

# SANMOTION

SERVO SYSTEMS

# R<sub>3E Model</sub>

400 VAC 550 W – 30 kW



**SANYO DENKI**

**Ver. 2**

# SANMOTION R

SERVO SYSTEMS *3E Model*

Input voltage 400 VAC

Output capacity 550 W to 30 kW

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Servo amplifier



Amplifier capacity 25, 50, 100, 150, 300 A

Servo motor



Flange size 100 mm sq., 130 mm sq., 180 mm sq.,  
220 mm sq., 275 mm sq.



Rated output 550 W to 30 kW



## Contents

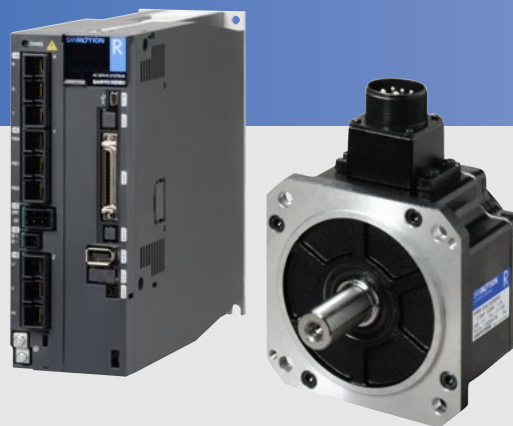
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# SANMOTION R

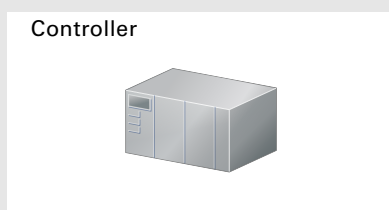
## AC SERVO SYSTEMS

The SANMOTION R series servo systems contribute to the evolution of your devices with a rich product lineup of high-precision servo amplifiers and servo motors.

These high-precision and highly reliable systems offer a wide range of products from small to large capacity servo systems.



### System Configurations



#### Servo system SANMOTION R

##### Servo amplifier

**SANMOTION R  
3E Model**

Analog/Pulse

Safety



##### Servo motor (Rotary motor)



#### SANMOTION C EtherCAT Interface type



Touch panel



Controller

#### Servo system SANMOTION R

##### Servo amplifier

**SANMOTION R  
3E Model**

EtherCAT

Safety



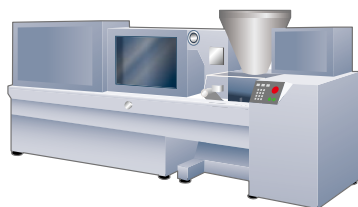
##### Servo motor (Rotary motor)



## Application Examples

Its high-precision and accurate positioning features allow it to be used in a wide range of applications.

- Injection molding machines, machine tools, machining centers, semiconductor related equipment, water jet cutters, laser processing machines, etc.



Injection molding machines



Machine tools

### • What is a servo system?

A servo system has an encoder (rotation detector) mounted on the servo motor and provides highly-reliable precise operation by giving feedback to commands from the servo amplifier. It can be used with confidence in applications that require high-speed and large-capacity operations.


The products featured in this catalog are designed to operate with a 400 VAC class main circuit power supply. We also have servo systems for 100 to 200 VAC and 48 VDC inputs available. Refer to our website and catalogs for details.

# Lineup


Servo Amplifier

### SANMOTION R 3E Model

Analog/Pulse Input type  
 More evolved AC servo amplifiers that provide improved basic performance including high responsiveness, and are more eco-efficient and easier to use.  
 Lineup: 25, 50, 100, 150, 300 A →p. 20



EtherCAT Interface type  
 With a 62.5 μs minimum communication cycle, the high-speed EtherCAT fieldbus subdivides position commands, realizing smoother operation of devices. It can be used together with our controller “SANMOTION C EtherCAT Interface type”.  
 Lineup: 25, 50, 100, 150, 300 A →p. 34



**Functional safety specifications**
 Models that facilitate easy integration of safety functions in devices to comply with functional safety are available.



