

(RoHS) RoHS-Compliant**Speed Controller****ES02**

● Additional Information ●
 Technical reference → Page F-1
 Safety standards → Page G-2

ES02 is a speed controller designed for ultimate ease of use when operating and wiring, focusing on the functions required for speed control.

A wide range of speed control motors are available for use with this controller.



● List of safety standard approved products (Model, Standards, File No., Certification Body)
 → Page G-10



Features

● Multi-Functions

Provide the functions necessary for speed control.

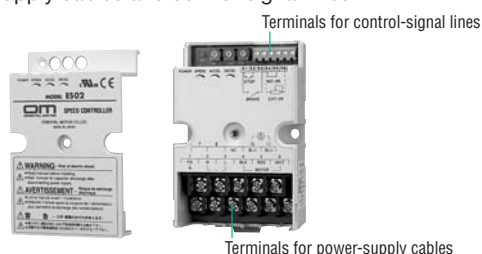
- Speed control 90 to 1400 r/min (50 Hz)
90 to 1600 r/min (60 Hz)
- Instantaneous stop
- Acceleration/deceleration function that enables smooth start and stop

● Can Be Used World-Wide

The **ES02** speed controller conforms to major power supply specifications world-wide. It is recognized by UL and CSA, while CE Marking is used in accordance with the EMC Directive and Low Voltage Directive.

● Simple Wiring

For easy of wiring the new design provides separate terminals for power-supply cables and control-signal lines.



● Controlling 6 W to 60 W with a Single Unit

One **ES02** unit is all you need to operate speed control motors with varying output of 6 W to 60 W.

● IP20-Compliant

Case design against electric shock and the IP20-compliant construction prevent the operator from touching the terminal block, thereby ensuring a high degree of safety.

● (RoHS) RoHS-Compliant

ES02 and the applicable speed control motors conform to the RoHS Directive that prohibits the use of six chemical substances including lead and cadmium.

● Details of RoHS Directive → Page G-23

Product Line

● Speed Controller (RoHS)

Model	Power Supply Voltage	Page
ES01	Single-Phase 100-115 VAC	*
ES02	Single-Phase 200-230 VAC	A-178

* For the single-phase 100-115 VAC model, please contact the nearest Oriental Motor sales office.

The following items are included in each product.
 Speed Controller, External Speed Potentiometer, Operating Manual

Specifications of Speed Controller (RoHS)



Model Name	ES02
Power Supply Voltage	Single-Phase 200-230 VAC ± 10%
Power Supply Frequency	50/60 Hz
Applicable Speed Control Motor Output	6 W, 15 W, 25 W, 40 W, 60 W
Variable Speed Range	50 Hz: 90~1400 r/min 60 Hz: 90~1600 r/min
Function	Speed control, Instantaneous stop, Acceleration/deceleration
Insulation Resistance	100 MΩ or more when 500 VDC megger is applied between the case and all the pins, the FG terminal and the AC input terminals under normal ambient temperature and humidity.
Dielectric Strength	Sufficient to withstand 1.5 kV at 50 Hz or 60 Hz applied between the FG terminals and the AC input terminals for 1 minute, under normal ambient temperature and humidity. Sufficient to withstand 3.0 kV at 50 Hz or 60 Hz applied between all the pins and the case for 1 minute.
Ambient Temperature	0~+40°C (non-freezing)
Ambient Humidity	85% or less (non-condensing)
Degree of Protection	IP20 (with cover)

Note:

These models cannot be used for applications requiring the control of more than one motor/controller set by the same external speed potentiometer. When instantaneous stop is activated, a large braking current will flow to the motor. Braking current → Page A-193

■ **Dimensions** → Page A-185

■ **Connection and Operation** → Page A-190

System Configuration

Gearheads and Linear Heads (Sold separately)

Parallel Shaft Gearheads (→ Page A-159)

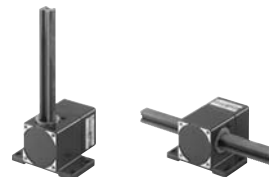


Right-Angle Gearheads (→ Page A-127)

Hollow Shaft Type Solid Shaft Type



Linear Heads (→ Page D-114)



Speed Control Motor (Sold separately)

World K Series Reversible Motor



Capacitor (Included with the motor)



Speed Controller ESO2 (Body)



AC Power Supply (Main Power Supply)

External Speed Potentiometer (Included with the speed controller)



Accessories (Sold separately)



① CR Circuit for Surge Suppression (→ Page A-240)



② Mounting Brackets (→ Page A-230)



③ Flexible Couplings (→ Page A-233)

No.	Product Name	Overview	Page
①	CR Circuit for Surge Suppression	Used to protect relay and switch contacts (EPCR1201-2).	A-240
②	Mounting Brackets	Dedicated mounting bracket for the motor and gearhead.	A-230
③	Flexible Couplings	Clamp type coupling that connects the motor or gearhead shaft to the driven shaft.	A-233

● Example of System Configuration

(Body)

(Sold separately)

(Sold separately)

Speed Controller	Reversible Motor (Pinion Shaft)	Long Life, Low Noise Gearhead	+	Mounting Bracket	Flexible Coupling
ES02	4RK25RGN-CW2E	4GN25S		SOL4M5	MCL301012

● Both of gearheads and linear heads cannot be combined with round shaft type motors.

● The system configuration shown above is an example. Other combinations are available.

Applicable Speed Control Motors (Sold separately)

● World K Series Speed Control Motor (6 W to 60 W) (RoHS)

Conforming to major safety standards, the World K Series sets the standard for AC motors. These motors can be used in wide-ranging applications. The new "long life, low noise GN-S gearhead" achieves a long rated life of 10000 hours, twice the level of a conventional gearhead, by adopting innovative technologies and structure. These gearheads are highly reliable and require less maintenance.

Product line → Page A-180



Product Number Code

World K Series Speed Control Motor

Motor

4 I K 25 R GN - CW2 E

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

①	Motor Frame Size	2: 60 mm 3: 70 mm 4: 80 mm 5: 90 mm
②	Motor Type	I: Induction Motor R: Reversible Motor
③	Series	K: K Series
④	Output Power (W)	(Example) 25: 25 W
⑤	Speed Control Motor	
⑥	Motor Shaft Type, Type of Pinion	GN: GN Type Pinion Shaft GU: GU Type Pinion Shaft A: Round Shaft
⑦	Power Supply Voltage	AW2, AW: Single-Phase 100 VAC, 110/115 VAC, RoHS-Compliant CW2, CW: Single-Phase 200 VAC, 220/230 VAC, RoHS-Compliant
⑧	Included Capacitor	J: For Single-Phase 100 VAC and 200 VAC U: For Single-Phase 110/115 VAC E: For Single-Phase 220/230 VAC

Gearhead

4 GN 50 S

① ② ③ ④

①	Gearhead Frame Size	2: 60 mm 3: 70 mm 4: 80 mm 5: 90 mm
②	Type of Pinion	GN: GN Type Pinion GU: GU Type Pinion
③	Gear Ratio	(Example) 50: Gear Ratio of 1:50 10X denotes the decimal gearhead of gear ratio 1:10
④	GN Type Pinion	S: Long Life, Low Noise GN-S Gearhead, RoHS-Compliant RH: Right-Angle, Hollow Shaft Gearhead, RoHS-Compliant RA: Right-Angle, Solid Shaft Gearhead, RoHS-Compliant
	GU Type Pinion	KB: GU Gearhead (Box type), RoHS-Compliant RH: Right-Angle, Hollow Shaft Gearhead, RoHS-Compliant RA: Right-Angle, Solid Shaft Gearhead, RoHS-Compliant

Product Line

World K Series Speed Control Motor

Pinion Shaft Type (6 W~60 W) (RoHS)

Type	Power Supply Voltage	□60 mm 6 W	□70 mm 15 W	□80 mm 25 W	□90 mm 40 W	□90 mm 60 W	Page	Applicable Controller (Sold separately)
		Model	Model	Model	Model	Model		
Induction Motors	Single-Phase 100 VAC	2IK6RGN-AW2J	3IK15RGN-AW2J	4IK25RGN-AW2J	5IK40RGN-AW2J	—	*	ES01
	Single-Phase 110/115 VAC	2IK6RGN-AW2U	3IK15RGN-AW2U	4IK25RGN-AW2U	5IK40RGN-AW2U	5IK60RGU-AWU	*	
	Single-Phase 200 VAC	2IK6RGN-CW2J	3IK15RGN-CW2J	4IK25RGN-CW2J	5IK40RGN-CW2J	—	*	ES02
	Single-Phase 220/230 VAC	2IK6RGN-CW2E	3IK15RGN-CW2E	4IK25RGN-CW2E	5IK40RGN-CW2E	5IK60RGU-CWE	A-181	
Reversible Motors	Single-Phase 100 VAC	2RK6RGN-AW2J	3RK15RGN-AW2J	4RK25RGN-AW2J	5RK40RGN-AW2J	—	*	ES01
	Single-Phase 110/115 VAC	2RK6RGN-AW2U	3RK15RGN-AW2U	4RK25RGN-AW2U	5RK40RGN-AW2U	5RK60RGU-AWU	*	
	Single-Phase 200 VAC	2RK6RGN-CW2J	3RK15RGN-CW2J	4RK25RGN-CW2J	5RK40RGN-CW2J	—	*	ES02
	Single-Phase 220/230 VAC	2RK6RGN-CW2E	3RK15RGN-CW2E	4RK25RGN-CW2E	5RK40RGN-CW2E	5RK60RGU-CWE	A-182	

*For the single-phase 100 VAC, the single-phase 110/115 VAC, the single-phase 200 VAC models, please contact the nearest Oriental Motor sales office.

