CITIZEN

Coreless DC Motors

CITIZEN CHIBA PRECISION CO., LTD.
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Coreless DC Motors

Contents

Coreless DC Motors

Motor Specifications						Option							
Series	Model	Size		Specification (Rated)		Encoder *2		Tachometer Generator	Gearhead				
		Diameter mm	Length mm	Voltage V	Output W	Optical 3ch	Optical 2ch		ZCP (φ13)	ZJP (φ18)	ZMP (φ25)	ZAP (φ30)	ZFP (φ38)
NC-13 (P.5~8)	NC-132501	φ13	25.2	12	0.78	100 256 360	*3	○	○				
	NC-132503			18	0.78								
	NC-132505			6	0.76								
	NC-133301		33.0	12	1.7								
	NC-133302			24	1.7								
	NC-133305			6	1.7								
NC-15 (P.9~10)	NC-153901	φ15	38.8	12	3.5	400 1000	*3	○		○			
	NC-153902			24	3.5								
	NC-155701		56.6	12	5.3								
	NC-155702			24	5.3								
NC-18 (P.11~12)	NC-184101	φ18	40.6	12	5.3	500 1000	*3	○			○		
	NC-184102			24	5.3								
	NC-185801		58.2	12	9.0							○	
	NC-185802			24	9.0								
NC-25 (P.13~14)	NC-256401	φ25	64.0	12	17.4	1000 2000	*3	○					○
	NC-256402			24	17.7								
	NC-258101		81.2	12	22.5								
	NC-258102			24	22.5								
C-18 (P.15~16)	C-184301	φ17 *1	46.0	12	2.4	100 200 256 300	100 200	○		○			
	C-184302			24	2.5								
	C-185801		61.6	12	3.3								
	C-185802			24	3.3								
C-21 (P.17~18)	C-214401	φ21	44.0	12	3.2	100 200 300	100 200	○			○		
	C-214402			24	3.2								
	C-214403			18	3.4								
	C-214404			36	3.3								
C-23 (P.19~20)	C-234401	φ23	44.0	12	5.6	100 200 300	100 200	○			○	○	
	C-234402			24	5.9								
	C-234403			18	6.0								
	C-234404			36	5.9								
C-32 (P.21~22)	C-326401	φ32	67.0	12	14.6	100 200 500	200 400	○					○
	C-326402			24	15.0								
	C-326403			18	15.0								
	C-326404			36	15.3								

*1 : The diameter of the motor alone is φ17mm and the one with encoder or tachometer generator is φ18mm.
*2 : The numbers indicate the number of output pulses (Pulse/Rev.)
*3 : Please ask our sales represetatives or authorized distributors for the details on the combination.

Our Miniaturized Coreless DC Servomotor Series achieved high response and high power by adapting powerful rare earth magnets and mechanically-strong coils.
And also, NC-Series achived higher power than C-Series by using neodymium boron magnets with high flux density.
By considering the actual usability, many options are availble according to your applications. By combining these options such as planetary gearhead, encoder, tachometer generator, and driver, you can further improve control of the reliability, accuracy, and performance.

Features

- Because the mechanical time constant is small for rotor inertia is small, it starts and stops quickly and has excellent responsiveness.
- Since it has no cogging, smooth rotation with low vibration and low noise can be obtained even at low speed and enables highly accurate control.
- Because the amateur inductance of the coil is small and the rectification is good, the life of the brush and commutator is long and electrical noise is low.
- Since it has no iron loss, high-speed rotation is possible under a high magnetic field. We can make a compact and high output model with tens of thousands rpm.
- It is a servo motor with extremely high output per unit volume for it is designed to have high density in magnetic, electric, and heat resistance, and has sufficient mechanical strength.

DC Servomotor with Tachometer Generator

For speed control, all our coreless motors are available with the appropriate tachometer generator mounted on the same shaft as the motor.

Features of Tachometer Generator

- Since it is coreless and has no effect of iron loss or overcurrent, it has extremely good linearity, small rotor inertia, and excellent controllability.
- Stable control is possible because the number of commutator is large, and has small ripple content rate.
- We use commutators and brushes made of materials that have been carefully examined based on our many years of experience and expertise. Since the ripple is small and has only a slight change over time, stable control is possible over a long period of time.
- We can also make the model using special precious metals for low-speed control.

DC Servomotor with Encoder

For high precision position control and speed control, all our coreless motors are available with the appropriate optical encoders mounted on the same shaft as the motor.

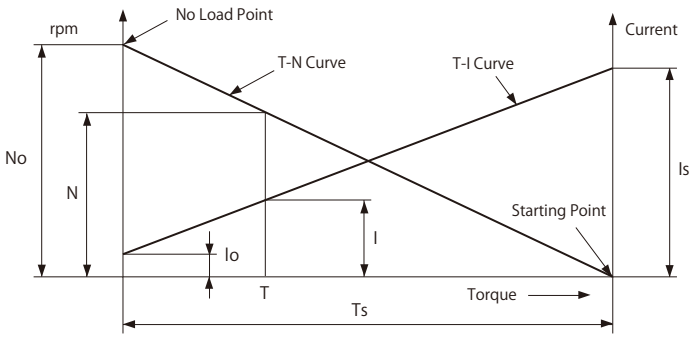
Features of Encoder

- Compact encoders with wave shaping circuit (3 phases/A, B, Z) are available for all models.
- Cost-effective encoders (2 phases/ A, B), which response frequency is 80 kHz, are also available.

DC Servomotor with Tachometer Generator and Encoder

It is possible to mount both encoder and tachometer generator on the same shaft as the motor for micro positioning control, such as a fine feed X-Y-table. Please ask our sales representatives or authorized distributors for details.

Basic Characteristic of DC Servomotor (at Rated Voltage)



No : No Load Speed (rpm)　　Ts : Stall Torque (mN·m)

Io : No Load Current (A)　　Is : Stall Current (A)

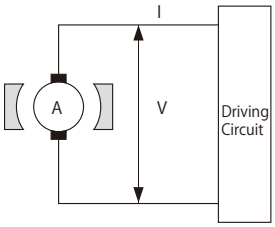
In general, the characteristic of a DC motor can be represented by T-N and T-I Curves. In the case of moving coil type DC motors with high performance rare earth magnets, these two curves become perfectly linear for the armature reaction can be completely ignored.

$$I = I_O + \frac{I_S - I_O}{T_S} \cdot T(A) \qquad (1)$$

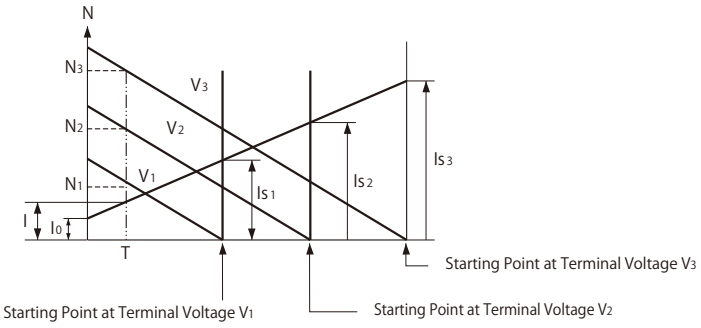
$$N = N_O - \frac{N_O}{T_S} \cdot T(rpm) \qquad (2)$$

From above formula, the current and speed can be calculated when rated voltage is applied to the motor and used by loaded torque (mN·m). The catalog values can be used as they are for the parameters, N_O, I_O, I_O, and T_S, required for the calculation.

Compensated Voltage Control of DC Servomotor



Compensated Voltage Control



The most commonly used control method for permanent magnet DC servomotors is the compensated voltage control shown above. In this case, the torque, speed, and current at any terminal voltage V can be calculated by the following formula.

$$I = I_O + \frac{T}{K_T} (A) \qquad (3)$$

$$T = K_T\left(\frac{V - K_E \cdot N}{R_a} - I_O\right)(mN \cdot m) \qquad (4)$$

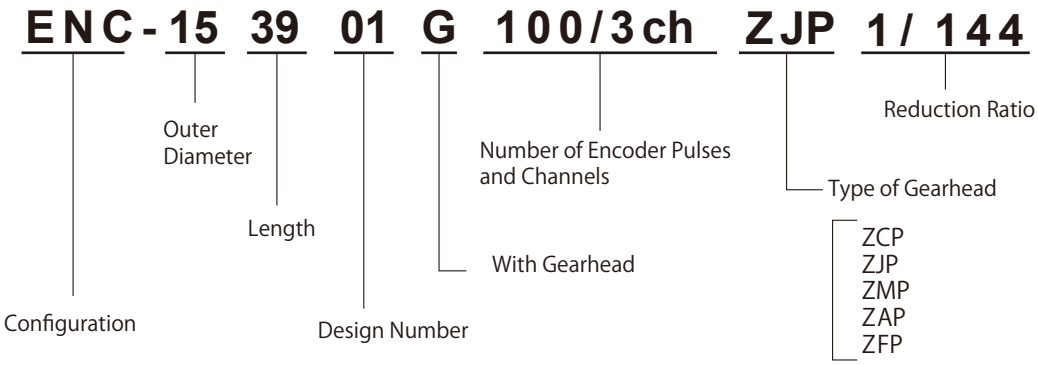
$$N = \frac{I}{K_E}\left\{V - R_a \cdot \left(\frac{T}{K_T} + I_O\right)\right\}(rpm) \qquad (5)$$

K_T : Torque Constant (mN·m/A)
K_E : EMF Constant (V/ rpm)
R_a : Armature Resistance (Ω)
V : Voltage between Terminals (V)

refer to the values in this catalog

From above formula, you can change the voltage between the terminals of the motor as desired from the rated voltage of the catalog value, then you can calcutale the relationship of load torque and speed, or load torque and current in compensated voltage control.

Model Number



Unit Conversion Chart

- Torque

N·m	mN·m	kgf·cm	gf·cm	oz·in
1	1000	10.20	10200	141.6
0.001	1	0.0102	10.20	0.142
0.09807	98.07	1	1000	13.89
9.807×10^{-5}	98.07×10^{-3}	0.001	1	13.89×10^{-3}
7.06×10^{-3}	7.06	0.072	72	1

- Rotor Inertia

$kg\cdot m^2$	$kg\cdot cm^2$	$GD^2(kg\cdot cm^2)$	$g\cdot cm\cdot s^2$	$oz\cdot in\cdot s^2$
1	10000	40000	10200	141.6
0.1×10^{-3}	1	4	1.020	14.16×10^{-3}
2.5×10^{-5}	0.2500	1	0.2549	3.541×10^{-3}
9.807×10^{-5}	0.9807	3.922	1	13.89×10^{-3}
7.061×10^{-3}	70.61	282.4	72	1

- Weight

kg	g	oz
1	1000	35.27
0.001	1	0.035
28.35×10^{-3}	28.35	1

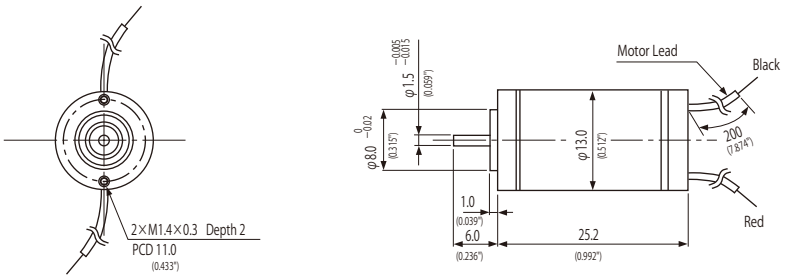
- Length

in	m	cm	mm	μm
1	25.4×10^{-3}	2.54	25.4	25.4×10^{-3}
39.37	1	100	1000	10^6
0.394	0.01	1	10	10^4
3.94×10^{-2}	0.001	0.1	1	10^3
3.94×10^{-5}	10^{-6}	10^{-4}	10^{-3}	1

- Speed

rad/s	rps	rpm
1	0.1592	9.549
6.283	1	60
0.1047	16.67×10^{-3}	1

■ NC-1325 □□



Unit : mm (in)

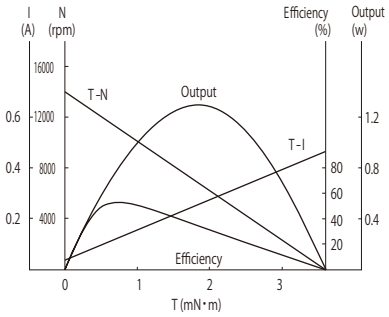
- The positions of screw holes and motor lead (terminals) cannot be determined.
- When positive electrode is applied to the red lead, the shaft rotates to CW direction seen from the output shaft side.

■ Specifications

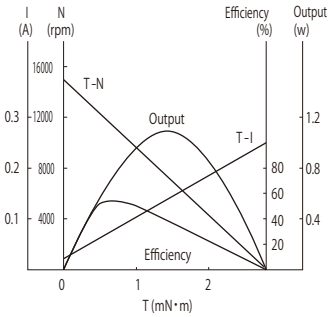
Items		NC − 132501			NC − 132503			NC − 132505		
Rated Voltage	V	12			18			6		
Maximum Allowable Output	W	1.5			1.5			1.5		
Maximum Continuous Current	mA	195			120			350		
Maximum Continuous Torque	mN·m / gf·cm / oz·in	1.27	13	0.180	1.17	12	0.167	1.17	12	0.167
Rated Output	W	0.78			0.78			0.76		
Rated Torque	mN·m / gf·cm / oz·in	0.68	7.0	0.097	0.68	7.0	0.097	0.68	7.0	0.097
Rated Speed	rpm	11200			11200			10800		
Rated Current	mA	125			80			230		
No Load Speed	rpm	14000			15000			14300		
No Load Current	mA	40			30			90		
Starting Torque	mN·m / gf·cm / oz·in	3.52	36.0	0.500	2.74	28.0	0.389	2.74	30.0	0.417
Starting Current	A	0.47			0.25			0.77		
Rotor Inertia	g·cm²	0.31			0.22			0.26		
Resistance	Ω	25.7			70.9			7.8		
Inductance	mH	0.45			0.90			0.11		
Mechanical Time Constant	ms	12.0			12.0			12.0		
EMF Constant	V ／ 10³rpm	0.86			1.31			0.44		
Torque Constant	mN·m/A / gf·cm/A / oz·in/A	8.2	83.7	1.16	12.4	127.3	1.76	4.1	42.8	0.59
Maximum Output at Rated Voltage	W	1.3			1.1			1.1		
Starting Acceleration	rad ／ sec²	122×10³			130.8×10³			122×10³		
Housing-to Ambient Thermal Resistance	℃／W	52								
Winding Insulation Class	—	B								
Maximum Armature Winding Temperature	℃	130								
Operating Ambient Temperature	℃	− 10 ～+ 50								
Number of Commutator Segments	—	5								
Bearing Type	—	Ball Bearing								
Brush Type	—	Silver Carbon								
Weight	g	16								

■ Basic Characteristics at Rated Voltage

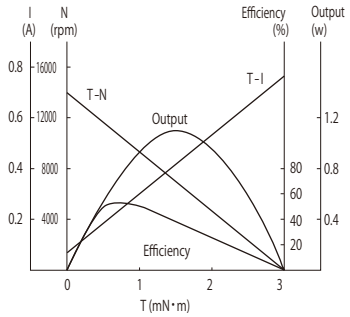
NC-132501
12 V



NC-132503
18 V



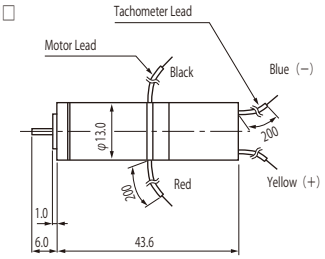
NC-132505
6 V



■ Example of Combination

● With Tachometer Generator

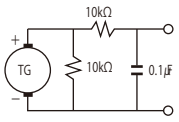
TNC − 1325 □□



■ Tachometer Generator Specifications

Output Voltage	V/1000rpm	0.33±15%
Linearity	% max	0.3
Ripple P-P (Test Circuit)	% max	7
Ripple Frequency	Cycle/ Rev	7
Directional Deviation	% max	0.5
Armature Resistance	Ω	16
Inductance	mH	0.2
Weight	g	32

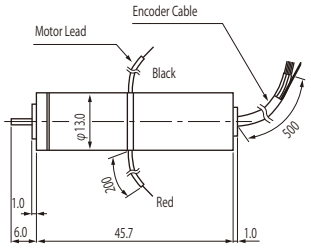
■ Ripple Test Circuit



- The positions of screw holes, motor lead, and tachometer lead cannot be determined.
- Tachometer generator output when rotates CW direction seen from the output shaft side : Yellow ……(＋), Blue ……(－)

●With Optical Encoder

ENC−1325□□ △△△ /3ch



Encoder Lead Color
Phase A ····· Green
Phase B ····· Yellow
Phase Z ····· White
+5V ····· Red
GND ····· Black

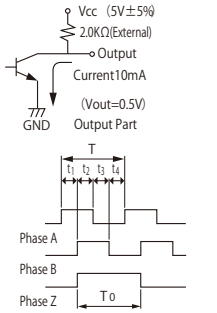
● The positions of screw holes, motor lead, and encoder cable cannot be determined.

■Optical Encoder Specifications

Encoder Type	–	Incremental
Number of Output Pulses	Pulse/ Rev	100、256、360
Number of Channels	–	3
Power Source Voltage	Vcc	5±5%
Consumption Current	mA	80 (max.)
Output Voltage	V	"H" 4.0 (min.) / "L" 0.5 (max.)
Response Frequency	kHz	50 (max.) *(1)
Weight	g	26

*(1) Motor speed is determined according to the response frequency.

■ Output Waveform



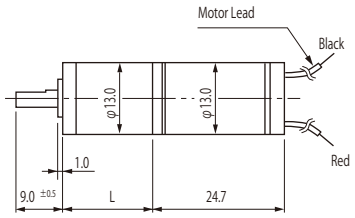
t1＋t2,t3＋t4=T/2±T/8
t1,t2,t3,t4≧T/8
To=T±T/2
The position of Phase A, B and Z cannot be determined.

Output Timing
(CW dorectoion seen from the output shaft side)

■With Gearhead

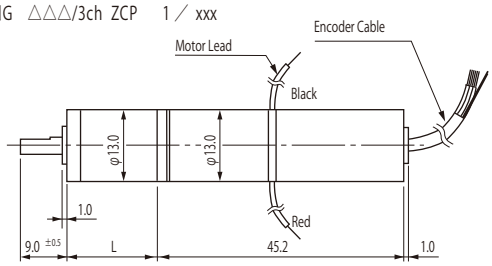
●Gearhead + Motor

NC −1325□□G ZCP 1／ xxx



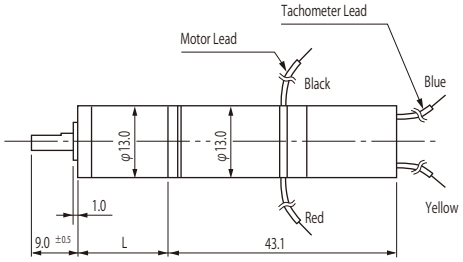
●Gearhead + Motor + Optical Encoder

ENC −1325□□G △△△/3ch ZCP 1／ xxx



●Gearhead + Motor + Tachometer

TNC −1325□□G ZCP 1／ xxx



● Please see page 23 for details on gearhead dimensions.
● The positions of screw holes and motor lead cannot be determined.