Servo amplifier type	Model no.		Functional safety specifications
	Analog/Pulse	EtherCAT	
SANMOTION R 3E Model	RS3C□□A□□□0	—	Models not conforming to the functional safety.
	RS3C□□A□□□2	RS3C□□A2H□4	These models have the Safe Torque Off function. IEC/EN 61800-5-2:2016, STO (Safe Torque Off)
SANMOTION R 3E Model Safety → p. 44	RS3C□□A□□□C	RS3C□□A2H□E	This model has integrated extended safety functions in addition to Safe Torque Off function. Maintenance work can be performed without shutting off the power to the device. System restarting after maintenance work has also been made easy. IEC/EN 61800-5-2:2016, STO (Safe Torque Off), SS1 (Safe Stop 1), SS2 (Safe Stop 2), SOS (Safe Operating Stop), SLS (Safely-Limited Speed), SBC (Safe Brake Control), and SSM (Safe Speed Monitor)

# Lineup

## Servo Amplifier

### Servo Motor (Rotary Motor)

Rotary servo motors with a wide range of products.

Motor type	Flange size, features	
<b>R2 Servo Motor</b> <b>Medium inertia</b> <small>Low ripple</small>	<b>100 mm sq., 130 mm sq., 180 mm sq., 220 mm sq., 275 mm sq.</b>  Medium inertia servo motors with a wide range of size variation ideal for positioning applications.	
<b>R1 Servo Motor</b> <b>Low inertia</b> <small>High power rate</small>	<b>100 mm sq., 130 mm sq., 180 mm sq., 220 mm sq.</b>  Low inertia servo motors that feature high-acceleration drive and high torque even at high rotational speed. Ideal for injection molding machines and general industrial machines.	

### Conformance to Safety Standards

Our standard servo amplifiers conform to the following safety standards: UL, cUL, and EN standards, and the KC Mark. Our servo motors conform to the following safety standards: UL, cUL, and EN standards. In addition, all model numbers manufactured after October 2012 in this catalog conform with the acceptable values of specific hazardous substances (cadmium, lead, mercury, hexavalent chrome, PBB, and PBDE) in Appendix II of EU RoHS directive (2011/65/EU).



# SANMOTION R

AC SERVO SYSTEMS

## 3E Model

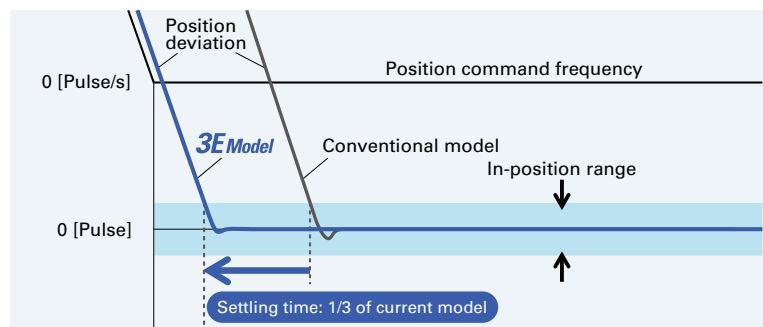
The 3rd generation of SANMOTION R servo amplifier series “3E Model” features evolved performance with high responsiveness and are more eco-efficient and easier to use. It contributes to improving the device performance.



## Evolved

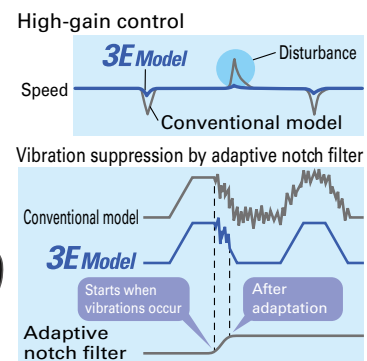
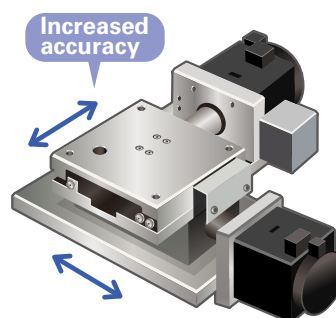
### Cycle time can be shortened by high-speed positioning control

The 3E Model has a speed frequency response of 2.2 kHz, approximately twice that of our conventional product. Additionally, the position settling time has been shortened to 1/3 of the original time. A function for switching the trajectory control and the positioning control in real time has been incorporated, significantly reducing the cycle time of the device.