The following items are included in each product.

Motor, Capacitor, Capacitor Cap, Operating Manual

Parallel Shaft Gearhead (Sold separately)

Long Life, Low Noise GN-S Gearhead (RoHS)

Applicable Motor Output Power (Pinion Shaft)	Gearhead Model	Gear Ratio
6 W	2GN□S	3~180
	2GN10XS (Decimal Gearhead)	
15 W	3GN□S	3~180
	3GN10XS (Decimal Gearhead)	
25 W	4GN□S	3~180
	4GN10XS (Decimal Gearhead)	
40 W	5GN□S	3~180
	5GN10XS (Decimal Gearhead)	

● Enter the gear ratio in the box (□) within the model name.

GU Gearhead (RoHS)

Applicable Motor Output Power (Pinion Shaft)	Gearhead Model	Gear Ratio
60 W	5GU□KB	3~180
	5GU10XKB (Decimal Gearhead)	

● Enter the gear ratio in the box (□) within the model name.

The following items are included in each product.

Gearhead, Mounting Screws, Parallel Key*, Operating Manual
*Only for the products with a key slot on the output shaft

● Right-Angle Gearhead (Sold separately)

◇ Hollow Shaft Type (RoHS)

Applicable Motor Output Power (Pinion Shaft)	Gearhead Model	Gear Ratio
25 W	4GN □RH	3~180
40 W	5GN □RH	3~180
60 W	5GU □RH	3~180

● Enter the gear ratio in the box (□) within the model name.

The following items are included in each product.
Gearhead, Mounting Screws, Parallel Key, Safety Cover (with screws), Gasket, Operating Manual

◇ Solid Shaft Type (RoHS)

Applicable Motor Output Power (Pinion Shaft)	Gearhead Model	Gear Ratio
25 W	4GN □RA	3~180
40 W	5GN □RA	3~180
60 W	5GU □RA	3~180

● Enter the gear ratio in the box (□) within the model name.

The following items are included in each product.
Gearhead, Mounting Screws, Parallel Key, Gasket, Operating Manual

◇ Round Shaft Type (6 W~60 W) (RoHS)

Type	Power Supply Voltage	□60 mm 6 W	□70 mm 15 W	□80 mm 25 W	□90 mm 40 W	□90 mm 60 W	Page	Applicable Controller (Sold separately)
		Model	Model	Model	Model	Model		
Induction Motor	Single-Phase 100 VAC	2IK6RA-AW2J	3IK15RA-AW2J	4IK25RA-AW2J	5IK40RA-AW2J	—	*	ES01
	Single-Phase 110/115 VAC	2IK6RA-AW2U	3IK15RA-AW2U	4IK25RA-AW2U	5IK40RA-AW2U	5IK60RA-AWU	*	
	Single-Phase 200 VAC	2IK6RA-CW2J	3IK15RA-CW2J	4IK25RA-CW2J	5IK40RA-CW2J	—	*	ES02
	Single-Phase 220/230 VAC	2IK6RA-CW2E	3IK15RA-CW2E	4IK25RA-CW2E	5IK40RA-CW2E	5IK60RA-CWE	A-181	
Reversible Motor	Single-Phase 100 VAC	2RK6RA-AW2J	3RK15RA-AW2J	4RK25RA-AW2J	5RK40RA-AW2J	—	*	ES01
	Single-Phase 110/115 VAC	2RK6RA-AW2U	3RK15RA-AW2U	4RK25RA-AW2U	5RK40RA-AW2U	5RK60RA-AWU	*	
	Single-Phase 200 VAC	2RK6RA-CW2J	3RK15RA-CW2J	4RK25RA-CW2J	5RK40RA-CW2J	—	*	ES02
	Single-Phase 220/230 VAC	2RK6RA-CW2E	3RK15RA-CW2E	4RK25RA-CW2E	5RK40RA-CW2E	5RK60RA-CWE	A-182	

* For the single-phase 100 VAC, the single-phase 110/115 VAC, the single-phase 200 VAC models, please contact the nearest Oriental Motor sales office.

The following items are included in each product.
Motor, Capacitor, Capacitor Cap, Operating Manual

Specifications

The following specifications assume combination with an applicable speed control motor.

● Induction Motors – Continuous Rating

◇ Single-Phase 220/230 VAC Applicable Speed Controller: **ES02** (RoHS)



Model	Max. Output Power	Voltage	Frequency	Variable Speed Range*1	Permissible Torque		Starting Torque	Current	Power Consumption	Capacitor			
					1200 r/min	90 r/min							
Pinion Shaft Type	Round Shaft Type	W	VAC	Hz	r/min	mN·m	mN·m	mN·m	A	W	μF		
Ⓟ 2IK6RGN-CW2E	2IK6RA-CW2E	6	Single-Phase 220	50	90~1400	36	33	35	0.130	27	0.6		
				60	90~1600	50							
				50	90~1400	40							
				60	90~1600	50							
Ⓟ 3IK15RGN-CW2E	3IK15RA-CW2E	15	Single-Phase 220	50	90~1400	110	38	65	0.23	43	1.0		
				60	90~1600	125				46			
				50	90~1400	115				44			
				60	90~1600	125				47			
Ⓟ 4IK25RGN-CW2E	4IK25RA-CW2E	25	Single-Phase 220	50	90~1400	205	40	110	0.37	70	1.5		
				60	90~1600	160							
				50	90~1400	205				120			
				60	90~1600	150							
Ⓟ 5IK40RGN-CW2E	5IK40RA-CW2E	40	Single-Phase 220	50	90~1400	300	75	190	0.55	96	2.3		
				60	90~1600	280				104			
				50	90~1400	320						70	200
				60	90~1600	260				105			
Ⓟ 5IK60RGU-CWE	5IK60RA-CWE	60	Single-Phase 220	50	90~1400	460	200	320	0.84	155	4.0		
				60	90~1600	490				170		175	
				50	90~1400	490						180	158
				60	90~1600	490				172			

Ⓟ: Impedance protected

Ⓟ: Contains a built-in thermal protector (automatic return type). If a motor overheats for any reason, the thermal protector is activated and the motor is stopped. When the motor temperature drops, the thermal protector closes and the motor restarts. Be sure to turn the motor off before inspecting.

*1 The variable speed ranges shown are under no load conditions.

*2 China Compulsory Certification System (CCC System) (CCC)

Those products with a "G" at the end of their model name are CCC certified for 60 W. If you require a CCC certified product, please specify a "G" at the end of the model name you're ordering. (Example) Model: **5IK60RGU-CWEG**

For details, please contact the nearest Oriental Motor sales office.

● In addition to the products shown above, the products for single-phase 100 VAC, single-phase 110/115 VAC and single-phase 200 VAC are also available. Please contact the nearest Oriental Motor sales office.

● Reversible Motors – 30 Minutes Rating

◇ Single-Phase 220/230 VAC Applicable Speed Controller: **ES02** (RoHS)

Model		Max. Output Power	Voltage	Frequency	Variable Speed Range*1	Permissible Torque		Starting Torque	Current	Power Consumption	Capacitor		
						1200 r/min	90 r/min						
Pinion Shaft Type	Round Shaft Type	W	VAC	Hz	r/min	mN-m	mN-m	mN-m	A	W	μF		
Ⓟ 2RK6RGN-CW2E	2RK6RA-CW2E	6	Single-Phase 220	50	90~1400	42	50	45	0.155	32	0.8		
				60	90~1600	50							
				Single-Phase 230	50	90~1400						46	
					60	90~1600						50	
Ⓟ 3RK15RGN-CW2E	3RK15RA-CW2E	15	Single-Phase 220	50	90~1400	125	87	100	0.30	63	1.5		
				60	90~1600								
				Single-Phase 230	50							90~1400	
					60							90~1600	
Ⓟ 4RK25RGN-CW2E	4RK25RA-CW2E	25	Single-Phase 220	50	90~1400	205	115	140	0.50	95	2.5		
				60	90~1600		110						
				Single-Phase 230	50		90~1400					115	
					60		90~1600					110	
Ⓟ 5RK40RGN-CW2E	5RK40RA-CW2E	40	Single-Phase 220	50	90~1400	320	180	270	0.75	140	3.5		
				60	90~1600		170						
				Single-Phase 230	50		90~1400					170	270
					60		90~1600						260
Ⓟ 5RK60RGU-CWE	5RK60RA-CWE	60	Single-Phase 220	50	90~1400	490	280	420	1.0	185	5.0		
				60	90~1600			380		198			
				Single-Phase 230	50			90~1400		460		1.0	188
					60			90~1600		380		1.1	202

● The permissible torque and the starting torque of reversible motors are shown without the friction brake installed. Please keep in mind that you should select a suitable motor with enough torque, when designing the equipment.

