Work piece inertia

$$J_W=\left(\frac{1}{G}\right)^2\cdot\frac{W}{10^4}\cdot\left(\frac{P}{2\pi}\right)^2\ [kg\cdot m^2]$$

"A" in the above equation stands for the ball screw length (L), the pinion thickness (t) or the pulley thickness (t).

5 : Tentatively select the motor type.

Select the motor type which satisfies the above requirements (JL), (TL),and (NP), referring to the catalogue.

6 : Calculate the acceleration/deceleration torque.

・Acceleration torque

$$Ta=\frac{2\pi(N_2-N_1)\cdot(J_L+J_M)}{60\cdot ta}+T_L\ [N\cdot m]$$

・Deceleration torque

$$Tb=\frac{2\pi(N_2-N_1)\cdot(J_L+J_M)}{60\cdot tb}-T_L\ [N\cdot m]$$

Does the tentatively selected motor type still satisfy the above requirements (Ta) and (Tb)?

7 : Calculate the rms(root-mean-square) torque(Trms).

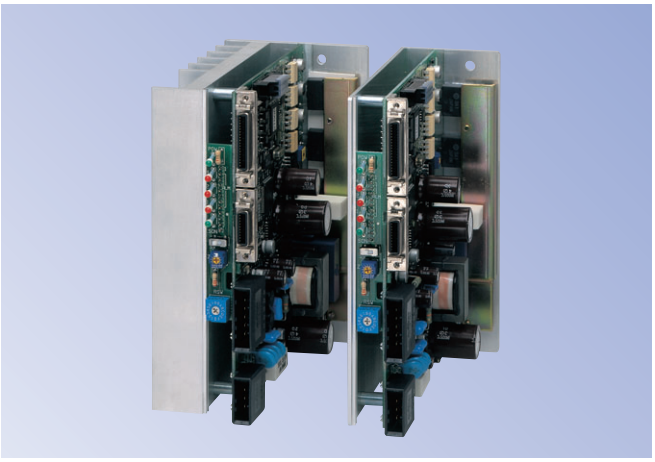
$$Trms=\sqrt{\frac{Ta^2\cdot Ta+T_L^2\cdot tc+Tb^2\cdot tb}{t}}\ [N\cdot m]$$

Does the tentatively selected motor type still satisfy the original requirement(Trms)?

DC servo amplifier for DC servo motor SANMOTION "T"

1.Overview

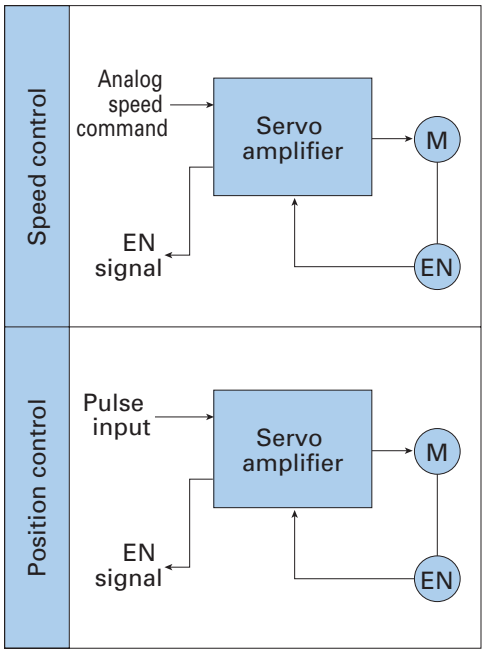
DC servo amplifier "DA0" is an optimum DC servo amplifier for DC servomotor SANMOTION "T" that has good controllability. Multifunctional flexibility is achieved.



2.Standard specification

(1) Main source power and control power are externally supplied.
(2) Encoder return is used.
(3) External choke coil is not required.
(4) Input signal form is an analog speed command type or a pulse input position control type.

