AC Servomotors [1S-series]
R88M-1L□/-1M□

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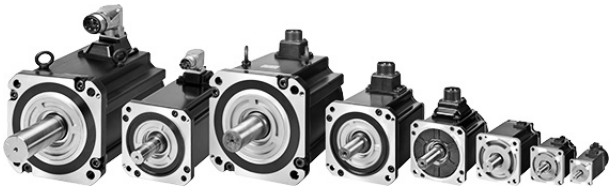


Ordering Information

Refer to the Ordering Information.

Specifications

General Specifications

Item			Specifications
Operating ambient temperature and humidity			0 to 40°C 20% to 90% (with no condensation)
Storage ambient temperature and humidity			-20 to 65°C 20% to 90% (with no condensation)
Operating and storage atmosphere			No corrosive gases
Vibration resistance ✻1			Acceleration of 49 m/s^2 ✻2 24.5 m/s^2 max. in X, Y, and Z directions when the motor is stopped
Impact resistance			Acceleration of 98 m/s^2 max. 3 times each in X, Y, and Z directions
Insulation resistance			Between power terminals and FG terminals: 10 MΩ min. (at 500 VDC Megger)
Dielectric strength			Between power terminals and FG terminals: 1,500 VAC for 1 min (voltage 100 V, 200 V) Between power terminals and FG terminals: 1,800 VAC for 1 min (voltage 400 V) Between brake terminal and FG terminals: 1,000 VAC for 1 min
Insulation class			Class F
Protective structure			IP67 (except for the through-shaft part and connector pins) IP20 if you use a 30-meter or longer encoder cable.
International standard	**EU Directives and UK legislation**	**Low Voltage**	EN 60034-1/-5
	UL standards		UL 1004-1/-6
	CSA standards		CSA C22.2 No.100 (with cUR mark)

✻1. The amplitude may be increased by machine resonance. As a guideline, 80% of the specified value must not be exceeded.
✻2. 24.5 m/s^2 for servomotors of 7.5 kW or more.
Note: 1. Do not use the cable when it is laying in oil or water.
2. Do not expose the cable outlet or connections to stress due to bending or its own weight.

Encoder Specifications

Item	Specifications
Encoder system	Optical batteryless absolute encoder
Resolution per rotation	23 bits
Multi-rotation data hold	16 bits
Power supply voltage	5 VDC±10%
Current consumption	230 mA max.
Output signal	Serial communications
Output interface	RS485 compliant

Note: It is possible to use an absolute encoder as an incremental encoder.
Refer to the *AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT® Communications User's Manual* (Cat.No.I586) for details.

Characteristics

3,000-r/min Servomotors

Item		Model (R88M-) / Unit	100 VAC			
			1M05030S	1M10030S	1M20030S	1M40030S
Rated output ✻1 ✻2		W	50	100	200	400
Rated torque ✻1 ✻2		N·m	0.159	0.318	0.637	1.27
Rated rotation speed ✻1 ✻2		r/min	3,000			
Maximum rotation speed		r/min	6,000			
Momentary maximum torque ✻1 ✻3		N·m	0.48	0.95	1.91	3.8
Rated current ✻1 ✻2		A (rms)	1.20	1.50	2.50	4.8
Momentary maximum current ✻1		A (rms)	4.00	4.70	8.40	14.7
Rotor inertia	Without brake	× 10^{-4} kg·m^2	0.0418	0.0890	0.2232	0.4452
	With brake	× 10^{-4} kg·m^2	0.0496	0.0968	0.2832	0.5052
Applicable load inertia		× 10^{-4} kg·m^2	0.810	1.62	4.80	8.40
Torque constant ✻1		N·m/ A (rms)	0.14	0.24	0.28	0.30
Power rate ✻1 ✻5		kW/s	6.7	11.9	18.5	36.6
Mechanical time constant ✻5		ms	1.7	1.1	0.76	0.61
Electrical time constant		ms	0.67	0.84	2.4	2.4
Allowable radial load ✻6		N	68	68	245	245
Allowable thrust load ✻6		N	58	58	88	88
Weight	Without brake	kg	0.35	0.52	1.0	1.4
	With brake	kg	0.59	0.77	1.3	1.9
Radiator plate dimensions (material)		mm	250 × 250 × t6 (aluminum)			
Brake specifications ✻7	Excitation voltage ✻8	V	24 VDC±10%			
	Current consumption (at 20°C)	A	0.27	0.27	0.32	0.32
	Static friction torque	N·m	0.32 min.	0.32 min.	1.37 min.	1.37 min.
	Attraction time	ms	25 max.	25 max.	30 max.	30 max.
	Release time ✻9	ms	15 max.	15 max.	20 max.	20 max.
	Backlash	°	1.2 max.	1.2 max.	1.2 max.	1.2 max.
	Allowable braking work	J	9	9	60	60
	Allowable total work	J	9000	9,000	60,000	60,000
	Allowable angular acceleration	rad/s^2	10,000 max.			
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.			
	Insulation class	---	Class F			

For models with an oil seal, the following derating is used due to increase in friction torque.

Item	Unit	Model (R88M-) 1M05030S-O/ -OS2/ -BO/ -BOS2	1M10030S-O/ -OS2/ -BO/ -BOS2	1M20030S-O/ -OS2/ -BO/ -BOS2	1M40030S-O/ -OS2/ -BO/ -BOS2
Derating rate	%	90	95	95	80
Rated output	W	45	95	190	320
Rated current	A (rms)	1.20	1.50	2.50	4.0

Item		Model (R88M-) / Unit	200 VAC				
			1M05030T	1M10030T	1M20030T	1M40030T	1M75030T
Rated output ✻1 ✻2		W	50	100	200	400	750
Rated torque ✻1 ✻2		N·m	0.159	0.318	0.637	1.27	2.39
Rated rotation speed ✻1 ✻2		r/min	3,000				
Maximum rotation speed		r/min	6,000				
Momentary maximum torque ✻1 ✻3		N·m	0.56 ✻4	1.11 ✻4	2.2 ✻4	4.5 ✻4	8.4 ✻4
Rated current ✻1 ✻2		A (rms)	0.67	0.84	1.5	2.5	4.6
Momentary maximum current ✻1		A (rms)	2.60	3.10	5.6	9.1	16.9
Rotor inertia	Without brake	× 10^{-4} kg·m^2	0.0418	0.0890	0.2232	0.4452	1.8242
	With brake	× 10^{-4} kg·m^2	0.0496	0.0968	0.2832	0.5052	2.0742
Applicable load inertia		× 10^{-4} kg·m^2	0.810	1.62	4.80	8.40	19.4
Torque constant ✻1		N·m/ A (rms)	0.25	0.42	0.48	0.56	0.59
Power rate ✻1 ✻5		kW/s	6.7	11.9	18.5	36.6	31.4
Mechanical time constant ✻5		ms	1.7	1.2	0.78	0.56	0.66
Electrical time constant		ms	0.67	0.83	2.4	2.6	3.3
Allowable radial load ✻6		N	68	68	245	245	490
Allowable thrust load ✻6		N	58	58	88	88	196
Weight	Without brake	kg	0.35	0.52	1.0	1.4	2.9
	With brake	kg	0.59	0.77	1.3	1.9	3.9
Radiator plate dimensions (material)		mm	250 × 250 × t6 (aluminum)				
Brake specifications ✻7	Excitation voltage ✻8	V	24 VDC±10%				
	Current consumption (at 20°C)	A	0.27	0.27	0.32	0.32	0.37
	Static friction torque	N·m	0.32 min.	0.32 min.	1.37 min.	1.37 min.	2.55 min.
	Attraction time	ms	25 max.	25 max.	30 max.	30 max.	40 max.
	Release time ✻9	ms	15 max.	15 max.	20 max.	20 max.	35 max.
	Backlash	°	1.2 max.	1.2 max.	1.2 max.	1.2 max.	1.0 max.
	Allowable braking work	J	9	9	60	60	250
	Allowable total work	J	9000	9,000	60,000	60,000	250,000
	Allowable angular acceleration	rad/s^2	10,000 max.				
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.				
	Insulation class	---	Class F				

For models with an oil seal, the following derating is used due to increase in friction torque.

Item	Model (R88M-) / Unit	1M05030T-O/ -OS2/ -BO/ -BOS2	1M10030T-O/ -OS2/ -BO/ -BOS2	1M20030T-O/ -OS2/ -BO/ -BOS2	1M40030T-O/ -OS2/ -BO/ -BOS2	1M75030T-O/ -OS2/ -BO/ -BOS2
Derating rate	%	90	95	95	80	90
Rated output	W	45	95	190	320	675
Rated current	A (rms)	0.67	0.84	1.5	2.1	4.2