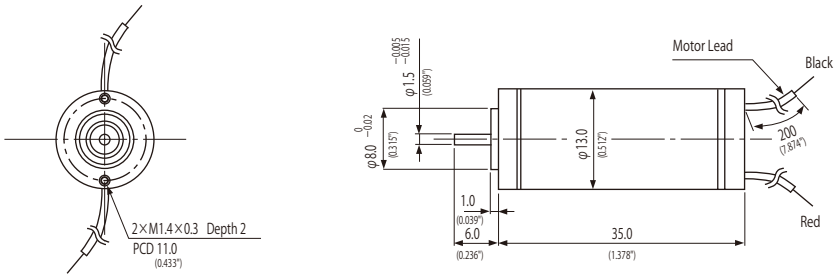
■Rated Specifications of Geared Motors

● NC−1325□□G ZCP 1／ xxx

	Reduction Ratio		4	16	24	64	96	144	256	384	576	864
ZCP (φ13)	Rated Torque	N·m	0.002	0.007	0.010	0.022	0.033	0.050	0.072	0.108	0.162	0.243
	Rated Speed	rpm	2800	700	466	175	116	77	43	29	19	12
	Rated Output	W	0.64	0.51	0.51	0.41	0.41	0.41	0.33	0.33	0.33	0.33
	Length	mm	15.1	17.5	17.5	21.4	21.4	21.4	25.3	25.3	25.3	25.3

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ NC-1333 □□



Unit : mm (in)

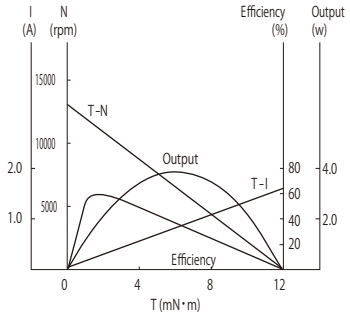
- The positions of screw holes and lead wires (terminals) cannot be determined.
- When positive electrode is applied to the red lead wire, the shaft rotates to CW direction seen from the output shaft side.

■ Specifications

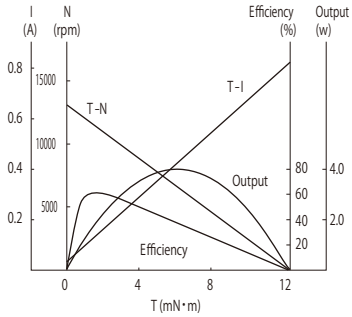
			NC − 133301			NC − 133302			NC − 133305		
Rated Voltage	V		12			24			6		
Maximum Allowable Output	W		3.0			3.0			3.0		
Maximum Continuous Current	mA		350			180			750		
Maximum Continuous Torque	mN·m	gf·cm / oz·in	2.45	25	0.348	2.45	25	0.348	2.45	25	0.348
Rated Output	W		1.7			1.7			1.7		
Rated Torque	mN·m	gf·cm / oz·in	1.47	15	0.209	1.47	15	0.209	1.47	15	0.209
Rated Speed	rpm		11300			11400			11200		
Rated Current	mA		250			120			480		
No Load Speed	rpm		13000			13000			13000		
No Load Current	mA		50			30			100		
Starting Torque	mN·m	gf·cm / oz·in	11.76	120	1.668	12.15	124	1.724	10.68	109	1.515
Starting Current	A		1.6			0.83			2.9		
Rotor Inertia	$g \cdot cm^2$		0.40			0.43			0.37		
Resistance	Ω		7.7			29.1			2.1		
Inductance	mH		0.21			0.86			0.05		
Mechanical Time Constant	m-sec		4.0			4.0			4.0		
EMF Constant	V ／ 10^3rpm		0.79			1.59			0.40		
Torque Constant	mN·m/A	gf·cm/A / oz·in/A	7.5	77.4	1.07	15.2	155.0	2.15	3.8	38.9	0.54
Maximum Output at Rated Voltage	W		3.9			4.0			3.5		
Starting Acceleration	rad ／ sec^2		340×10^3			340×10^3			340×10^3		
Housing-to Ambient Thermal Resistance	℃／W		40								
Winding Insulation Class	—		B								
Maximum Armature Winding Temperature	℃		130								
Operating Ambient Temperature	℃		− 10 ～+ 50								
Number of Commutator Segments	—		5								
Bearing Type	—		Ball Bearing								
Brush Type	—		Silver Carbon								
Weight	g		22								

■ Basic Characteristics at Rated Voltage

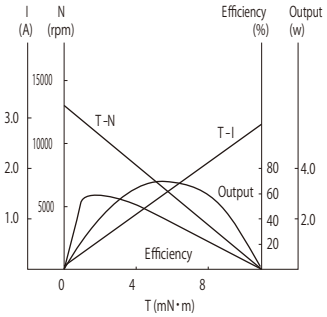
NC-133301
12 V



NC-133302
24 V



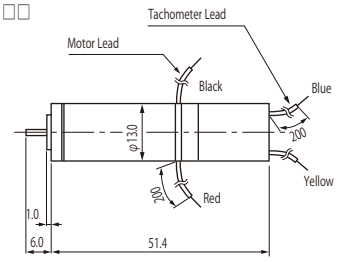
NC-133305
6 V



■ Example of Combination

●With Tachometer Generator

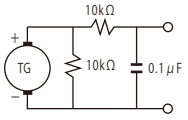
TNC −1333 □□



■ Tachometer Generator Specifications

Output Voltage	V/1000rpm	0.33±15%
Linearity	% max	0.3
Ripple P-P (Test Circuit)	% max	7
Ripple Frequency	Cycle/ Rev	7
Directional Deviation	% max	0.5
Armature Resistance	Ω	16
Inductance	mH	0.2
Weight	g	32

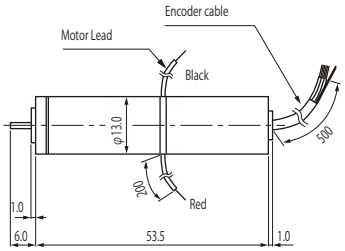
■ Ripple Test Circuit



- The positions of screw holes, motor lead, and tachometer cannot be determined.
- Tachometer generator output when rotates CW direction seen from the output shaft side : Yellow ……(＋), Blue ……(－)

●With Optical Encoder

ENC −1333 □□ △△△ /3ch



Encoder Lead Color
Phase A ····· Green
Phase B ····· Yellow
Phase Z ····· White
＋5V ····· Red
GND ····· Black

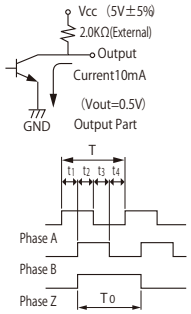
● The positions of screw holes, motor lead, and encoder cable cable cannot be determined.

■Optical Encoder Specifications

Encoder Type	–	Incremental
Number of Output Pulses	Pulse/ Rev	100、256、360
Number of Channels	–	3
Power Source Voltage	Vcc	5±5%
Consumption Current	mA	80 (max.)
Output Voltage	V	"H" 4.0 (min.) / "L" 0.5 (max.)
Response Frequency	kHz	50 (max.) (1)
Weight	g	33

*(1) Motor speed is determined according to the response frequency.

■ Output Waveform



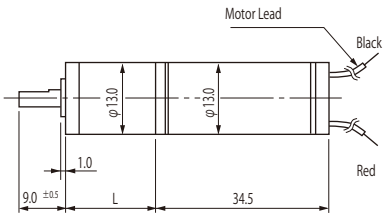
t1 ＋t2,t3 ＋t4 =T/2±T/8
t1,t2,t3,t4 ≧T/8
To =T±T/2
The position of Phase A, B and Z cannot be determined.

Output Timing
(CW direction seen from the output shaft side)

■With Gearhead

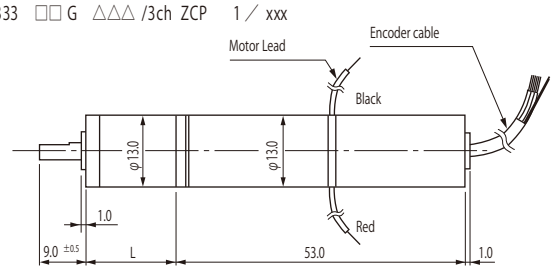
●Gearhead + Motor

NC −1333 □□G ZCP 1 ／ xxx



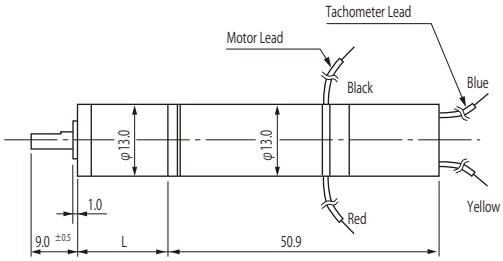
●Gearhead + Motor + Optical Encoder

ENC −1333 □□ G △△△ /3ch ZCP 1 ／ xxx



●Gearhead + Motor + Tachometer

TNC −1333 □□ G ZCP 1 ／ xxx



● Please see page 23 for details on gearhead dimensions.
● The positions of screw holes and motor lead cannot be determined.

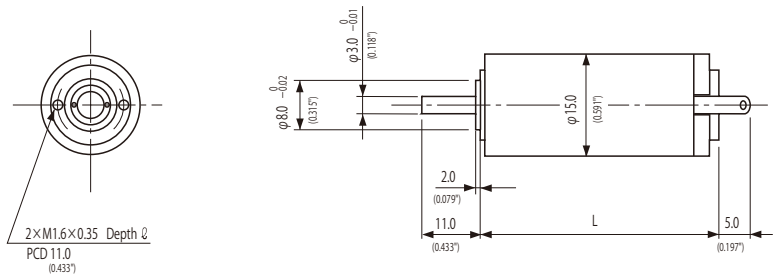
■Rated Specifications of Geared Motors

● NC−1333 □□G ZCP 1 ／ xxx

	Reduction Ratio		4	16	24	64	96	144	256	384	576	※864
ZCP (φ13)	Rated Torque	N·m	0.004	0.015	0.022	0.047	0.071	0.107	0.154	0.231	0.347	0.400
	Rated Speed	rpm	2850	712	475	178	118	79	44	29	19	13
	Rated Output	W	1.4	1.1	1.1	0.8	0.8	0.8	0.7	0.7	0.7	0.5
	Length	mm	15.1	17.5	17.5	21.4	21.4	21.4	25.3	25.3	25.3	25.3

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ NC-1539 □□ ■ NC-1557 □□



Unit : mm (in)

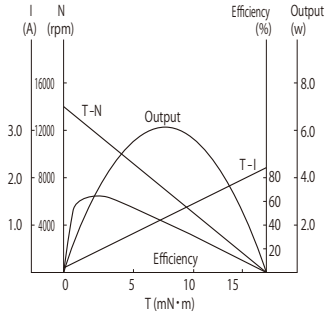
- The positions of screw holes and lead wires (terminals) cannot be determined.
- When positive electrode is applied to the positive terminal, the shaft rotates to CW direction seen from the output shaft side.

Specifications

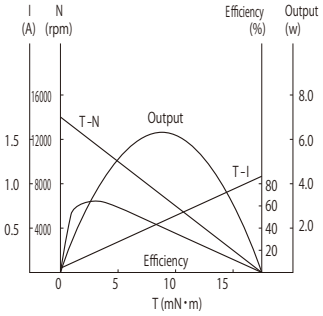
Items		NC − 153901			NC − 153902			NC − 155701			NC − 155702		
Rated Voltage	V	12			24			12			24		
Rated Output	W	3.5			3.5			5.3			5.3		
Rated Torque	mN·m / gf·cm / oz·in	2.94	30	0.417	2.94	30	0.417	6.37	65	0.905	6.37	65	0.905
Rated Speed	rpm	11600			11600			8200			8200		
Rated Current	mA	430			220			600			320		
No Load Speed	rpm	14000			14000			9800			9800		
No Load Current	mA	100			55			70			40		
Starting Torque	mN·m / gf·cm / oz·in	17.15	175	2.435	17.64	180	2.505	39.2	400	5.566	38.22	390	5.427
Starting Current	A	2.2			1.1			3.4			1.7		
Rotor Inertia	g·cm²	1.27			1.27			1.85			1.85		
Resistance	Ω	5.4			21.0			3.6			14.5		
Inductance	mH	0.30			1.20			0.22			0.89		
Mechanical Time Constant	m-sec	9.0			9.0			4.5			4.5		
EMF Constant	V / 10³rpm	0.86			1.77			1.23			2.41		
Torque Constant	mN·m/A / gf·cm/A / oz·in/A	8.1	83.3	1.15	16.8	172.2	2.39	11.7	120.1	1.66	23.0	234.9	3.26
Maximum Output at Rated Voltage	W	6.1			6.3			9.8			9.6		
Starting Acceleration	rad / sec²	162.8×10³			162.8×10³			227.9×10³			227.9×10³		
Housing-to Ambient Thermal Resistance	℃ / W	24.9			24.9			18.8			18.8		
Winding Insulation Class	—	F											
Maximum Armature Winding Temperature	℃	155											
Operating Ambient Temperature	℃	− 10 ～+ 50											
Number of Commutator Segments	—	9											
Bearing Type	—	Ball Bearing											
Brush Type	—	Silver Carbon											
Weight	g	33			33			51			51		
Length	mm	38.8			38.8			56.6			56.6		
Length (Depth) ℓ	mm	3.0			3.0			4.0			4.0		

Basic Characteristics at Rated Voltage

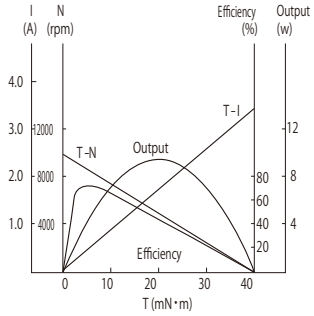
NC-153901
12 V



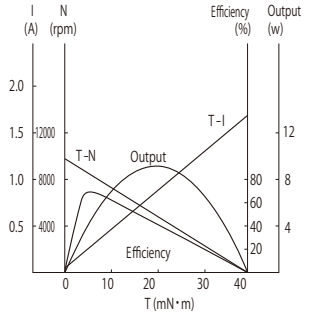
NC-153902
24 V



NC-155701
12 V



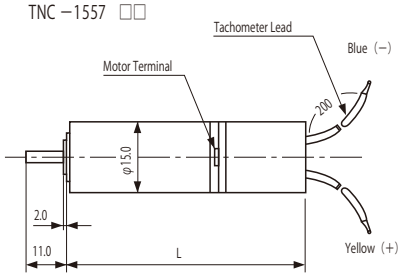
NC-155702
24 V



Example of Combination

●With Tachometer Generator

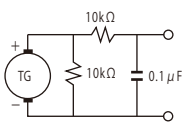
TNC −1539 □□
TNC −1557 □□



■Tachometer Generator Specifications

Model Numbers		TNC − 1539□□	TNC − 1557□□
Output Voltage	V/1000rpm	0.55±15%	
Linearity	% max	0.3	
Ripple P-P (Test Circuit)	% max	7	
Ripple Frequency	Cycle/ Rev	7	
Directional Deviation	% max	0.5	
Armature Resistance	Ω	30	
Inductance	mH	0.4	
Rotor Inertia	g·cm²	0.3	
Temperature Coefficient of Output Voltage	% / ℃	− 0.04	
Weight (Motor +Tachometer)	g	46	64
Length	mm	57.8	75.6

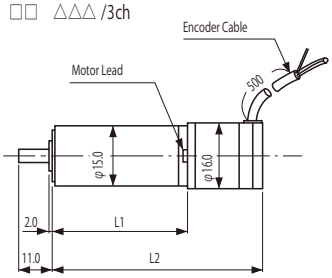
■Ripple Test Circuit



- The positions of screw holes, motor terminal, and tachometer lead cannot be determined.
- Tachometer generator output when rotates CW direction seen from the output shaft side : Yellow ……(+), Blue ……(−)

●With Optical Encoder

ENC −1539 □□ △△△ /3ch
ENC −1557 □□ △△△ /3ch



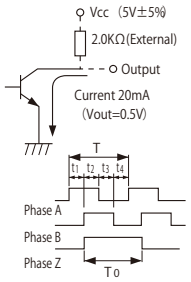
Encoder Lead Color
Phase A ····· Green
Phase B ····· Yellow
Phase Z ····· White
＋5V ····· Red
GND ····· Black

■Optical Encoder Specifications

Model Number			ENC−1539□□	ENC−1557□□
Encoder Type		–	Incremental	
Number of Output Pulses		Pulse/ Rev	400、1000	
Number of Channels		–	3	
Power Source Voltage		Vcc	5±5%	
Consumption Current		mA	80 (max.)	
Output Voltage		V	"H" 4.0 (min.) / "L" 0.5 (max.)	
Output Waveform		–	Rectangular Wave	
Response Frequency		kHz	100 (1)	
Rotor Inertia		g·cm²	0.04	
Weight (Motor + Encoder)		g	56	74
Length	L1	mm	37.0	54.8
	L2	mm	57.8	75.6

*(1) Motor speed is determined according to the response frequency.

■ Output Waveform



(CW direction seen from the output shaft side)

t1＋t2,t3＋t4=T/2±T/8
t1,t2,t3,t4≧T/8
T0=T±T/2

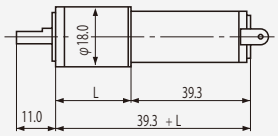
The position of Phase A, B and Z cannot be determined.

● The positions of screw holes, motor lead, and encoder cable cannot be determined.

■With Gearhead

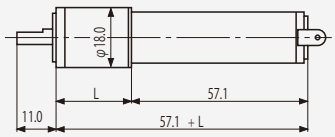
●Gearhead + Motor

NC −1539 □□ G ZJP 1 ／ xxx



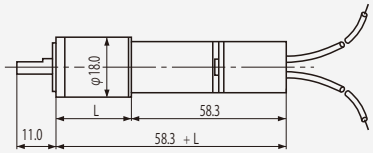
●Gearhead + Motor

NC −1557 □□ G ZJP 1 ／ xxx



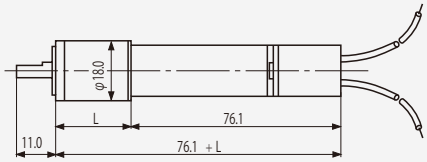
●Gearhead + Motor + Tachometer Generator

TNC −1539 □□ G ZJP 1 ／ xxx



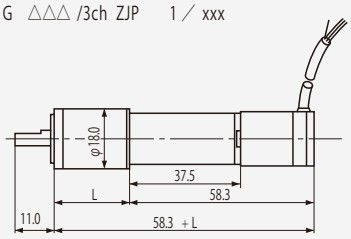
●Gearhead + Motor + Tachometer Generator

TNC −1557 □□ G ZJP 1 ／ xxx



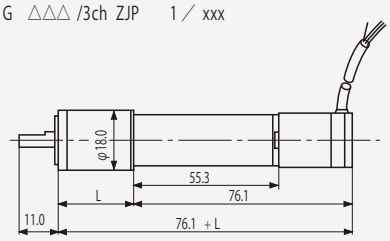
●Gearhead + Motor + Optical Encoder

ENC −1539 □□ G △△△ /3ch ZJP 1 ／ xxx



●Gearhead + Motor + Optical Encoder

ENC −1557 □□ G △△△ /3ch ZJP 1 ／ xxx



● Please see page 23 for details on gearhead dimensions.
● The positions of screw holes, terminals, and cable cannot be determined.