3.System block diagram

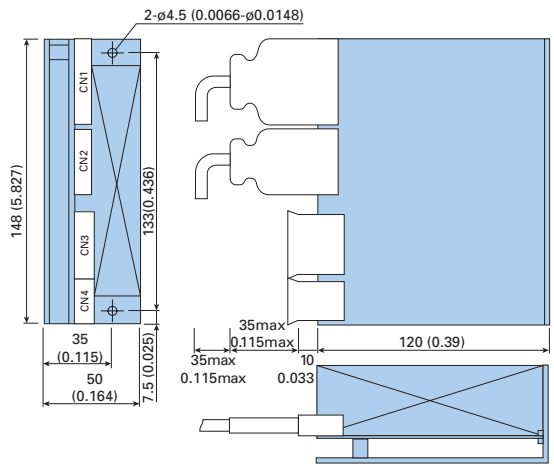


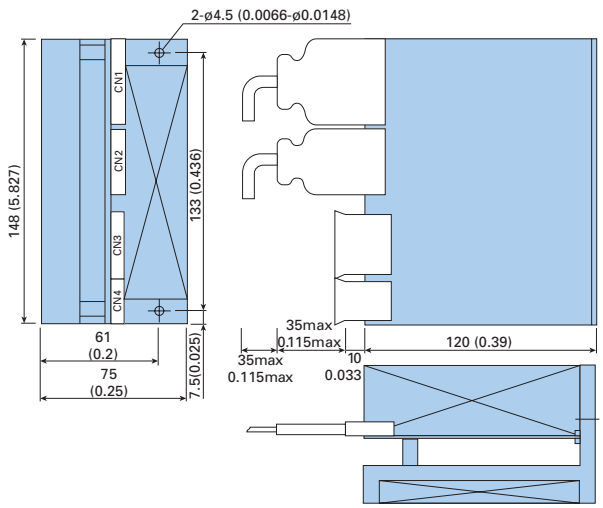
4.Standard combination table

SANMOTION "T" model No.	"DA0" amplifier model No.	Speed control range	Rated torque	Instantaneous maximum torque
T404-012EL8	DA0D020DT27□00	1～3000min^{-1}	0.127N・m 1.124lb・in	0.319N・m 2.823lb・in
T406-012EL8	DA0D020DT37□00	1～3000min^{-1}	0.176N・m 1.558lb・in	0.441N・m 3.9lb・in
T506-012EL8	DA0D020DT47□00	1～3000min^{-1}	0.186N・m 1.646lb・in	0.441N・m 3.9lb・in
T511-012EL8	DA0D020DT57□00	1～3000min^{-1}	0.32N・m 2.83lb・in	0.66N・m 5.84lb・in
T720-012EL8	DA0D020DT67□00	1～3000min^{-1}	0.608N・m 5.38lb・in	1.47N・m 13.0lb・in
T730-012EL8	DA0D030DT77□00	1～2500min^{-1}	1.078N・m 9.54lb・in	2.45N・m 21.68lb・in
T840-012EL8	DA0D030DT87□00	1～2500min^{-1}	1.57N・m 13.89lb・in	3.72N・m 32.92lb・in
T850-012EL8	DA0D030DT97□00	1～2500min^{-1}	1.862N・m 16.48lb・in	4.214N・m 37.29lb・in

5.Amplifier dimensions

Unit: mm (inch)





Questionnaire

When making an inquiry or placing an order, please fill out the following list.
If you have any question or desire, write them on a separate sheet.

Company name

Section　　Person in charge　　Date.　.　.　.

Phone No

Fax No

Phone No. +81-3-3917-5151 (Main)
FAX No. +81-3-3917-0643

1. Application :

2. Machine name :　　**3. Quantity:**

4.Enter the control method to the following item: ①Speed control　②Position control　③Torque control

5. Enter your desired sensor to the following item:

①Incremental encoder　②Absolute sensor　③Manchester
④DeviceNet　⑤SERCOS

6. Enter the drive direction to the following item: ①Horizontal　②Vertical　③Inclined

7.Fill out the following list referring to the driving method

	Symbol	Unit	1st axis	2nd axis	3rd axis	4th axis	5th axis
(4) Desired Model No.							
(5) Control Method No.							
(6) Desired Sensor No.							
(7) Drive Direction No.							
(8) Driving Method No.							
Desired revolving speed		min^{-1}					
Mover mass	W	kg					
Driver specific gravity	ρ	kg/m^3					
Load inertia	GD^2	$kg \cdot m^2$					
Loading torque	T_L	N·m					
Tension	F	N					
Pressing force	W	N					
Roll diameter	D	cm					
Friction factor	μ						
Transmission efficiency	η						
Gear reduction ratio	1/G						
Ball screw pitch	P	cm					
Ball screw diameter	D	cm					
Ball screw length	L	cm					
Pulley diameter (Motor side)	D_1	cm					
Pulley length (Motor side)	t_1	cm					
Pulley diameter (Load side)	D_2	cm					
Pulley length (Load side)	t_2	cm					
Pinion pitch	P	cm					
Pinion diameter	D	cm					
Pinion thickness	t	cm					

8. Duty Cycle

	Symbol	Unit	1st axis	2nd axis	3rd axis	4th axis	5th axis
Positioning distance	Lp	mm					
Moving part speed	Vp	m/min					
Positioning time	tr	s					
Accelerating/Decelerating time	ta,tb	s					

9. Working Environment　· Operating temperature _____ ~ _____
· Others _____

※ Contact our sales personnel for Servomotor selecting software.

■ Precautions For Adoption

⚠ Cautions

Failure to follow the precautions on the right may cause moderate injury and property damage, or in some circumstances, could lead to a serious accident. Always follow all listed precautions.

⚠ Cautions

- Read the accompanying Instruction Manual carefully prior to using the product.
- If applying to medical devices and other equipment affecting people's lives, please contact us beforehand and take appropriate safety measures.
- If applying to equipment that can have significant effects on society and the general public, please contact us beforehand.
- Do not use this product in an environment where vibration is present, such as in a moving vehicle or shipping vessel.
- Do not perform any retrofitting, re-engineering, or modification to this equipment.
- The amplifiers presented in this catalog are meant to be used for general industrial applications. If using for special applications related to aviation and space, nuclear power, electric power, submarine repeaters, etc., please contact us beforehand.

＊For any question or inquiry regarding the above, contact our Sales Department.

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*Remarks : Specifications Are Subject To Change Without Notice.

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