Item		Model (R88M-) / Unit	200 VAC					
			1L1K030T	1L1K530T	1L2K030T	1L3K030T	1L4K030T	1L4K730T
Rated output ✻1 ✻2		W	1,000	1,500	2,000	3,000	4,000	4,700
Rated torque ✻1 ✻2		N·m	3.18	4.77	6.37	9.55	12.7	15.0
Rated rotation speed ✻1 ✻2		r/min	3,000					
Maximum rotation speed		r/min	5,000					
Momentary maximum torque ✻1 ✻3		N·m	9.55	14.3	19.1	28.7	38.2	47.7
Rated current ✻1 ✻2		A (rms)	5.2	8.8	12.5	17.1	22.8	25.7
Momentary maximum current ✻1		A (rms)	16.9	28.4	41.0	54.7	74	84.8
Rotor inertia	Without brake	× 10^{-4} kg·m^2	2.1042	2.1042	2.4042	6.8122	8.8122	10.6122
	With brake	× 10^{-4} kg·m^2	2.5542	2.5542	2.8542	7.3122	11.3122	13.1122
Applicable load inertia		× 10^{-4} kg·m^2	35.3	47.6	60.2	118	213	279
Torque constant ✻1		N·m/ A (rms)	0.67	0.58	0.56	0.64	0.63	0.65
Power rate ✻1 ✻5		kW/s	48	108	169	134	183	209
Mechanical time constant ✻5		ms	0.58	0.58	0.50	0.47	0.37	0.37
Electrical time constant		ms	5.9	6.1	6.4	11	12	12
Allowable radial load ✻6		N	490				880	
Allowable thrust load ✻6		N	196				343	
Weight	Without brake	kg	5.7	5.7	6.4	11.5	13.5	16
	With brake	kg	7.4	7.4	8.1	12.5	16	18.5
Radiator plate dimensions (material)		mm	400 × 400 × t20 (aluminum)		470 × 470 × t20 (aluminum)			540 × 540 × t20 (aluminum)
Brake specifications ✻7	Excitation voltage ✻8	V	24 VDC±10%					
	Current consumption (at 20°C)	A	0.70	0.70	0.70	0.66	0.6	0.6
	Static friction torque	N·m	9.3 min.	9.3 min.	9.3 min.	12.0 min.	16 min.	16 min.
	Attraction time	ms	100 max.	100 max.	100 max.	100 max.	150 max.	150 max.
	Release time ✻9	ms	30 max.	30 max.	30 max.	30 max.	50 max.	50 max.
	Backlash	°	1.0 max.	1.0 max.	1.0 max.	0.8 max.	0.6 max.	0.6 max.
	Allowable braking work	J	500	500	500	1,000	350	350
	Allowable total work	J	900,000	900,000	900,000	3,000,000	1,000,000	1,000,000
	Allowable angular acceleration	rad/s^2	10,000 max.					
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.					
	Insulation class	---	Class F					

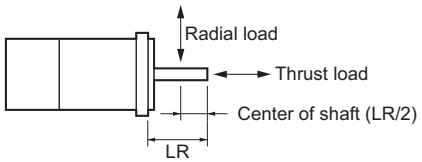
Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

Item		Model (R88M-) / Unit	400 VAC		
			1L75030C	1L1K030C	1L1K530C
Rated output ✻1 ✻2		W	750	1,000	1,500
Rated torque ✻1 ✻2		N·m	2.39	3.18	4.77
Rated rotation speed ✻1 ✻2		r/min	3,000		
Maximum rotation speed		r/min	5,000		
Momentary maximum torque ✻1 ✻3		N·m	7.16	9.55	14.3
Rated current ✻1 ✻2		A (rms)	3.0	3.0	4.5
Momentary maximum current ✻1		A (rms)	9.6	9.6	14.1
Rotor inertia	Without brake	× 10^{-4} kg·m^2	1.3042	2.1042	2.1042
	With brake	× 10^{-4} kg·m^2	1.7542	2.5542	2.5542
Applicable load inertia		× 10^{-4} kg·m^2	38.6	35.3	47.6
Torque constant ✻1		N·m/ A (rms)	0.91	1.17	1.17
Power rate ✻1 ✻5		kW/s	44	48	108
Mechanical time constant ✻5		ms	1.09	0.6	0.58
Electrical time constant		ms	4.3	5.9	5.9
Allowable radial load ✻6		N	490		
Allowable thrust load ✻6		N	196		
Weight	Without brake	kg	4.1	5.7	5.7
	With brake	kg	5.8	7.4	7.4
Radiator plate dimensions (material)		mm	305 × 305 × t20 (aluminum)	400 × 400 × t20 (aluminum)	
Brake specifications ✻7	Excitation voltage ✻8	V	24 VDC±10%		
	Current consumption (at 20°C)	A	0.70	0.70	0.70
	Static friction torque	N·m	9.3 min.	9.3 min.	9.3 min.
	Attraction time	ms	100 max.	100 max.	100 max.
	Release time ✻9	ms	30 max.	30 max.	30 max.
	Backlash	°	1.0 max.	1.0 max.	1.0 max.
	Allowable braking work	J	500	500	500
	Allowable total work	J	900,000	900,000	900,000
	Allowable angular acceleration	rad/s^2	10,000 max.		
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.		
	Insulation class	---	Class F		

Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

Item		Model (R88M-) / Unit	400 VAC			
			1L2K030C	1L3K030C	1L4K030C	1L5K030C
Rated output ✻1 ✻2		W	2,000	3,000	4,000	5,000
Rated torque ✻1 ✻2		N·m	6.37	9.55	12.7	15.9
Rated rotation speed ✻1 ✻2		r/min	3,000			
Maximum rotation speed		r/min	5,000			
Momentary maximum torque ✻1 ✻3		N·m	19.1	28.7	38.2	47.7
Rated current ✻1 ✻2		A (rms)	6.3	8.7	12.8	13.6
Momentary maximum current ✻1		A (rms)	19.8	27.7	42.4	42.4
Rotor inertia	Without brake	× 10^{-4} kg·m^2	2.4042	6.8122	8.8122	10.6122
	With brake	× 10^{-4} kg·m^2	2.8542	7.3122	11.3122	13.1122
Applicable load inertia		× 10^{-4} kg·m^2	60.2	118	213	279
Torque constant ✻1		N·m/ A (rms)	1.15	1.23	1.11	1.32
Power rate ✻1 ✻5		kW/s	169	134	183	238
Mechanical time constant ✻5		ms	0.52	0.49	0.36	0.35
Electrical time constant		ms	6.3	11	12	13
Allowable radial load ✻6		N	490		880	
Allowable thrust load ✻6		N	196		343	
Weight	Without brake	kg	6.4	11.5	13.5	16
	With brake	kg	8.1	12.5	16	18.5
Radiator plate dimensions (material)		mm	470 × 470 × t20 (aluminum)			540 × 540 × t20 (aluminum)
Brake specifications ✻7	Excitation voltage ✻8	V	24 VDC±10%			
	Current consumption (at 20°C)	A	0.70	0.66	0.6	0.6
	Static friction torque	N·m	9.3 min.	12 min.	16 min.	16 min.
	Attraction time	ms	100 max.	100 max.	150 max.	150 max.
	Release time ✻9	ms	30 max.	30 max.	50 max.	50 max.
	Backlash	°	1.0 max.	0.8 max.	0.6 max.	0.6 max.
	Allowable braking work	J	500	1,000	350	350
	Allowable total work	J	900,000	3,000,000	1,000,000	1,000,000
	Allowable angular acceleration	rad/s^2	10,000 max.			
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.			
	Insulation class	---	Class F			

✻1. This is a typical value for when the Servomotor is used at a normal temperature (20°C, 65%) in combination with a Servo Drive.
✻2. The rated values are the values with which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
✻3. The momentary maximum torque is approximately 300% of the rated torque, except for some models.
✻4. The momentary maximum torque is approximately 350% of the rated torque. Output at the momentary maximum torque shortens detection time of the overload protection function. Refer to Electronic Thermal Function in the *AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT® Communications User's Manual* (Cat.No.I586) for details.
✻5. This value is for models without options.
✻6. The allowable radial and thrust loads are the values determined for a limit of 20,000 hours at normal operating temperatures.
The allowable radial loads are applied as shown in the following diagram.

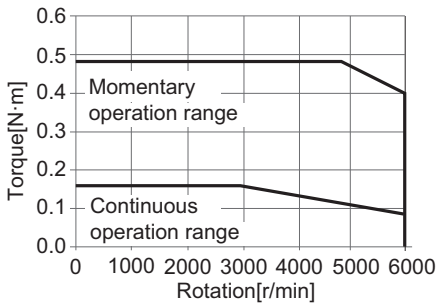


✻7. When the brake is released for a vertical axis, refer to the *AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT® Communications User's Manual* (Cat.No.I586) to set an appropriate value for Brake Interlock Output (4610 hex).
✻8. This is a non-excitation brake. It is released when excitation voltage is applied.
✻9. This value is a reference value.
Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

Torque-Rotation Speed Characteristics for 3,000-r/min Servomotors (100 VAC)

The following graphs show the characteristics with a 3-m standard cable and a 100 VAC input.

• R88M-1M05030S



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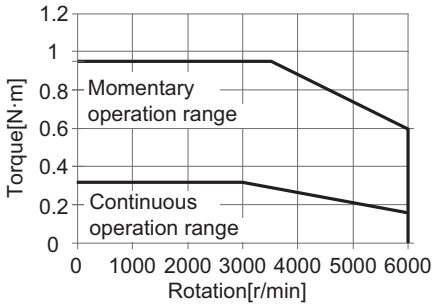
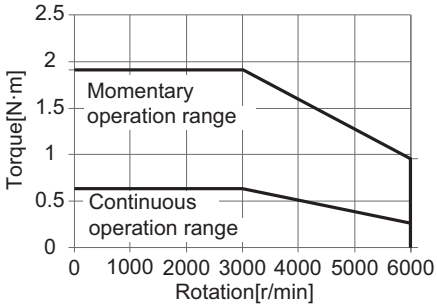
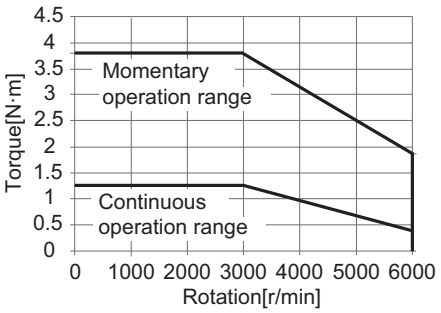


• R88M-1M20030S



• R88M-1M40030S

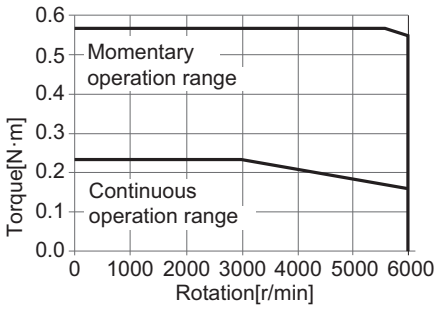


Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

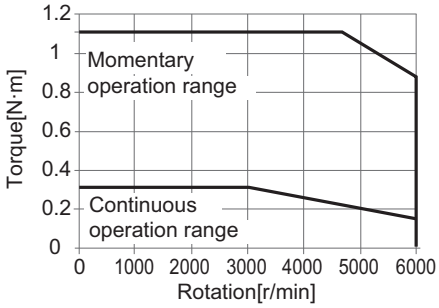
Torque-Rotation Speed Characteristics for 3,000-r/min Servomotors (200 VAC)

The following graphs show the characteristics with a 3-m standard cable and a 3-phase 200-VAC or single-phase 220-VAC input.