Ⓟ: Impedance protected

Ⓟ: Contains a built-in thermal protector (automatic return type). If a motor overheats for any reason, the thermal protector is activated and the motor is stopped.

When the motor temperature drops, the thermal protector closes and the motor restarts. Be sure to turn the motor off before inspecting.

*1 The variable speed ranges shown are under no load conditions.

*2 China Compulsory Certification System (CCC System) (CCC)

Those products with a "G" at the end of their model name are CCC certified for 60 W. If you require a CCC certified product, please specify a "G" at the end of the model name you're ordering.

(Example) Model: **5RK60RGU-CWEG**

For details, please contact the nearest Oriental Motor sales office.

● In addition to the products shown above, the products for single-phase 100 VAC, single-phase 110/115 VAC and single-phase 200 VAC are also available. Please contact the nearest Oriental Motor sales office.

■ General Specifications of Applicable Speed Control Motors

Item	Specifications
Insulation Resistance	100 MΩ or more when 500 VDC megger is applied between the windings and the case after rated operation under normal ambient temperature and humidity.
Dielectric Strength	Sufficient to withstand 1.5 kV at 50 Hz or 60 Hz applied between the windings and the case for 1 minute after rated operation under normal ambient temperature and humidity.
Temperature Rise	Temperature rise of windings are 80°C or less measured by the resistance change method after rated operation with no load under normal ambient temperature and humidity with connecting a gearhead or equivalent heat radiation plate* to a motor.
Insulation Class	Class B (130°C)
Overheat Protection	6 W type has impedance protection. All others have built-in thermal protector (automatic return type). Operating temperature; open: 130±5°C, close: 82±15°C
Ambient Temperature	-10~+40°C (non-freezing)
Ambient Humidity	85% or less (non-condensing)
Degree of Protection	6 W, 15 W, 25 W, 40 W : IP20 60 W : IP40

* Heat radiation plate (Material: Aluminum)

Motor Output	Size (mm)	Thickness (mm)
6 W	115×115	5
15 W	125×125	
25 W	135×135	
40 W	165×165	
60 W	200×200	

■ Variable Speed Range When Gearhead is Attached

Unit = r/min

Gear Ratio	3	3.6	5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180	
	High Speed	50 Hz	466	388	280	233	186	155	112	93	77	56	46	38	28	23	18	15	14	11	9
	60 Hz	533	444	320	266	213	177	128	106	88	64	53	44	32	26	21	17	16	13	10	8.8
Low Speed		30	25	18	15	12	10	7.2	6	5	3.6	3	2.5	1.8	1.5	1.2	1	0.9	0.75	0.6	0.5

Gearmotor – Torque Table

- Gearheads are sold separately.
- To reduce the speed beyond the gear ratio in the table, attach a decimal gearhead of gear ratio 1/10 (sold separately) between the gearhead and the motor. In that case, the permissible torques are as follows.

2GN□S: 3 N·m, **3GN□S:** 5 N·m
4GN□S: 8 N·m (6 N·m when a gearhead of 1/25~1/36 is attached)
5GN□S: 10 N·m, **5GU□KB:** 20 N·m

- Enter the gear ratio in the box (□) within the model name.
- A colored background (□) indicates gear shaft rotation in the same direction as the motor shaft, while the others rotate in the opposite direction.

Induction Motors

◇ Single-Phase 220/230 VAC

Unit = N·m

Model Motor/Gearhead	Gear Ratio Speed	3	3.6	5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180	
		Unit = N·m																				
2IK6RGN-CW2E /2GN□S	1200 r/min	220 VAC 50 Hz	0.087	0.10	0.15	0.17	0.22	0.26	0.36	0.44	0.52	0.66	0.79	0.95	1.2	1.4	1.8	2.1	2.4	2.9	3	3
		230 VAC 50 Hz	0.097	0.12	0.16	0.19	0.24	0.29	0.41	0.49	0.58	0.73	0.88	1.1	1.3	1.6	2.0	2.4	2.6	3	3	3
		60 Hz	0.12	0.15	0.20	0.24	0.30	0.36	0.51	0.61	0.73	0.91	1.1	1.3	1.7	2.0	2.5	3	3	3	3	3
	90 r/min	0.08	0.096	0.13	0.16	0.20	0.24	0.33	0.40	0.48	0.60	0.72	0.87	1.1	1.3	1.6	2.0	2.2	2.6	3	3	
3IK15RGN-CW2E /3GN□S	1200 r/min	220 VAC 50 Hz	0.27	0.32	0.45	0.53	0.67	0.80	1.1	1.3	1.6	2.0	2.4	2.9	3.6	4.4	5	5	5	5	5	5
		230 VAC 50 Hz	0.28	0.34	0.47	0.56	0.70	0.84	1.2	1.4	1.7	2.1	2.5	3.0	3.8	4.6	5	5	5	5	5	5
		60 Hz	0.30	0.36	0.51	0.61	0.76	0.91	1.3	1.5	1.8	2.3	2.7	3.3	4.1	5	5	5	5	5	5	5
	90 r/min	0.092	0.11	0.15	0.18	0.23	0.28	0.38	0.46	0.55	0.69	0.83	1.0	1.3	1.5	1.9	2.3	2.5	3.0	3.8	4.5	
4IK25RGN-CW2E /4GN□S	1200 r/min	50 Hz	0.50	0.60	0.83	1.0	1.2	1.5	2.1	2.5	3.0	3.7	4.5	5.4	6.8	8	8	8	8	8	8	8
		220 VAC 60 Hz	0.39	0.47	0.65	0.78	0.97	1.2	1.6	1.9	2.3	2.9	3.5	4.2	5.3	6.3	7.9	8	8	8	8	8
		230 VAC 60 Hz	0.36	0.44	0.61	0.73	0.91	1.1	1.5	1.8	2.2	2.7	3.3	3.9	5.0	5.9	7.4	8	8	8	8	8
	90 r/min	0.097	0.12	0.16	0.19	0.24	0.29	0.41	0.49	0.58	0.73	0.88	1.1	1.3	1.6	2.0	2.4	2.6	3.2	4.0	4.8	
5IK40RGN-CW2E /5GN□S	1200 r/min	220 VAC 50 Hz	0.73	0.87	1.2	1.5	1.8	2.2	3.0	3.6	4.4	5.5	6.6	7.9	9.9	10	10	10	10	10	10	10
		220 VAC 60 Hz	0.68	0.82	1.1	1.4	1.7	2.0	2.8	3.4	4.1	5.1	6.1	7.4	9.2	10	10	10	10	10	10	10
		230 VAC 50 Hz	0.78	0.93	1.3	1.6	1.9	2.3	3.2	3.9	4.7	5.8	7.0	8.4	10	10	10	10	10	10	10	10
	230 VAC 60 Hz	0.63	0.76	1.1	1.3	1.6	1.9	2.6	3.2	3.8	4.7	5.7	6.8	8.6	10	10	10	10	10	10	10	10
90 r/min	220 VAC	0.18	0.22	0.30	0.36	0.46	0.55	0.76	0.91	1.1	1.4	1.6	2.0	2.5	3.0	3.7	4.5	5.0	5.9	7.4	8.9	
	230 VAC	0.17	0.20	0.28	0.34	0.43	0.51	0.71	0.85	1.0	1.3	1.5	1.8	2.3	2.8	3.5	4.2	4.6	5.5	6.9	8.3	
5IK60RGU-CWE /5GU□KB	1200 r/min	50 Hz	1.1	1.3	1.9	2.2	2.8	3.4	4.2	5.0	6.0	7.6	9.1	10.9	15.2	18.2	20	20	20	20	20	20
		60 Hz	1.2	1.4	2.0	2.4	3.0	3.6	4.5	5.4	6.4	8.1	9.7	11.6	16.2	19.4	20	20	20	20	20	20
	90 r/min	220 VAC 50 Hz	0.49	0.58	0.81	0.97	1.2	1.5	1.8	2.2	2.6	3.3	4.0	4.8	6.6	7.9	8.9	10.6	11.8	14.2	17.7	20
		220 VAC 60 Hz	0.52	0.63	0.87	1.0	1.3	1.6	2.0	2.4	2.8	3.5	4.3	5.1	7.1	8.5	9.5	11.4	12.7	15.2	19.0	20
230 VAC 50 Hz	0.41	0.50	0.69	0.83	1.0	1.2	1.6	1.9	2.2	2.8	3.4	4.0	5.6	6.7	7.5	9.0	10.0	12.0	15.0	18.1	20	
230 VAC 60 Hz	0.44	0.52	0.73	0.87	1.1	1.3	1.6	2.0	2.4	3.0	3.6	4.3	5.9	7.1	8.0	9.6	10.6	12.7	15.9	19.1	20	

