YASKAWA ELECTRIC

TSEZ-C249-1C
BULLETIN

SMALL SIZE DC SERVOMOTORS

Minertia® Motor Mini Series FOR COMPUTER PERIPHERALS

TYPE UGTMEM-□□□□□

Creative design engineering and time-proven manufacturing technologies, blended with accumulated knowledge on computer peripherals, achieve light weight, low cost, and high reliability in the Mini Series.

Thermal time constants of ten minutes or more fully protect the motor from short term overloads. Nine standard models range from 1.5 to 3.35 inches in diameter, and their versatile functional ratings cover most application requirements.

FEATURES

. Light weight, compact, high performance

Alnico V field structure allows high power rate (kW/sec) per weight and size and weight reductions for many applications.

. Large load capacity

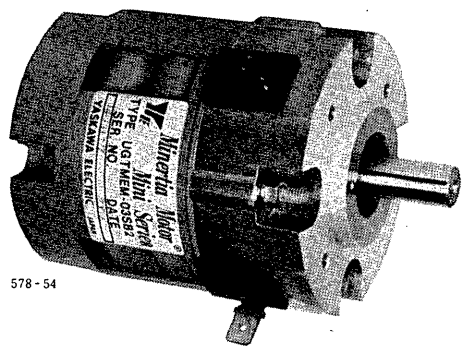
Thermal time constants from 7 to 27 minutes protect motor from short term overloads.

. Smooth operation

A special armature design greatly reduces cogging to provide smooth torque.

. Motors are available with optical encoders and analog tachometers.

. Construction suitable for application to the equipment.



Type UGTMEM-03

1. RATINGS AND SPECIFICATIONS

Time rating: Continuous
Dielectric Strength: 500 VAC/min.
Enclosure: Totally-enclosed self-cooled type
Ambient Temperature:
-10 °C to +40 °C in operation
-20 °C to +60 °C in storage (no condensation)
Humidity: 35% to 80% RH in operation
10% to 80% RH in storage (no condensation)

Vibration: V15
Finish in Munsell Notation: N7
Excitation: Parmanent magnet
Mounting: Flange-mounted type
Drive Method: Direct Drive
Motor Life: 5000 Hours

TYPE DESIGNATION

UGTM EM 03M B 4 OE

Minertia Motor Mini Series
TOTALLY-ENCLOSED SELF-COOLED
FRAME No.

01	S, M, L
03	S, M, L
06	S, M, L

DESIGN ORDER

NUNBER OF MOTOR BRUSHES

2	Two brushes
4	Four brushes

OPTIONAL DETECTORS (MODULAR SERIES)

—	Motor alone
0E	Optical encoder
0F	Freedback unit (Encoder & TG)
7S	DC tachometer generator Type TG-7SVC (7V/1000r/min output)
3V	DC tachometer generator Type TG-3VC (3V/1000r/min output)

1. RATINGS AND SPECIFICATIONS (Cont'd)

Table 1 Ratings and Specifications

Specifications \ Motor Type		UGTMEM-01□			UGTMEM-03□			UGTMEM-06□		
		SB4	MB4	LB4	SB2	MB2	LB2	SB2	MB2	LB4
Peak Rated Torque	N-m	0.122	0.2	0.246	0.493	0.758	1.01	0.918	1.5	2.53
Rated Torque	N-m	0.0588	0.0882	0.098	0.255	0.392	0.49	0.431	0.657	0.98
Torque Constant	N-m/A±10%	0.0344	0.0525	0.0573	0.0754	0.0716	0.119	0.0907	0.12	0.172
Armature Winding Resistance (at 25°C)	Ω±10%	3.26	3.77	3.67	1.62	0.68	1.35	1.04	1.05	1.16
Armature Inductance	mH	0.8	0.9	0.8	1.2	0.7	1.2	1.9	1.7	3.1
Peak Current	A	3.8	4.0	4.5	6.8	10.9	8.7	10.4	12.8	15.0
Voltage Constant	V/1000rpm±10%	3.6	5.5	6.0	7.9	7.5	12.5	9.5	12.6	18.0
Viscous Damping Coefficient	N-m/1000rpm	0.00196	0.0353	0.005	0.00569	0.00804	0.00882	0.0118	0.123	0.0196
Friction Torque	N-m	0.00853	0.0101	0.114	0.0196	0.0225	0.333	0.025	0.353	0.05
Inertia	$kg \cdot m^2 \times 10^{-4}$	0.0157	0.0221	0.0265	0.235	0.333	0.372	0.951	1.05	1.76
Mechanical Time Constant	ms	4.3	3.0	3.0	6.7	4.4	3.5	12	7.6	6.9
Electrical Time Constant	ms	0.25	0.24	0.22	0.74	1.0	0.89	1.8	1.6	2.7
Power Rate	kW/s	2.2	3.53	3.63	2.76	4.61	6.44	1.96	4.11	5.44
Torque Inertia Ratio	rad/s^2	37500	40000	37000	10800	11800	13200	4540	6260	5560
Thermal Resistance	deg C/watt	5.2	4.7	4.6	2.55	2.5	2.45	2.35	1.85	1.8
Thermal Time Constant	minutes	7.0	8.0	10	11	12	13	21	22	27
Max Allowable Armature Temperature	°C	155	155	155	155	155	155	155	155	155
Rated Speed	r/min	3000	2500	2000	2000	1500	1000	1300	1000	700
Max Safe Operating Speed	r/min	4500	4500	4500	3000	3000	2000	2500	2000	3500
Max No Load Speed	r/min	6000	6000	6000	6000	6000	6000	6000	6000	6000
Cooling Required	cfm, in H_2O	Totally-enclosed non-ventilated								

Note:

1. Rated torque is indicated by allowable continuous torque value at ambient temperature 40°C, when the following heat dissipating aluminum plate is mounted on the motor:
   - Type UGTMEM-01—100mm x 100mm x 3mm
   - Type UGTMEM-03 and -06—250mm x 250mm x 6mm
2. Rated voltages are the values when the armature winding temperature is 125°C.
3. Breakaway torques are normal (TYP) values.
4. For the motor brush:
   - Type UGTMEM-01——provided with four brushes. Motor with two brushes is available on order. In that case, rated torque becomes 110% and maximum safe operating speed is reduced for the values shown in Table 1.
   - Type UGTMEM-03 and -06 (except for Type UGTMEM-06LB)—provided with two brushes. Motor with four brushes is available on order. In that case, rated torque becomes 90% of the values shown in Table 1.
   - Type UGTMEM-06LB—provided with four brushes.
   - With optical encoder—provided with four brushes. Rated troque becomes 90% of the values shown in Table 1 according to the operating conditions of the optical encoder.