■Rated Specifications of Geared Motors

● NC−1539 □□G ZJP 1 ／ xxx

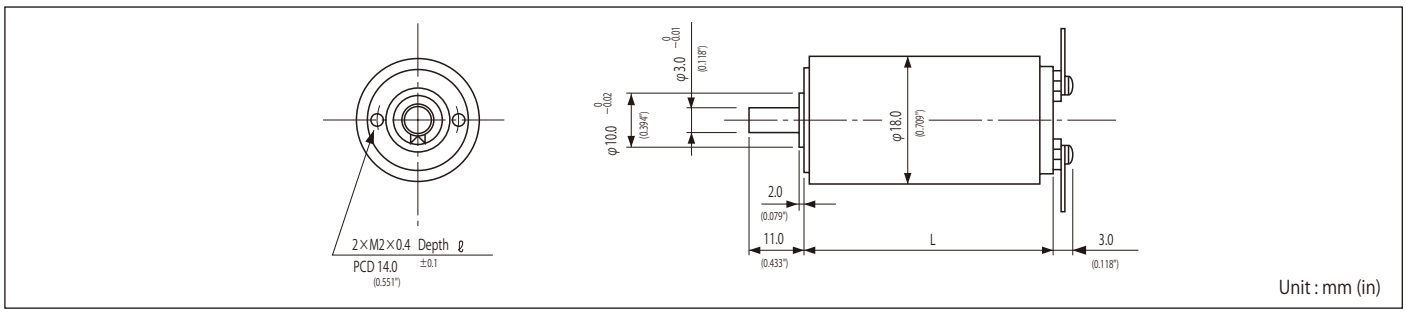
	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	864	※1296
ZJP (φ18)	Rated Torque	N·m	0.009	0.014	0.030	0.045	0.067	0.096	0.144	0.216	0.324	0.308	0.463	0.694	1.042	1.200
	Rated Speed	rpm	2900	1933	725	483	322	181	120	80	53	45	30	20	13	8
	Rated Output	W	2.8	2.8	2.2	2.2	2.2	1.8	1.8	1.8	1.8	1.4	1.4	1.4	1.4	1.1
	Length	mm	19.4	19.4	22.9	22.9	22.9	28.2	28.2	28.2	28.2	33.5	33.5	33.5	33.5	33.5

● NC−1557 □□G ZJP 1 ／ xxx

	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	※576	※864	※1296
ZJP (φ18)	Rated Torque	N·m	0.020	0.030	0.065	0.097	0.146	0.208	0.312	0.468	0.580	0.669	1.003	1.200	1.200	1.200
	Rated Speed	rpm	1871	1247	467	311	207	114	76	50	37	28	19	14	9	6
	Rated Output	W	4.0	4.0	3.2	3.2	3.2	2.5	2.5	2.5	2.3	2.0	2.0	1.7	1.1	0.7
	Length	mm	19.4	19.4	22.9	22.9	22.9	28.2	28.2	28.2	26.2	33.5	33.5	33.5	33.5	33.5

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ NC-1841 □□ ■ NC-1858 □□



Unit : mm (in)

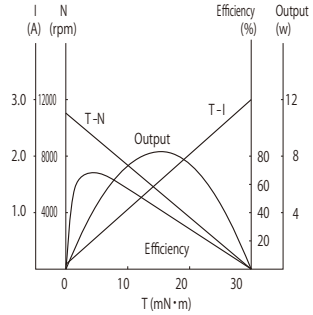
- The positions of screw holes and lead wires (terminals) cannot be determined.
- When positive electrode is applied to the positive terminal, the shaft rotates to CW direction seen from the output shaft side.

Specifications

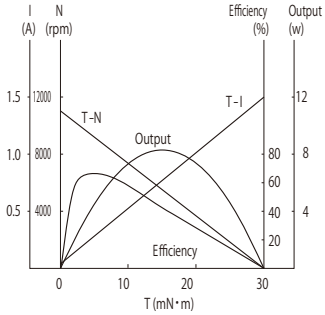
Items		NC − 184101	NC − 184102	NC − 185801	NC − 185802
Rated Voltage	V	12	24	12	24
Rated Output	W	5.3	5.3	9.0	9.0
Rated Torque	mN·m / gf·cm / oz·in	5.88 / 60 / 0.834	5.88 / 60 / 0.834	12.74 / 130 / 1.807	12.74 / 130 / 1.807
Rated Speed	rpm	8900	8800	6900	6900
Rated Current	mA	650	340	1000	500
No Load Speed	rpm	11050	11050	8400	8400
No Load Current	mA	110	45	90	50
Starting Torque	mN·m / gf·cm / oz·in	29.4 / 300 / 4.170	29.4 / 300 / 4.170	78.89 / 805 / 11.190	78.89 / 805 / 11.190
Starting Current	A	3.0	1.5	5.8	2.9
Rotor Inertia	g·cm²	2.40	2.40	3.84	3.84
Resistance	Ω	4.0	16.0	2.1	8.3
Inductance	mH	0.26	1.05	0.19	0.76
Mechanical Time Constant	m-sec	9.0	9.0	4.1	4.1
EMF Constant	V ／ 10³rpm	1.07	2.12	1.45	2.90
Torque Constant	mN·m/A / gf·cm/A / oz·in/A	10.1 / 103.8 / 1.44	20.2 / 206.2 / 2.86	13.8 / 141.0 / 1.95	27.6 / 282.2 / 3.91
Maximum Output at Rated Voltage	W	8.3	8.3	16.9	16.9
Starting Acceleration	rad ／ sec²	128.5×10³	128.5×10³	214.4×10³	214.4×10³
Housing-to Ambient Thermal Resistance	℃／W	19.3	19.3	14.2	14.2
Winding Insulation Class	—	F			
Maximum Armature Winding Temperature	℃	155			
Operating Ambient Temperature	℃	−10～+50			
Number of Commutator Segments	—	11			
Bearing Type	—	Ball Bearing			
Brush Type	—	Silver Carbon			
Weight	g	49	49	75	75
Length	mm	40.6	40.6	58.2	58.2
Length (Depth) ℓ	mm	3.0	3.0	4.0	4.0

Basic Characteristics at Rated Voltage

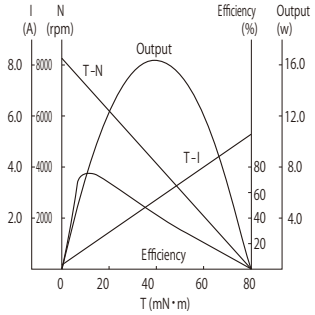
NC-184101
12 V



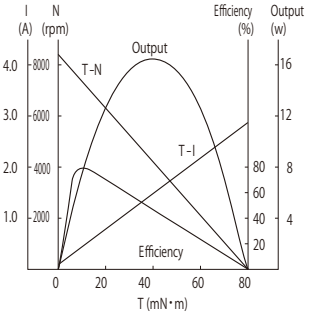
NC-184102
24 V



NC-185801
12 V



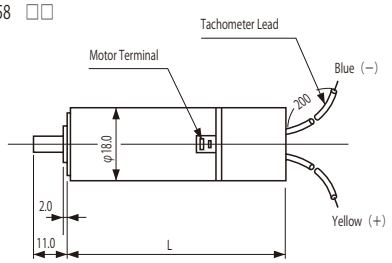
NC-185802
24 V



Example of Combination

●With Tachometer Generator

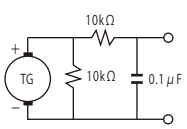
TNC −1841 □□
TNC −1858 □□



■Tachometer Generator Specifications

Model Numbers		TNC − 1539□□	TNC − 1557□□
Output Voltage	V/1000rpm	1.0±15%	
Linearity	% max	0.3	
Ripple P-P (Test Circuit)	% max	7	
Ripple Frequency	Cycle/ Rev	7	
Directional Deviation	% max	0.5	
Armature Resistance	Ω	72.6	
Inductance	mH	0.8	
Rotor Inertia	g·cm²	0.4	
Temperature Coefficient at Output Voltage	% ／ ℃	−0.04	
Weight (Motor＋Tachometer)	g	71	97
Length	mm	60.2	77.8

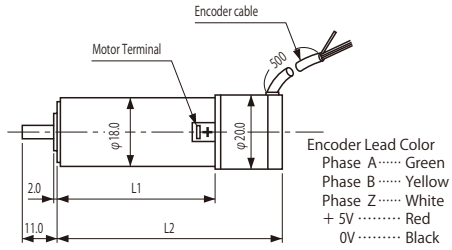
■Ripple Test Circuit



- The positions of screw holes, motor terminal, and tachometer lead cannot be determined.
- Tachometer generator output when rotates CW direction seen from the output shaft side : Yellow ……(＋), Blue ……(－)

●With Optical Encoder

ENC −1841 □□ △△△ /3ch
ENC −1858 □□ △△△ /3ch



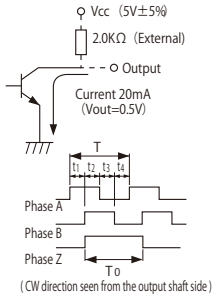
● The positions of screw holes, motor lead (terminal), and encoder cable cannot be determined.

■Optical Encoder Specifications

Model Numbers			ENC −1539□□	ENC −1557□□
Encoder Type		–	Incremental	
Number of Output Pulses		Pulse/ Rev	500、1000	
Number of Channels		–	3	
Power Supply Voltage		Vcc	5±5%	
Consumption Current		mA	80 (max.)	
Output Voltage		V	"H" 4.0 (min.) / "L" 0.5 (max.)	
Output Waveform		–	Rectangular Wave	
Response Frequency		kHz	100 *(1)	
Rotor Inertia		g·cm²	0.1	
Weight (Motor + Encoder)		g	76	102
Length	L1	mm	40.8	55.4
	L2	mm	59.2	76.8

*(1) Motor speed is determined according to the response frequency.

■ Output Waveform



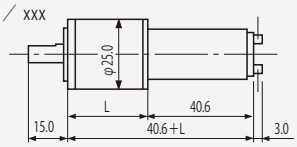
(CW direction seen from the output shaft side)

t1 +t2,t3 +t4=T/2±T/8
t1,t2,t3,t4 ≧T/8
To=T±T/2
The positions of Phase A, B and Z cannot be determined

■ With Gearhead

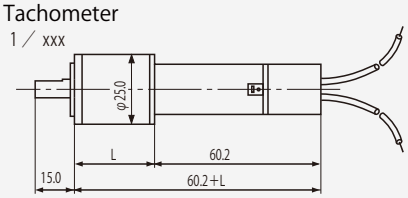
●Gearhead + Motor

NC −1841 □□G ZMP 1 / xxx



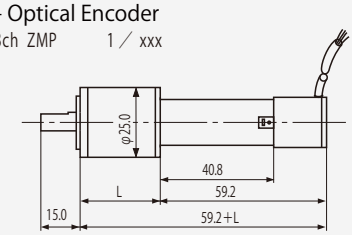
●Gearhead + Motor + Tachometer

TNC −1841 □□G ZMP 1 / xxx



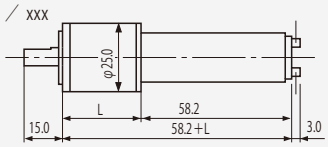
●Gearhead + Motor + Optical Encoder

ENC −1841 □□G △△△/3ch ZMP 1 / xxx



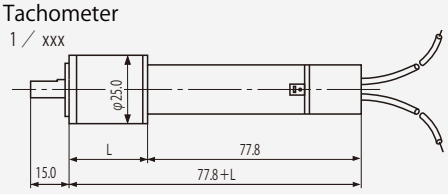
●Gearhead + Motor

NC −1858 □□G ZMP 1 / xxx



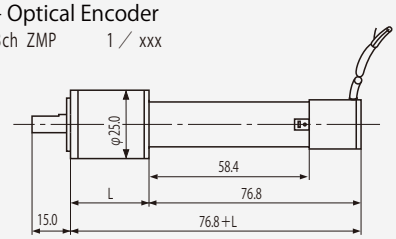
●Gearhead + Motor + Tachometer

TNC −1858 □□G ZMP 1 / xxx



●Gearhead + Motor + Optical Encoder

ENC −1858 □□G △△△/3ch ZMP 1 / xxx



● Please see page 24 for details on gearhead dimensions.
● The positions of screw holes, terminals, and cable cannot be determined.

■Rated Specifications of Geared Motors

● NC−1841 □□G ZMP 1 / xxx

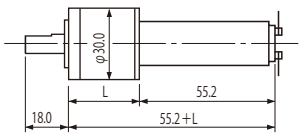
	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	864	※1296
ZMP (φ18)	Rated Torque	N·m	0.019	0.029	0.067	0.101	0.152	0.229	0.344	0.516	0.774	0.782	1.174	1.761	2.641	3.000
	Rated Speed	rpm	2225	1483	556	370	247	139	92	61	41	34	23	15	10	6
	Rated Output	W	4.6	4.6	3.9	3.9	3.9	3.3	3.3	3.3	3.3	2.8	2.8	2.8	2.8	2.1
	Length	mm	24.7	24.7	29.6	29.6	29.6	37.1	37.1	37.1	37.1	44.6	44.6	44.6	44.6	44.6

● NC−1858 □□G ZMP 1 / xxx

	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	※576	※864	※1296
ZMP (φ18)	Rated Torque	N·m	0.043	0.064	0.146	0.220	0.330	0.497	0.746	1.119	1.200	1.695	2.543	3.000	3.000	3.000
	Rated Speed	rpm	1725	1150	390	260	173	95	63	42	31	22	15	11	7	5
	Rated Output	W	7.8	7.8	6.0	6.0	6.0	5.0	5.0	5.0	4.0	4.0	4.0	3.7	2.5	1.6
	Length	mm	24.7	24.7	29.6	29.6	29.6	37.1	37.1	37.1	37.1	44.6	44.6	44.6	44.6	44.6

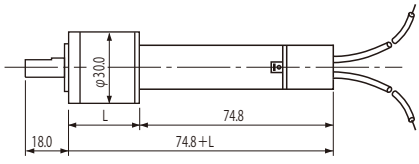
●Gearhead + Motor

NC−1858 □□G ZAP



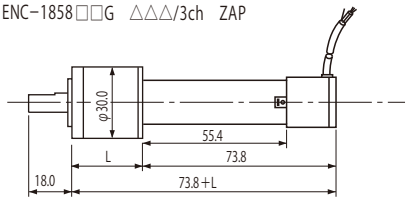
●Gearhead + Motor + Tachometer

TNC−1858 □□G ZAP



●Gearhead + Motor + Optical Encoder

ENC−1858 □□G △△△/3ch ZAP



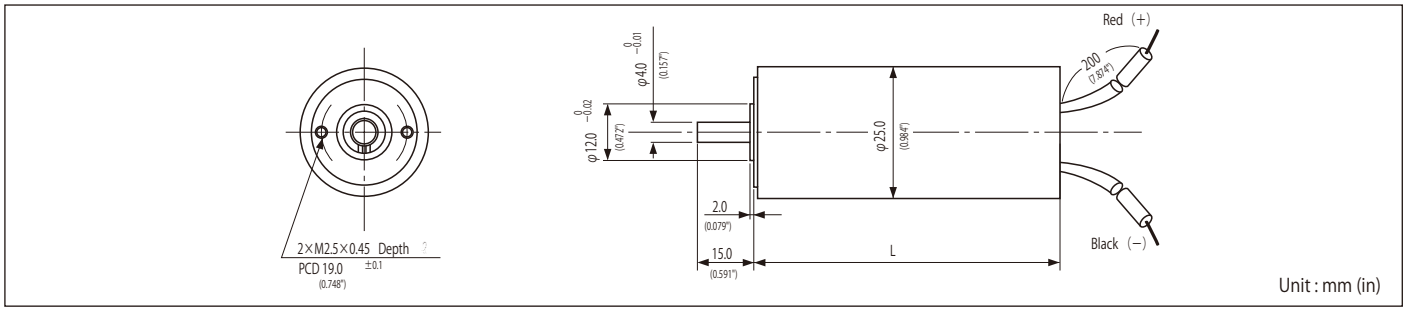
■Rated Specifications of Geared Motors

● NC−1858 □□G ZAP 1 / xxx

	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	※864	※1296
ZJP (φ30)	Rated Torque	N·m	0.043	0.064	0.146	0.220	0.330	0.497	0.746	1.119	1.678	1.695	2.543	3.815	4.800	4.800
	Rated Speed	rpm	1725	1150	431	287	191	107	71	47	31	26	17	11	7	5
	Rated Output	W	7.8	7.8	6.6	6.6	6.6	5.6	5.6	5.6	5.6	4.7	4.7	4.7	4.0	2.6
	Length	mm	29.9	29.9	35.3	35.3	35.3	44.0	44.0	44.0	44.0	52.7	52.7	52.7	52.7	52.7

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ NC-2564 □□ ■ NC-2581 □□



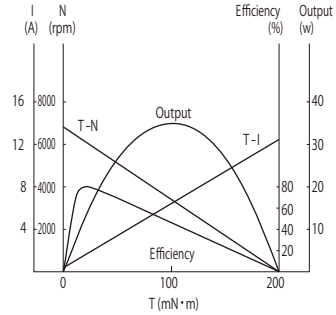
- The positions of screw holes and motor lead (terminals) cannot be determined.
- When positive electrode is applied to the positive terminal, the shaft rotates to CW direction seen from the output shaft side.