### Improved control accuracy

The 3E Model is equipped with a gain increase function, a function for suppressing microvibrations at settling time, an adaptive notch filter for suppressing mechanical resonance, and a feed-forward vibration control function. The improved 5th-order notch filter realizes accurate shaft feeding for machine tools, significantly enhancing the processing quality.



### Built-in safety functions

The series product lineup includes Safe Torque Off (STO) function models\*1 and Safety models\*2 that offer even wider range of safety functions. Safety models feature monitoring of position and speed of devices as well as safe operation stop so that workers nearby can concentrate on their work with confidence. With these safety functions, motors can be stopped without shutting down the amplifier power, shortening the device reboot time. These products are suitable for devices that require high levels of safety.

\*1 Safe Torque Off (STO) is a safety function defined in IEC/EN 61800-5-2:2016.

\*2 In addition to \*1, SS1 (Safe Stop 1), SS2 (Safe Stop 2), SOS (Safe Operating Stop), SLS (Safely-Limited Speed), SBC (Safe Brake Control), and SSM (Safe Speed Monitor)



## Eco-efficient

### Reduced power consumption

Our new servo amplifiers consume less power; a maximum of 15% reduction in power consumption and a maximum of 29% reduction in standby power consumption have been achieved.

Power  
consumption  
REDUCED



Note: Compared with a conventional RS1C02A model.

### Power consumption management

Power consumption of the device can be managed by the monitoring function. The servo amplifier calculates power consumption based on the motor current, and displays it on the setup software or digital operator.

Axis	Power consumption	Unit
X	0.41	kWh
Y	0.75	kWh
Z	0.21	kWh
Total	1.37	kWh

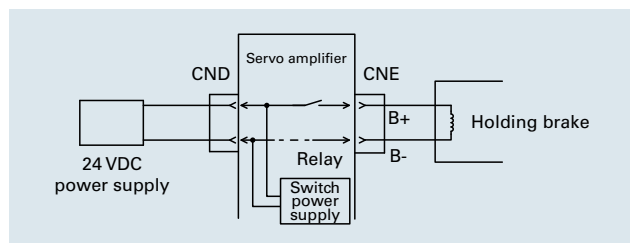
## Easy to use

### Holding brake control function incorporated as standard

The holding brake function has been incorporated into servo amplifiers as standard, which eliminates the need to newly establish a brake control circuit. This reduces wiring and costs.

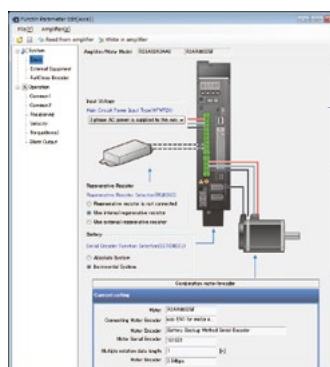
This only applies to 24 VDC brakes.

Note: The holding brake holds the motor in position when the power is off, preventing loads from falling.



### Easy startup

"SANMOTION MOTOR SETUP SOFTWARE" (see p. 127) displays the parameters required for operation in an easy-to-understand manner in order to enable fast and easy equipment startup. The 3E Model has a virtual motor operation function to simulate operation of the motor and amplifier without moving the machine, and a jog function for testing the motor and amplifier connection, without the need to connect to a host device.



Minimally required parameters can be set prior to the start of an operation, which are lumped together by categories, to shorten time for startup.

### Easy servo tuning

With the setup software, the 3E Model amplifiers offer a variety of servo tuning support functions such as the automatic optimal tuning mode selection according to equipment and load conditions, basic tuning mode for 2-parameter adjustment, and application tuning mode for adjustment by purpose. This greatly shortens the time required for servo tuning.