2. ELECTRIC CHARACTERISTICS

2. 1 SPEED-TORQUE CHARACTERISTICS

Speed-torque characteristics shown in Fig. 1 are based on armature voltage (Et) maintained constant at an armature winding temperature of 125 °C.

A : Continuous duty zone
B : Intermittent duty zone
C : Accel/decel duty zone

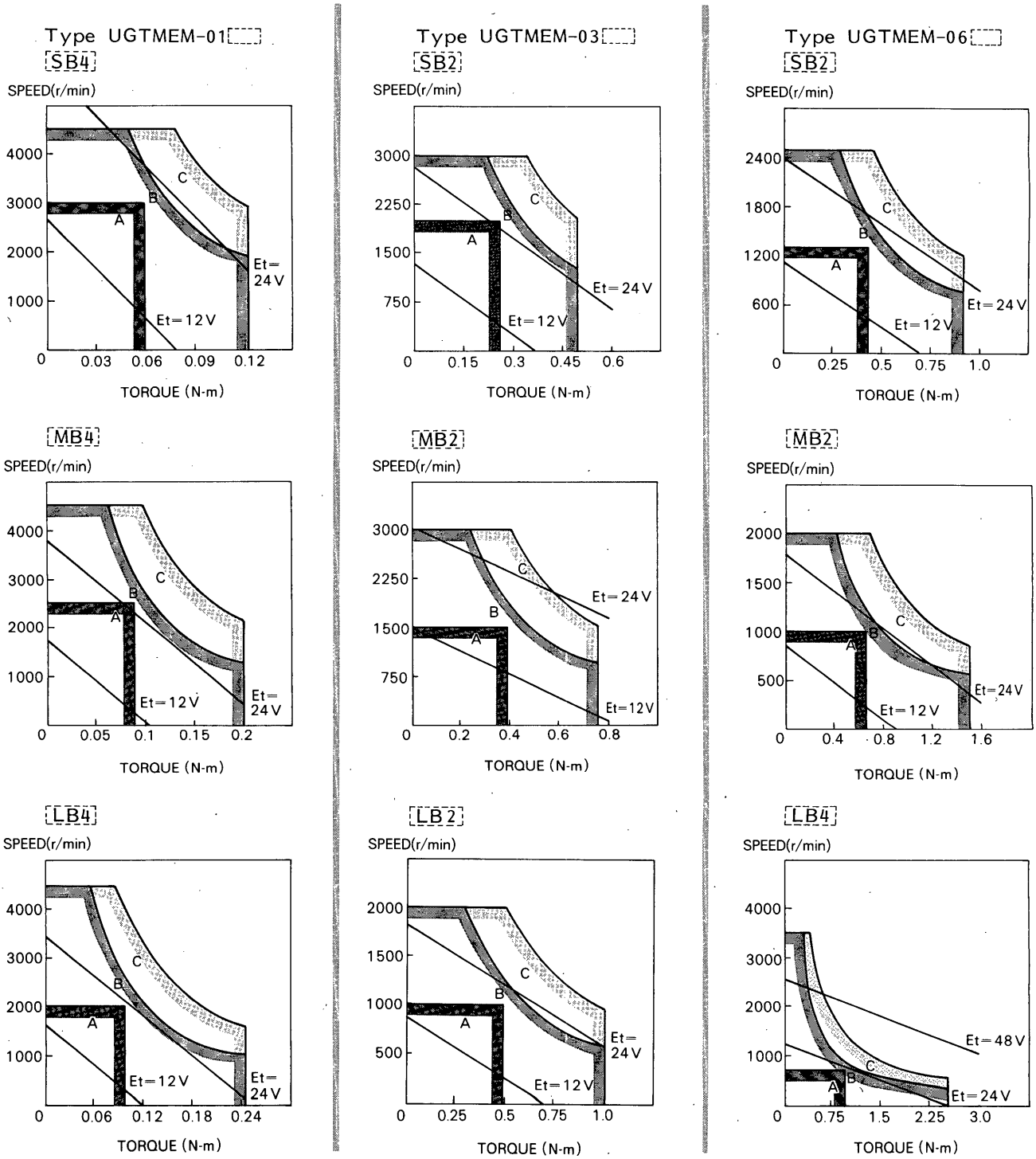


Fig. 1 Speed-Torque Characteristics

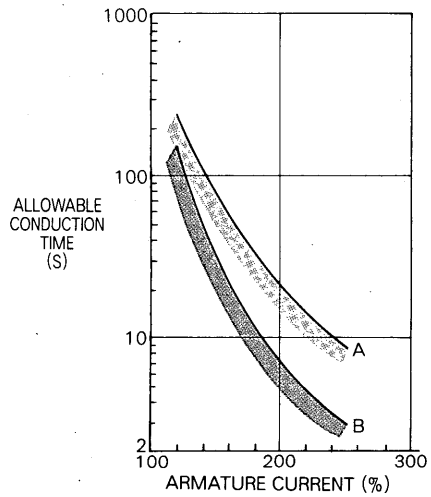
2. 2 STARTING AND OVERLOAD CHARACTERISTICS

Fig. 2 shows the allowable conduction time of armature current at starting and during overload operation.