Specifications

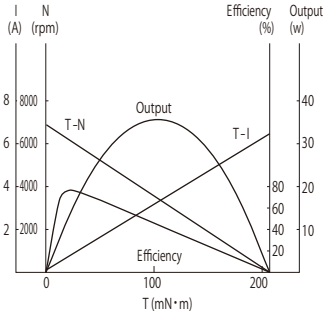
Items			NC − 256401			NC − 256402			NC − 258101			NC − 258102		
Rated Voltage	V		12			24			12			24		
Rated Output	W		17.4			17.7			22.5			22.5		
Rated Torque	mN·m	gf·cm oz·in	29.4	300	4.17	29.4	300	4.17	49.0	500	6.95	49.0	500	6.95
Rated Speed	rpm		5800			5900			4500			4500		
Rated Current	mA		1900			1000			2500			1200		
No Load Speed	rpm		6870			6870			5360			5360		
No Load Current	mA		100			50			100			50		
Starting Torque	mN·m	gf·cm oz·in	198.9	2030	28.22	202.9	2070	28.77	302.8	3090	42.95	296.9	3030	42.12
Starting Current	A		12.5			6.4			14.3			7.0		
Rotor Inertia	g·cm²		16.0			16.0			21.8			21.8		
Resistance	Ω		0.96			3.75			0.84			3.42		
Inductance	mH		0.13			0.51			0.13			0.52		
Mechanical Time Constant	m-sec		5.5			5.5			4.0			4.0		
EMF Constant	V ／ 10³rpm		1.68			3.35			2.23			4.48		
Torque Constant	mN·m/A	gf·cm/A oz·in/A	16.0	163.7	2.27	31.9	326.0	4.52	21.3	217.6	3.02	42.7	436.0	6.05
Maximum Output at Rated Voltage	W		34.9			35.6			41.4			40.6		
Starting Acceleration	rad ／ sec²		130.7×10³			130.7×10³			140.3×10³			140.3×10³		
Housing-to Ambient Thermal Resistance	℃／W		12.1			12.1			10.3			10.3		
Winding Insulation Class	—		F											
Maximum Armature Winding Temperature	℃		155											
Operating Ambient Temperature	℃		− 10 ～+ 50											
Number of Commutator Segments	—		11											
Bearing Type	—		Ball Bearing											
Brush Type	—		Silver Carbon											
Weight	g		158			158			209			209		
Length	mm		64.0			64.0			81.2			81.2		
Length (Depth) ℓ	mm		5.0			5.0			6.0			6.0		

Basic Characteristics at Rated Voltage

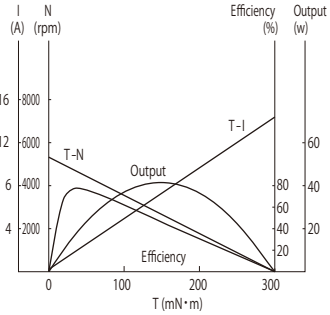
NC-256401 12 V



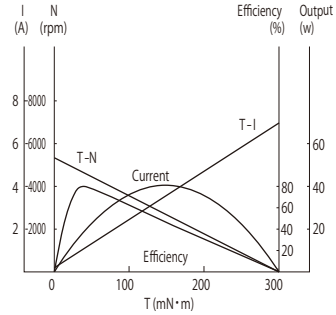
NC-256402 24 V



NC-258101 12 V



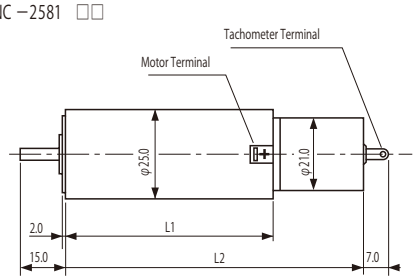
NC-258102 24 V



Example of Combination

●With Tachometer Generator

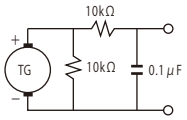
TNC −2564 □□
TNC −2581 □□



■Tachometer Generator Specifications

Model Numbers			TNC −2564□□	TNC −2581□□
Output Voltage		V/1000rpm	1.5±10%	
Linearity		% max	0.3	
Ripple P-P (Test Circuit)		% max	5	
Ripple Frequency		Cycle/ Rev	11	
Directional Deviation		% max	0.5	
Armature Resistance		Ω	27	
Inductance		mH	0.4	
Rotor Inertia		g·cm²	10	
Temperature Coefficient at Output Voltage		% ／ ℃	− 0.04	
Weight (Motor ＋ Tachometer)		g	210	260
Length	Length L1	mm	65.0	82.2
	Length L2	mm	93.2	110.4

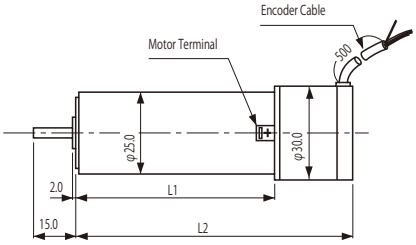
■Ripple Test Circuit



- The positions of screw holes and motor and tachometer terminals cannot be determined.

●With Optical Encoder

ENC −2564 □□ △△△ /3ch
ENC −2581 □□ △△△ /3ch



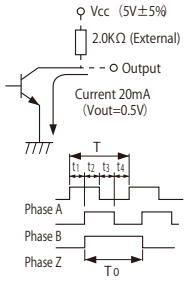
Encoder Lead Color
Phase A····· Green
Phase B····· Yellow
Phase Z····· White
＋5V ····· Red
0V ····· Black

■Optical Encoder Specifications

Model Numbers			ENC −1539□□	ENC −1557□□
Encoder Type		–	Incremental	
Number of Output Pulses		Pulse/ Rev	1000、2000	
Number of Channels		–	3	
Power Supply Voltage		Vcc	5±5%	
Consumption Current		mA	80 (max.)	
Output Voltage		V	"H" 4.0 (min.) / "L" 0.5 (max.)	
Output Waveform		–	Rectangular Wave	
Response Frequency		kHz	200 *(1)	
Rotor Inertia		g·cm²	0.8	
Weight (Motor + Encoder)		g	210	260
Length	L1	mm	64.0	81.2
	L2	mm	83.8	101.0

*(1) Motor speed is determined according to the response frequency.

■ Output Waveform



(CW direction seen from the output shaft side)

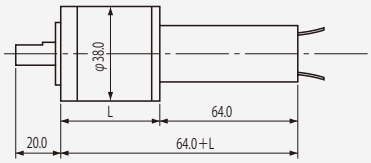
t1 ＋t2 ,t3 ＋t4 =T/2±T/8
t1 ,t2 ,t3 ,t4 ≧T/8
To =T±T/2
The positions of Phase A, B and Z cannot be determined

● The positions of screw holes, terminal and cable cannot be determined.

■With Gearhead

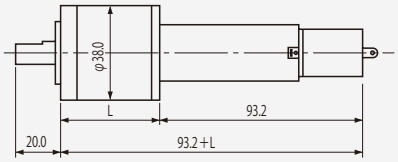
●Gearhead + Motor

NC −2564 □□G ZFP 1 ／ xxx



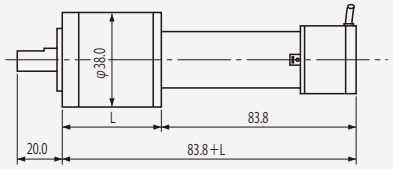
●Gearhead + Motor + Tachometer

TNC −2564 □□G ZFP 1 ／ xxx



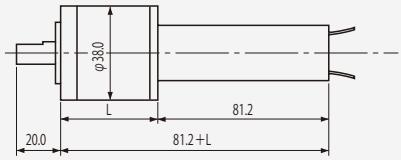
●Gearhead + Motor + Optical Encoder

ENC −2564 □□G △△△/3ch ZFP 1 ／ xxx



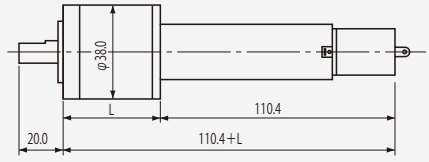
●Gearhead + Motor

NC −2581 □□G ZFP 1 ／ xxx



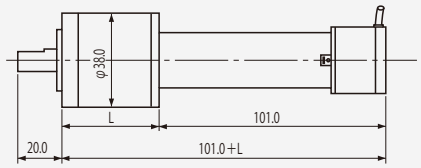
●Gearhead + Motor + Tachometer

TNC −2581 □□G ZFP 1 ／ xxx



●Gearhead + Motor + Optical Encoder

ENC −2581 □□G △△△/3ch ZFP 1 ／ xxx



● Please see page 25 for details on gearhead dimensions.
● The positions of screw holes, terminals and cable cannot be determined.

■Rated Specifications of Geared Motors

● NC−2564□□G ZFP 1 ／ xxx

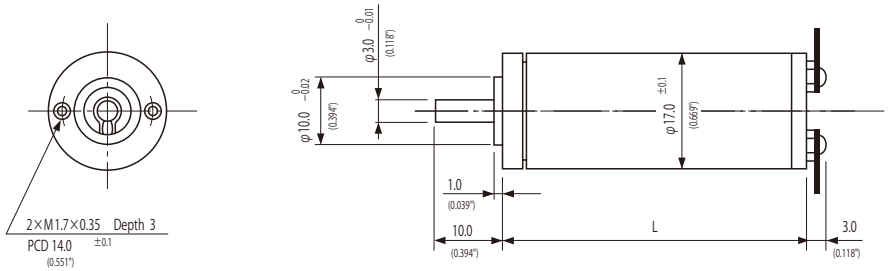
	Reduction Ratio		5.43	20.73	29.47	79.24	112.52	160	302.15	429.62	※610.82	※868.44
ZFP (φ13)	Rated Torque	N·m	0.14	0.49	0.70	1.70	2.41	3.43	5.86	8.33	10.00	10.00
	Rated Speed	rpm	1062	280	197	72	51	36	19	13	9	6
	Rated Output	W	16.0	14.5	14.5	13.0	13.0	13.0	11.9	11.9	10.1	7.1
	Length	mm	35.2	42.1	42.1	53.4	53.4	53.4	64.7	64.7	64.7	64.7

● NC−2581□□G ZFP 1 ／ xxx

	Reduction Ratio		5.43	20.73	29.47	79.24	112.52	160	302.15	※429.62	※610.82	※868.44
ZFP (φ38)	Rated Torque	N·m	0.23	0.82	1.16	2.83	4.02	5.72	9.77	10.00	10.00	10.00
	Rated Speed	rpm	637	168	118	43	30	21	11	10	7	5
	Rated Output	W	16	14.5	14.5	13.0	13.0	13.0	12.0	10.9	7.7	5.4
	Length	mm	35.2	42.1	42.1	53.4	53.4	53.4	64.7	64.7	64.7	64.7

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ C-1843 □□ ■ C-1858 □□



Unit : mm (in)

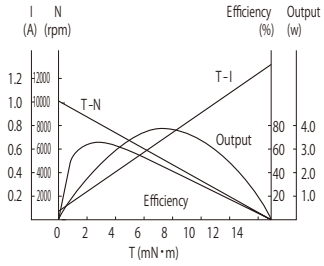
- The positions of screw holes and motor lead (terminals) cannot be determined.
- When positive electrode is applied to the positive terminal, the shaft rotates to CW direction seen from the output shaft side.

■ Specifications

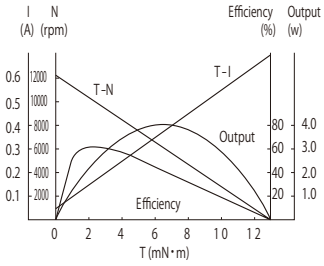
Items		C − 184301	C − 184302	C − 185801	C − 185802
Rated Voltage	V	12	24	12	24
Rated Output	W	2.4	2.5	3.3	3.3
Rated Torque	mN·m / gf·cm / oz·in	2.94 / 30 / 0.417	2.45 / 25 / 0.348	3.92 / 40 / 0.556	3.92 / 40 / 0.556
Rated Speed	rpm	8000	9900	8300	8350
Rated Current	mA	310	170	400	200
No Load Speed	rpm	10000	12300	9870	10000
No Load Current	mA	65	45	65	35
Starting Torque	mN·m / gf·cm / oz·in	14.70 / 150 / 2.085	12.74 / 130 / 1.807	24.50 / 250 / 3.475	23.52 / 240 / 3.336
Starting Current	A	1.3	0.7	2.2	1.0
Rotor Inertia	g·cm²	1.2	0.8	1.8	1.4
Resistance	Ω	9.2	34.3	5.6	24.0
Inductance	mH	0.22	0.58	0.11	0.48
Mechanical Time Constant	m-sec	8.5	8.0	6.0	6.5
EMF Constant	V ／ 10³rpm	1.14	1.83	1.18	2.32
Torque Constant	mN·m/A / gf·cm/A / oz·in/A	11.7 / 120 / 1.66	19.6 / 200 / 2.77	11.7 / 120 / 1.66	24.5 / 250 / 3.47
Maximum Output at Rated Voltage	W	3.8	4.0	6.2	6.0
Starting Acceleration	rad ／ sec²	123×10³	160×10³	172×10³	161×10³
Housing-to Ambient Thermal Resistance	℃／ W	16	16	13	13
Winding Insulation Class	—	F			
Maximum Armature Winding Temperature	℃	155			
Operating Ambient Temperature	℃	− 10 ～+ 60			
Number of Commutator Segments	—	9			
Bearing Type	—	Ball Bearing			
Brush Type	—	Silver Carbon			
Weight	g	52	52	73	73
Length	mm	46	46	61.6	61.6

■ Basic Characteristics at Rated Voltage

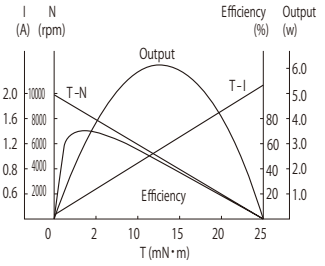
C-184301 12 V



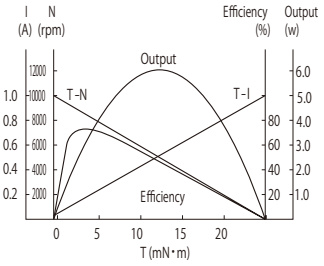
C-184302 24 V



C-185801 12 V



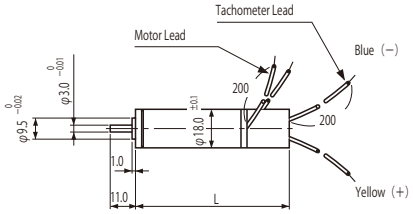
NC-185802 24 V



■ Example of Combination

●With Tachometer Generator

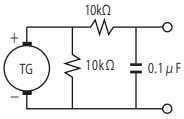
TC −1843 □□
TC −1858 □□



■ Tachometer Generator Specifications

Model Numbers		TC − 1843□□	TC − 1858□□
Output Voltage	V/1000rpm	1.0±15%	
Linearity	% max	0.3	
Ripple P-P (Test Circuit)	% max	7	
Ripple Frequency	Cycle/ Rev	7	
Directional Deviation	% max	0.5	
Armature Resistance	Ω	72.6	
Inductance	mH	0.8	
Rotor Inertia	g·cm²	0.4	
Temperature Coefficient at Output Voltage	% ／ ℃	− 0.04	
Weight (Motor + Tachometer)	g	85	110
Length	mm	70.5	86.1

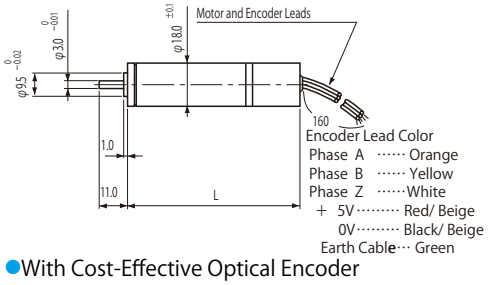
■ Ripple Test Circuit



- The positions of screw holes and motor and tachometer leads cannot be determined.
- Tachometer generator output when rotates CW direction seen from the output shaft side : Yellow ……(＋), Blue ……(－)

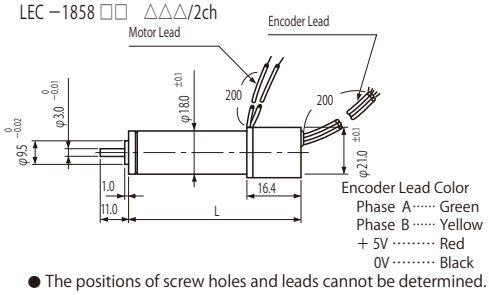
●With Optical Encoder

EC −1843□□ △△△/3ch
EC −1858□□ △△△/3ch



●With Cost-Effective Optical Encoder

LEC −1843□□ △△△/2ch
LEC −1858□□ △△△/2ch



● The positions of screw holes and leads cannot be determined.

■ Optical Encoder Specifications

Model Numbers		EC −1843□□	EC −1858□□
Encoder Type	—	Incremental	
Number of Output Pulses	Pulse/ Rev	100、200、256、300	
Number of Channels	—	3	
Power Source Voltage	Vcc	5±2%	
Consumption Current	mA	80 (max.)	
Output Voltage	V	"H" 2.4 (min.) / "L" 0.8 (max.)	
Response Frequency	kHz	20 *(1)	
Rotor Inertia	g·cm²	0.1	
Weight (Motor + Encoder)	g	73	95
Length	mm	65.9	81.5

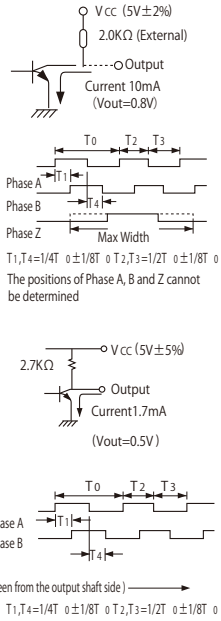
*(1) Motor speed is determined according to the response frequency.

■ Cost-Effective Optical Encoder Specifications

Model Numbers		LEC −1843□□	LEC −1858□□
Encoder Type	—	Incremental	
Number of Output Pulses	Pulse/ Rev	100、200	
Number of Channels	—	2	
Power Source Voltage	Vcc	5±5%	
Consumption Current	mA	60 (max.)	
Output Voltage	V	"H" 2.4 (min.) / "L" 0.5 (max.)	
Response Frequency	kHz	35 *(1)	
Rotor Inertia	g·cm²	0.03	
Weight (Motor + Encoder)	g	65	90
Length	mm	65.4	81.0

*(1) Motor speed is determined according to the response frequency.

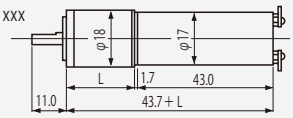
■ Output Waveform



■ With Gearhead

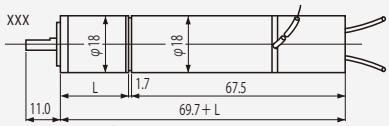
●Gearhead + Motor

C −1843□□G ZJP 1 / xxx



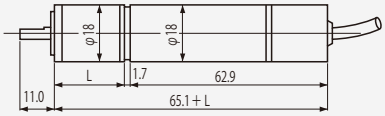
●Gearhead + Motor + Tachometer

TC −1843□□G ZJP 1 / xxx



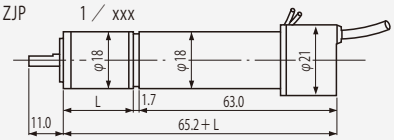
●Gearhead + Motor + Optical Encoder

EC −1843□□G △△△/3ch ZJP 1 / xxx



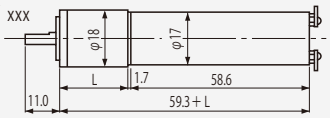
●Gearhead + Motor + Cost-effective Encoder

LEC −1843□□G △△△/2ch ZJP 1 / xxx



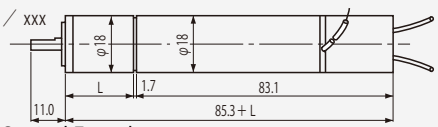
●Gearhead + Motor

C −1858□□G ZJP 1 / xxx



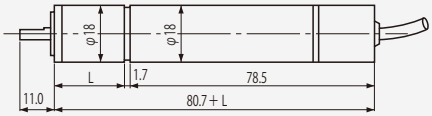
●Gearhead + Motor + Tachometer

TC −1858□□G ZJP 1 / xxx



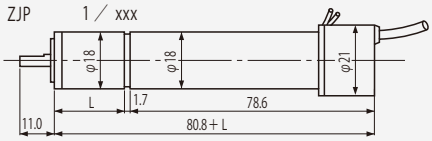
●Gearhead + Motor + Optical Encoder

EC −1858□□G △△△/3ch ZJP 1 / xxx



●Gearhead + Motor + Cost-effective Encoder

LEC −1858□□G △△△/2ch ZJP 1 / xxx



● Please see page 23 for details on gearhead dimensions.
● The positions of screw holes and lead wires cannot be determined.