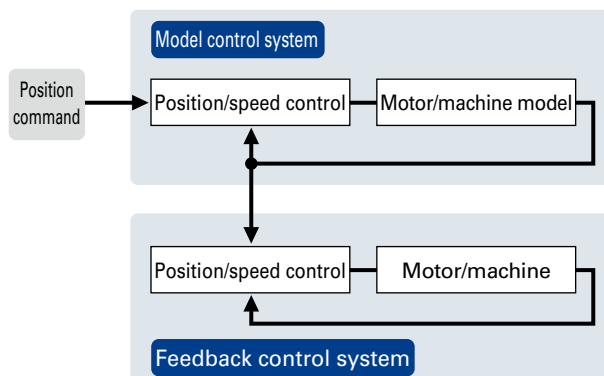
### Easy troubleshooting

With a 1 ms time stamp and a drive recorder function to record motor and amplifier operating status, details of abnormal state occurrences such as alarms can be accurately checked even at a later time, facilitating troubleshooting.



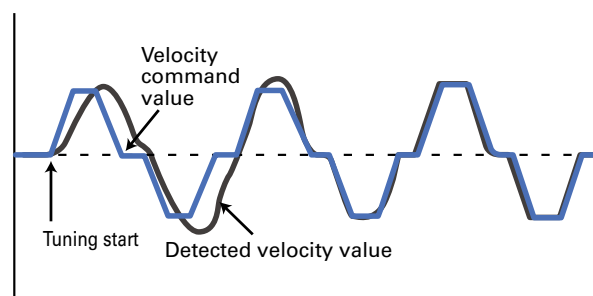
## Model-based following control

Model-based following control enables an improved target value response, enhanced disturbance suppression, and greater robustness.



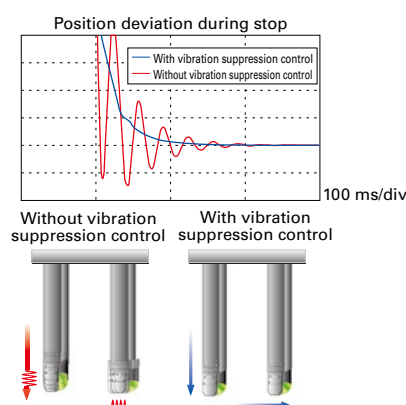
## Auto-tuning

The servo amplifier automatically optimizes servo gain and filter frequency in real time.



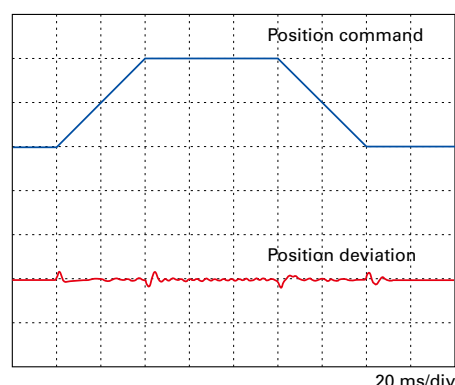
## Feed-forward vibration suppression control

With feed-forward vibration suppression control, vibrations at the end effector and base of a machine can be suppressed through simple tuning procedures. Vibration control frequencies are selectable.



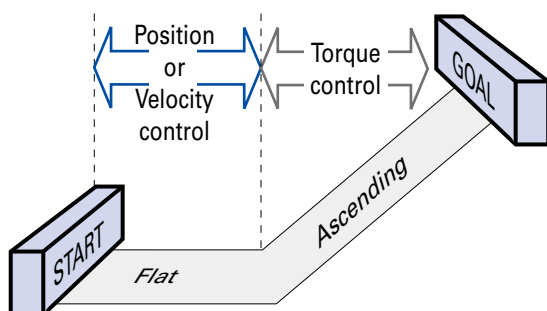
## Command following control

Newly-employed position and velocity controller has improved the tracking capability to the position commands. Position deviation  $\approx 0$  has been achieved.



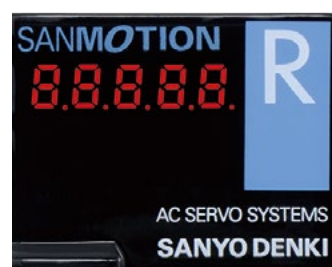
## All-in-one control

Configurable parameters allow switching between control modes for torque, position or velocity.