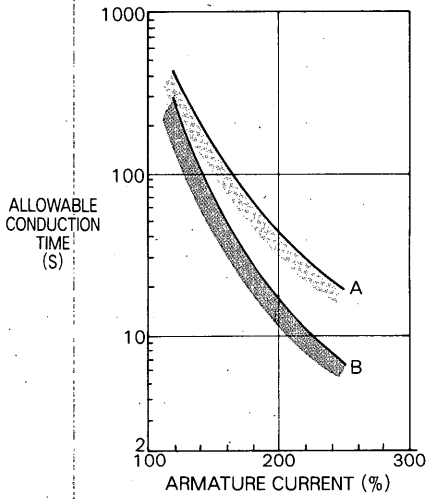
At cold condition (A) - Curves are obtained at starting operation when armature temperature is equal to ambient temperature.

At hot condition (B) - Curves obtained when armature temperature is at optimum at the rated operation.

· Type UGTMEM-01



· Type UGTMEM-03



· Type UGTMEM-06

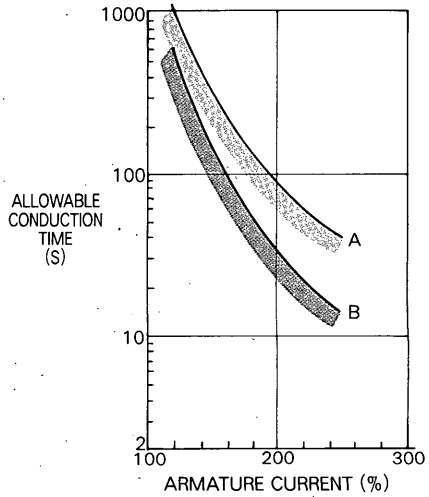


Fig. 2 Starting and Overload Characteristics

2. 3 GROUNDING MOTOR POWER SUPPLY

When the Minertia Motor Mini series is operated on DC power obtained by rectifying a single-phase AC current, the circuit should be grounded by the transformer as shown in Fig. 3.

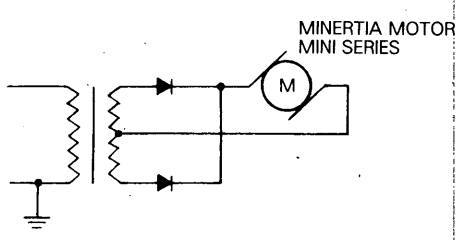


Fig. 3 Grounding of Motor Power Supply

2. 4 OVERLOAD PROTECTION

It is recommended that the motor be provided with Yaskawa thermal overload relay type RHP-15/F for overload protection. See Table 2. and Fig. 4.

Table 2 Selection of Thermal Overload Relay

Motor Type UGTMEM-	Rated Current A	Thermal Overload Relay Type RHP-
01SB4	2.0	15/1.9
01MB4	1.9	15/1.9
01LB4	2.0	15/1.9
03SB2	3.6	15/3.6
03MB2	5.6	15/5.4F
03LB2	4.4	15/4.4F
06SB2	4.8	15/4.4F
06MB2	5.4	15/5.4F
06LB4	5.6	15/5.4F

Type	Rated Contact Current A				No. of Thermal Elements	Contact Arrangement	Approx Weight g
	110V	220V	440V	550V			
RHP-15/□	6	3	1.5	1.2	1	1C	70

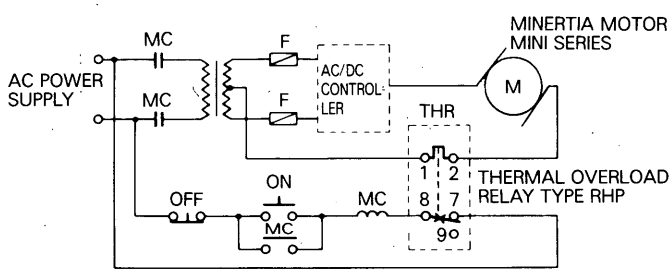


Fig. 4 Connection Diagram of Thermal Overload Relay Type RHP

3. MECHANICAL CHARACTERISTICS

3. 1 ALLOWABLE THRUST LOAD AND ALLOWABLE EQUIVALENT RADIAL LOAD

Table 3 shows allowable loads according to motor types.

Table 3 Allowable Radial Load and Thrust Load

	Motor Type UGTMEM-	Rated Speed r/min	L mm	Allowable Radial Load (Fr) kg	Allowable Thrust Load (Fs) kg
Motor alone	01SB4	3000	16	2.0	2.0
	01MB4	2500	16	2.0	2.0
	01LB4	2000	16	2.0	2.0
	03SB2	2000	25	8.0	4.5
	03MB2	1500	25	8.0	6.5
	03LB2	1000	25	8.0	9.5
	06SB2	1300	30	14.5	7.0
	06MB2	1000	30	14.5	9.5
	06LB4	700	30	14.5	14.5
With DC TACHOMETER GENERATOR or OPTICAL ENCODER	01SB	3000	16	2.0	1.0
	01MB	2500	16	2.0	1.0
	01LB	2000	16	2.0	1.0
	03SB	2000	25	8.0	2.0
	03MB	1500	25	8.0	2.0
	03LB	1000	25	8.0	2.0
	06SB	1300	30	14.5	2.0
	06MB	1000	30	14.5	2.0
	06LB	700	30	14.5	2.0

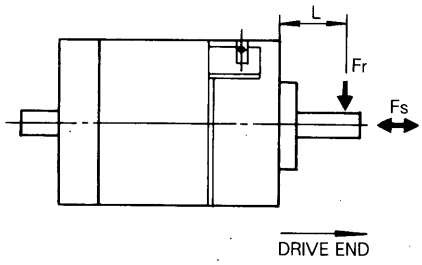


Fig. 5

3. 2 MECHANICAL SPECIFICATIONS

Table 4 Mechanical Specifications (See par. 6 "Dimensions.")