■ Rated Specifications of Geared Motors

● C−184301G ZJP 1 / xxx

	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	864	※1296
ZJP (φ18)	Rated Torque	N·m	0.009	0.014	0.030	0.045	0.067	0.096	0.144	0.216	0.324	0.308	0.463	0.694	1.042	1.200
	Rated Speed	rpm	2000	1333	500	333	222	125	83	55	37	31	20	13	9	6
	Rated Output	W	1.9	1.9	1.5	1.5	1.5	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	0.7
	Length	mm	19.4	19.4	22.9	22.9	22.9	28.2	28.2	28.2	28.2	33.5	33.5	33.5	33.5	33.5

● C−184302G ZJP 1 / xxx

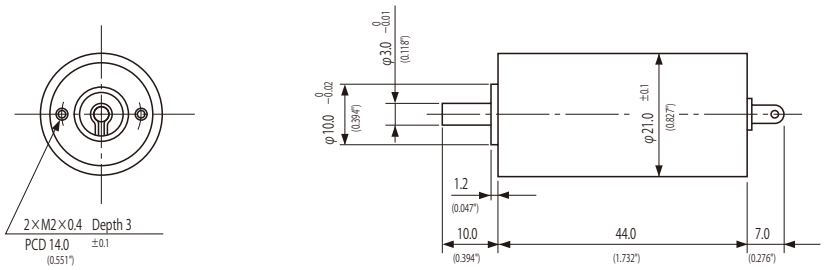
	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	864	※1296
ZJP (φ18)	Rated Torque	N·m	0.007	0.011	0.025	0.037	0.056	0.080	0.120	0.180	0.270	0.257	0.386	0.579	0.868	1.200
	Rated Speed	rpm	2475	1650	618	412	275	154	103	68	45	38	25	17	11	7
	Rated Output	W	2.0	2.0	1.6	1.6	1.6	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	0.9
	Length	mm	19.4	19.4	22.9	22.9	22.9	28.2	28.2	28.2	28.2	33.5	33.5	33.5	33.5	33.5

● C−1858□□G ZJP 1 / xxx

	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	※864	※1296
ZJP (φ18)	Rated Torque	N·m	0.012	0.018	0.040	0.060	0.090	0.128	0.192	0.288	0.432	0.411	0.617	0.926	1.200	1.200
	Rated Speed	rpm	2087	1391	521	347	231	130	86	57	38	32	21	14	9	6
	Rated Output	W	2.7	2.7	2.1	2.1	2.1	1.7	1.7	1.7	1.7	1.4	1.4	1.4	1.2	0.8
	Length	mm	19.4	19.4	22.9	22.9	22.9	28.2	28.2	28.2	28.2	33.5	33.5	33.5	33.5	33.5

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ C-2144 □□



Unit : mm (in)

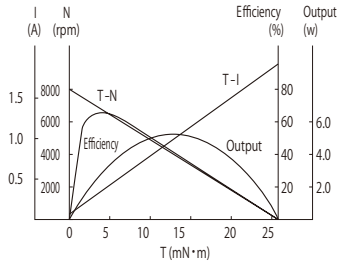
- The positions of screw holes and motor lead (terminals) cannot be determined.
- When positive electrode is applied to the positive terminal, the shaft rotates to CW direction seen from the output shaft side.

Motor Specifications

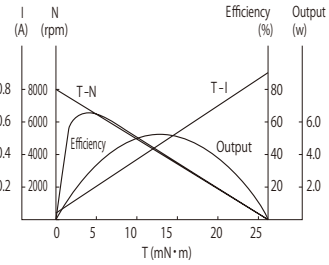
Items		C－214401			C－214402			C－214403			C－214404		
Rated Voltage	V	12			24			18			36		
Rated Output	W	3.2			3.2			3.4			3.3		
Rated Torque	mN·m / gf·cm / oz·in	4.90	50	0.695	4.90	50	0.695	4.90	50	0.695	4.90	50	0.695
Rated Speed	rpm	6450			6450			6750			6600		
Rated Current	mA	400			200			300			150		
No Load Speed	rpm	8000			8000			8150			8000		
No Load Current	mA	70			40			55			25		
Starting Torque	mN·m / gf·cm / oz·in	25.48	260	3.614	25.48	260	3.614	28.42	290	4.031	28.42	290	4.031
Starting Current	A	1.9			0.9			1.5			0.8		
Rotor Inertia	g·cm²	1.9			1.9			2.2			2.0		
Resistance	Ω	6.3			26.7			12.1			48.6		
Inductance	mH	0.17			0.69			0.40			1.60		
Mechanical Time Constant	m-sec	6.0			6.0			6.0			6.0		
EMF Constant	V ／ 10³rpm	1.44			2.87			2.13			4.35		
Torque Constant	mN·m/A / gf·cm/A / oz·in/A	13.7	140	1.94	29.4	300	4.16	19.6	200	2.77	40.2	410	5.69
Maximum Output at Rated Voltage	W	5.2			5.2			5.9			5.8		
Starting Acceleration	rad ／ sec²	140×10³			140×10³			142×10³			140×10³		
Housing-to Ambient Thermal Resistance	℃／W	11			11			11			11		
Winding Insulation Class	—	F											
Maximum Armature Winding Temperature	℃	155											
Operating Ambient Temperature	℃	－10～＋60											
Number of Commutator Segments	—	11											
Bearing Type	—	Ball Bearing											
Brush Type	—	Silver Carbon											
Weight	g	84			84			84			84		

Basic Characteristics at Rated Voltage

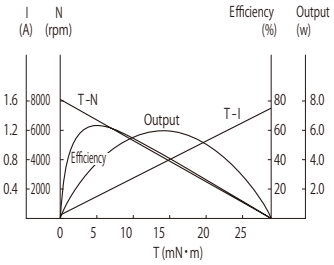
C-214401
12 V



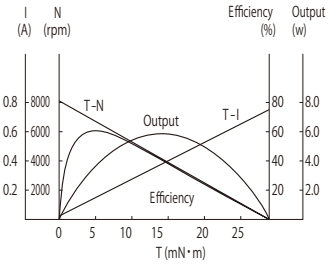
C-214402
24 V



C-214403
18 V



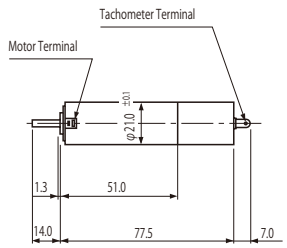
C-214404
36 V



Example of Combination

●With Tachometer Generator

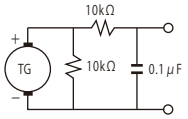
TC －2144 □□



■Tachometer Generator Specifications

Output Voltage	V/1000rpm	TNC －2564□□	TNC －2581□□
Linearity	% max	0.3	
Ripple P-P (Test Circuit)	% max	5	
Ripple Frequency	Cycle/ Rev	11	
Directional Deviation	% max	0.5	
Armature Resistance	Ω	27	
Inductance	mH	0.4	
Rotor Inertia	g·cm²	1.0	
Temperature Coefficient at Output Voltage	% ／ ℃	－0.04	
Weight (Motor ＋ Tachometer)	g	142	

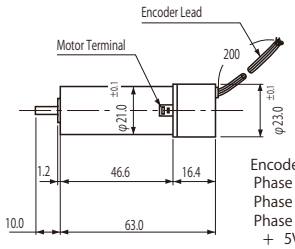
■Ripple Test Circuit



- The positions of screw holes and motor and tachometer terminals cannot be determined.

●With Optical Encoder

EC −2144□□ △△△/3ch



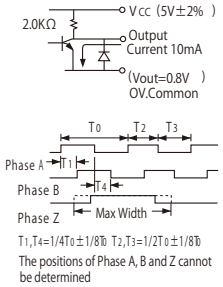
Encoder Lead Color
Phase A ····· Orange
Phase B ····· Yellow
Phase Z ····· White
＋ 5V····· Red
0V····· Black
Earth Cable ··· Green

■ Optical Encoder Specifications

Encoder Type	—	Incremental
Number of Output Pulses	Pulse/ Rev	100、200、300
Numbe of Channels	—	3
Power Source Voltage	Vcc	5±2%
Consumption Current	mA	80 (max.)
Output Voltage	V	"H" 2.4 (min.) "L" 0.8 (max.)
Response Frequency	kHz	20 (1)
Rotor Inertia	g·cm²	0.3
Weight (Motor + Encoder)	g	145

*(1) Motor speed is determined according to the response frequency.

■Output Waveform

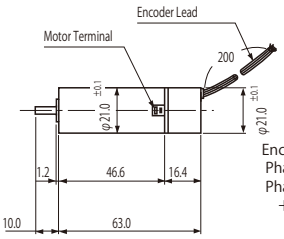


T1,T4=1/4T0±1/8T0 T2,T3=1/2T0±1/8T0

The positions of Phase A, B and Z cannot be determined

●With Cost-Effective Optical Encoder

LEC −2144□□ △△△/2ch



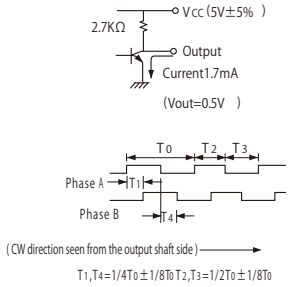
Encoder Lead Color
Phase A ····· Green
Phase B ····· Yellow
＋5V····· Red
0V····· Black

■ Cost-Effective Optical Encoder Specifications

Encoder Type	—	Incremental
Number of Output Pulses	Pulse/ Rev	100、200
Number of Channels	—	2
Power Source Voltage	Vcc	5±5%
Consumption Current	mA	60 (max.)
Output Voltage	V	"H" 2.4 (min.) "L" 0.5 (max.)
Response Frequency	kHz	35 *(1)
Rotor Inertia	g·cm²	0.03
Weight (Motor + Encoder)	g	95

*(1) Motor speed is determined according to the response frequency.

■Output Waveform



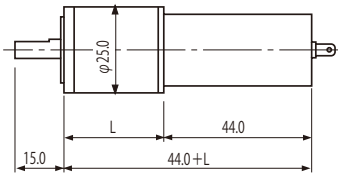
T1,T4=1/4T0±1/8T0 T2,T3=1/2T0±1/8T0

● The positions of screw holes, motor terminal and encoder leads cannot be determined.

■ With Gearhead

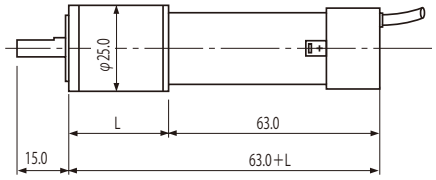
●Gearhead + Motor

C −2144□□G ZMP 1／xxx



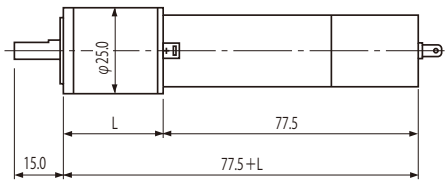
●Gearhead + Motor + Optical Encoder

EC −2144□□G △△△/3ch ZMP 1／xxx



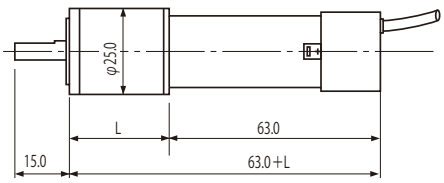
●Gearhead + Motor + Tachometer

TC −2144□□G ZMP 1／xxx



●Gearhead + Motor + Cost-Effective Encoder

LEC −2144□□G △△△ /2ch ZMP 1／xxx



● Please see page 24 for details on gearhead dimensions.
● The positions of screw holes and terminals cannot be determined.

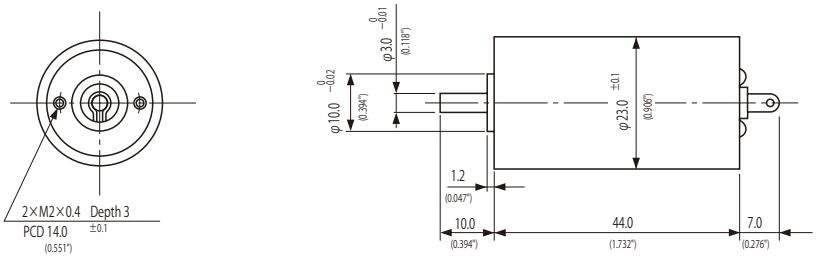
■Rated Specifications of Geared Motors

● C−2144□□G ZMP 1／xxx

	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	864	※1296
ZMP (φ25)	Rated Torque	N·m	0.016	0.024	0.056	0.084	0.127	0.191	0.286	0.430	0.645	0.652	0.978	1.467	2.201	3.000
	Rated Speed	rpm	1687	1125	421	281	187	105	70	46	31	26	17	11	7	5
	Rated Output	W	2.9	2.9	2.4	2.4	2.4	2.1	2.1	2.1	2.1	1.8	1.8	1.8	1.8	1.6
	Length	mm	24.7	24.7	29.6	29.6	29.6	37.1	37.1	37.1	37.1	44.6	44.6	44.6	44.6	44.6

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ C-2344 □□



Unit : mm (in)

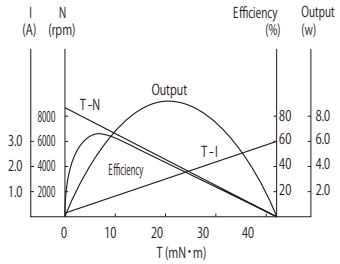
- The positions of screw holes and motor lead (terminals) cannot be determined.
- When positive electrode is applied to the positive terminal, the shaft rotates to CW direction seen from the output shaft side.

Specifications

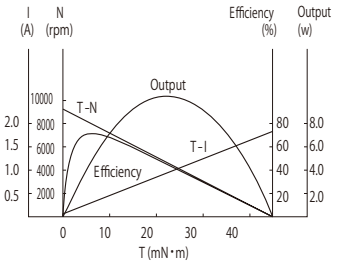
Items		C－214401			C－214402			C－214403			C－214404		
Rated Voltage	V	12			24			18			36		
Rated Output	W	5.6			5.9			6.0			5.9		
Rated Torque	mN·m / gf·cm / oz·in	7.84	80	1.112	7.84	80	1.112	7.84	80	1.112	7.84	80	1.112
Rated Speed	rpm	7000			7400			7450			7400		
Rated Current	mA	650			350			500			240		
No Load Speed	rpm	8700			9000			9000			9000		
No Load Current	mA	100			45			60			30		
Starting Torque	mN·m / gf·cm / oz·in	41.16	420	5.838	44.10	450	6.255	45.08	460	6.394	44.10	450	6.255
Starting Current	A	3.0			1.8			2.6			1.3		
Rotor Inertia	g·cm²	2.8			2.9			3.4			3.3		
Resistance	Ω	4.0			13.3			7.0			28.6		
Inductance	mH	0.11			0.42			0.24			0.96		
Mechanical Time Constant	m-sec	6.5			6.0			6.5			6.5		
EMF Constant	V ／ 10³rpm	1.33			2.60			1.95			3.90		
Torque Constant	mN·m/A / gf·cm/A / oz·in/A	14.7	150	2.08	25.4	260	3.61	17.6	180	2.50	36.2	370	5.13
Maximum Output at Rated Voltage	W	9.1			10.1			10.4			10.1		
Starting Acceleration	rad ／ sec²	140×10³			157×10³			145×10³			145×10³		
Housing-to Ambient Thermal Resistance	℃／W	11			11			11			11		
Winding Insulation Class	—	F											
Maximum Armature Winding Temperature Rise	℃	155											
Operating Ambient Temperature	℃	−10～+60											
Number of Commutator Segments	—	11											
Bearing Type	—	Ball Bearing											
Brush Type	—	Silver Carbon											
Weight	g	100			100			100			100		

Basic Characteristics at Rated Voltage

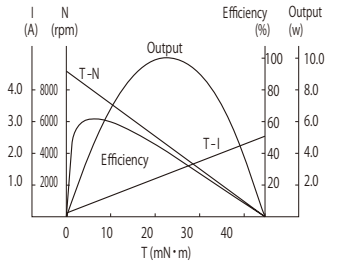
C-234401 12 V



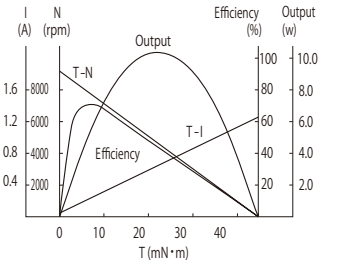
C-234402 24 V



C-234403 18 V



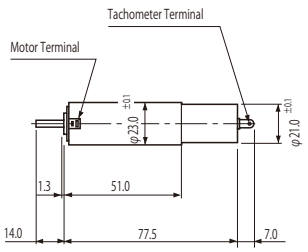
C-234404 36 V



Example of combination

●With Tachometer Generator

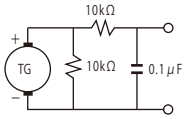
TC −2344 □□



■Tachometer Generator Specifications

Output Voltage	V/1000rpm	1.5±10%
Linearity	% max	0.3
Ripple P-P (Test Circuit)	% max	5
Ripple Frequency	Cycle/ Rev	11
Directional Deviation	% max	0.5
Armature Resistance	Ω	27
Inductance	mH	0.4
Rotor Inertia	g·cm²	1.0
Temperature Coefficient at Output Voltage	% ／ ℃	− 0.04
Weight (Motor ＋ Tachometer)	g	164

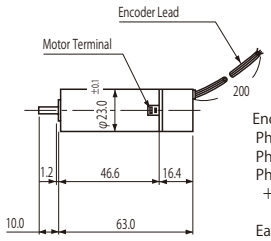
■Ripple Test Circuit



- The positions of screw holes and terminals cannot be determined.

●With Optical Encoder

EC −2344□□ △△△/3ch



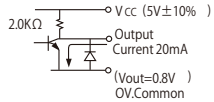
Encoder Lead Color
Phase A ····· Orange
Phase B ····· Yellow
Phase Z ····· White
＋ 5V····· Red
0V····· Black
Earth Cable ··· Green

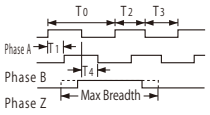
■ Optical Encoder Specifications

Encoder	—	Incremental
Number of Output Pulses	Pulse/ Rev	100、200、300
Number of Channels	—	3
Power Source Voltage	Vcc	5±2%
Consumption Current	mA	80 (max.)
Output Voltage	V	"H" 2.4 (min.) / "L" 0.8 (max.)
Response Frequency	kHz	20 *(1)
Rotor Inertia	g·cm²	0.3
Weight (Motor+Encoder)	g	162

*(1) Motor speed is determined according to the response frequency.