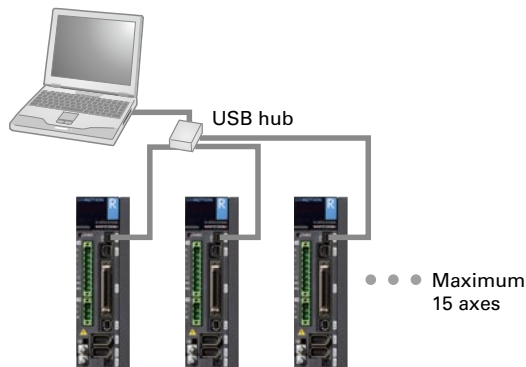
## 5-digit LED, built-in operator

The built-in digital operator allows you to change parameters and monitor amplifier status and alarm traces.



## Multiaxial monitor function

The setup software allows up to 15 axes—that is, 15 sets of a servo motor and a servo amplifier—to be monitored.



## EtherCAT Interface type

EtherCAT is a 100 Mbps high-speed fieldbus system. This contributes to reducing equipment cycle time. This highly versatile EtherCAT is compatible with Ethernet, which makes it possible to build a system that co-exists with various devices. The servo amplifier firmware can be updated via EtherCAT network. Also, the EtherCAT conformance test certificate from a trusted third party has been acquired.

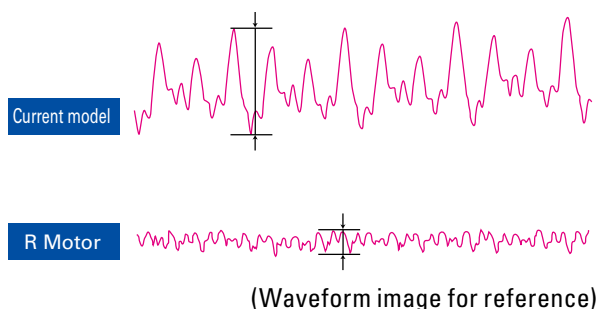


EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

## Low cogging torque

Cogging torque has been reduced in comparison with our conventional products, achieving smoother movement.

Comparison of cogging torque waveforms

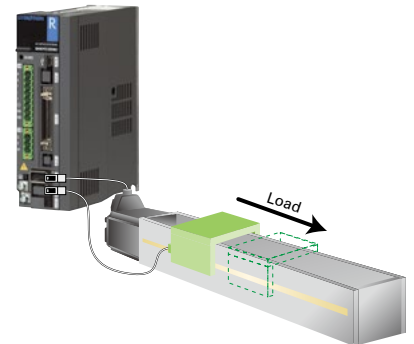


\* Compared with a conventional SANMOTION Q model.

## Dual position feedback fully-closed loop control

Dual position feedback fully-closed loop control is possible by using information from two encoders: a linear encoder mounted on the device (load) and a high resolution motor-mounted encoder.

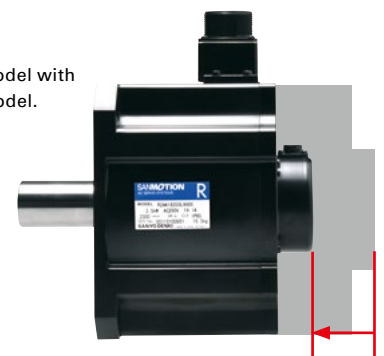
Even when there is high motor shaft torsion from the load, servo gain can be improved and high response achieved.



## Downsized servo motors

Our R2 series servo motors have 22% reduced motor length while achieving high torque and high overall performance compared with our conventional model.\*

\* Comparing the R2CA18350 model with a conventional Q2CA18350 model.



22% reduction

## Waterproof and dustproof

Our servo motors are highly resistant to water and dust ingress with an IP65 rating, ensuring normal operation even in severe environments.

IP67 is available as an option.



\* Except for shaft through-hole and cable ends. Use with a waterproof cannon plug connector. This motor meets the standardized waterproof test conditions. It cannot be used in environments exceeding IP65 or IP67, such as where it is subject to submersion in water for prolonged periods.