Motor Type UGTMEM-	Accuracy (T. I. R.*)				
	Shaft A Run Out	Flange Surface S Perpendicular to Shaft A	Spigot Joint B Concentric to Shaft A	Shaft C Run Out†	Surface P Perpendicular to Shaft C
01	0.06mm or below†	0.10mm/R15 or below	0.10mm or below	0.06mm or below†	0.10mm/R15 or below
03		0.10mm/R25 or below			0.10mm/R25 or below
06		0.10mm/R30 or below			0.10mm/R30 or below

*T.I.R. (Total Indicator Reading)
†The values are for motor alone (no option).
‡The values are measured at 3mm from shaft end.

3. 3 IMPACT RESISTANCE

Motor Only

When mounted horizontally and exposed to vertical shock impulses, the motor can withstand up to three impacts with impact acceleration of 50 G.

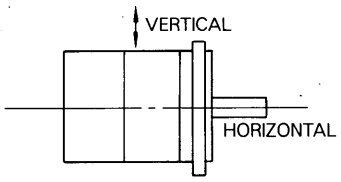


Fig. 6 Impact Resistance

With Optical Encoder

With motor mounted horizontally and exposed to vertical shock impulses, the motor can withstand up to two impacts with impact acceleration of 10 G.

3. 4 VIBRATION RESISTANCE

With motor mounted horizontally, the motor can withstand the vibration (vertical, lateral, axial) with vibration acceleration of 2.5 G.

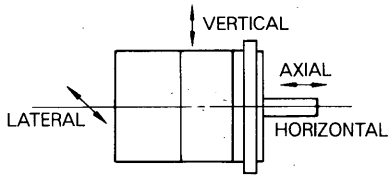


Fig. 7 Vibration Resistance

3. 5 VIBRATION CLASS

Vibration of the motor running at no load is V15 or below. (amplitude 1.5 micron meter maximum p-p)

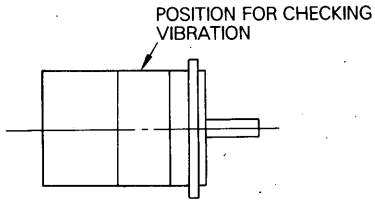


Fig. 8 Vibration Measurment

4. MODULAR MINERTIA MOTORS MINI SERIES

Modular Minertia Motors consist of any combination of Minertia Motor Mini series with DC tachometer generator, optical encoder, or feedback unit.

Table 5 List of Options Combined with Minertia Motors Mini Series

OP: Optical encoder
FBU: Feedback unit
TG: DC tachometer generator

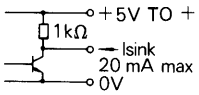
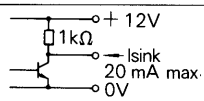
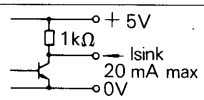
Motor Type UGTMEM- \ Options	—	0E	0F	7S	3V
	Motor alone	OP	FBU*	TG (7V/1000r/min)	TG (3V/1000r/min)
01SB4[ ]	Standard	Available on order	Not Manufactured	Not Manufactured	Not Manufactured
01MB4[ ]					
01LB4[ ]					
03SB2[ ]					
03MB2[ ]					
03LB2[ ]					
06SB2[ ]					
06MB2[ ]					
06LB4[ ]					

*For dimensions of feedback unit, contact your Yaskawa representative.

With Optical Encoder

Optical encoders are available to generate position and speed feedback signals. (For speed feedback signals, F/V converter should be used.) Specifications are listed in Table 6.

Table 6 Optical Encoder Characteristics

Optical Encoder Type UTOPI-	□□□ SE	□□□ SC	□□□ MAB*1	□□□ MUB*1
Input Supply Voltage	+5V to +12VDC ±5%	+5VDC ±5%	+12VDC ±5%	+5VDC ±5%
Current Consumption	150mA max			
Number of Output Pulses	Type UTOPI -020……200 -030……300 -040……400 -050……500 -060……600 -080……800 -100……1000 -150……1500*2 -200……2000*2 -250……2500*2 pulses/rev		Type UTOPI -040……400 -050……500 -060……600 -080……800 -100……1000 pulses/rev	
Output Wave Form	Square wave			
Output Signal Level	V_{OH}: 4V min at 5V, V_{OH}: 10V min at 12V V_{OL}: 0.4V max at 5V, V_{OL}: 1.5V max at 12V	V_{OH}: 4V min V_{OL}: 0.4V max	V_{OH}: 10V min V_{OL}: 1.5V max	V_{OH}: 4V min V_{OL}: 0.4V max
Rise Time	1 μs max			
Fall Time	0.5 μs max			
Output Circuit		Balanced line driver		
Phase Offset	25 ±10%			
Flutter	2% p-p max			
Pulse Duty Cycle	50 ±10%			
Origin Signal Pulse Width	50 ±10%			
Response Frequency	75kHz	200kHz	75kHz	
Emission Element	LED (Light emitting diode)			
Sensor	Photo diode			
Max Allowable Speed	12,000r/min			
Moment of Inertia	7×10^{-7}kg·m²	7×10^{-7}kg·m²	6×10^{-7}kg·m²	
Ambient Temperature	0 to +60°C (in operation), −20 to +80°C (at standby)			
Humidity	20 to 80% RH			
Vibration (in operation)	2.5G max			

Optical Encoder Type UTOPI-	□□□ SJ*2, □□□ MJ*2
Input Supply Voltage	+5VDC ±5%
Current Consumption	150mA max
Number of Output Pulses	Type UTOPI -020……200 -030……300 -040……400 -050……500 -060……600 -080……800 -100……1000 pulses/rev
Output Wave Form	Approximates sine wave

*1 Minertia Motor type UGTMEM-01 is combined with optical encoder type UTOPI-□□□ MAB, MUB or MJ.
*2 For details, contact your Yaskawa representative.