■Output Waveform

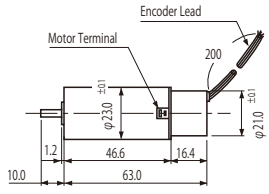




T1,T4=1/4T0±1/8T0 T2,T3=1/2T0±1/8T0
The positions of Phase A, B and Z cannot be determined

●With Cost-Effective Optical Encoder

LEC −2344□□ △△△/2ch



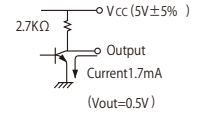
Encoder Lead Color
Phase A ·····Green
Phase B ·····Yellow
＋5V····· Red
0V····· Black

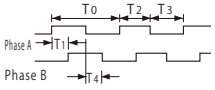
■ Cost-Effective Optical Encoder Specifications

Encoder	—	Incremental
Number of Output Pulses	Pulse/ Rev	100、200
Number of Channels	—	2
Power Source Voltage	Vcc	5±5%
Consumption Current	mA	60 (max.)
Output Voltage	V	"H" 2.4 (min.) / "L" 0.5 (max.)
Response Frequency	kHz	35 *(1)
Rotor Inertia	g·cm²	0.03
Weight (Motor+Encoder)	g	110

*(1) Motor speed is determined according to the response frequency.

■Output Waveform





(CW direction seen from the output shaft side)

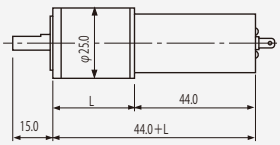
T1,T4=1/4T0±1/8T0 T2,T3=1/2T0±1/8T0

● The positions of screw holes, terminals and lead wires cannot be determined.

■ With Gearhead

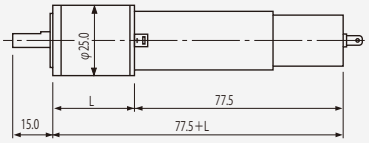
●Gearhead + Motor

C −2344□□ G ZMP 1 ／ xxx



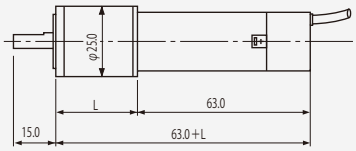
●Gearhead + Motor + Tachometer

TC −2344□□ G ZMP 1 ／ xxx



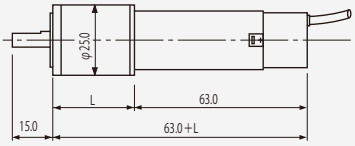
●Gearhead + Motor + Optical Encoder

EC −2344□□ G △△△ /3ch ZMP 1 ／ xxx



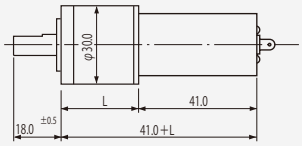
●Gearhead + Motor + Cost-Effective Encoder

LEC −2344□□ G △△△ /2ch ZMP 1 ／ xxx



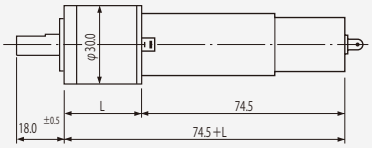
●Gearhead + Motor

C −2344□□ G ZAP 1 ／ xxx



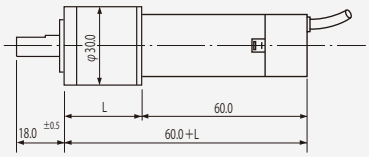
●Gearhead + Motor + Tachometer

TC −2344□□ G ZAP 1 ／ xxx



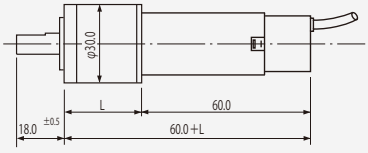
●Gearhead + Motor + Optical Encoder

EC −2344□□ G △△△ /3ch ZAP 1 ／ xxx



●Gearhead + Motor + Cost-Effective Encoder

LEC −2344□□ G △△△ /2ch ZAP 1 ／ xxx



● Please see page 24 for details on gearhead dimensions.
● The positions of screw holes, terminals and lead wires cannot be determined.

■Rated Specifications of Geared Motors

● C−2344□□G ZMP 1 ／ xxx

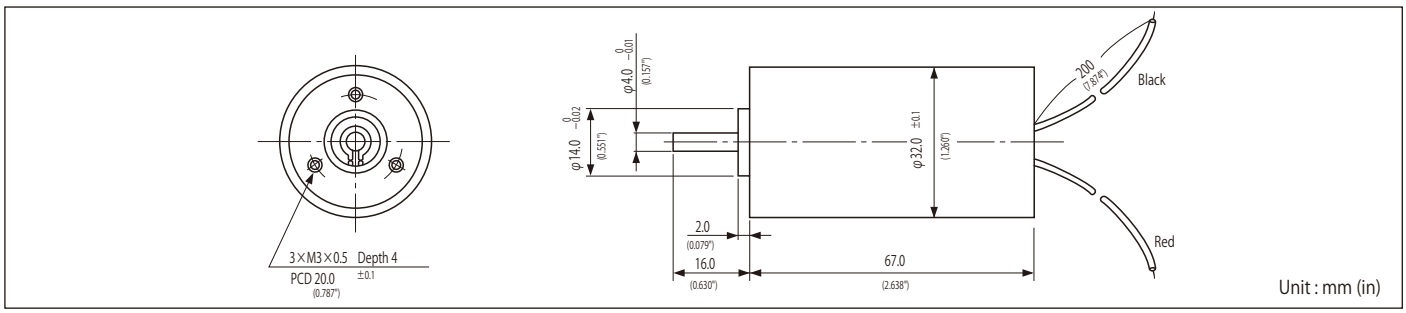
ZMP (φ25)	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	※864	※1296
	Rated Torque	N·m	0.026	0.039	0.090	0.135	0.203	0.306	0.459	0.688	1.032	1.043	1.565	2.348	3.000	3.000
	Rated Speed	rpm	1862	1241	465	310	206	116	77	51	34	29	19	12	8	5
	Rated Output	W	5.2	5.2	4.4	4.4	4.4	3.7	3.7	3.7	3.7	3.1	3.1	3.1	2.7	1.8
	Length	mm	24.7	24.7	29.6	29.6	29.6	37.1	37.1	37.1	37.1	44.6	44.6	44.6	44.6	44.6

● C−2344□□G ZAP 1 ／ xxx

ZAP (φ30)	Reduction Ratio		4	6	16	24	36	64	96	144	216	256	384	576	864	※1296
	Rated Torque	N·m	0.026	0.039	0.090	0.135	0.203	0.306	0.459	0.688	1.032	1.043	1.565	2.348	3.522	4.800
	Rated Speed	rpm	1862	1241	465	310	206	116	77	51	34	29	19	12	8	5
	Rated Output	W	5.2	5.2	4.4	4.4	4.4	3.7	3.7	3.7	3.7	3.1	3.1	3.1	3.1	2.8
	Length	mm	29.9	29.9	35.3	35.3	35.3	44.0	44.0	44.0	44.0	52.7	52.7	52.7	52.7	52.7

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ C-3264 □□



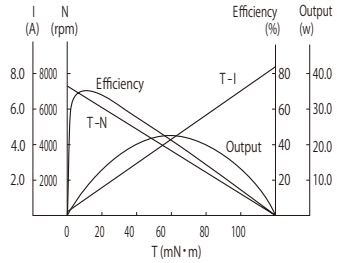
- The positions of screw holes and motor lead (terminals) cannot be determined.
- When positive electrode is applied to the positive terminal, the shaft rotates to CW direction seen from the output shaft side.

■ Motor Specifications

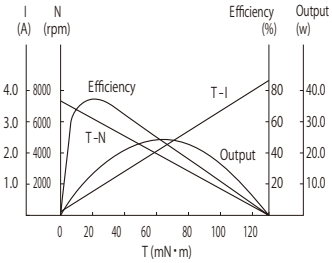
Items		C − 326401			C − 326402			C − 326403			C − 326404		
Rated Voltage	V	12			24			18			36		
Rated Output	W	14.6			15.0			15.0			15.3		
Rated Torque	mN·m / gf·cm / oz·in	24.5	250	3.475	24.5	250	3.475	24.5	250	3.475	24.5	250	3.475
Rated Speed	rpm	5850			6000			6000			6100		
Rated Current	mA	1850			850			1170			600		
No Load Speed	rpm	7400			7400			7400			7400		
No Load Current	mA	140			50			75			40		
Starting Torque	mN·m / gf·cm / oz·in	117.6	1200	26.68	127.4	1300	18.07	127.4	1300	18.07	142.1	1450	20.16
Starting Current	A	8.4			4.2			5.8			3.3		
Rotor Inertia	g·cm²	29.1			21.9			26.5			29.7		
Resistance	Ω	1.4			5.7			3.1			10.9		
Inductance	mH	0.12			0.56			0.30			1.20		
Mechanical Time Constant	m-sec	17			13			15			15		
EMF Constant	V ／ 10³rpm	1.60			3.20			2.40			4.81		
Torque Constant	mN·m/A / gf·cm/A / oz·in/A	14.7	150	2.08	30.4	310	4.30	21.5	220	3.05	44.1	450	6.25
Maximum Output at Rated Voltage	W	22.2			24.1			24.1			26.8		
Starting Acceleration	rad ／ sec²	45.6×10³			59.6×10³			51.6×10³			51.6×10³		
Housing-to Ambient Thermal Resistance	℃／W	8			8			8			8		
Winding Insulation Class	—	F											
Maximum Armature Winding Temperature Rise	℃	155											
Operating Ambient Temperature	℃	− 10 ～+ 60											
Number of Commutator Segments	—	11											
Bearing Type	—	Ball Bearing											
Brush Type	—	Silver Carbon											
Weight	g	260			260			260			260		

■ Basic Characteristics at Rated Voltage

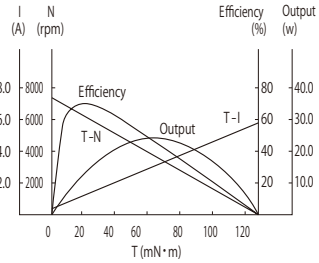
C-326401
12 V



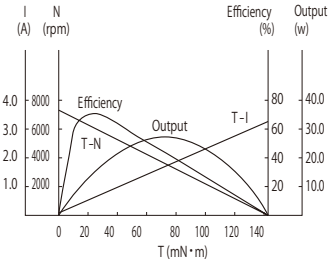
C-326402
24 V



C-326403
18 V



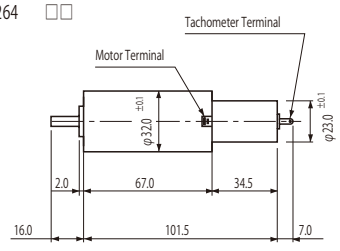
C-326404
36 V



■ Example of Combination

●With Tachometer Generator

TC −3264 □□

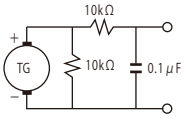


- The positions of screw holes and terminals cannot be determined.

■ Tachometer Generator Specifications

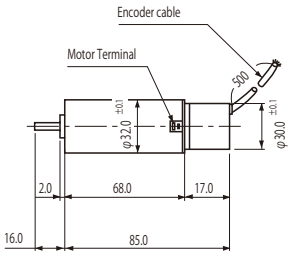
Output Voltage	V/1000rpm	3.0±10%
Linearity	% max	0.3
Ripple P-P (Test Circuit)	% max	5
Ripple Frequency	Cycle/ Rev	11
Directional Deviation	% max	0.5
Armature Resistance	Ω	88
Inductance	mH	1.0
Rotor Inertia	g·cm²	1.8
Temperature Coefficient at Output Voltage	% ／ ℃	− 0.04
Weight (Motor ＋ Tachometer)	g	353

■ Ripple Test Circuit



●With Optical Encoder

EC −3264□□ PC△△△/3ch



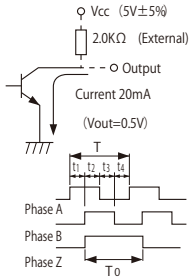
Encoder Lead Color
Phase A ·····Orange
Phase B ·····Yellow
Phase Z ·····White
＋ 5V····· Red
0V····· Black
Earth Cable··· Green

■ Optical Encoder Specifications

Encoder Type	—	Incremental
Number of Output Pulses	Pulse/ Rev	100、200、500
Number of Channels	—	3
Power Source Voltage	Vcc	5±5%
Consumption Current	mA	80 (max.)
Output Voltage	V	"H" | 4.0 (min.) "L" | 0.5 (max.)
Response Frequency	kHz	100 *(1)
Rotor Inertia	g·cm²	0.5
Weight (Motor + Encoder)	g	290

*(1) Motor speed is determined according to the response frequency.

■Output Waveform



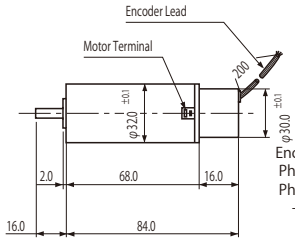
(CW direction seen from the output shaft side)

t1 +t2,t3 +t4=T/2±T/8
t1,t2,t3,t4 ≧T/8
To=T±T/2

The positions of Phase A, B and Z cannot be determined

●With Cost-Effective Optical Encoder

LEC −3264□□ △△△/2ch



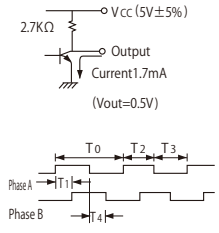
Encoder Lead Color
Phase A ·····Green
Phase B ·····Yellow
＋5V····· Red
0V····· Black

■Cost-Effective Optical Encoder Specifications

Encoder Type	—	Incremental
Number of Output Pulses	Pulse/ Rev	200、400
Number of Channels	—	2
Power Source Voltage	Vcc	5±5%
Consumption Current	mA	60 (max.)
Output Voltage	V	"H" | 2.4 (min.) "L" | 0.5 (max.)
Response Frequency	kHz	45 *(1)
Rotor Inertia	g·cm²	0.5
Weight (Motor + Encoder)	g	290

*(1) Motor speed is determined according to the response frequency.

■Output Waveform



(CW direction seen from the output shaft side)

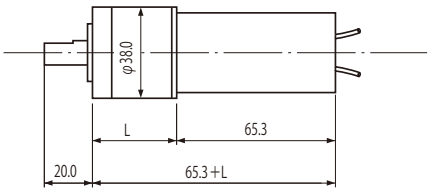
T1,T4=1/4To±1/8To T2,T3=1/2To±1/8To

● The positions of screw holes, terminals and lead wires cannot be determined.

■ With Gearhead

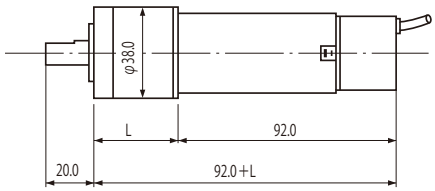
●Gearhead + Motor

C −3264□□G ZFP 1／xxx



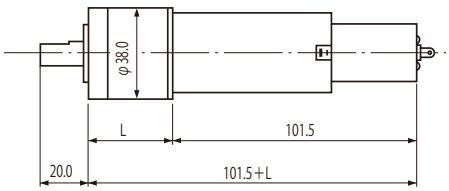
●Gearhead + Motor + Optical Encoder

EC −3264□□G PC△△△/3ch ZFP 1／xxx



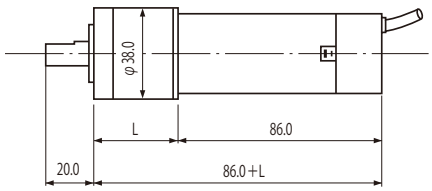
●Gearhead + Motor + Tachometer

TC −3264□□G ZFP 1／xxx



●Gearhead + Motor + Cost-Effective Encoder

LEC −3264□□G △△△/2ch ZFP 1／xxx



● Please see page 25 for details on gearhead dimensions.
● The positions of screw holes, terminals and lead wires cannot be determined.

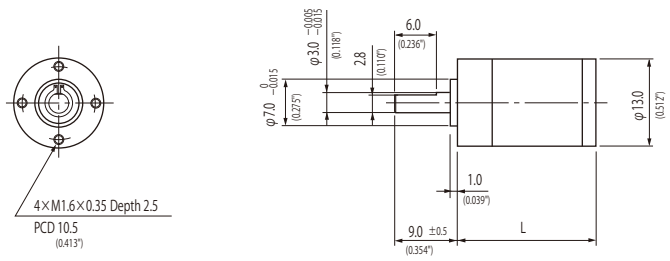
■Rated Specifications of Geared Motors

● C−3264□□G ZFP 1／xxx

	Reduction Ratio		5.43	20.73	29.47	79.24	112.52	160	302.15	429.62	610.82	※886.4
ZFP (φ38)	Rated Torque	N·m	0.11	0.41	0.58	1.41	2.01	2.86	4.88	6.94	9.87	10.00
	Rated Speed	rpm	1123	294	206	76	54	38	20	14	9	7
	Rated Output	W	14.0	12.6	12.6	11.4	11.4	11.4	10.3	10.3	10.3	7.3
	Length	mm	35.2	42.1	42.1	53.4	53.4	53.4	64.7	64.7	64.7	64.7

*1 : If using reduction ratio marked with an asterisk (*), please make sure not to exceed the allowable output torque of the gearhead.
*2 : Those are the values for continuous operation with uniform load.