Reversible Motors

◇ Single-Phase 220/230 VAC

Unit = N·m

Model Motor/Gearhead	Gear Ratio Speed	3	3.6	5	6	7.5	9	12.5	15	18	25	30	36	50	60	75	90	100	120	150	180	
		Unit = N·m																				
2RK6RGN-CW2E /2GN□S	1200 r/min	220 VAC 50 Hz	0.10	0.12	0.17	0.20	0.26	0.31	0.43	0.51	0.61	0.77	0.92	1.1	1.4	1.7	2.1	2.5	2.8	3	3	3
		230 VAC 50 Hz	0.11	0.13	0.19	0.22	0.28	0.34	0.47	0.56	0.67	0.84	1.0	1.2	1.5	1.8	2.3	2.7	3	3	3	3
		60 Hz	0.12	0.15	0.20	0.24	0.30	0.36	0.51	0.61	0.73	0.91	1.1	1.3	1.7	2.0	2.5	3	3	3	3	3
90 r/min	0.12	0.15	0.20	0.24	0.30	0.36	0.51	0.61	0.73	0.91	1.1	1.3	1.7	2.0	2.5	3	3	3	3	3	3	
3RK15RGN-CW2E /3GN□S	1200 r/min	0.30	0.36	0.51	0.61	0.76	0.91	1.3	1.5	1.8	2.3	2.7	3.3	4.1	5	5	5	5	5	5	5	
	90 r/min	0.21	0.25	0.35	0.42	0.53	0.63	0.88	1.1	1.3	1.6	1.9	2.3	2.9	3.4	4.3	5	5	5	5	5	
4RK25RGN-CW2E /4GN□S	1200 r/min	0.50	0.60	0.83	1.0	1.2	1.5	2.1	2.5	3.0	3.7	4.5	5.4	6.8	8	8	8	8	8	8	8	
	90 r/min	50 Hz	0.28	0.34	0.47	0.56	0.70	0.84	1.2	1.4	1.7	2.1	2.5	3.0	3.8	4.6	5.7	6.8	7.6	8	8	8
60 Hz		0.27	0.32	0.45	0.53	0.67	0.80	1.1	1.3	1.6	2.0	2.4	2.9	3.6	4.4	5.4	6.5	7.3	8	8	8	
5RK40RGN-CW2E /5GN□S	1200 r/min	0.78	0.93	1.3	1.6	1.9	2.3	3.2	3.9	4.7	5.8	7.0	8.4	10	10	10	10	10	10	10	10	
	90 r/min	220 VAC 50 Hz	0.44	0.52	0.73	0.87	1.1	1.3	1.8	2.2	2.6	3.3	3.9	4.7	5.9	7.1	8.9	10	10	10	10	10
		220 VAC 60 Hz 230 VAC	0.41	0.50	0.69	0.83	1.0	1.2	1.7	2.1	2.5	3.1	3.7	4.5	5.6	6.7	8.4	10	10	10	10	10
5RK60RGU-CWE /5GU□KB	1200 r/min	1.2	1.4	2.0	2.4	3.0	3.6	4.5	5.4	6.4	8.1	9.7	11.6	16.2	19.4	20	20	20	20	20	20	
	90 r/min	0.68	0.82	1.1	1.4	1.7	2.0	2.6	3.1	3.7	4.6	5.5	6.7	9.2	11.1	12.4	14.9	16.5	19.8	20	20	

■ Gearmotor – Torque Table When Right-Angle Gearhead is Attached

A right-angle gearhead can be attached to 25 W, 40 W and 60 W types. → Page A-140

■ Permissible Overhung Load and Permissible Thrust Load

Motor (Round Shaft Type) → Page A-15

Gearhead → Page A-15

■ Permissible Load Inertia of Gearhead: J

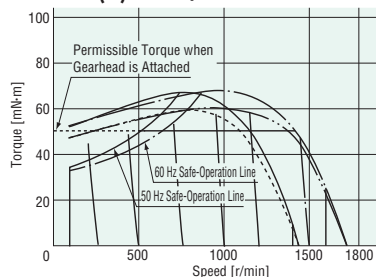
→ Page A-16

■ Speed – Torque Characteristics

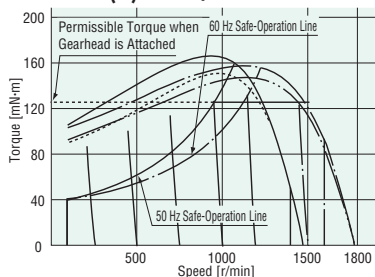
● Induction Motors

◇ Single-Phase 220/230 VAC -----220 VAC 50 Hz ———230 VAC 50 Hz - - - -220 VAC 60 Hz - · - · -230 VAC 60 Hz

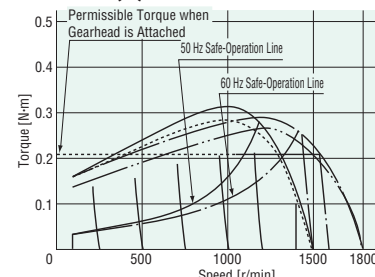
2IK6RGN(A)-CW2E/ES02



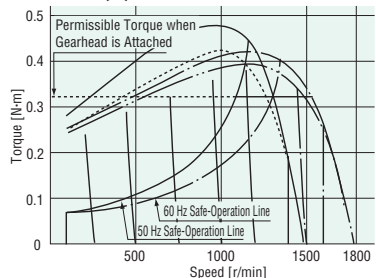
3IK15RGN(A)-CW2E/ES02



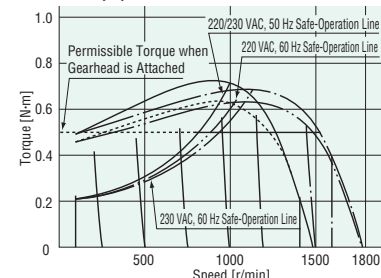
4IK25RGN(A)-CW2E/ES02



5IK40RGN(A)-CW2E/ES02



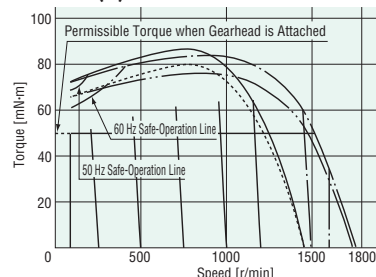
5IK60RGU(A)-CWE/ES02



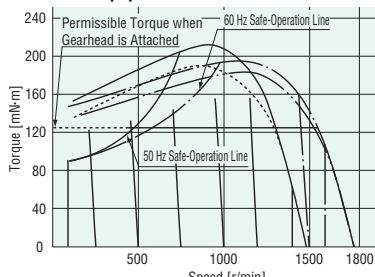
● Reversible Motors

◇ Single-Phase 220/230 VAC -----220 VAC 50 Hz ———230 VAC 50 Hz - - - -220 VAC 60 Hz - · - · -230 VAC 60 Hz

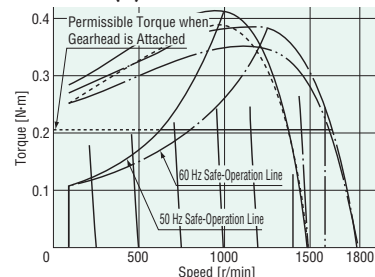
2RK6RGN(A)-CW2E/ES02



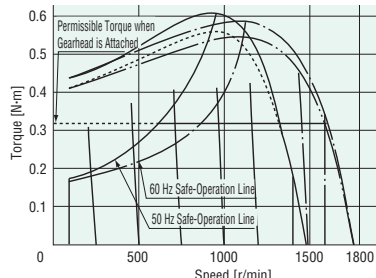
3RK15RGN(A)-CW2E/ES02



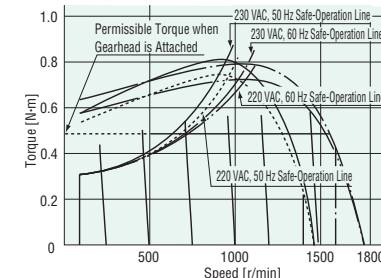
4RK25RGN(A)-CW2E/ES02



5RK40RGN(A)-CW2E/ES02



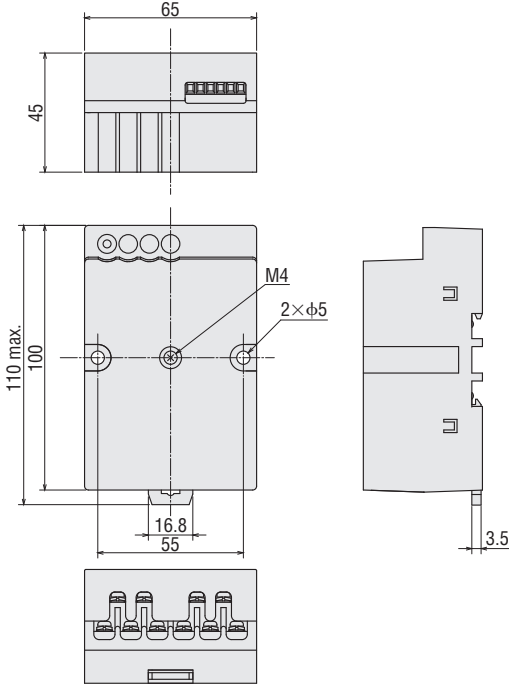
5RK60RGU(A)-CWE/ES02



Dimensions (Unit = mm)