4. MODULAR MINERTIA (Cont'd)

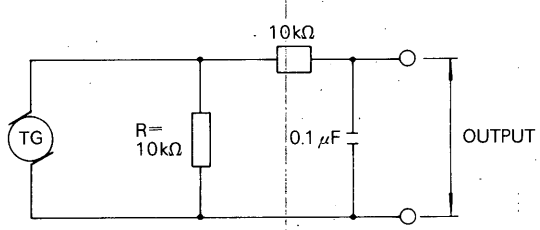
With DC Tachometer Generator

DC tachometer generators are available as speed feedback units. Specifications of DC tachometer generators are shown in Table 7.

Table 7 Specifications of DC Tachometer Generator

Type		TG-7SVC	TG-3VC
Output Voltage	(V/1000 r/min) ± 10%	7	3
Ripple Amplitude	%p-p (at 1000 r/min)	1.5	
Ripple Frequency	Cycles/rev.	13	
Linearity	% (at 200—4000 r/min)	1	
Direction Deviation	% (at 200—4000 r/min)	1	
Armature Inertia	$kg \cdot m^2$	1.5×10^{-6}	
Armature Resistance	Ω (20°C) ± 10%	150	30
Temperature Coefficient	%/°C	−0.05	
Speed Range	r/min	200—4000	
Max Speed	r/min	5000	
Min Load Resistance	kΩ	5.1	
Insulation Resistance	MΩ (at 500 megger)	10	
Dielectric Strength	VAC (for one minute)	500	
Ripple Expectancy	H	5000	

Note:
1. Output voltage is measured across the output terminals.
2. Ripple amplitude and linearity are obtained through filter circuit as shown below.



5. MOTOR CONTROLLER

Applicable motor controller for Minertia Motor Mini Series is Servopack Type CPCR-FR☐RB. Table 8 shows Minertia Motor Mini Series, Servopack and f/V Converters. The f/V converters are to be used only when speed feedback signal must be obtained from optical encoder.

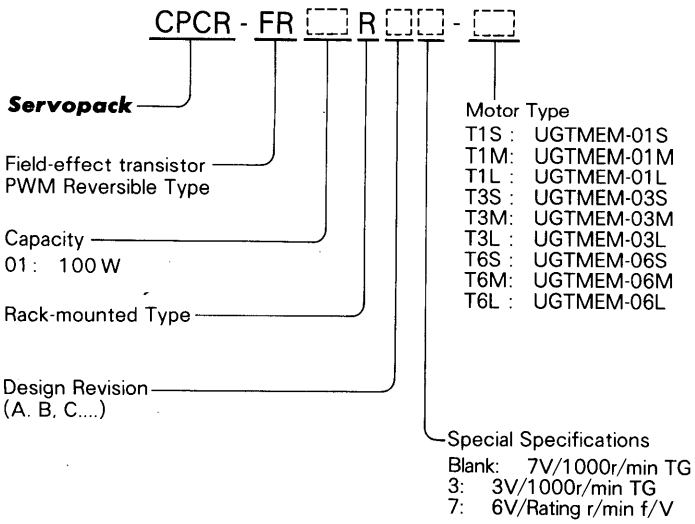
For detailed data on Servopack, refer to bulletin below.

- Servopack Type CPCR-FR☐RB (TSE-C717-10.1)
- Servopack Type CPCR-SWA☐B (TSE-C717-24)
- Servopack Type CPCR-SF☐☐B (TSE-C717-25)

Table 8 Minertia Motors and Applicable Controller ***Servopack***

Minertia Motor Type UGTMEM-	*Servopack* Type CPCR*-	DC Reactor Type	Power Transformer Type CPT-	f/V Converter† Type JASP-
01SB40E 01MB40E 01LB40E	FR01RB7-T1S FR01RB7-T1M FR01RB7-T1L	×5019 (3mH 2A)	10042 (150VA)	FV010
03SB40E 03SB40F 03MB40E 03MB40F 03LB40E 03LB40F	FR01RB7-T3S FR01RB-T3S FR01RB7-T3M FR01RB-T3M FR01RB7-T3L FR01RB-T3L	×3064 (1mH 8A)	10114 (210VA)	FV010 — FV010 — FV010 —
06SB40E 06SB40F 06MB40E 06MB40F 06LB40E 06LB40F	FR01RB7-T6S FR01RB-T6S FR01RB7-T6M FR01RB-T6M FR01RB7-T6L FR01RB-T6L	—		FV010 — FV010 — FV010 —

*Type Designation of Servopack



†Specifications of f/V Converter

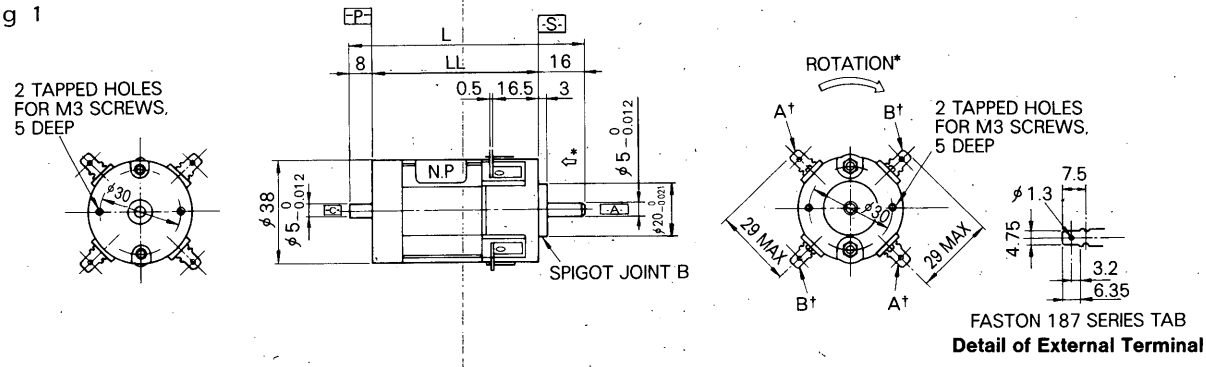
		JASP-FV010
Power Supply		+12V ±5% 60mA, −12V ±5% 20mA, +5V ±5% 200mA
Environmental Condition	Operating Temperature	0 to +60°C
	Storage Temperature	−20 to +70°C
	Humidity	85% Max (No condensation)
Input	Frequency	90°C phase difference 2-phase pulse 100kHz max
	Pulse Voltage	5V level/12V level selectable
Output		Standard setting: Input 50kHz/output 6V change the internal setting according to the combined optical encoder.