## Highly precise battery-less absolute encoder

This high-precision battery-less absolute encoder Model No. HA035 comes equipped with our servo motors as standard.

Optional higher precision encoders with a resolution of up to 8,388,608 (23-bit) and angular accuracy of up to 0.0167° (1 arcmin) are available.



No need to worry about battery life and battery exporting procedures.

We offer a variety of optional encoders to meet various encoder needs.

Refer to the following table.

### Absolute encoder

Type (Encoder model number in parentheses)	Classification	Resolution during single rotation	Total number of rotations during multiple rotations	Baud rate	Absolute angular accuracy
<b>Battery-less absolute encoder</b> (Model No. HA035) This is a high-precision, battery-less, optical multi-turn encoder. Because there is no need to replace batteries, the encoder is maintenance free.  Compatible servo amplifiers: R 3E Model	Standard	131072 (17 bit)	65536 (16 bit)	2.5 Mbps	Approx. 0.167°
	Options	1048576 (20 bit)		4.0 Mbps	Under 0.0167°
		8388608 (23 bit)			
<b>Single-turn absolute encoder</b> (Model No. PA035S) This is a thin, optical single-turn encoder. It achieves wire saving particularly for systems that currently use incremental encoders, and helps downsize the systems.	Standard	131072 (17 bit)	—	2.5 Mbps	Approx. 0.167°
	Options	1048576 (20 bit)		4.0 Mbps	Approx. 0.167°
<b>Battery-backup absolute encoder</b> (Model No. PA035C) This is a thin, battery-backed, optical multi-turn encoder. Because the length of the motor can be shortened, it is ideal for devices with limited motor installation space. It requires an optional battery.	Options	131072 (17 bit)	65536 (16 bit)	2.5 Mbps	Approx. 0.167°
		1048576 (20 bit)		4.0 Mbps	Approx. 0.167°
<b>Battery-less absolute resolver encoder</b> (Model No. RA035C) This is a resolver method battery-less multi-turn encoder. This is an environmentally durable resolver encoder.	Options	131072 (17 bit)	65536 (16 bit)	2.5 Mbps	Approx. 0.167°
				4.0 Mbps	Approx. 0.167°

### Incremental encoder

Type (Encoder model number in parentheses)	Classification	Pulse/rotation
<b>Wire-saving incremental encoder</b> (Model No. PP031H) This is an incremental encoder with A, B, and Z-phase outputs that can easily be combined with a host controller.	Options	Up to 10000 P/R

# List of Compatible Servo Amplifiers and Servo Motors

Standard specification **S** ...Output shaft: Straight, Oil seal: None, Connecting method: Cannon plug

**K** ...Output shaft: With key, Oil seal: Yes, Connecting method: Cannon plug (15 kW or lower), Terminal block (20 kW or higher)