■ ZCP : φ13

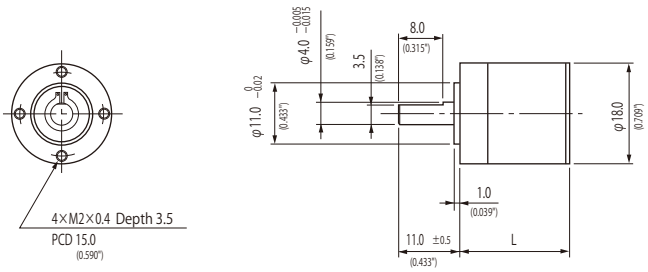


Unit : mm (in)

Gear Specifications

Reduction Ratio	Allowable Output Torque			Allowable Output	Maximum Input Speed	Efficiency	Allowable Radial Load	Allowable Thrust Load	Backlash	Length		Type of Pinion	Weight
	N·m	kgf·cm	oz·in	W	rpm	%	N(kgf)	N(kgf)	deg	mm	inch		g
1 / 4.00	0.05	0.51	7.08	2.4	14000	80	6.0 (0.6)	7.0 (0.7)	1.5	16.6	0.65	A	10
1 / 16.00	0.13	1.33	18.41	1.9	14000	64	7.0 (0.7)	10.0 (1.0)	1.5	19.0	0.75	A	12
1 / 24.00	0.13	1.33	18.41	1.9	14000	64	7.0 (0.7)	10.0 (1.0)	1.5	19.0	0.75	A	12
1 / 64.00	0.26	2.65	36.82	1.5	14000	51	8.0 (0.8)	21.0 (2.1)	1.5	22.9	0.90	A	16
1 / 96.00	0.26	2.65	36.82	1.5	14000	51	8.0 (0.8)	21.0 (2.1)	1.5	22.9	0.90	A	16
1 / 144.00	0.26	2.65	36.82	1.5	14000	51	8.0 (0.8)	21.0 (2.1)	1.5	22.9	0.90	A	16
1 / 256.00	0.40	4.08	56.64	1.2	14000	41	9.0 (0.9)	35.0 (3.5)	1.5	26.8	1.06	A	20
1 / 384.00	0.40	4.08	56.64	1.2	14000	41	9.0 (0.9)	35.0 (3.5)	1.5	26.8	1.06	A	20
1 / 576.00	0.40	4.08	56.64	1.0	14000	41	9.0 (0.9)	35.0 (3.5)	1.5	26.8	1.06	A	20
1 / 864.00	0.40	4.08	56.64	0.7	14000	41	9.0 (0.9)	35.0 (3.5)	1.5	26.8	1.06	A	20

■ ZJP : φ18

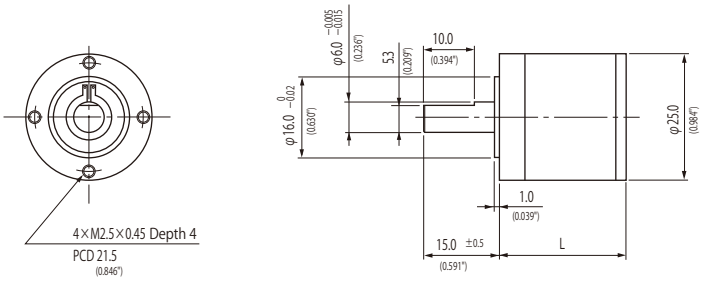


Unit : mm (in)

Gear Specifications

Reduction Ratio	Allowable Output Torque			Allowable Output	Maximum Input Speed	Efficiency	Allowable Radial Load	Allowable Thrust Load	Backlash	Length		Type of Pinion	Weight
	N·m	kgf·cm	oz·in	W	rpm	%	N(kgf)	N(kgf)	deg	mm	inch		g
1 / 4.00	0.13	1.33	18.41	4.0	12000	80	10.0 (1.0)	10.0 (1.0)	1.5	19.4	0.76	A	26
1 / 6.00	0.13	1.33	18.41	4.0	12000	80	10.0 (1.0)	10.0 (1.0)	1.5	19.4	0.76	B	26
1 / 16.00	0.27	2.75	38.23	3.2	12000	64	11.0 (1.1)	15.0 (1.5)	1.5	22.9	0.90	A	31
1 / 24.00	0.27	2.75	38.23	3.2	12000	64	11.0 (1.1)	15.0 (1.5)	1.5	22.9	0.90	B	31
1 / 36.00	0.27	2.75	38.23	3.2	12000	64	11.0 (1.1)	15.0 (1.5)	1.5	22.9	0.90	B	31
1 / 64.00	0.58	5.92	82.13	2.5	12000	51	12.0 (1.2)	30.0 (3.0)	1.5	28.2	1.11	A	38
1 / 96.00	0.58	5.92	82.13	2.5	12000	51	12.0 (1.2)	30.0 (3.0)	1.5	28.2	1.11	B	38
1 / 144.00	0.58	5.92	82.13	2.5	12000	51	12.0 (1.2)	30.0 (3.0)	1.5	28.2	1.11	B	38
1 / 216.00	0.58	5.92	82.13	2.5	12000	51	12.0 (1.2)	30.0 (3.0)	1.5	28.2	1.11	B	38
1 / 256.00	1.20	12.24	169.9	2.0	12000	41	13.0 (1.3)	50.0 (5.0)	1.5	33.5	1.32	A	45
1 / 384.00	1.20	12.24	169.9	2.0	12000	41	13.0 (1.3)	50.0 (5.0)	1.5	33.5	1.32	B	45
1 / 576.00	1.20	12.24	169.9	2.0	12000	41	13.0 (1.3)	50.0 (5.0)	1.5	33.5	1.32	B	45
1 / 864.00	1.20	12.24	169.9	1.5	12000	41	13.0 (1.3)	50.0 (5.0)	1.5	33.5	1.32	B	45
1 / 1296.00	1.20	12.24	169.9	1.1	12000	41	13.0 (1.3)	50.0 (5.0)	1.5	33.5	1.32	B	45

■ ZMP : φ25

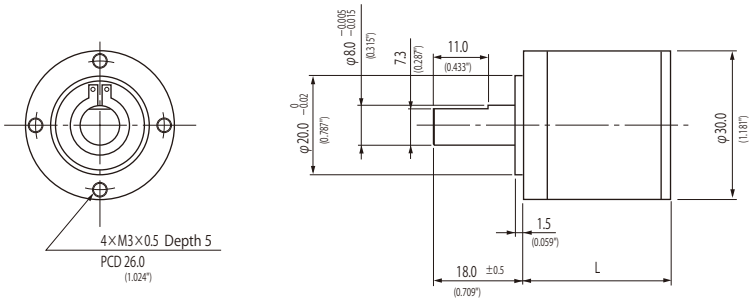


Unit : mm (in)

Gear Specifications

Reduction Ratio	Allowable Output Torque			Allowable Output	Maximum Input Speed	Efficiency	Allowable Radial Load	Allowable Thrust Load	Backlash	Length		Type of Pinion	Weight
	N·m	kgf·cm	oz·in	W	rpm	%	N(kgf)	N(kgf)	deg	mm	inch		g
1 / 4.00	0.25	2.5	35.4	8.0	10000	85	35.0 (3.5)	30.0 (3.0)	1.5	24.7	0.97	A	63
1 / 6.00	0.25	2.5	35.4	8.0	10000	85	35.0 (3.5)	30.0(3.0)	1.5	24.7	0.97	B	63
1 / 16.00	0.60	6.1	85.0	6.0	10000	72	40.0 (4.0)	50.0 (5.1)	1.5	29.6	1.17	A	75
1 / 24.00	0.60	6.1	85.0	6.0	10000	72	40.0 (4.0)	50.0 (5.1)	1.5	29.6	1.17	B	75
1 / 36.00	0.60	6.1	85.0	6.0	10000	72	40.0 (4.0)	50.0 (5.1)	1.5	29.6	1.17	B	75
1 / 64.00	1.20	12.2	170.0	5.0	10000	61	50.0 (5.1)	90.0 (9.1)	1.5	37.1	1.46	A	95
1 / 96.00	1.20	12.2	170.0	5.0	10000	61	50.0 (5.1)	90.0 (9.1)	1.5	37.1	1.46	B	95
1 / 144.00	1.20	12.2	170.0	5.0	10000	61	50.0 (5.1)	90.0 (9.1)	1.5	37.1	1.46	B	95
1 / 216.00	1.20	12.2	170.0	5.0	10000	61	50.0 (5.1)	90.0 (9.1)	1.5	37.1	1.46	B	95
1 / 256.00	3.00	30.6	424.8	4.0	10000	52	55.0 (5.6)	150.0 (15.3)	1.5	44.6	1.76	A	115
1 / 384.00	3.00	30.6	424.8	4.0	10000	52	55.0 (5.6)	150.0 (15.3)	1.5	44.6	1.76	B	115
1 / 576.00	3.00	30.6	424.8	4.0	10000	52	55.0 (5.6)	150.0 (15.3)	1.5	44.6	1.76	B	115
1 / 864.00	3.00	30.6	424.8	3.5	10000	52	55.0 (5.6)	150.0 (15.3)	1.5	44.6	1.76	B	115
1 / 1296.00	3.00	30.6	424.8	2.5	10000	52	55.0 (5.6)	150.0 (15.3)	1.5	44.6	1.76	B	115

■ ZAP : φ30

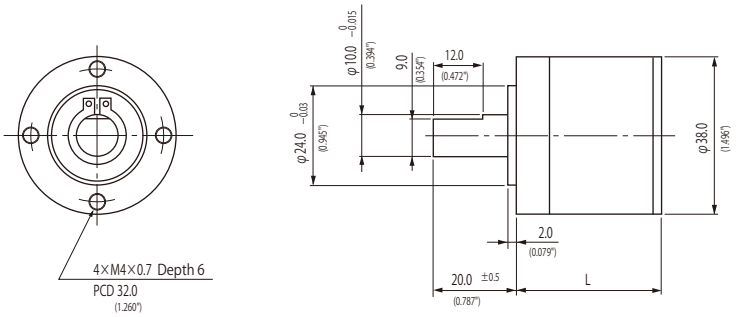


Unit : mm (in)

Gear Specifications

Reduction Ratio	Allowable Output Torque			Allowable Output	Maximum Input Speed	Efficiency	Allowable Radial Load	Allowable Thrust Load	Backlash	Length		Type of Pinion	Weight
	N·m	kgf·cm	oz·in	W	rpm	%	N(kgf)	N(kgf)	deg	mm	inch		g
1 / 4.00	0.4	4.1	56.6	13.0	10000	85	50.0 (5.1)	40.0 (4.0)	1.5	29.9	1.18	A	110
1 / 6.00	0.4	4.1	56.6	13.0	10000	85	50.0 (5.1)	40.0 (4.0)	1.5	29.9	1.18	B	110
1 / 16.00	1.0	10.2	141.6	10.0	10000	72	55.0 (5.6)	70.0 (7.1)	1.5	35.3	1.39	A	130
1 / 24.00	1.0	10.2	141.6	10.0	10000	72	55.0 (5.6)	70.0 (7.1)	1.5	35.3	1.39	B	130
1 / 36.00	1.0	10.2	141.6	10.0	10000	72	55.0 (5.6)	70.0 (7.1)	1.5	35.3	1.39	B	130
1 / 64.00	2.0	20.4	283.2	8.0	10000	61	65.0 (6.6)	120.0 (12.2)	1.5	44.0	1.73	A	160
1 / 96.00	2.0	20.4	283.2	8.0	10000	61	65.0 (6.6)	120.0 (12.2)	1.5	44.0	1.73	B	160
1 / 144.00	2.0	20.4	283.2	8.0	10000	61	65.0 (6.6)	120.0 (12.2)	1.5	44.0	1.73	B	160
1 / 216.00	2.0	20.4	283.2	8.0	10000	61	65.0 (6.6)	120.0 (12.2)	1.5	44.0	1.73	B	160
1 / 256.00	4.8	49.0	679.7	6.5	10000	52	75.0 (7.6)	200.0 (20.4)	1.5	52.7	2.07	A	190
1 / 384.00	4.8	49.0	679.7	6.5	10000	52	75.0 (7.6)	200.0 (20.4)	1.5	52.7	2.07	B	190
1 / 576.00	4.8	49.0	679.7	6.5	10000	52	75.0 (7.6)	200.0 (20.4)	1.5	52.7	2.07	B	190
1 / 864.00	4.8	49.0	679.7	5.5	10000	52	75.0 (7.6)	200.0 (20.4)	1.5	52.7	2.07	B	190
1 / 1296.00	4.8	49.0	679.7	4.0	10000	52	75.0 (7.6)	200.0 (20.4)	1.5	52.7	2.07	B	190

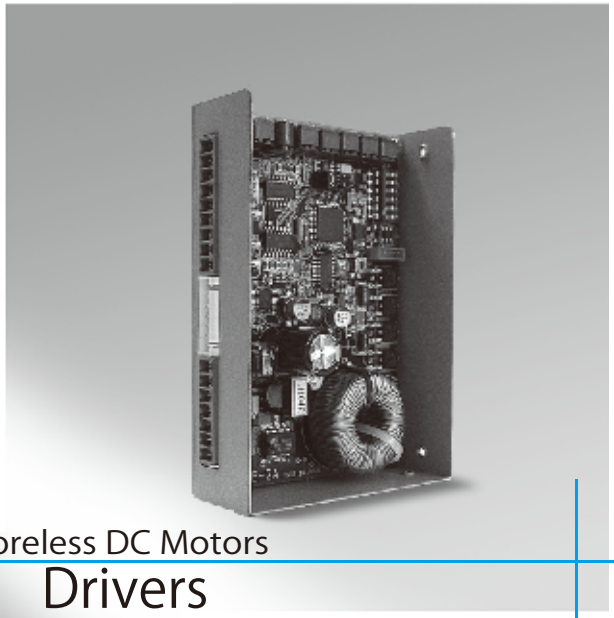
■ ZFP : φ38



Unit : mm (in)

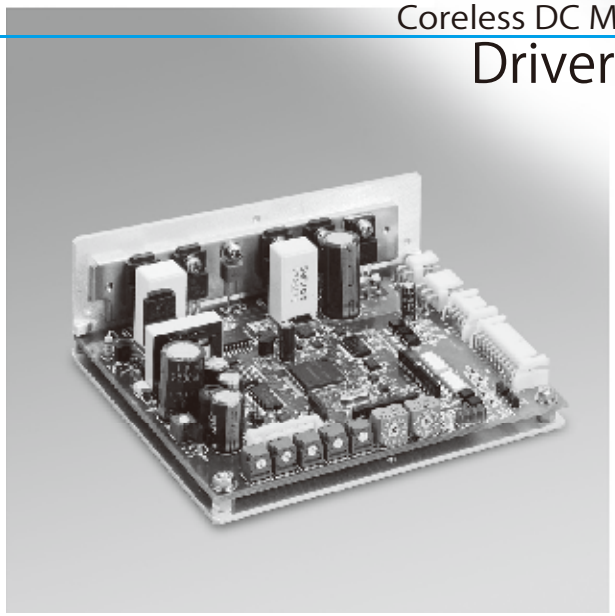
■ Gear Specifications

Reduction Ratio	Allowable Output Torque			Allowable Output	Maximum Input Speed	Efficiency	Allowable Radial Load	Allowable Thrust Load	Backlash	Length		Type of Pinion	Weight
	N·m	kgf·cm	oz·in	W	rpm	%	N(kgf)	N(kgf)	deg	mm	inch		g
1 / 5.43	1.5	15.3	212.4	16.0	7000	90	100.0 (10.2)	60.0 (6.1)	1.5	35.2	1.39	A	190
1 / 20.73	3.0	30.6	424.8	14.5	7000	81	120.0 (12.2)	120.0 (12.2)	1.5	42.1	1.66	A	230
1 / 29.47	3.0	30.6	424.8	14.5	7000	81	120.0 (12.2)	120.0 (12.2)	1.5	42.1	1.66	A	230
1 / 79.24	6.0	61.2	849.6	13.0	7000	73	150.0 (15.3)	200.0 (20.4)	1.5	53.4	2.10	A	290
1 / 112.52	6.0	61.2	849.6	13.0	7000	73	150.0 (15.3)	200.0 (20.4)	1.5	53.4	2.10	A	290
1 / 160.00	6.0	61.2	849.6	13.0	7000	73	150.0 (15.3)	200.0 (20.4)	1.5	53.4	2.10	A	290
1 / 302.15	10.0	102.0	1416.0	12.0	7000	66	180.0 (18.3)	300.0 (30.6)	1.5	64.7	2.55	A	350
1 / 429.62	10.0	102.0	1416.0	12.0	7000	66	180.0 (18.3)	300.0 (30.6)	1.5	64.7	2.55	A	350
1 / 610.82	10.0	102.0	1416.0	11.5	7000	66	180.0 (18.3)	300.0 (30.6)	1.5	64.7	2.55	A	350
1 / 868.44	10.0	102.0	1416.0	8.0	7000	66	180.0 (18.3)	300.0 (30.6)	1.5	64.7	2.55	A	350



Coreless DC Motors

Drivers



■ USE-2A

Small and Lightweighted Analog DC Servo Driver

■ With Three Control Modes: Speed Control Mode/ Torque Control Mode/ Voltage Control Mode

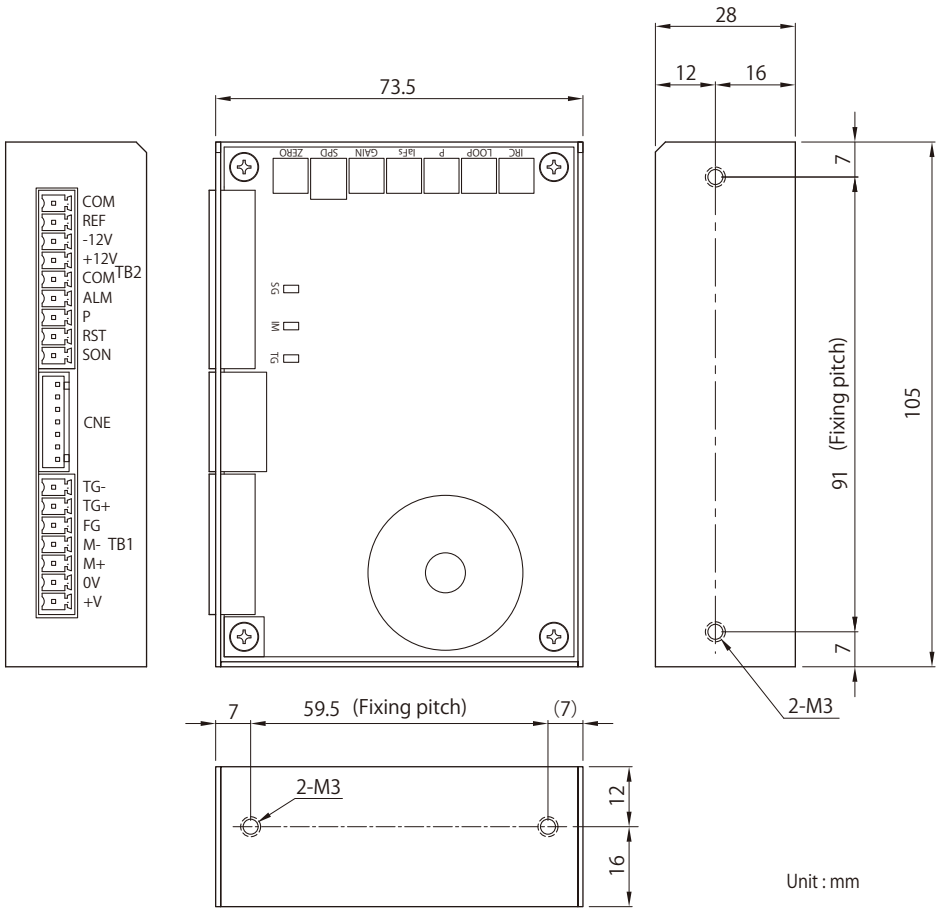
■ Features

- Since the input power source voltage is wide input from +12V to +50V, you can select a coreless motor from a wide range. And since it is a single power source, you do not need to prepare a complicated control power source.
- Tachometer Generator Feedback or Encoder Feedback can be selected during speed control mode.
- Because it equips a high-speed F/V converter, it is possible to use a motor with encoder and it responds up to 500kHz in maximum frequency of encoder. (The maximum frequency is the frequency of Phase A or Phase B. The inside operates at 4x / 2MHz).
- Since output stage choke coil is installed as standard, it can be used with many different coreless motors.
- Encoder disconnection detection function can prevent motor to run out of control in speed control mode.
- Because IR correction is applied in the voltage control mode, speed fluctuations due to load fluctuations can be reduced.