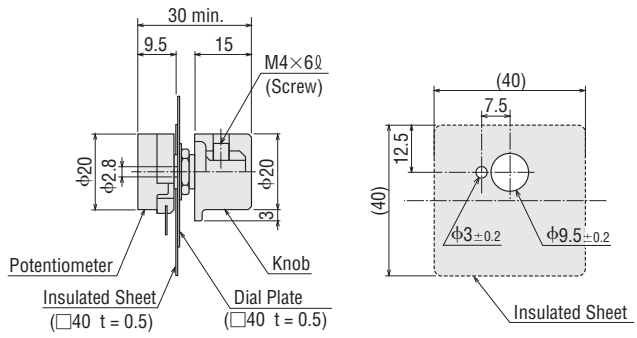
● **Speed Controller**
ES02

Mass: 0.18 kg



◇ **External Speed Potentiometer**
(Included with the speed controller)

PAVR-20KZ
Mass: 20 g



Recommended thickness of a mounting plate is a maximum 4.5 mm.

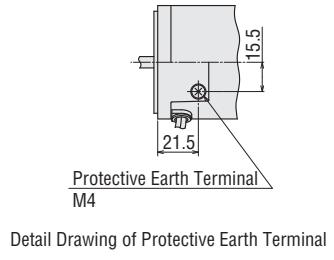
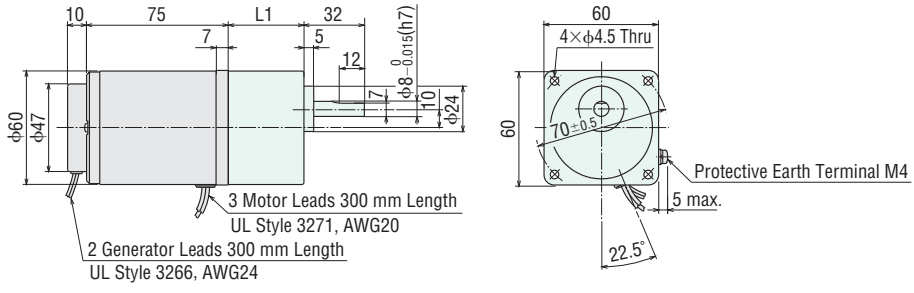
● **World K Series**

● Mounting screws are included with gearheads. Dimensions for mounting screws → Page A-246

◇ **Motor/Gearhead**

Motor Model	Gearhead Model	Gear Ratio	L1
2IK6RGN-CW2E	2GN□S	3~18	30
2RK6RGN-CW2E		25~180	40

Mass: Motor 0.8 kg
Gearhead 0.4 kg



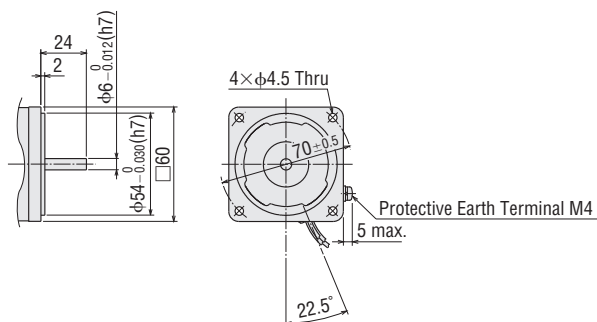
● Enter the gear ratio in the box (□) within the model name.

◇ Shaft Section of Round Shaft Type

The motor's dimensions (excluding the shaft section) are the same as those of the pinion shaft types.

2IK6RA-CW2E
2RK6RA-CW2E

Mass: 0.8 kg

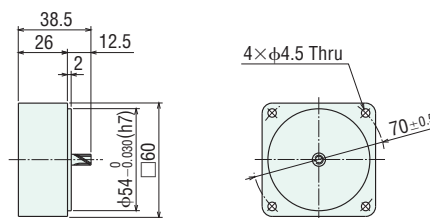


◇ Decimal Gearhead

Can be connected to **GN** pinion shaft type.

2GN10XS

Mass: 0.2 kg

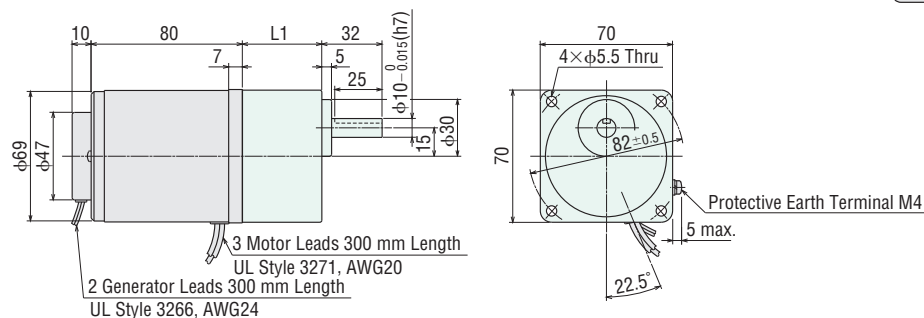


◇ Motor/Gearhead

Motor Model	Gearhead Model	Gear Ratio	L1
3IK15RGN-CW2E 3RK15RGN-CW2E	3GN□S	3~18	32
		25~180	42

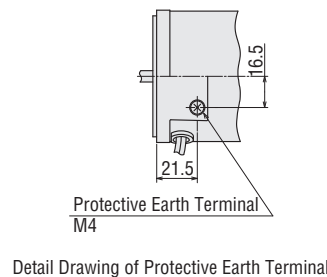
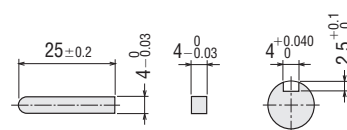
Mass: Motor 1.2 kg

Gearhead 0.55 kg



◇ Key and Key Slot

(The key is included with the gearhead)

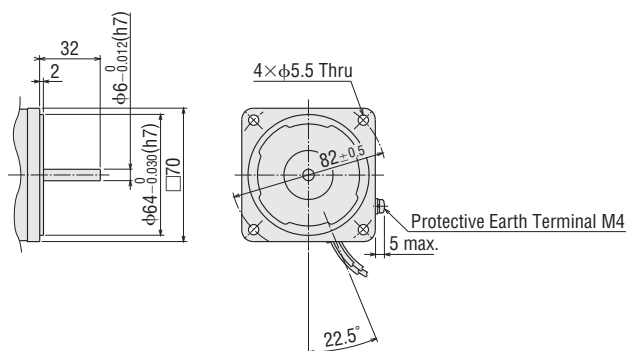


◇ Shaft Section of Round Shaft Type

The motor's dimensions (excluding the shaft section) are the same as those of the pinion shaft types.

3IK15RA-CW2E
3RK15RA-CW2E

Mass: 1.2 kg

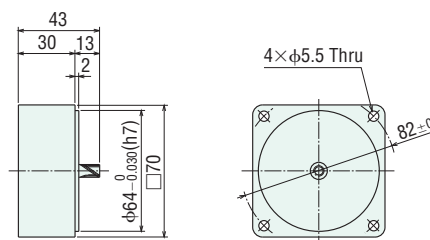


◇ Decimal Gearhead

Can be connected to **GN** pinion shaft type.

3GN10XS

Mass: 0.3 kg

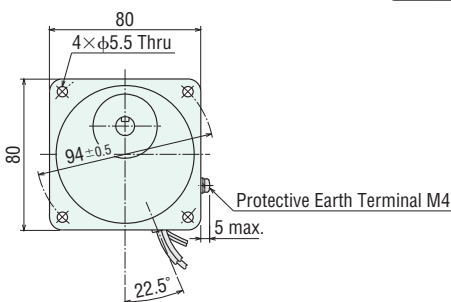
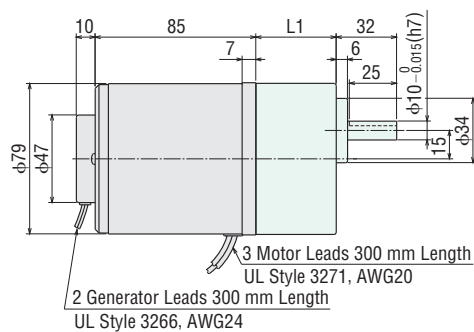


● Enter the gear ratio in the box (□) within the model name.