Note:
1. Power supply will be added PG current consumption.
2. Mounting one JASP-FV010 on a unit makes one-axis unit type JUSP-FV110.
   Mounting two JASP-FV010 on a unit makes two-axis unit type JUSP-FV210.
3. Refer to "f/V converters" (TSE-C717-10.10).

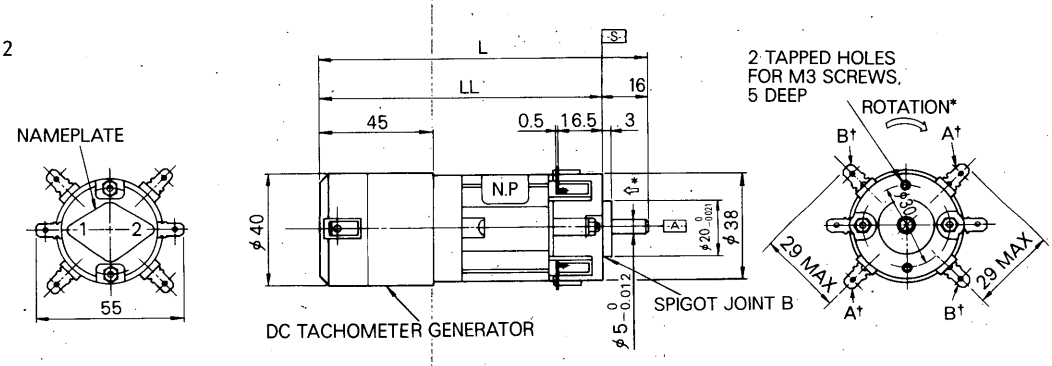
6. DIMENSIONS in mm (inches)

(1) Type UGTMEM-01

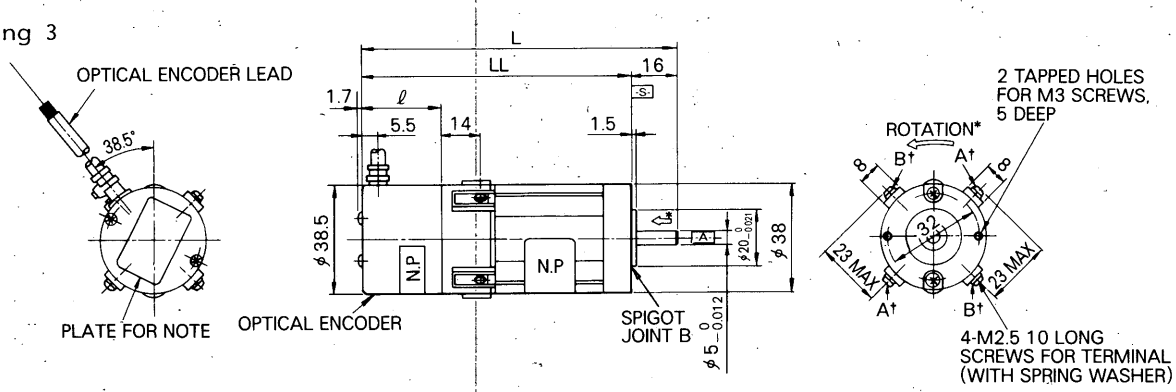
Drawing 1



Drawing 2



Drawing 3



Minertia Motor Type UGTMEM-	Dwg No.	L	LL	ℓ	Approx Weight kg	Specifications	
01SB4 01MB4 01LB4	1	74.5 84 93.5	50.5 60 69.5	—	0.22 0.28 0.36	Motor alone	
01SB47S 01MB47S 01LB47S	2	108.5 118 127.5	92.5 102 111.5	—	0.42 0.48 0.56	With DC tachometer generator*	Type TG-7SVC (7V/1000r/min)
01SB43V 01MB43V 01LB43V	2	108.5 118 127.5	92.5 102 111.5	—	0.42 0.48 0.56	With DC tachometer generator*	Type TG-3VC (3V/1000r/min)
01SB40E 01MB40B 01LB40E	3	95 104.5 114	79 88.5 98	32.5	0.28 0.34 0.42	With Optical Encoder	Types UTOPI-□□□MAB UTOPI-□□□MUB
01SB40E 01MB40E 01LB40E	3	90.5 100 109.5	74.5 84 93.5	28	0.28 0.34 0.42	With Optical Encoder	Type UTOPI-□□□MJ

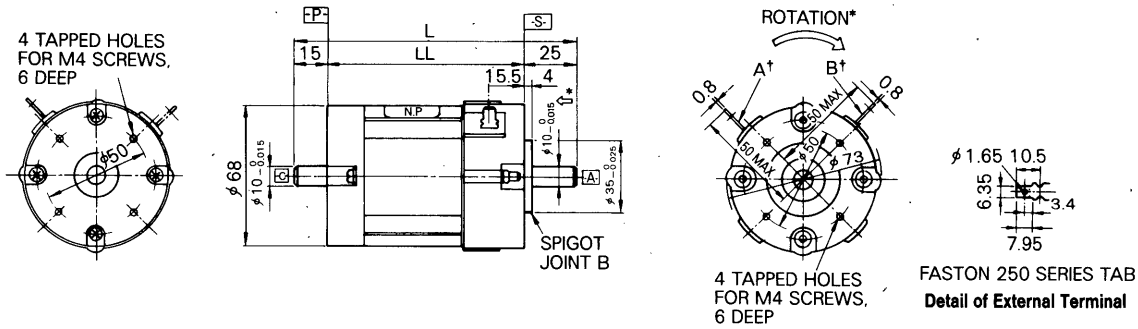
*For details, refer to Table 6.