■ Specifications

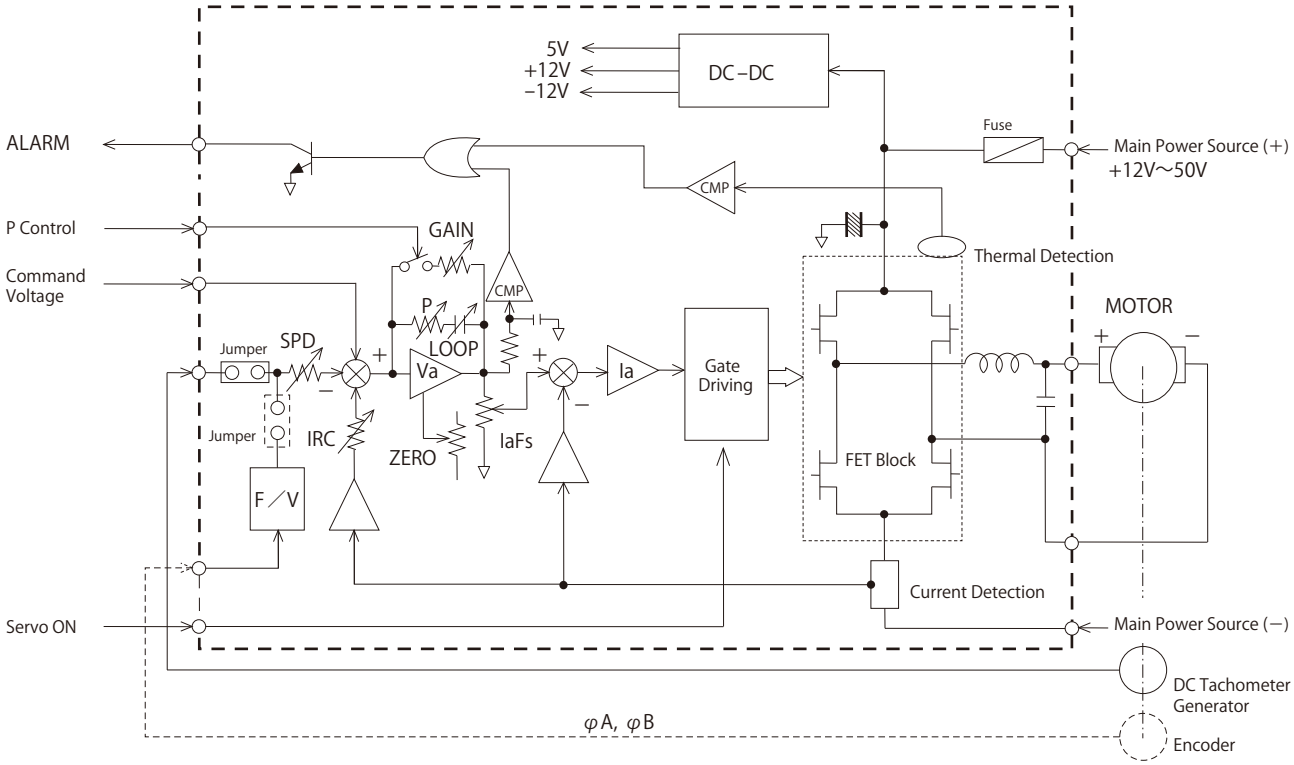
Items		Remarks
Control Mode	Speed/ Control/ Voltage	Switchable by jumper
Drive System	PWM (over 40kHz)	Frequency of driver output
Power Source Voltage	＋12V～＋50V±10%	Single power source
Continuous Rated Output Current	±2Arms	
Maximum Output Current	±5A（－0%～＋5%）	When IaFs is at maximum volume
Maximum Output Voltage	±20V DC	When power source: 24V and output: 2A
Speed Feedback Voltage	±6V～±50V DC	Tachometer Generator Voltage at rated speed
Command Input	0～±10V	
Command Input Impedance	200KΩ	
Speed Resolution	Over 5,000:1	At Speed Control Mode / When Using Tachometer Generator
Speed Stability Level 1	Below ± 0.5% (load: 0 - 100%)	At Speed Control Mode
Speed Stability Level 2	Below ± 0.5% (load: 0 - +50 C)	When using an encoder
Current Response Speed	Below 200 μsec	
Maximum Response Frequency of Encoder	500kHz (The inside operates at 4x)	Frequency of Phase A or Phase B
Input Signal	Servo ON, Alarm Reset, P Control	
Alarm Output	Loop Error, Overheat, Encoder Disconnection	Output is High when alarm
Adjust Function	OffSet Speed, Full-Scale Speed, Proportional Gain, Full-Scale Current, Speed Loop Gain, IR Correction Gain	ZERO, SPD, GAIN, IaFs, LOOP, IRC
Display Function	Power Indicator, Loop Error, Overheat, Encoder Disconnection	PWR, LE, OH, EE
Check Terminal	Motor Speed, Motor Amateur Current	TG, IM
Operating Ambient Temperature	0～50℃ / 35～80% RH without condensation	
Storage Ambient Temperature	－20～＋85℃ / 35～80% RH without condensation	
Outer Dimension	W105×D73.5×H28	
Weight	210g	

Outside Configuration



Unit : mm

Circuit Configuration



■ TSD-04-060

For Position Control

■ Features

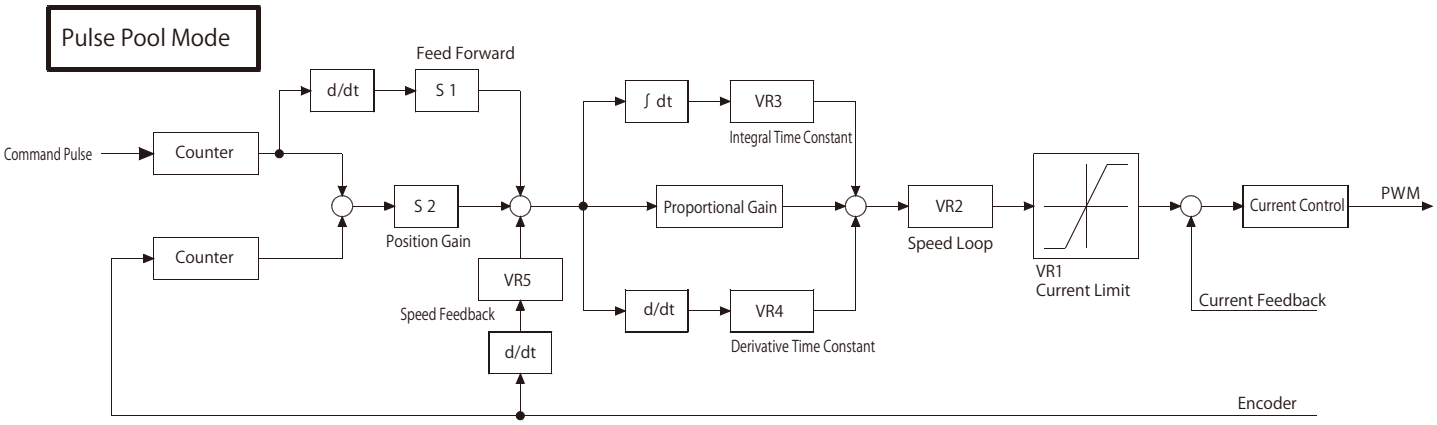
- **Because it is a full software servo, it would not be affected by the environment such as temperature.**
- **Synchronous Tracking Drive Circuit :**
  It is possible to control with almost no accumulated error pulse (pulse pool).
- **Stable Positioning :**
  Since it is integrated, stable and high-precision positioning is possible.
- **Single Power Source :**
  Because it supplies only a single DC power source, switching regulator and battery on the market can be used.
- **Multiplication Function in Encoder**
  ×1, ×2, ×4 multiplications are selectable by internal setting.
- **Protection Circuit**
  Various protection circuits are installed to protect the motor.

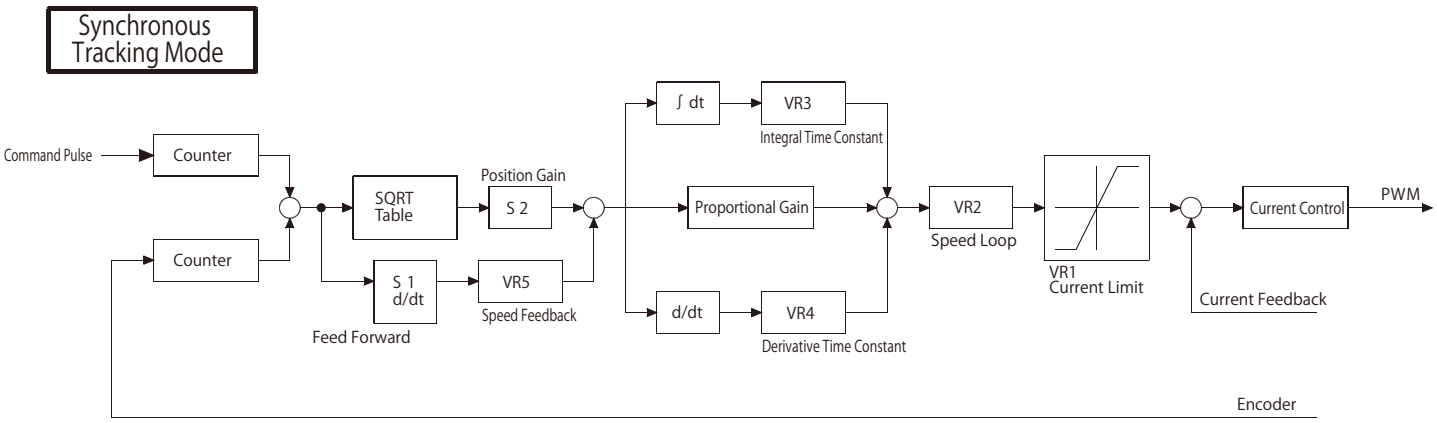
■ Specifications

Items		
Input Power Source		DC12V ～ 40V　*Please apply it according to the motor specification
Rated Output		Driver Output　120W (when power source voltage is 40V)
Maximum Output		Driver Output　240W (when power source voltage is 40V)
Output System		Full Bridge PWM System
Feedback		3 Phases (A/ B/ Z), Incremental Encoder, Line Driver or Open Collector
Operating Ambient Temperature		0℃～ 40℃　Below 85% RH without condensation
Storage Condition		− 20℃～ 85℃　Below 85% RH without condensation
Input Signal		Position Control (*Please serelet one: CW/ CCW, Pulse/ DIR, 2 Phase Input), Counter Clear, Reset, External Alarm Input, Gain Low Input
Output Signal		Alarm Output, Deviation Counter Overflow, Ready, In Position, Encoder Output A/ B/ Z (Line Driver Output)
Function	Multiplication	Encoder Multiplication ×1, ×2, ×4 (set by DIP Switch)
	Safeguard	Deviation Counter Overflow, Driver Overheat, Detection of Full Torque and Overrun
	Adjustment	Gain Adjustment, Speed Loop Gain, Speed Loop Integral TC, Speed Feedback Gain, Derivative Gain, Positioning Gain
	Display	OF (Deviation Counter Overflow), RDY (Ready), IP (In Position), ALM (Alarm), PWR (Internal Power Set)
	Check Terminal	SPD: Motor Speed Waveform, TRQ: Motor Current Waveform
Structure		Open Frame
Outside Dimensions		H40×L120×W102 (The protruding part of connector is not included)
Weight		230g

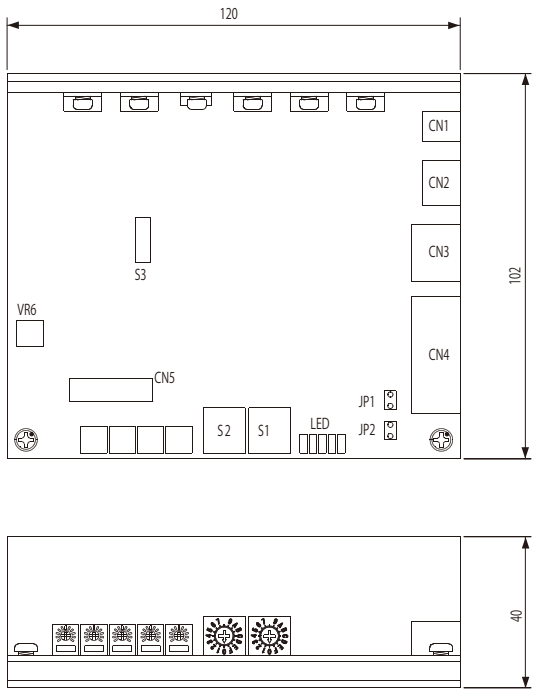
Operating Block Diagrams

The diagrams below are operating block diagrams of the driver.
Although it is not shown in the diagrams, the external input / output parts are isolated by a photocoupler.
However, the encoder output is not isolated and so it is a line driver output.
After removing noise, the external input will be transformed into waveform and then input to the controller.

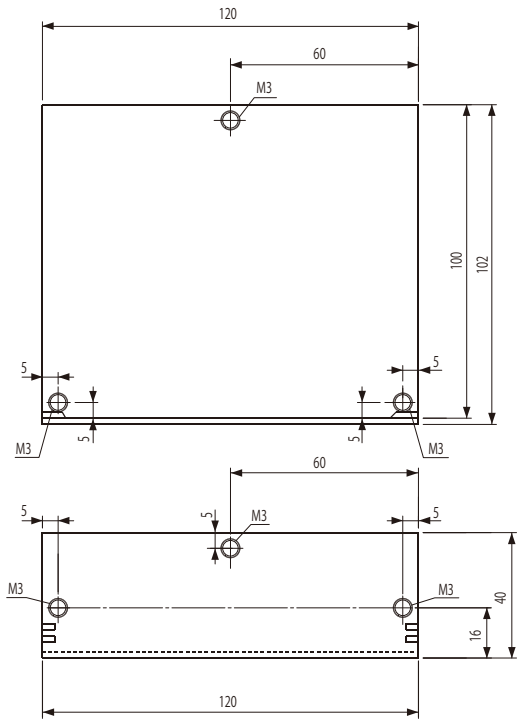




Outside Configuration (Unit: mm)



Install Dimension (Unit: mm)



Models for Special Environments

Model for Chemical Cleanliness

Model for Clean Room

Model for Vacuum

Based on the standard models, we can customize our products to meet our customers' requirement.
We customize our products not only for general environment but also for special environment such as vacuum environment and clean room which require countermeasures for dust, gas, and/or chemical substance.

Examples of Solution for Chemical Cleanliness

● We use the components which emit the limited amount of gas :

- Change grease of the bearings and gearheads to fluorine grease
- Use fluorine resin cable and lead wire
- Use special adhesive

● We can also customize the motor characteristics, shape, design etc. at the same time.

*Caution for Specification Change According to the Components Change

By changing the grease to fluorine type, the characteristics such as increase of current value and decrease of gear's allowable output / torque may change.
And also, bearing life may be significantly shortened by the deterioration in lubricity depending on the grease used.

■ Examples of Application for Chemical Cleanliness

- Semiconductor Equipments
- Electron Microscopes
- Other applications requiring low gas emission

Examples of Customized Product

Brushless Motors for
Chemical Cleanliness

AC Servomotors for
Clean Room

Linear Actuators for
Vacuum Environment

⚠ Cautions for Handling Products

Our motors, encoders, drivers, and accessories are precision-machined products and it is assumed that all the cautions and warnings listed below are correctly understood and handled.

Please do not install, operate, maintain, or inspect the product until you have a full knowledge on the product, safety information, and cautions.

The minimum cautions required for your safety are as follows.

【Caution When Unpacking】

● When you received the product, please check the package for damage and if it is the product you ordered.

【Cautions for Handling】

1. Be sure to check the wiring before turning on the power. Failure to follow this caution may result in mechanical damage and/or operation error.
2. The cables or lead wires should not be damaged, stressed excessively, loaded heavily, or pinched. Failure to follow this causion may result in malfuncition and/or the products would not operate correctly.
3. Since they are small precision products, there are many parts where strength is secured by adhesion. Please handle with care such as do not apply impact or stress to the joints of the gear and encoder. Failure to follow this caution may result in injury and/or malfunction.
4. Please do not apply impact or radial load to the shaft. Also please do not apply thrust load that exceeds the specified value. Failure to follow this caution may result in malfunction.
5. Hall sensor and encoder include semiconductor components. Please process the lead wire in an anti-static environment.
6. When installing the product, please use the specified number of screws by the torque specified in JIS. Please select the screws according to the dimensions shown in the external layout drawings. Failure to follow this caution, such as screws are too long or fixing torque excessive, may result in a malfunction for mechanical parts inside may be deformed or destroyed.
7. Please do not use or store the product in an environment subject to corrosive gas or any other hazardous gas. Also, please keep dust, water or oil out of the product.
8. If smoke, abnormal heat generation, strange odor, abnormal noise, abnormal vibration, etc. is generated, please stop operating immediately and turn off the power.
9. Our motors do not have a ground terminal. If you need to ground it, please use a housing.
10. When mounting the driver and other optional items, please use screws that conform to the specifications in the outline drawing. Especially, if the screw for fixing the driver is too long, it may damage the board, causing malfunction, short circuit, or fire.
11. Since the life of the motor and its accessories varies greatly depending on the load conditions, operating mode and operating environment, please check the operation of the actual machine thoroughly.

【Product Warranty】

1. Duration of the warranty is one year from the date of delivery. If the customer discovered a defect in material and workmanship within this period, we will repair the product for free only if the customer carry it in or return it to our company address by customer's expense.

   Please note that it would take several days to repair.
2. For the defect caused by "misuse" or "mishandling" by any party, or the defect caused later than one year from the date of delivery, the customer is responsible for repairing charges. We will repair the product only if the customer carry it in to our company address or the customer is responsible to all shipping charges.
3. We are not liable to the damages caused while in transit. Please pack the product with sufficient cushioning materials to prevent external vibration.

【Other】

1. If you got any problem with our product, please do not disassemble it and keep it as it is. Then please contact our sales representatives and return it. We will investigate and repair the product only if it is brought or sent to our company by a customer's expence.
2. Information listed above is subject to change without notice.
   For further information, please contact our sales representatives or our authorized distributors.

Memo

Memo

■ Product Lineup


Coreless DC Motors


Brushless Motors


AC Servomotors


Linear Actuators


Galvanometer Optical Scanners


Gearheads


Tachometer Generator/ Encoder

■ Application for Solution

● Please visit our website for more details.
https://ccj.citizen.co.jp/en/case

■ Semiconductor Equipment :
Lithography Machine / Wafer Inspection System / Turbo Molecular Pumps / Wafer Dicing Machine / Conveyance System for Semiconductor Factories

■ Medical and Clinical Equipment :
Denture Processing Machine / Down Flow Masks for Virus Protection / OCT / Ultrasonic Diagnostic System / Lens Edger / Cancer Treatment / Autoclavable Medical Equipment / Robotic Exoskeleton

■ Beauty and Cosmetic Equipment :
Handpieces for Nail Art

■ Measuring and Analyzing Equipment :
LiDAR / Electron Microscope / Confocal Microscope / Railway Track Measuring Device / Surface Roughness Tester

■ Factory Automation and Robots :
Laser Marking Machine / Motors for Robots / Grinding Machine / Optical Disk Equipment

* Technical data and products are subject to change without prior notice. For further information, please contact our sales representatives or authorized distributors.

CITIZEN

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2021.12