◇ Motor/Gearhead

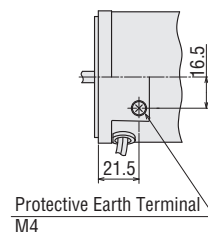
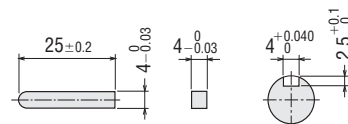
Motor Model	Gearhead Model	Gear Ratio	L1
4IK25RGN-CW2E 4RK25RGN-CW2E	4GN□S	3~18	32
		25~180	42.5

Mass: Motor 1.6 kg
Gearhead 0.65 kg



◇ Key and Key Slot

(The key is included with the gearhead)



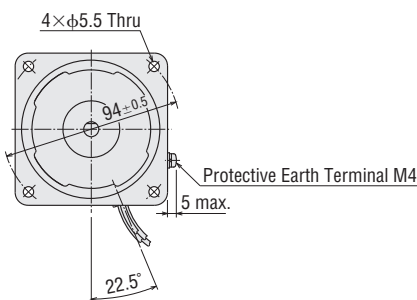
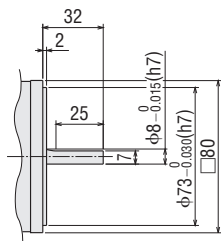
Detail Drawing of Protective Earth Terminal

◇ Shaft Section of Round Shaft Type

The motor's dimensions (excluding the shaft section) are the same as those of the pinion shaft types.

4IK25RA-CW2E
4RK25RA-CW2E

Mass: 1.6 kg

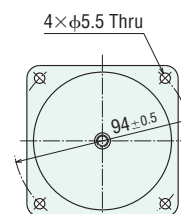
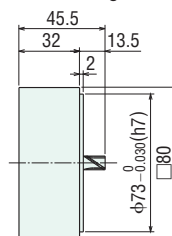


◇ Decimal Gearhead

Can be connected to **GN** pinion shaft type.

4GN10XS

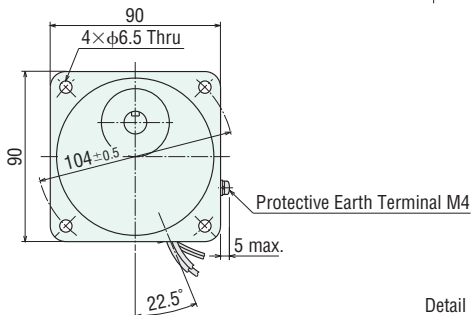
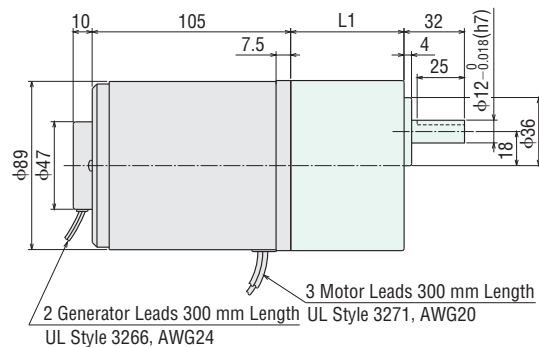
Mass: 0.4 kg



◇ Motor/Gearhead

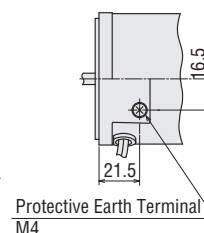
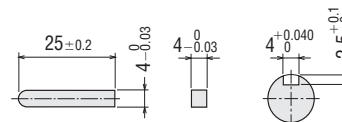
Motor Model	Gearhead Model	Gear Ratio	L1
5IK40RGN-CW2E 5RK40RGN-CW2E	5GN□S	3~18	42
		25~180	60

Mass: Motor 2.6 kg
Gearhead 1.5 kg



◇ Key and Key Slot

(The key is included with the gearhead)



Detail Drawing of Protective Earth Terminal

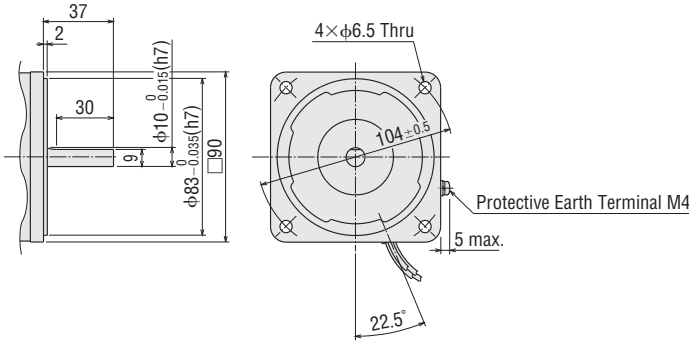
● Enter the gear ratio in the box (□) within the model name.

◇ Shaft Section of Round Shaft Type

The motor's dimensions (excluding the shaft section) are the same as those of the pinion shaft types.

5IK40RA-CW2E
5RK40RA-CW2E

Mass: 2.6 kg

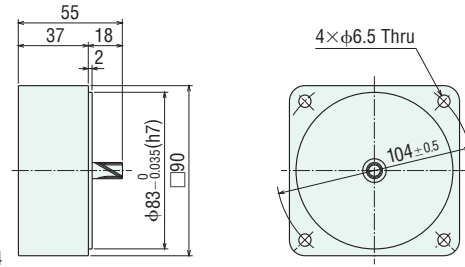


◇ Decimal Gearhead

Can be connected to **GN** pinion shaft type.

5GN10XS

Mass: 0.6 kg



◇ Motor/Gearhead

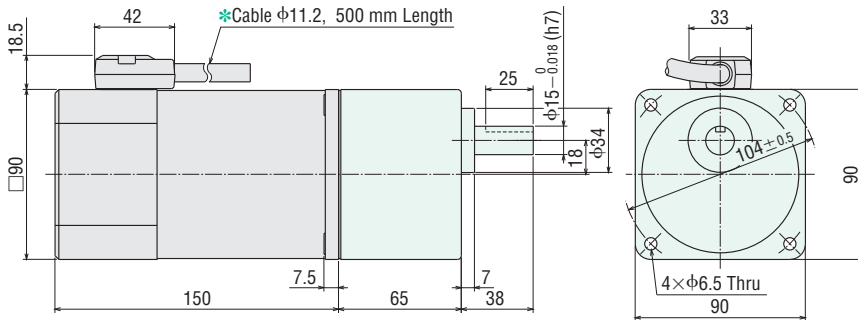
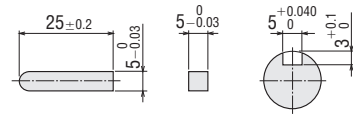
Motor Model	Gearhead Model	Gear Ratio
5IK60RGU-CWE 5RK60RGU-CWE	5GU□KB	3~180

Mass: Motor 3.2 kg

Gearhead 1.5 kg

◇ Key and Key Slot

(The key is included with the gearhead)



*Cable Cores

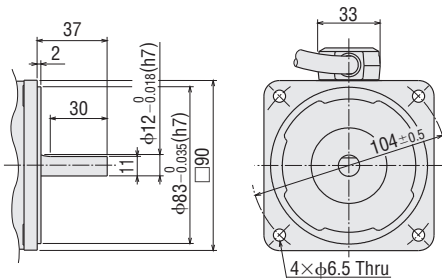
- 3 Motor Leads: UL Style 3266, AWG20
- 2 Cooling Fan Leads: UL Style 3266, AWG24
- 2 Generator Leads: UL Style 3266, AWG24

◇ Shaft Section of Round Shaft Type

The motor's dimensions (excluding the shaft section) are the same as those of the pinion shaft types.

5IK60RA-CWE
5RK60RA-CWE

Mass: 3.2 kg

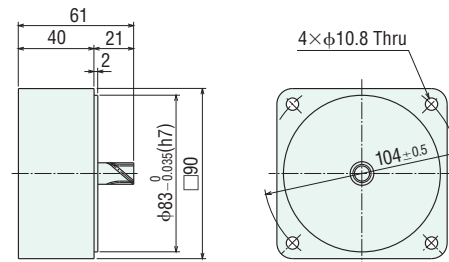


◇ Decimal Gearhead

Can be connected to **GU** pinion shaft type.

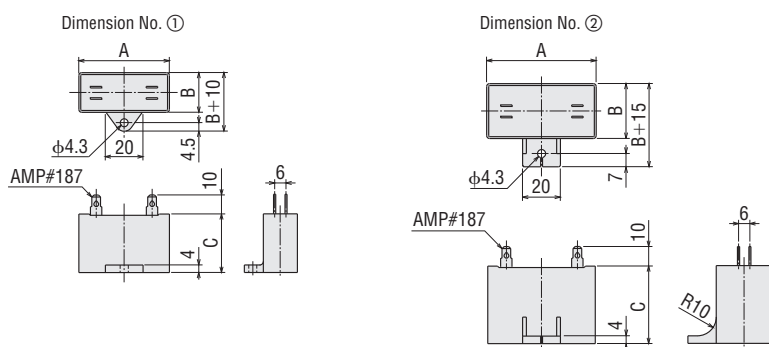
5GU10XKB

Mass: 0.6 kg



● Enter the gear ratio in the box (□) within the model name.