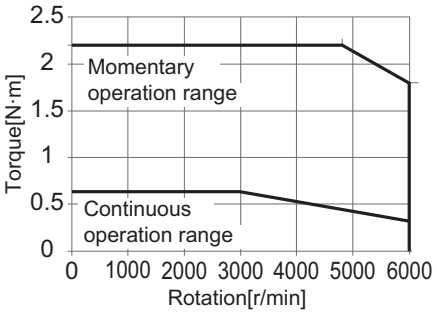
• R88M-1M05030T



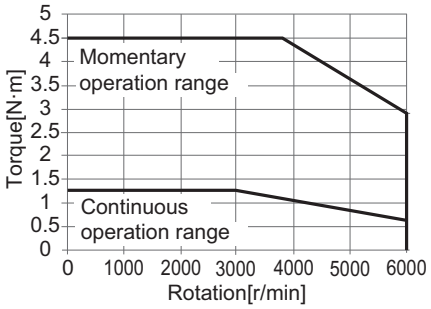
• R88M-1M10030T



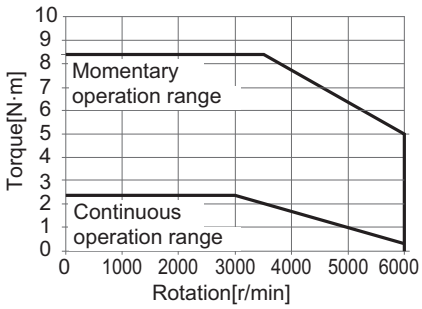
• R88M-1M20030T



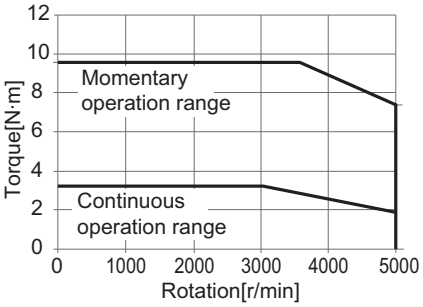
• R88M-1M40030T



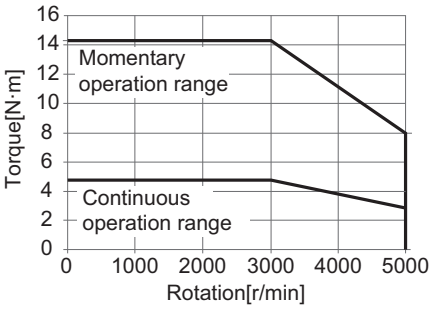
• R88M-1M75030T



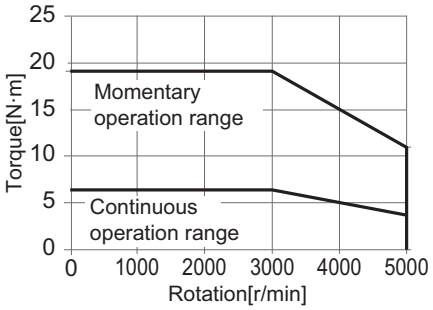
• R88M-1L1K030T



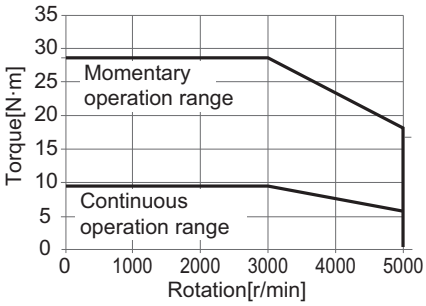
• R88M-1L1K530T



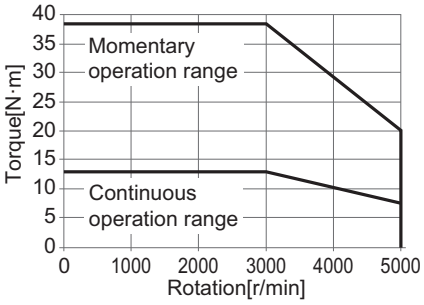
• R88M-1L2K030T



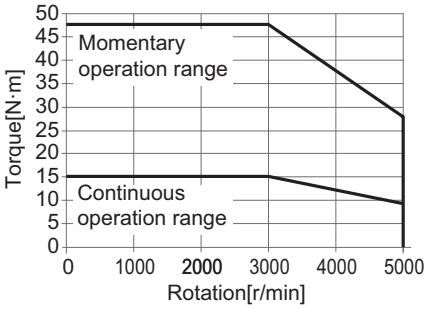
• R88M-1L3K030T



• R88M-1L4K030T



• R88M-1L4K730T

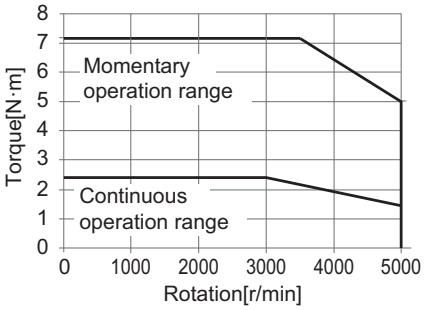


Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

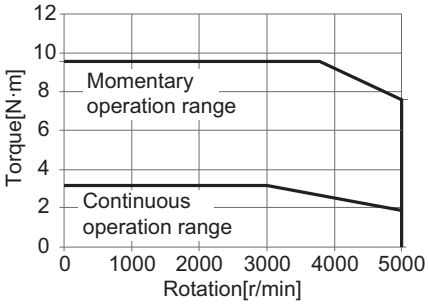
Torque-Rotation Speed Characteristics for 3,000-r/min Servomotors (400 VAC)

The following graphs show the characteristics with a 3-m standard cable and a 3-phase 400 VAC input.

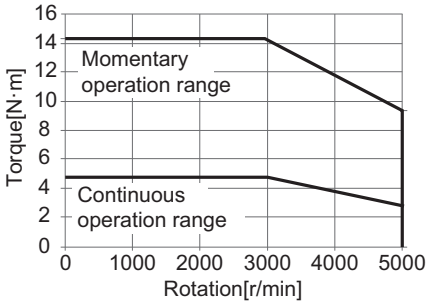
• R88M-1L75030C



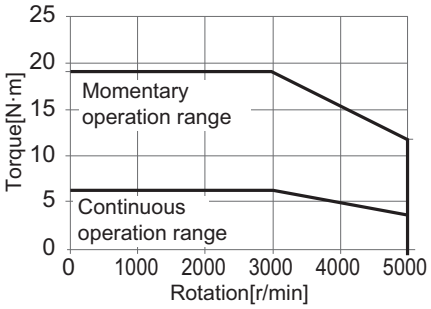
• R88M-1L1K030C



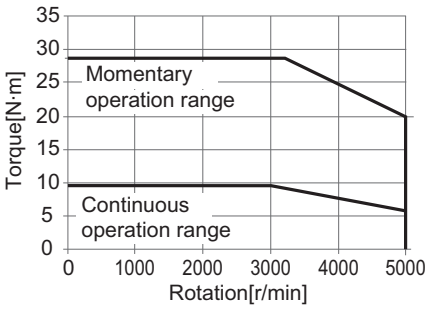
• R88M-1L1K530C



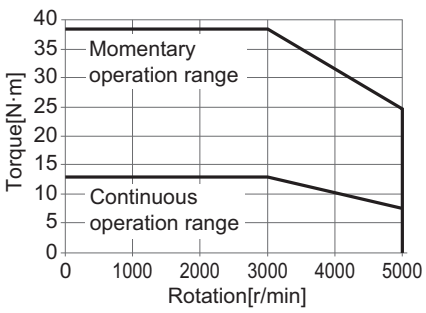
• R88M-1L2K030C



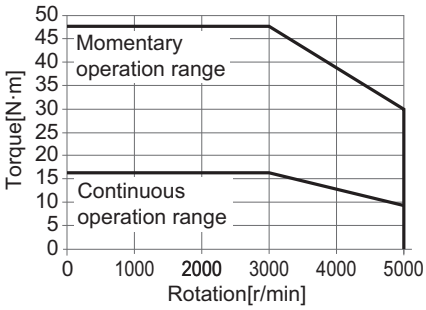
• R88M-1L3K030C



• R88M-1L4K030C



• R88M-1L5K030C



Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

2,000-r/min Servomotors

Item		Model (R88M-) / Unit	200 VAC			
			1M1K020T	1M1K520T	1M2K020T	1M3K020T
Rated output ✻1 ✻2		W	1,000	1,500	2,000	3,000
Rated torque ✻1 ✻2		N·m	4.77	7.16	9.55	14.3
Rated rotation speed ✻1 ✻2		r/min	2,000			
Maximum rotation speed		r/min	3,000			
Momentary maximum torque ✻1		N·m	14.3	21.5	28.7	43.0
Rated current ✻1 ✻2		A (rms)	5.2	8.6	11.3	15.7
Momentary maximum current ✻1		A (rms)	16.9	28.4	40.6	54.7
Rotor inertia	Without brake	× 10^{-4} kg·m^2	6.0042	9.0042	12.2042	15.3122
	With brake	× 10^{-4} kg·m^2	6.5042	9.5042	12.7042	17.4122
Applicable load inertia		× 10^{-4} kg·m^2	59.0	79.9	100	142
Torque constant ✻1		N·m/ A (rms)	0.93	0.83	0.85	0.93
Power rate ✻1 ✻3		kW/s	38	57	75	134
Mechanical time constant ✻3		ms	0.94	0.78	0.81	0.80
Electrical time constant		ms	13	15	14	19
Allowable radial load ✻4		N	490			784
Allowable thrust load ✻4		N	196			343
Weight	Without brake	kg	6.6	8.5	10	12
	With brake	kg	8.6	10.5	12	15
Radiator plate dimensions (material)		mm	400 × 400 × t20 (aluminum)	470 × 470 × t20 (aluminum)		
Brake specifications ✻5	Excitation voltage ✻6	V	24 VDC±10%			
	Current consumption (at 20°C)	A	0.51	0.51	0.66	0.60
	Static friction torque	N·m	9.0 min.	9.0 min.	12 min.	16 min.
	Attraction time	ms	100 max.	100 max.	100 max.	150 max.
	Release time ✻7	ms	30 max.	30 max.	30 max.	50 max.
	Backlash	°	0.6 max.	0.6 max.	0.6 max.	0.6 max.
	Allowable braking work	J	1,000	1,000	1,000	350
	Allowable total work	J	3,000,000	3,000,000	3,000,000	1,000,000
	Allowable angular acceleration	rad/s^2	10,000 max.			
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.			
	Insulation class	---	Class F			