*Ouput shaft rotates in the direction of the arrow when two external terminals A are connected to the plus (+) side of power supply and two external terminals B to the minus (-) side.

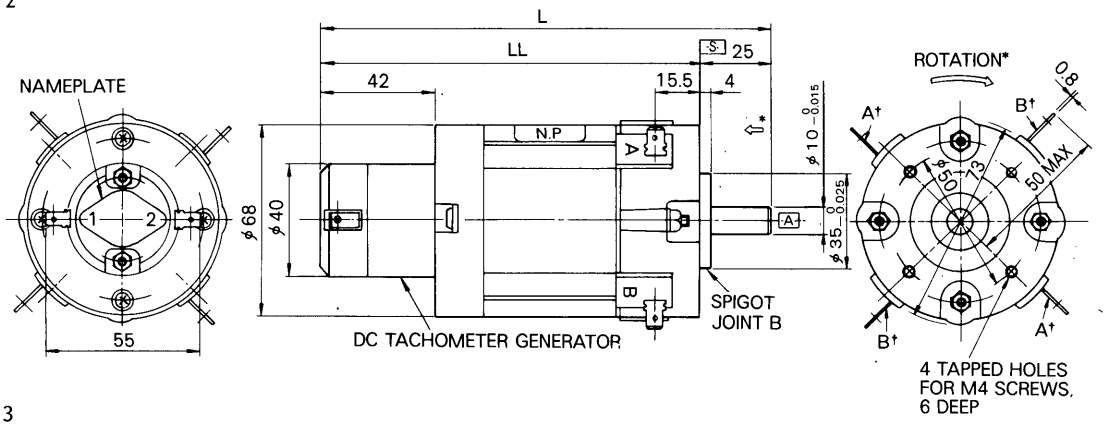
†External terminal

(2) Type UGTMEM-03

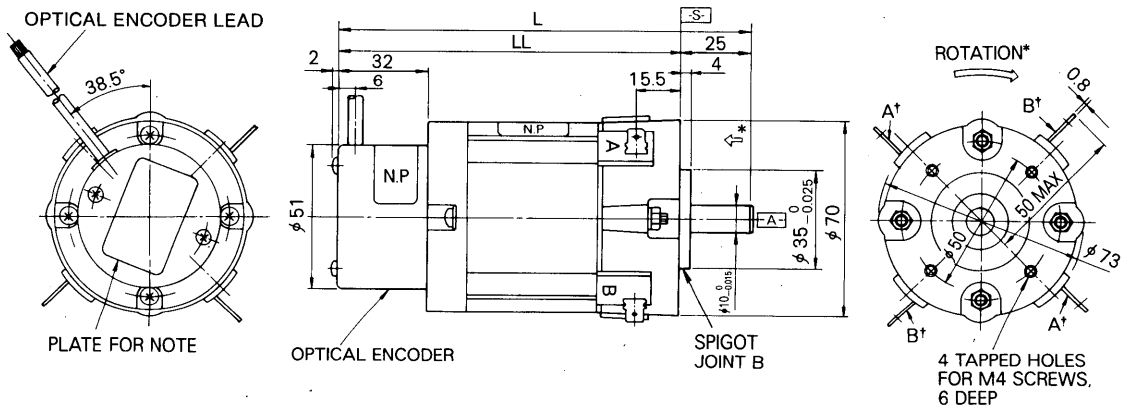
Drawing 1



Drawing 2



Drawing 3



Minertia Motor Type UGTMEM-	Dwg No.	L	LL	Approx Weight kg	Specifications	
03SB2	1	118	78	1.1	Motor alone	
03MB2		132	92	1.3		
03LB2		146	106	1.5		
03SB47S	2	146	121	1.2	With DC tachometer generator*	Type TG-7SVC (7V/1000r/min)
03MB47S		160	135	1.4		
03LB47S		174	149	1.9		
03SB43V	2	146	121	1.2	With DC tachometer generator*	Type TG-3VC (3V/1000r/min)
03MB43V		160	135	1.4		
03LB43V		174	149	1.9		
03SB40E	3	134	109	1.5	With optical encoder Type UTOPI-□□□SE	
03MB40E		148	123	1.7	With optical encoder Type UTOPI-□□□SJ	
03LB40E		162	137	1.9	With optical encoder Type UTOPI-□□□SC	

*For details, refer to Table 6.

*Output shaft rotates in the direction of the arrow when external terminal A are connected to the plus (+) side of power supply and terminal B to the minus (-) side.