◇ Capacitor (Included)



◇ Capacitor Dimensions (mm)

● Induction Motor

Model Pinion Shaft Type	Capacitor Model	Dimensions (mm)			Mass (g)	Dimension No.
		A	B	C		
2IK6RGN-CW2E	CH06BFAUL	31	14.5	23.5	15	①
3IK15RGN-CW2E	CH10BFAUL	37	18	27	30	
4IK25RGN-CW2E	CH15BFAUL	38	21	31	35	
5IK40RGN-CW2E	CH23BFAUL	48	21	31	40	
5IK60RGU-CWE	CH40BFAUL	58	23.5	37	70	②

- A capacitor cap is included with a capacitor.
- The capacitors for round shaft type motors are the same as those of pinion shaft type motors with the same output and voltage.

● Reversible Motor

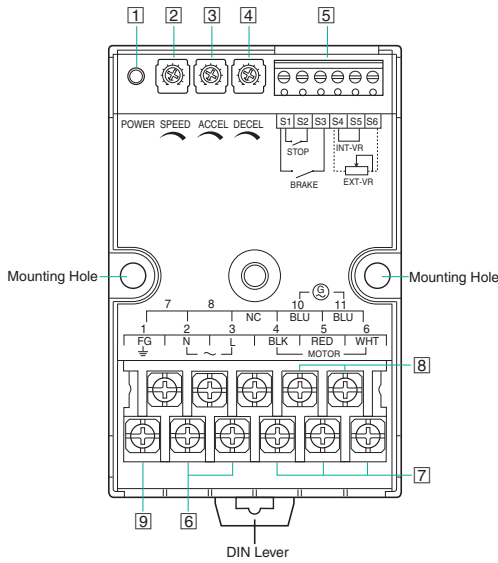
Model Pinion Shaft Type	Capacitor Model	Dimensions (mm)			Mass (g)	Dimension No.
		A	B	C		
2RK6RGN-CW2E	CH08BFAUL	31	17	27	20	①
3RK15RGN-CW2E	CH15BFAUL	38	21	31	35	
4RK25RGN-CW2E	CH25BFAUL	48	21	31	45	
5RK40RGN-CW2E	CH35BFAUL	58	22	35	55	
5RK60RGU-CWE	CH50BFAUL	58	29	41	85	②

- A capacitor cap is included with a capacitor.
- The capacitors for round shaft type motors are the same as those of pinion shaft type motors with the same output and voltage.

Connection and Operation

Names and Functions of Speed Controller Parts

The illustration shows the cover removed. Install the cover after connection.
Figures in parentheses represent pin numbers.



1 POWER LED (POWER)

Lights (green) while power is being supplied.

2 Internal speed potentiometer (SPEED)

Sets the motor's operating speed.

3 Acceleration time potentiometer (ACCEL)

Sets the acceleration time at starting of motor.

4 Deceleration time potentiometer (DECEL)

Sets the deceleration time at stopping of motor.

5 Control input terminal

S1: Common terminal for running and braking

S2: Run/Stop input

Runs (OFF) or stops (ON) the motor.

S3: Run/Brake input

Runs (OFF) or brakes (ON) the motor.

S4, S5, S6: Speed potentiometer inputs

When S4 and S5 are shorted, the speed can be set using the internal speed potentiometer (INT-VR).

When S4 and S5 are open, the speed can be set using an external speed potentiometer (EXT-VR).

When using an external speed potentiometer, connect it to S4 and S6.

6 Power connection terminal (terminals 2 and 3)

7 Motor connection terminal (terminals 4, 5 and 6)

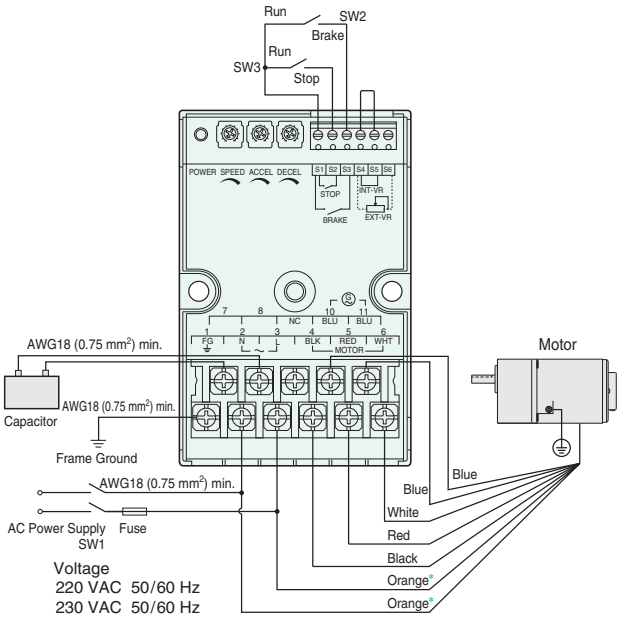
8 Generator connection terminal (terminals 10 and 11)

9 FG terminal (terminal 1)

Connection Diagrams

Uni-Directional Operation

(When using internal speed potentiometer)

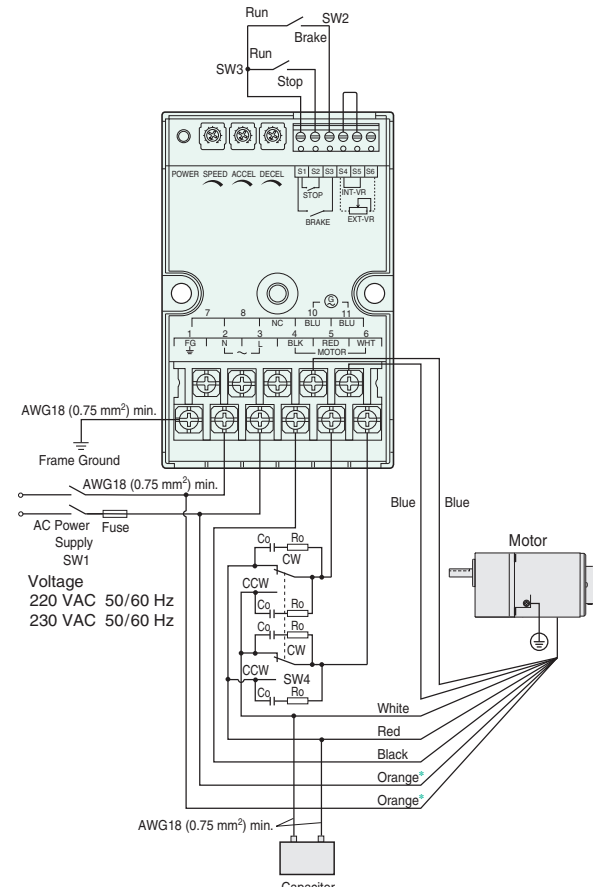


* These are leads for the cooling fan.
These should be connected only when using 60 W type.

- For uni-directional operation, connect the red lead to motor connection terminal 5, and the white lead to terminal 6. In this case, the motor rotates in the clockwise direction, as viewed from the motor output shaft.
If you connect the white lead to terminal 5 and the red lead to terminal 6, the motor rotates in the counterclockwise direction, as viewed from the motor output shaft.
- When using external speed potentiometer, refer to page A-192.
- How to connect a capacitor → Page A-247

Bi-Directional Operation

(When using internal speed potentiometer)



* These are leads for the cooling fan.
These should be connected only when using 60 W type.

● Specifications of the Switches and Fuse

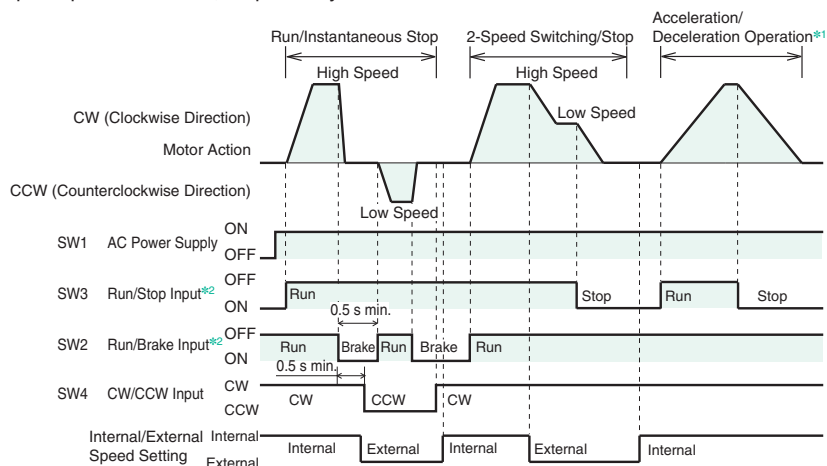
Power Supply Voltage	220/230 VAC
SW1	250 VAC 5 A
SW2, SW3	18 VDC 1 mA
SW4	250 VAC 5 A
R ₀ , C ₀ (CR circuit for surge suppression)	R ₀ = 5~200 Ω, C ₀ = 0.1~0.2 μF, 400 WV
Fuse	Product recognized by UL/CSA in accordance with UL/CSA248-14 or equivalent, 250 VAC 5 A

Notes:

- The control input terminals are not insulated from the AC power supply. Any equipment (programmable controller, relay and switch) that will be connected to the control input terminals must have contact ratings of 18 VDC and 1 mA min. Do not use a transistor output type controller.
- The length of the cable connecting the motor and speed controller should be 10 m or less. The length of the control cable should be 2 m or less and as short as possible.
- Be sure to connect a CR circuit for surge suppression across SW4. **EPCR1201-2** (CR circuit) is available as an accessory. → Page A-240

● Timing Chart

The timing chart below shows an example of two-level speed control operation when the high speed and low speed are selected via the internal and external speed potentiometers, respectively.