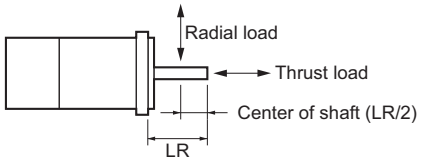
Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

Item		Model (R88M-) / Unit	400 VAC		
			1M40020C	1M60020C	1M1K020C
Rated output ✻1 ✻2		W	400	600	1,000
Rated torque ✻1 ✻2		N·m	1.91	2.86	4.77
Rated rotation speed ✻1 ✻2		r/min	2,000		
Maximum rotation speed		r/min	3,000		
Momentary maximum torque ✻1		N·m	5.73	8.59	14.3
Rated current ✻1 ✻2		A (rms)	1.1	1.6	2.9
Momentary maximum current ✻1		A (rms)	3.9	5.5	9.4
Rotor inertia	Without brake	× 10^{-4} kg·m^2	2.5042	3.9042	6.0042
	With brake	× 10^{-4} kg·m^2	2.8472	4.2472	6.5042
Applicable load inertia		× 10^{-4} kg·m^2	19.0	23.5	59.0
Torque constant ✻1		N·m/ A (rms)	1.75	1.84	1.69
Power rate ✻1 ✻3		kW/s	14.6	21.0	38
Mechanical time constant ✻3		ms	1.57	1.21	0.94
Electrical time constant		ms	6.8	7.8	13
Allowable radial load ✻4		N	490		
Allowable thrust load ✻4		N	196		
Weight	Without brake	kg	3.9	4.7	6.6
	With brake	kg	4.8	5.8	8.6
Radiator plate dimensions (material)		mm	305 × 305 × t12 (aluminum)		400 × 400 × t20 (aluminum)
Brake specifications ✻5	Excitation voltage ✻6	V	24 VDC±10%		
	Current consumption (at 20°C)	A	0.30	0.30	0.51
	Static friction torque	N·m	3.92 min.	3.92 min.	9.0 min.
	Attraction time	ms	40 max.	40 max.	100 max.
	Release time ✻7	ms	25 max.	25 max.	30 max.
	Backlash	°	1.0 max.	1.0 max.	0.6 max.
	Allowable braking work	J	330	330	1,000
	Allowable total work	J	330,000	330,000	3,000,000
	Allowable angular acceleration	rad/s^2	10,000 max.		
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.		
	Insulation class	---	Class F		

Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

Item		Model (R88M-) / Unit	400 VAC		
			1M1K520C	1M2K020C	1M3K020C
Rated output ✻1 ✻2		W	1,500	2,000	3,000
Rated torque ✻1 ✻2		N·m	7.16	9.55	14.3
Rated rotation speed ✻1 ✻2		r/min	2,000		
Maximum rotation speed		r/min	3,000		
Momentary maximum torque ✻1		N·m	21.5	28.7	43.0
Rated current ✻1 ✻2		A (rms)	4.1	5.7	8.6
Momentary maximum current ✻1		A (rms)	13.5	19.8	28.3
Rotor inertia	Without brake	× 10^{-4} kg·m^2	9.0042	12.2042	15.3122
	With brake	× 10^{-4} kg·m^2	9.5042	12.7042	17.4122
Applicable load inertia		× 10^{-4} kg·m^2	79.9	100	142
Torque constant ✻1		N·m/ A (rms)	1.75	1.75	1.74
Power rate ✻1 ✻3		kW/s	57	75	134
Mechanical time constant ✻3		ms	0.85	0.80	0.76
Electrical time constant		ms	13	14	20
Allowable radial load ✻4		N	490		784
Allowable thrust load ✻4		N	196		343
Weight	Without brake	kg	8.5	10	12
	With brake	kg	10.5	12	15
Radiator plate dimensions (material)		mm	470 × 470 × t20 (aluminum)		
Brake specifications ✻5	Excitation voltage ✻6	V	24 VDC±10%		
	Current consumption (at 20°C)	A	0.51	0.66	0.60
	Static friction torque	N·m	9.0 min.	12 min.	16 min.
	Attraction time	ms	100 max.	100 max.	150 max.
	Release time ✻7	ms	30 max.	30 max.	50 max.
	Backlash	°	0.6 max.	0.6 max.	0.6 max.
	Allowable braking work	J	1,000	1,000	350
	Allowable total work	J	3,000,000	3,000,000	1,000,000
	Allowable angular acceleration	rad/s^2	10,000 max.		
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.		
	Insulation class	---	Class F		

✻1. This is a typical value for when the Servomotor is used at a normal temperature (20°C, 65%) in combination with a Servo Drive.
✻2. The rated values are the values with which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
✻3. This value is for models without options.
✻4. The allowable radial and thrust loads are the values determined for a limit of 20,000 hours at normal operating temperatures. The allowable radial loads are applied as shown in the following diagram.

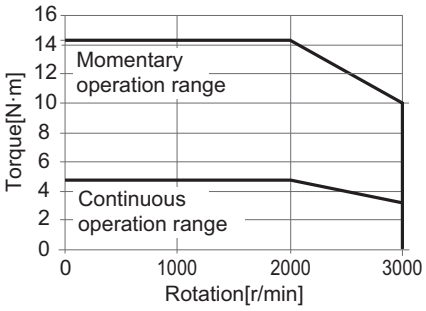


✻5. When the brake is released for a vertical axis, refer to the *AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT® Communications User's Manual* (Cat.No.I586) to set an appropriate value for Brake Interlock Output (4610 hex).
✻6. This is a non-excitation brake. It is released when excitation voltage is applied.
✻7. This value is a reference value.
Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

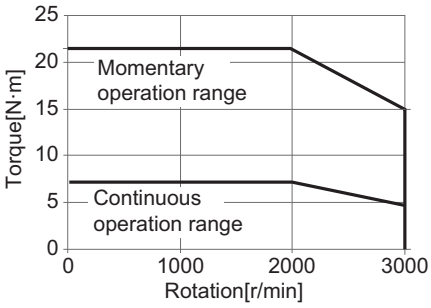
Torque-Rotation Speed Characteristics for 2,000-r/min Servomotors (200 VAC)

The following graphs show the characteristics with a 3-m standard cable and a 3-phase 200-VAC or single-phase 220-VAC input.

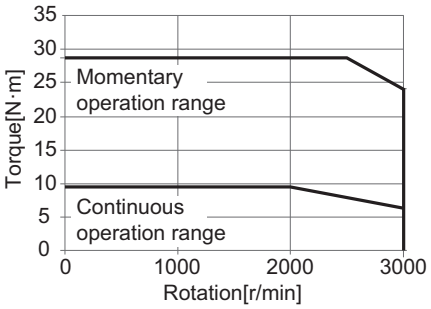
• R88M-1M1K020T



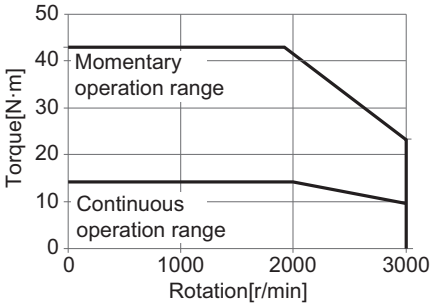
• R88M-1M1K520T



• R88M-1M2K020T



• R88M-1M3K020T

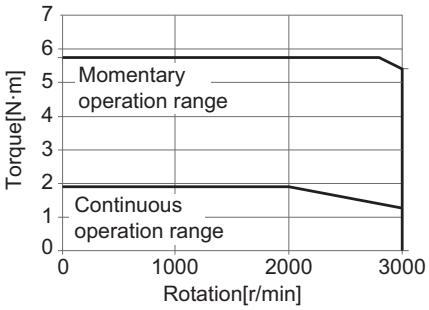


Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

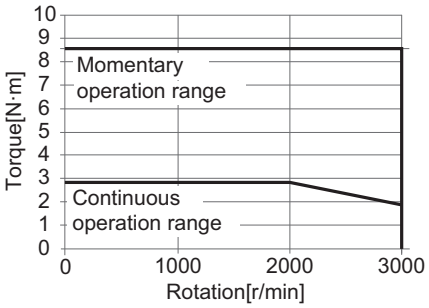
Torque-Rotation Speed Characteristics for 2,000-r/min Servomotors (400 VAC)

The following graphs show the characteristics with a 3-m standard cable and a 400 VAC input.