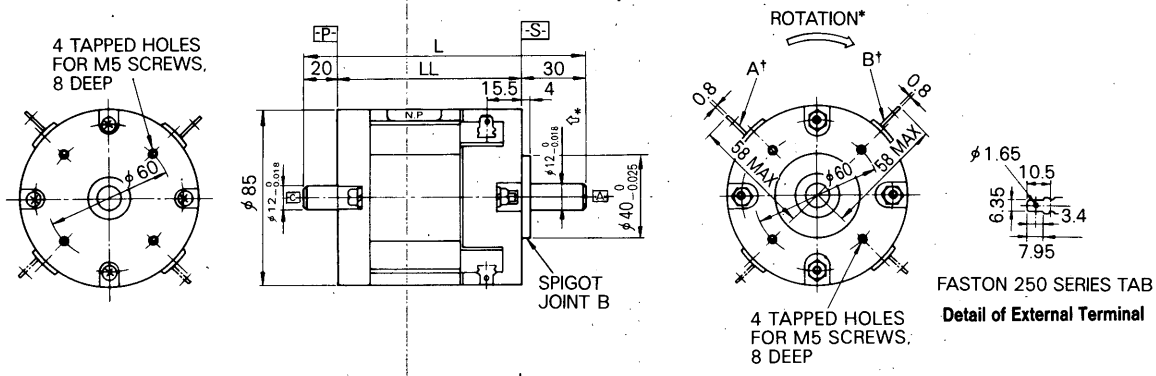
For terminal connection of servomotor provided with four brushes, connect two terminals A to the plus (+) side and two terminals B to the minus (-) side.

†External terminal

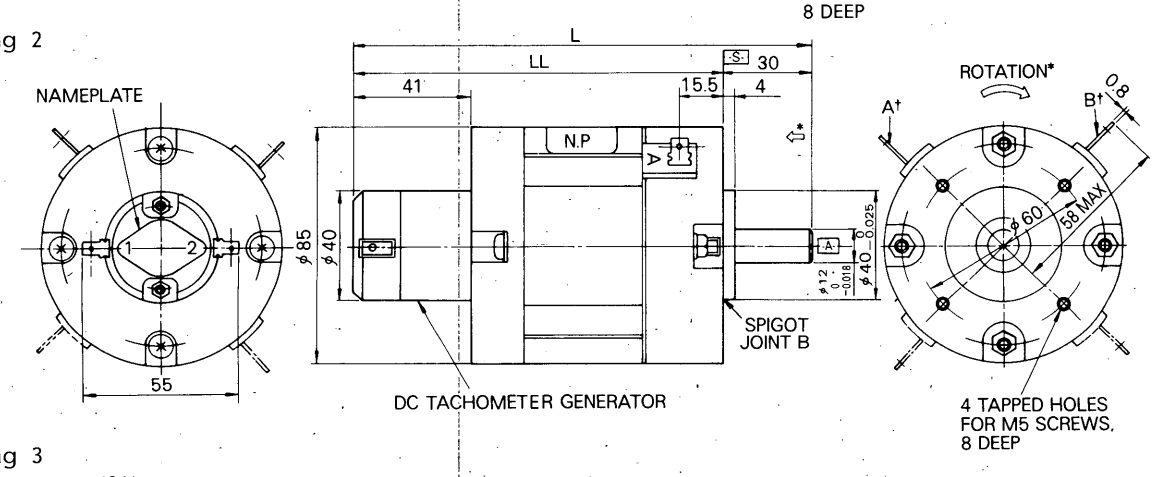
6. DIMENSIONS in mm (inches) (Cont'd)

(3) Type UGTMEM-06

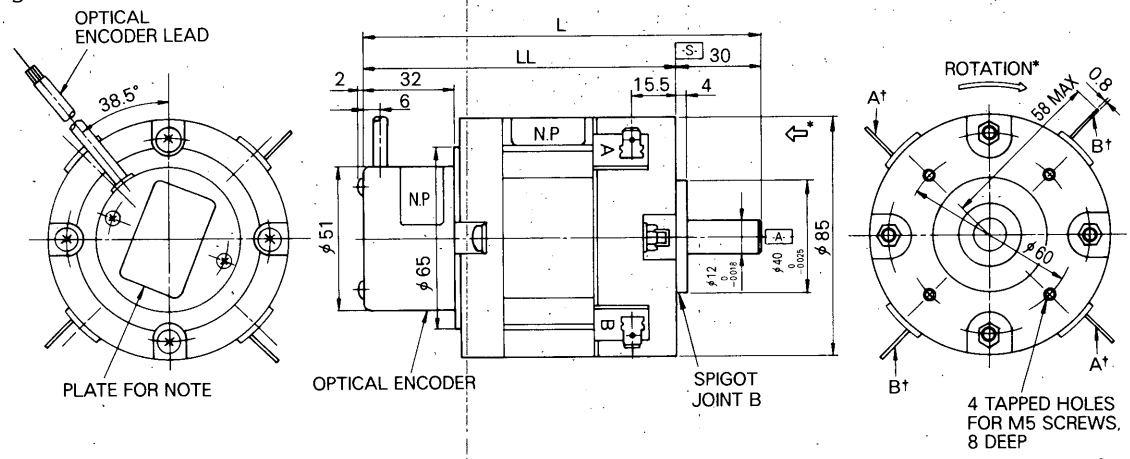
Drawing 1



Drawing 2



Drawing 3



Minertia Motor Type UGTMEM-	Dwg No.	L	LL	Approx Weight kg	Specifications	
06SB2 06MB2 06LB4	1	128 135 156	78 85 106	1.6 1.7 2.5	Motor alone	
06SB27S 06MB27S 06LB27S	2	149.4 156.4 177.4	119.4 126.4 147.4	1.9 2.0 2.8	With DC tachometer generator*	Type TG-7VC (7V/1000 r/min)
06SB23V 06MB23V 06LB43V	2	149.4 156.4 177.4	119.4 126.4 147.4	1.9 2.0 2.8	With DC tachometer generator*	Type TG-3VC (3V/1000 r/min)
06SB40E 06MB40E 06LB40E	3	139 149 167	109 116 137	1.8 1.9 2.8	With optical encoder Type UTOPI-□□□SE Type UTOPI-□□□SJ Type UTOPI-□□□SC	

*For details, refer to Table 6.

*Output shaft rotates in the direction of the arrow when external terminal A are connected to the plus (+) side of power supply and terminal B to the minus (-) side.

For terminal connection of servomotor provided with four brushes, connect two terminals A to the plus (+) side and two terminals B to the minus (-) side.

†External terminal

MEMO

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