*1 Case where the acceleration and deceleration times are set longer by turning each potentiometer clockwise.
 *2 In case SW2 and SW3 are turned on at the same time, Brake input (SW2) is given priority.

◇ Run/Brake, Stop

Setting SW2/SW3 to "Run" (OFF) causes the motor to rotate at the speed set via the speed potentiometers.
 Setting SW2 to "Brake" (ON) during operation causes the motor to stop instantaneously.
 Setting SW3 to "Stop" (ON) during operation causes the motor to coast to a stop.

Run/Stop Input	Run/Brake Input	Motor Operation
OFF	OFF	Run
OFF	ON	Instantaneous stop
ON	OFF	Coast to a stop*

* The deceleration time set with a potentiometer is longer than the time which motor coasts to a stop, motor will stop with deceleration time.

The braking function (current through the motor) is only active for approximately 0.4 seconds after the Run/Brake input is turned ON. Do not switch SW2, SW3, SW4 within 0.5 seconds after Run/Brake input is turned ON.

◇ Switching the Rotation Direction

SW4 is used to switch the rotation direction of motor. When SW4 is set to CW, the motor rotates in the clockwise direction, as viewed from the motor output shaft. When SW4 is set to CCW, the motor rotates in the counterclockwise direction, as viewed from the motor output shaft.

- Be sure to connect a surge suppressor to SW4. Failure to do so may damage the speed controller. **EPCR1201-2** CR circuit for surge suppression is available as an accessory. → Page A-240
- Instant switching between forward and reverse operation is possible with a reversible motor.
- For bi-directional operation of an induction motor, switch the rotation direction after the motor has come to a complete stop.

● Speed Setting Methods

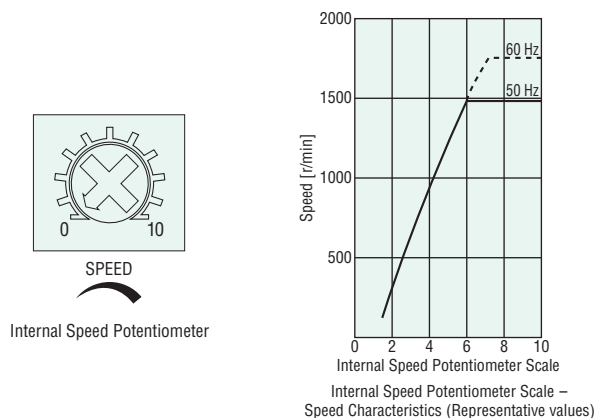
The following two methods of setting speed can be used. Multi-motor control or DC voltage control cannot be used.

◇ Internal Speed Potentiometer

The setting speed range is 90 to 1400 r/min at 50 Hz or 90 to 1600 r/min at 60 Hz.

Short the speed potentiometer input terminals S4 and S5. When the dial on the internal speed potentiometer is turned in the clockwise direction, the set speed will be faster.

The factory setting is 0 r/min.

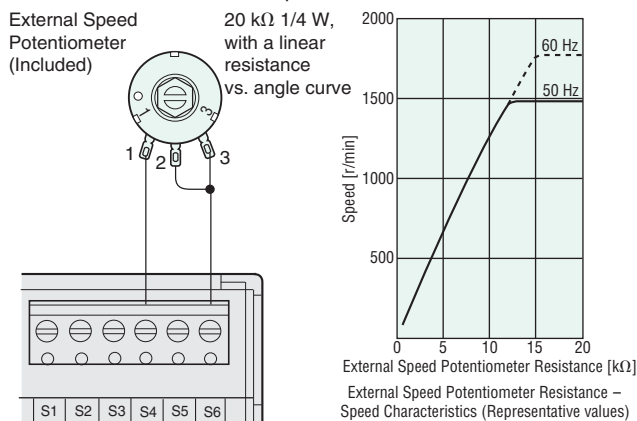


◇ External Speed Potentiometer (Included)

Open the speed potentiometer input terminals S4 and S5.

Before connecting, turn the dial on the external speed potentiometer in the counterclockwise direction to set the speed to 0 r/min.

When the dial on the external speed potentiometer is turned in the clockwise direction, the set speed will be faster.

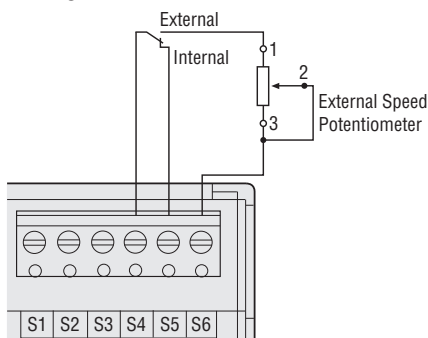


Note:

- Do not operate multiple speed controllers with a single external speed potentiometer. This may damage the speed controllers.

● Two-Level Speed Control

The motor can be controlled over two-level speed by switching between the internal and external speed potentiometers. Select the internal speed potentiometer or external speed potentiometer with speed setting switch.



Note:

The control input terminals are not insulated from the AC power supply. Any equipment (programmable controller, relay and switch) that will be connected to the control input terminals must have contact ratings of 18 VDC and 1 mA min. Do not use a transistor output type programmable controller.

● Acceleration (ACCEL) and Deceleration (DECEL) Operation

Equipment and loads are subject to large acceleration/deceleration force when starting, stopping, and changing speed. When you want to accelerate/decelerate without any accompanying shock, the acceleration/deceleration time can be extended using the acceleration/deceleration function. The acceleration/deceleration time can be set using acceleration/deceleration time potentiometers built in the controller. The setting range is approximately 0.5 to 10 seconds (at 1000 r/min, with no inertial load).

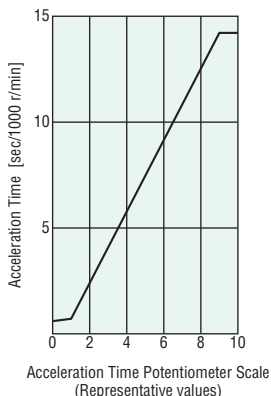
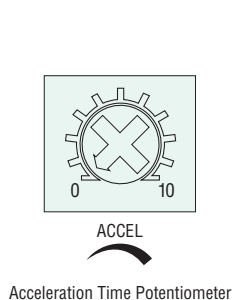
However, when the load inertia is large, the deceleration time cannot be set at a shorter time than when the motor is coasted to a stop.

◇ Acceleration (ACCEL)

The acceleration function is activated at starting or when the speed is switched to the higher setting in a two-level speed control.

When the dial on the acceleration time potentiometer is turned in the clockwise direction, the set time will be longer.

The factory setting is 0 (no acceleration).

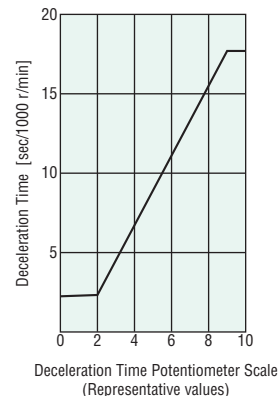
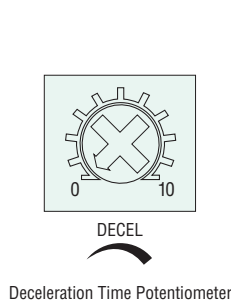


◇ Deceleration (DECEL)

The deceleration function is activated at coast to a stop or when the speed is switched to the lower setting in a two-level speed control.

When the dial on the deceleration time potentiometer is turned in the clockwise direction, the set time will be longer.

The factory setting is 0 (no deceleration).



● Repeated Operation/Braking Cycle

When running/braking of the motor is repeated in short cycles, the motor temperature rise will increase and the continuous operation time will be limited. Use the following values as shown below.

The motor may generate heat depending on drive conditions. Ensure that the temperature of the motor case does not exceed 90°C.

Motor Output	Repetition Cycle
6 W ~ 40 W	2 seconds min. (Running 1 second, stopping 1 second)
60 W	4 seconds min. (Running 2 seconds, stopping 2 seconds)

● Braking Current

● When the motor is stopped instantaneously, a large braking current flows through the motor. When connecting a circuit breaker (or fuse), refer to the table below for the braking current (peak value) and select its current capacity.

● Be careful that repeated motor running and braking may cause the motor's temperature to rise.

Motor Output Power	Braking Current (Peak value) [A]
	Single-Phase 220/230 VAC
6 W	1.0
15 W	2.0
25 W	4.0
40 W	6.0
60 W	8.0