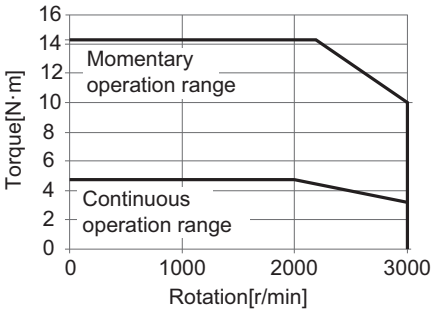
• R88M-1M40020C



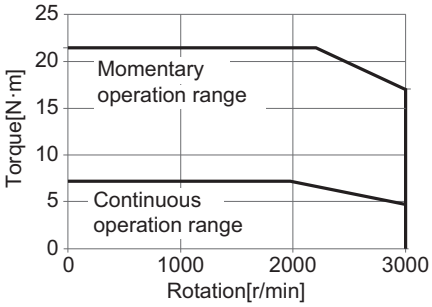
• R88M-1M60020C



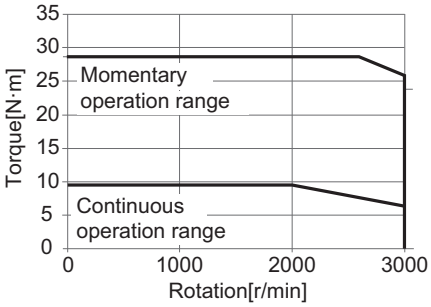
• R88M-1M1K020C



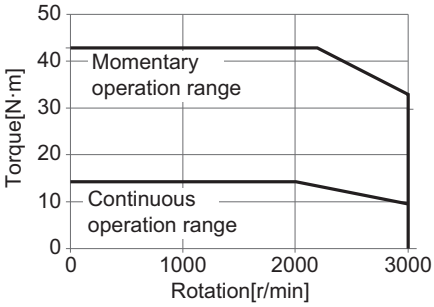
• R88M-1M1K520C



• R88M-1M2K020C



• R88M-1M3K020C



Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

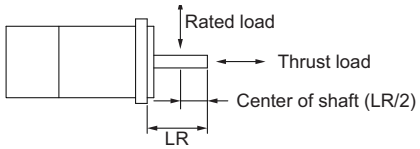
1,500-r/min Servomotors

Item		Model (R88M-) / Unit	200 VAC				
			1M4K015T	1M5K015T	1M7K515T	1M11K015T	1M15K015T
Rated output ✻1 ✻2		W	4,000	5,000	7,500	11,000	15,000
Rated torque ✻1 ✻2		N·m	25.5	31.8	47.8	70.0	95.5
Rated rotation speed ✻1 ✻2		r/min	1,500				
Maximum rotation speed		r/min	3,000			2,000	
Momentary maximum torque ✻1		N·m	75	95	119	175	224
Rated current ✻1 ✻2		A (rms)	25.7	25.8	41.2	57	60.7
Momentary maximum current ✻1		A (rms)	84.8	84.8	113.0	150.0	150.0
Rotor inertia	Without brake	× 10^{-4} kg·m^2	54.0122	77.0122	113.0122	229.0122	340.0122
	With brake	× 10^{-4} kg·m^2	60.0122	83.0122	118.0122	253.0122	365.0122
Applicable load inertia		× 10^{-4} kg·m^2	687	955	1,070	2,200	3,110
Torque constant ✻1		N·m/ A (rms)	1.08	1.36	1.29	1.40	1.79
Power rate ✻1 ✻3		kW/s	120	131	202	214	268
Mechanical time constant ✻3		ms	1	1.1	0.75	0.61	0.56
Electrical time constant		ms	19	19	24	32	32
Allowable radial load ✻4		N	1,200	1,470	1,470	2,500	2,500
Allowable thrust load ✻4		N	343	490	490	686	686
Weight	Without brake	kg	21	29	39	63	85
	With brake	kg	26	34	45	73	99
Radiator plate dimensions (material)		mm	470 × 470 × t20 (aluminum)	540 × 540 × t20 (aluminum)		670 × 630 × t35 (aluminum)	
Brake specifications ✻5	Excitation voltage ✻6	V	24 VDC±10%				
	Current consumption (at 20°C)	A	1.0	1.0	1.4	1.7	0.92
	Static friction torque	N·m	32 min.	42 min.	54.9 min.	90 min.	100 min.
	Attraction time	ms	150 max.	150 max.	300 max.	300 max.	600 max.
	Release time ✻7	ms	60 max.	60 max.	140 max.	140 max.	215 max.
	Backlash	°	0.8 max.	0.8 max.	0.2 max.	0.2 max.	0.2 max.
	Allowable braking work	J	1,400	1,400	830	1,400	1,400
	Allowable total work	J	4,600,000	4,600,000	2,500,000	4,600,000	6,100,000
	Allowable angular acceleration	rad/s^2	10,000 max.		5,000 max.	3,000 max.	
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.				
	Insulation class	---	Class F				

Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

Item		Model (R88M-) / Unit	400 VAC				
			1M4K015C	1M5K515C	1M7K515C	1M11K015C	1M15K015C
Rated output ✻1 ✻2		W	4,000	5,500	7,500	11,000	15,000
Rated torque ✻1 ✻2		N·m	25.5	35.0	47.8	70	95.5
Rated rotation speed ✻1 ✻2		r/min	1,500				
Maximum rotation speed		r/min	3,000			2,000	
Momentary maximum torque ✻1		N·m	75	95	119	175	224
Rated current ✻1 ✻2		A (rms)	12.8	14.0	22.0	31.4	33.3
Momentary maximum current ✻1		A (rms)	42.4	42.4	56.5	80.7	81.2
Rotor inertia	Without brake	× 10^{-4} kg·m^2	54.0122	77.0122	113.0122	229.0122	340.0122
	With brake	× 10^{-4} kg·m^2	60.0122	83.0122	118.0122	253.0122	365.0122
Applicable load inertia		× 10^{-4} kg·m^2	687	955	1070	2200	3110
Torque constant ✻1		N·m/ A (rms)	2.07	2.68	2.49	2.6	3.27
Power rate ✻1 ✻3		kW/s	120	159	202	214	268
Mechanical time constant ✻3		ms	1.2	1	0.78	0.63	0.62
Electrical time constant		ms	18	19	23	29	29
Allowable radial load ✻4		N	1,200	1,470	1470	2,500	2,500
Allowable thrust load ✻4		N	343	490	490	686	686
Weight	Without brake	kg	21	29	39	63	85
	With brake	kg	26	34	45	73	99
Radiator plate dimensions (material)		mm	470 × 470 × t20	540 x 540x t20 (aluminum)		670 × 630 × t35 (aluminum)	
Brake specifications ✻5	Excitation voltage ✻6	V	24 VDC ± 10%				
	Current consumption (at 20°C)	A	1.0	1.0	1.4	1.7	0.92
	Static friction torque	N·m	32 min.	42 min.	54.9 min.	90 min.	100 min.
	Attraction time	ms	150 max.	150 max.	300 max.	300 max.	600 max.
	Release time ✻7	ms	60 max.	60 max.	140 max.	140 max.	215 max.
	Backlash	°	0.8 max.	0.8 max.	0.2 max.	0.2 max.	0.2 max.
	Allowable braking work	J	1,400	1,400	830	1,400	1,400
	Allowable total work	J	4,600,000	4,600,000	2,500,000	4,600,000	6,100,000
	Allowable angular acceleration	rad/s^2	10,000 max.		5,000 max.	3,000 max.	
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.				
	Insulation class	---	Class F				

✻1. This is a typical value for when the Servomotor is used at a normal temperature (20°C, 65%) in combination with a Servo Drive.
✻2. The rated values are the values with which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
✻3. This value is for models without options.
✻4. The allowable radial and thrust loads are the values determined for a limit of 20,000 hours at normal operating temperatures. The allowable radial loads are applied as shown in the following diagram.

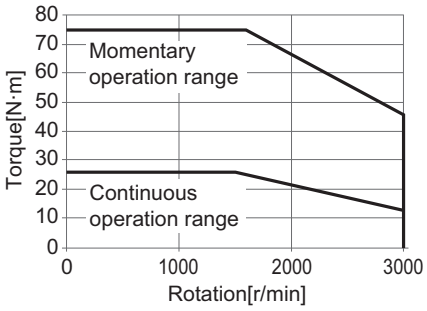


✻5. When the brake is released for a vertical axis, refer to the *AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT® Communications User's Manual* (Cat.No.I586) to set an appropriate value for Brake Interlock Output (4610 hex).
✻6. This is a non-excitation brake. It is released when excitation voltage is applied.
✻7. This value is a reference value.
Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

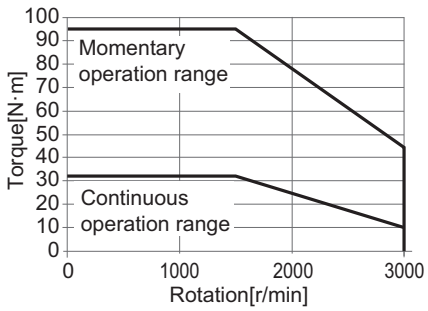
Torque-Rotation Speed Characteristics for 1,500-r/min Servomotors (200 VAC)

The following graphs show the characteristics with a 3-m standard cable and a 3-phase 200-VAC input.

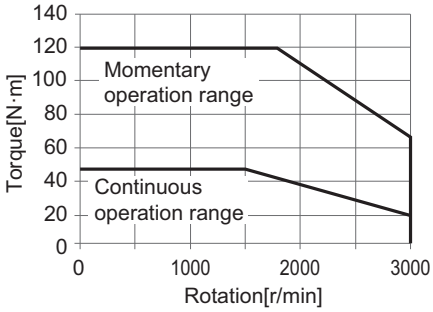
• R88M-1M4K015T



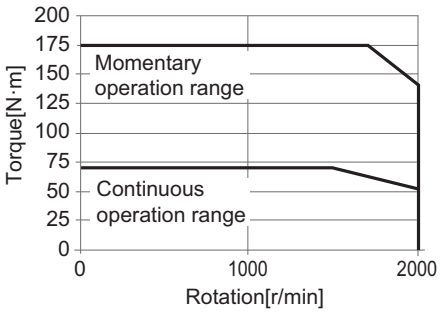
• R88M-1M5K015T



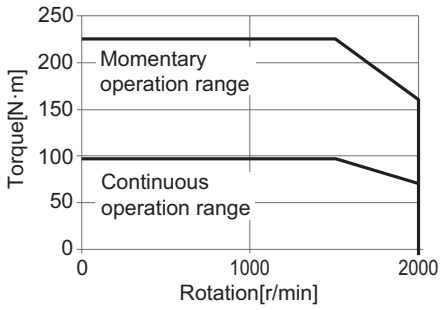
• R88M-1M7K515T



• R88M-1M11K015T



• R88M-1M15K015T

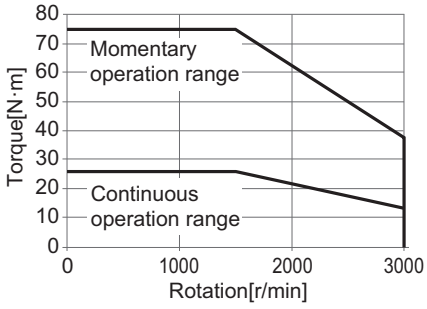


Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

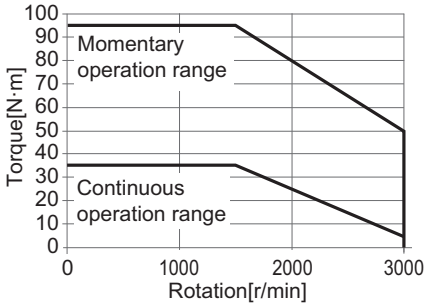
Torque-Rotation Speed Characteristics for 1,500-r/min Servomotors (400 VAC)

The following graphs show the characteristics with a 3-m standard cable and a 400 VAC input.

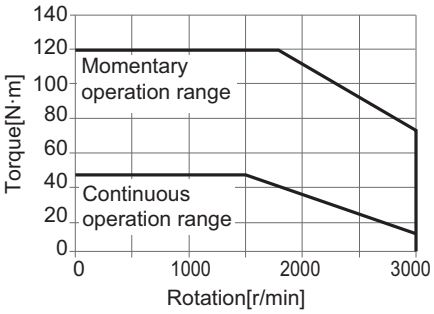
• R88M-1M4K015C



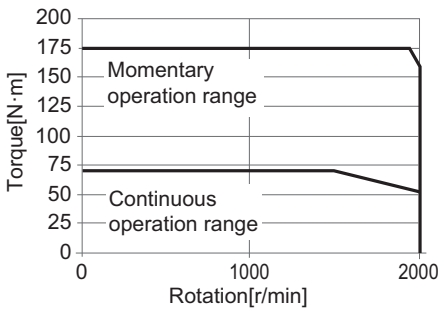
• R88M-1M5K515C



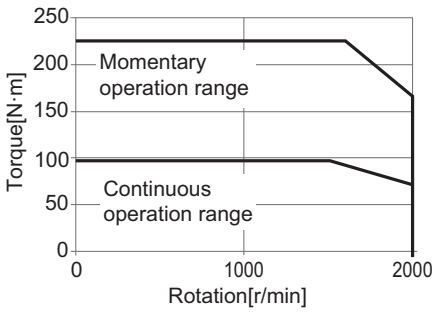
• R88M-1M7K515C



• R88M-1M11K015C



• R88M-1M15K015C



Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

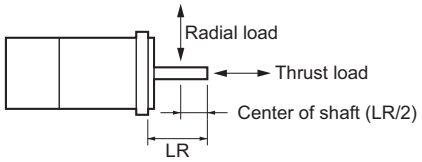
1,000-r/min Servomotors

Item		Model (R88M-) / Unit	200 VAC		
			1M90010T	1M2K010T	1M3K010T
Rated output ✻1 ✻2		W	900	2,000	3,000
Rated torque ✻1 ✻2		N·m	8.59	19.1	28.7
Rated rotation speed ✻1 ✻2		r/min	1,000		
Maximum rotation speed		r/min	2,000		
Momentary maximum torque ✻1		N·m	19.3	47.7	71.7
Rated current ✻1 ✻2		A (rms)	6.7	14.4	21.2
Momentary maximum current ✻1		A (rms)	16.9	40.6	54.7
Rotor inertia	Without brake	× 10^{-4} kg·m^2	9.0042	40.0122	68.0122
	With brake	× 10^{-4} kg·m^2	9.5042	45.1122	73.1122
Applicable load inertia		× 10^{-4} kg·m^2	79.9	314	492
Torque constant ✻1		N·m/ A (rms)	1.28	1.45	1.51
Power rate ✻1 ✻3		kW/s	82	91	121
Mechanical time constant ✻3		ms	0.77	1.0	0.83
Electrical time constant		ms	15	18	22
Allowable radial load ✻4		N	686	1,176	1,470
Allowable thrust load ✻4		N	196	490	
Weight	Without brake	kg	8.5	18	28
	With brake	kg	10.5	22	33
Radiator plate dimensions (material)		mm	470 × 470 × t20 (aluminum)		540 × 540 × t20 (aluminum)
Brake specifications ✻5	Excitation voltage ✻6	V	24 VDC±10%		
	Current consumption (at 20°C)	A	0.51	1.2	1.0
	Static friction torque	N·m	9.0 min.	22 min.	42 min.
	Attraction time	ms	100 max.	120 max.	150 max.
	Release time ✻7	ms	30 max.	50 max.	60 max.
	Backlash	°	0.6 max.	0.8 max.	0.8 max.
	Allowable braking work	J	1,000	1,400	1,400
	Allowable total work	J	3,000,000	4,600,000	4,600,000
	Allowable angular acceleration	rad/s^2	10,000 max.		
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.		
	Insulation class	---	Class F		

Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

Item		Model (R88M-) / Unit	400 VAC		
			1M90010C	1M2K010C	1M3K010C
Rated output ✻1 ✻2		W	900	2,000	3,000
Rated torque ✻1 ✻2		N·m	8.59	19.1	28.7
Rated rotation speed ✻1 ✻2		r/min	1,000		
Maximum rotation speed		r/min	2,000		
Momentary maximum torque ✻1		N·m	19.3	47.7	71.7
Rated current ✻1 ✻2		A (rms)	3.6	7.1	10.6
Momentary maximum current ✻1		A (rms)	9.0	19.5	27.7
Rotor inertia	Without brake	× 10^{-4} kg·m^2	9.0042	40.0122	68.0122
	With brake	× 10^{-4} kg·m^2	9.5042	45.1122	73.1122
Applicable load inertia		× 10^{-4} kg·m^2	79.9	314	492
Torque constant ✻1		N·m/ A (rms)	2.41	3.00	2.97
Power rate ✻1 ✻3		kW/s	82	91	121
Mechanical time constant ✻3		ms	0.88	1.2	0.92
Electrical time constant		ms	13	16	19
Allowable radial load ✻4		N	686	1,176	1,470
Allowable thrust load ✻4		N	196	490	
Weight	Without brake	kg	8.5	18	28
	With brake	kg	10.5	22	33
Radiator plate dimensions (material)		mm	470 × 470 × t20 (aluminum)		540 × 540 × t20 (aluminum)
Brake specifications ✻5	Excitation voltage ✻6	V	24 VDC±10%		
	Current consumption (at 20°C)	A	0.51	1.2	1.0
	Static friction torque	N·m	9.0 min.	22 min.	42 min.
	Attraction time	ms	100 max.	120 max.	150 max.
	Release time ✻7	ms	30 max.	50 max.	60 max.
	Backlash	°	0.6 max.	0.8 max.	0.8 max.
	Allowable braking work	J	1,000	1,400	1,400
	Allowable total work	J	3,000,000	4,600,000	4,600,000
	Allowable angular acceleration	rad/s^2	10,000 max.		
	Brake lifetime (acceleration/ deceleration)	---	10 million times min.		
	Insulation class	---	Class F		

✻1. This is a typical value for when the Servomotor is used at a normal temperature (20°C, 65%) in combination with a Servo Drive.
✻2. The rated values are the values with which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
✻3. This value is for models without options.
✻4. The allowable radial and thrust loads are the values determined for a limit of 20,000 hours at normal operating temperatures. The allowable radial loads are applied as shown in the following diagram.

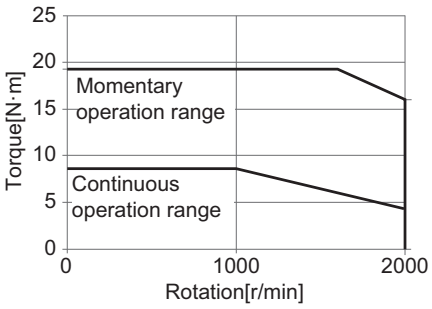


✻5. When the brake is released for a vertical axis, refer to the *AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT® Communications User's Manual* (Cat.No.I586) to set an appropriate value for Brake Interlock Output (4610 hex).
✻6. This is a non-excitation brake. It is released when excitation voltage is applied.
✻7. This value is a reference value.
Note: 1. For the models listed in the table above, there is no derating for models with an oil seal.

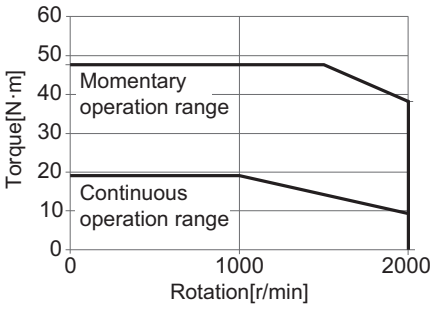
Torque-Rotation Speed Characteristics for 1,000-r/min Servomotors (200 V/400 VAC)

The following graphs show the characteristics with a 3-m standard cable and a single-phase 220-VAC or 3-phase 400-VAC input.

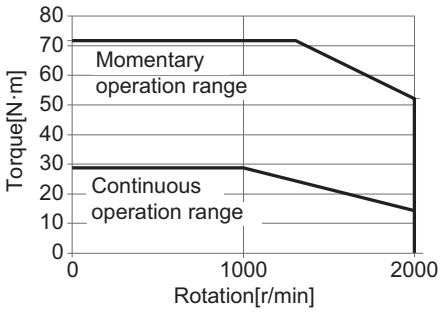
• R88M-1M90010T



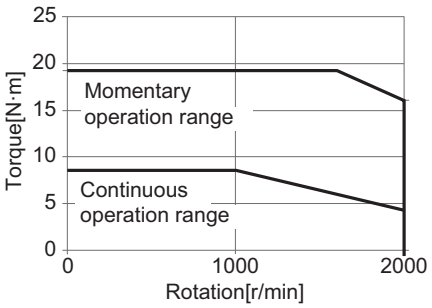
• R88M-1M2K010T



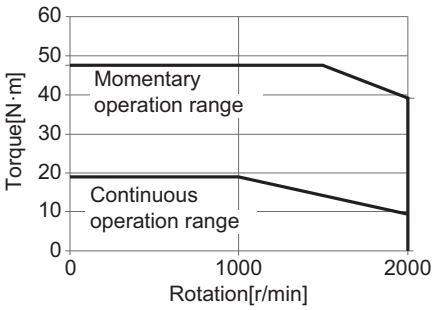
• R88M-1M3K010T



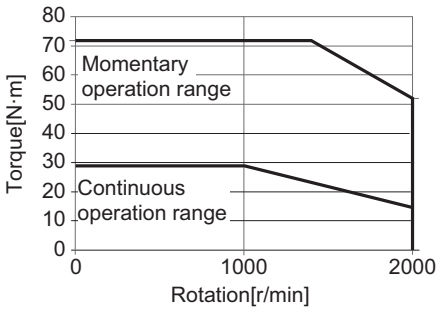
• R88M-1M90010C



• R88M-1M2K010C



• R88M-1M3K010C

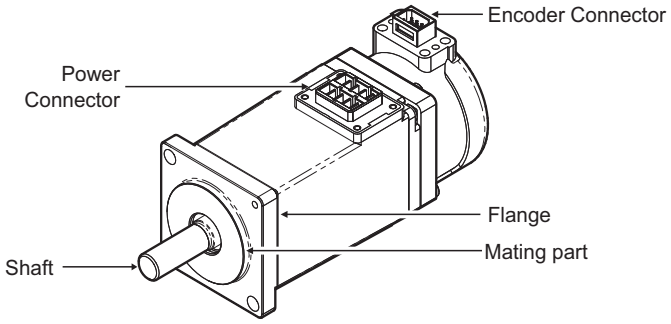


Note: The continuous operation range is the range in which continuous operation is possible at an ambient temperature of 40°C when the Servomotor is horizontally installed on a specified radiator plate.
Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

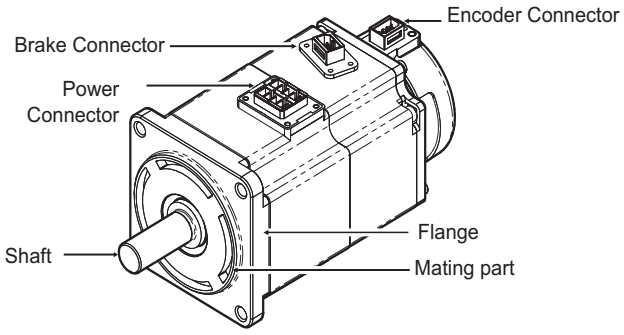
Part Names

Servomotor Part Names

Flange Size of 80 × 80 or less

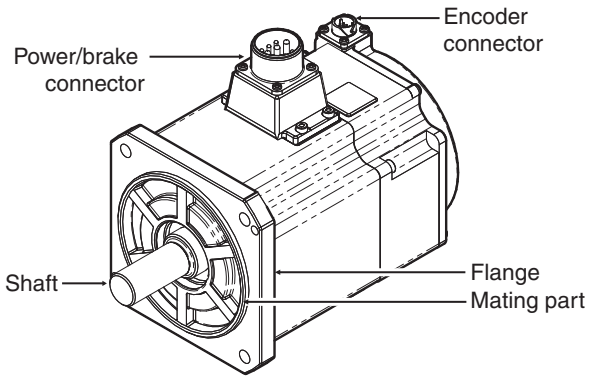


100 VAC 100 W Servomotors (without Brake)



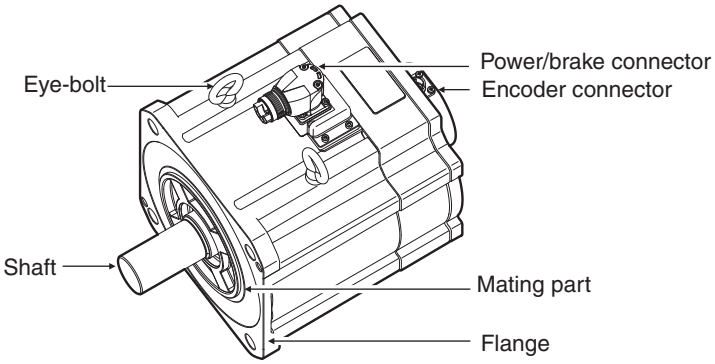
200 VAC 200 W Servomotors (with Brake)

Flange Size of 100 × 100 or more



200 VAC 1.5 kW Servomotors (with Brake)

Flange Size of 130 × 130 or more (4 kW or more)



200VAC 4kW Servomotors (with Brake)

Servomotor Functions

Shaft

The load is mounted on this shaft.
The direction which is in parallel with the shaft is called the thrust direction, and the direction which is perpendicular to the shaft is called the radial direction.

Flange

Used for mounting the Servomotor on the equipment.
Fit the mating part into the equipment and use the mounting holes to screw the Servomotor.

Power Connector

Used for supplying power to the phase U, V, and W of the Servomotor.
For Servomotors with a brake and flange size of 100 × 100 or more, the pins for power and brake are set on the same connector.
In the case of a Servomotor with its flange size □130 or more, the cable outlet direction can be selected. The change of the cable outlet direction shall be up to five times.

Encoder Connector

Used for supplying power to the encoder of the Servomotor and communicating with the Servo Drive.
When a Servomotor at 3000 r/min 4 kW or more and a Servomotor at 1500 r/min are selected, use encoder cables with metal shell type (for applicable Servomotor type B at 4 kw or more).

Brake Connector

Used for supplying power to the brake coil of the Servomotor.
This part is attached only to the Servomotors with a brake and flange size of 80 × 80 or less.

Eye-bolt

Used for lifting and moving the motor by putting a wire rope, for example, through the shaft.

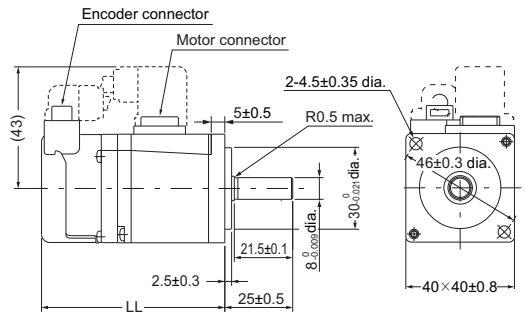
External Dimensions

(Unit: mm)

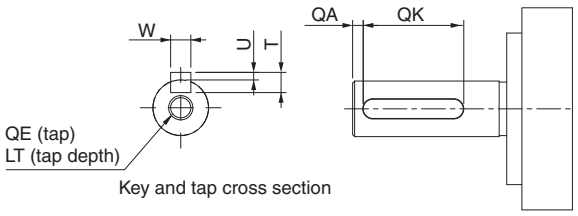
3,000-r/min Servomotors (100 V and 200 V)

50 W (without Brake)

R88M-1M05030S(-O/-S2/-OS2)
R88M-1M05030T(-O/-S2/-OS2)



Shaft-end with key and tap



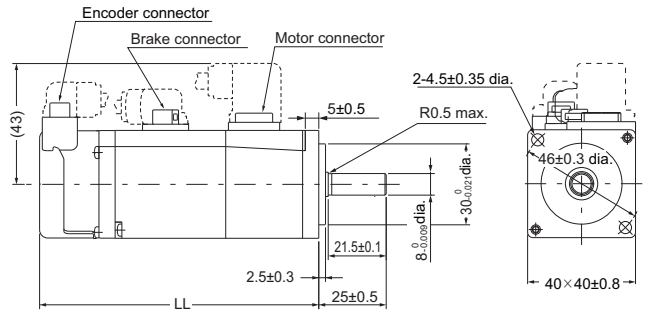
Model	Dimensions [mm]
	LL
R88M-1M05030S(-S2) R88M-1M05030T(-S2)	67.5±1
R88M-1M05030S-O(S2) R88M-1M05030T-O(S2)	72.5±1

Model	Dimensions [mm]						
	QA	QK	W	T	U	QE	LT
R88M-1M05030S (-S2/-OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8
R88M-1M05030T (-S2/-OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8

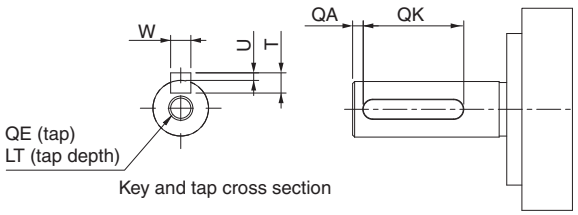
Note: The standard shaft type is a straight shaft. Models with a key and tap are indicated with “S2” at the end of the model number. Models with an oil seal are indicated with “O” at the end of the model number.

50 W (with Brake)

R88M-1M05030S-B(O/S2/OS2)
R88M-1M05030T-B(O/S2/OS2)



Shaft-end with key and tap



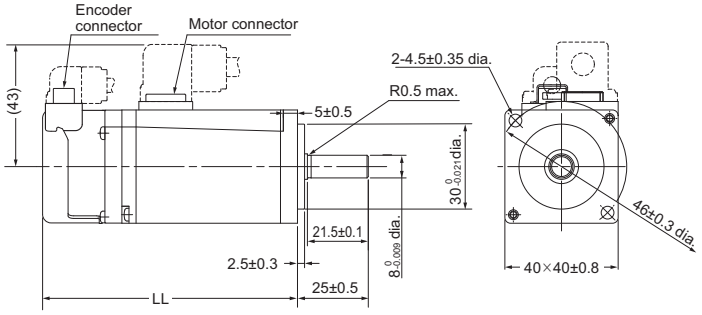
Model	Dimensions [mm]
	LL
R88M-1M05030S-B(S2) R88M-1M05030T-B(S2)	103.5±1
R88M-1M05030S-BO(S2) R88M-1M05030T-BO(S2)	108.5±1

Model	Dimensions [mm]						
	QA	QK	W	T	U	QE	LT
R88M-1M05030S-B (S2/OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8
R88M-1M05030T-B (S2/OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8

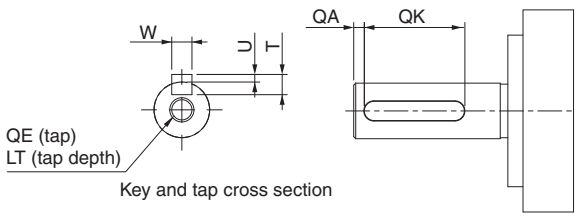
Note: The standard shaft type is a straight shaft. Models with a key and tap are indicated with “S2” at the end of the model number. Models with an oil seal are indicated with “O” at the end of the model number.

100 W (without Brake)

R88M-1M10030S(-O/-S2/-OS2)
R88M-1M10030T(-O/-S2/-OS2)



Shaft-end with key and tap



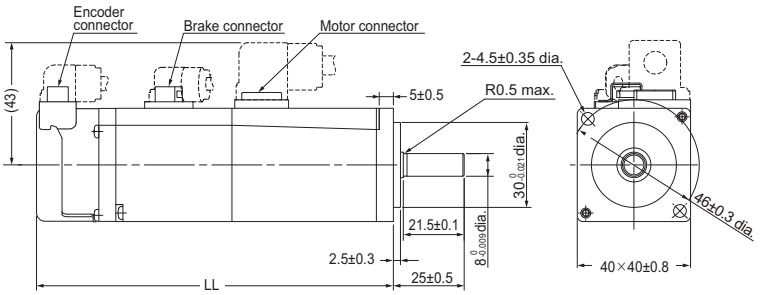
Model	Dimensions [mm]
	LL
R88M-1M10030S(-S2) R88M-1M10030T(-S2)	90±1
R88M-1M10030S-O(S2) R88M-1M10030T-O(S2)	95±1

Model	Dimensions [mm]						
	QA	QK	W	T	U	QE	LT
R88M-1M10030S(-S2/-OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8
R88M-1M10030T(-S2/-OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8

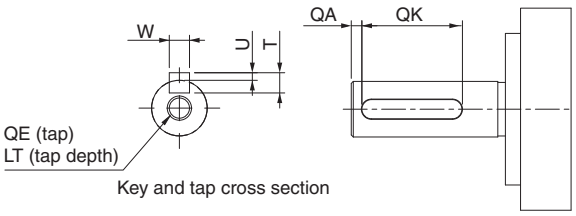
Note: The standard shaft type is a straight shaft. Models with a key and tap are indicated with “S2” at the end of the model number. Models with an oil seal are indicated with “O” at the end of the model number.

100 W (with Brake)

R88M-1M10030S-B(O/S2/OS2)
R88M-1M10030T-B(O/S2/OS2)



Shaft-end with key and tap



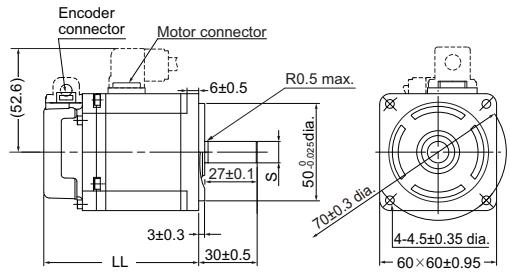
Model	Dimensions [mm]
	LL
R88M-1M10030S-B(S2) R88M-1M10030T-BS2)	126±1
R88M-1M10030S-BO(S2) R88M-1M10030T-BO(S2)	131±1

Model	Dimensions [mm]						
	QA	QK	W	T	U	QE	LT
R88M-1M10030S-B(S2/OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8
R88M-1M10030T-B(S2/OS2)	2	12	$3^{0}_{-0.025}$	3	$1.2^{0}_{-0.2}$	M3	8

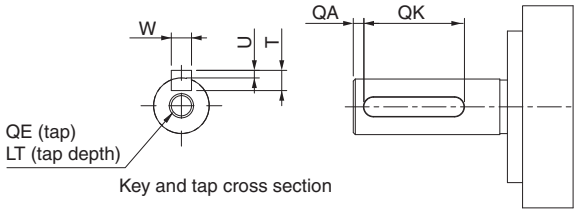
Note: The standard shaft type is a straight shaft. Models with a key and tap are indicated with “S2” at the end of the model number. Models with an oil seal are indicated with “O” at the end of the model number.

200 W/400 W (without Brake)

R88M-1M20030S(-O/-S2/-OS2)/R88M-1M20030T(-O/-S2/-OS2)
R88M-1M40030S(-O/-S2/-OS2)/R88M-1M40030T(-O/-S2/-OS2)



Shaft-end with key and tap



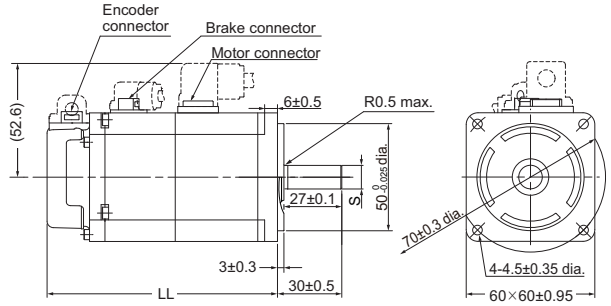
Model	Dimensions [mm]	
	S	LL
R88M-1M20030S(-S2) R88M-1M20030T(-S2)	$11^{0}_{-0.011}$ dia.	79.5±1
R88M-1M40030S(-S2) R88M-1M40030T(-S2)	$14^{0}_{-0.011}$ dia.	105.5±1
R88M-1M20030S-O(S2) R88M-1M20030T-O(S2)	$11^{0}_{-0.011}$ dia.	86.5±1
R88M-1M40030S-O(S2) R88M-1M40030T-O(S2)	$14^{0}_{-0.011}$ dia.	112.5±1

Model	Dimensions [mm]						
	QA	QK	W	T	U	QE	LT
R88M-1M20030S(-S2/-OS2)	2	20	$4^{0}_{-0.03}$	4	$1.5^{0}_{-0.2}$	M4	10
R88M-1M20030T(-S2/-OS2)	2	20	$4^{0}_{-0.03}$	4	$1.5^{0}_{-0.2}$	M4	10
R88M-1M40030S(-S2/-OS2)	2	20	$5^{0}_{-0.03}$	5	$2^{0}_{-0.2}$	M5	12
R88M-1M40030T(-S2/-OS2)	2	20	$5^{0}_{-0.03}$	5	$2^{0}_{-0.2}$	M5	12

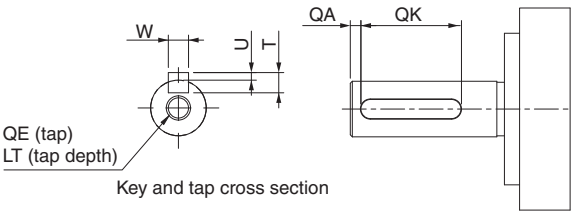
Note: The standard shaft type is a straight shaft. Models with a key and tap are indicated with “S2” at the end of the model number. Models with an oil seal are indicated with “O” at the end of the model number.

200 W/400 W (with Brake)

R88M-1M20030S-B(O/S2/OS2)/R88M-1M20030T-B(O/S2/OS2)
R88M-1M40030S-B(O/S2/OS2)/R88M-1M40030T-B(O/S2/OS2)



Shaft-end with key and tap



Model	Dimensions [mm]	
	S	LL
R88M-1M20030S-B(S2) R88M-1M20030T-B(S2)	$11^{0}_{-0.011}$ dia.	107.5±1
R88M-1M40030S-B(S2) R88M-1M40030T-B(S2)	$14^{0}_{-0.011}$ dia.	133.5±1
R88M-1M20030S-BO(S2) R88M-1M20030T-BO(S2)	$11^{0}_{-0.011}$ dia.	114.5±1
R88M-1M40030S-BO(S2) R88M-1M40030T-BO(S2)	$14^{0}_{-0.011}$ dia.	140.5±1

Model	Dimensions [mm]						
	QA	QK	W	T	U	QE	LT
R88M-1M20030S-B(S2/OS2)	2	20	$4^{0}_{-0.03}$	4	$1.5^{0}_{-0.2}$	M4	10
R88M-1M20030T-B(S2/OS2)	2	20	$4^{0}_{-0.03}$	4	$1.5^{0}_{-0.2}$	M4	10
R88M-1M40030S-B(S2/OS2)	2	20	$5^{0}_{-0.03}$	5	$2^{0}_{-0.2}$	M5	12
R88M-1M40030T-B(S2/OS2)	2	20	$5^{0}_{-0.03}$	5	$2^{0}_{-0.2}$	M5	12

Note: The standard shaft type is a straight shaft. Models with a key and tap are indicated with “S2” at the end of the model number. Models with an oil seal are indicated with “O” at the end of the model number.