Servo motor							Servo amplifier
Motor type	Rated output	Flange size	Model name	Standard specification	Page		<b>R 3E Model</b> <b>Analog/Pulse Input type</b> p. 20 <b>EtherCAT Interface type</b> p. 34
					Specifications	Dimensions	
<b>R2</b> Servo motor <b>400 V system</b> <b>Medium inertia</b>	<b>550 W</b>	130 mm sp.	R2CA13050D	<b>K</b>	p. 50	p. 60	RS3C02□□〈25 A〉
	<b>750 W</b>	100 mm sp.	R2CA10075F	<b>S</b>	p. 50	p. 60	RS3C02□□〈25 A〉
	<b>1.0 kW</b>	100 mm sp.	R2CA10100F	<b>S</b>	p. 50	p. 60	RS3C05□□〈50 A〉
	<b>1.2 kW</b>	130 mm sp.	R2CA13120R	<b>K</b>	p. 50	p. 60	RS3C02□□〈25 A〉
		130 mm sp.	R2CA13120F	<b>K</b>	p. 51	p. 60	RS3C05□□〈50 A〉
	<b>1.8 kW</b>	130 mm sp.	R2CA13180H	<b>K</b>	p. 51	p. 60	RS3C02□□〈25 A〉
		130 mm sp.	R2CA13180D	<b>K</b>	p. 51	p. 60	RS3C05□□〈50 A〉
	<b>2.0 kW</b>	130 mm sp.	R2CA13200L	<b>K</b>	p. 52	p. 61	RS3C02□□〈25 A〉
		130 mm sp.	R2CA13200H	<b>K</b>	p. 52	p. 61	RS3C05□□〈50 A〉
	<b>3.5 kW</b>	180 mm sp.	R2CA18350L	<b>K</b>	p. 52	p. 61	RS3C05□□〈50 A〉
		180 mm sp.	R2CA18350D	<b>K</b>	p. 53	p. 61	RS3C10□□〈100 A〉
	<b>4.5 kW</b>	180 mm sp.	R2CA18450H	<b>K</b>	p. 53	p. 61	RS3C10□□〈100 A〉
	<b>5.5 kW</b>	180 mm sp.	R2CA18550R	<b>K</b>	p. 53	p. 61	RS3C10□□〈100 A〉
		180 mm sp.	R2CA18550H	<b>K</b>	p. 54	p. 61	RS3C15□□〈150 A〉
	<b>7.5 kW</b>	180 mm sp.	R2CA18750H	<b>K</b>	p. 54	p. 62	RS3C15□□〈150 A〉
	<b>11 kW</b>	220 mm sp.	R2CA2211KB	<b>K</b>	p. 54	p. 62	RS3C15□□〈150 A〉
	<b>15 kW</b>	220 mm sp.	R2CA2215KV	<b>K</b>	p. 55	p. 62	RS3C15□□〈150 A〉
	<b>20 kW</b>	220 mm sp.	R2CA2220KV	<b>K</b>	p. 55	p. 63	RS3C30□□〈300 A〉
	<b>30 kW</b>	275 mm sp.	R2CA2830KV	<b>K</b>	p. 55	p. 63	RS3C30□□〈300 A〉
<b>R1</b> Servo motor <b>400 V system</b> <b>Low inertia</b>	<b>1.5 kW</b>	100 mm sp.	R1CA10150V	<b>K</b>	p. 56	p. 64	RS3C02□□〈25 A〉
	<b>2.0 kW</b>	100 mm sp.	R1CA10200V	<b>K</b>	p. 56	p. 64	RS3C05□□〈50 A〉
	<b>3.0 kW</b>	130 mm sp.	R1CA13300V	<b>K</b>	p. 57	p. 64	RS3C05□□〈50 A〉
	<b>5.5 kW</b>	180 mm sp.	R1CA18550H	<b>K</b>	p. 57	p. 65	RS3C15□□〈150 A〉
	<b>7.5 kW</b>	180 mm sp.	R1CA18750L	<b>K</b>	p. 58	p. 65	RS3C15□□〈150 A〉
	<b>11 kW</b>	180 mm sp.	R1CA1811KR	<b>K</b>	p. 58	p. 65	RS3C15□□〈150 A〉
	<b>15 kW</b>	180 mm sp.	R1CA1815KB	<b>K</b>	p. 59	p. 65	RS3C15□□〈150 A〉
	<b>21 kW</b>	220 mm sp.	R1CA2220KV	<b>K</b>	p. 59	p. 65	RS3C30□□〈300 A〉

# Standard Model Number List For specifications on other models, contact us for details.

Input voltage **400 VAC**

## Servo Amplifier R 3E Model Analog/Pulse Input type

Main circuit power supply	Control circuit power supply	Encoder type	General-purpose output	Internal regenerative resistor	Safe Torque Off function*1	Safety*2	Amplifier capacity	Model no.	Page	
									Specifications	Dimensions
400 VAC system 380 to 480 VAC 3-phase	24 VDC	Absolute encoder	Sink (NPN)	Yes	No	No	25 A	RS3C02A0AA0	p. 24	p. 26
							50 A	RS3C05A0AA0	p. 24	p. 26
							100 A	RS3C10A0AA0	p. 24	p. 26
							150 A	RS3C15A0AL0	p. 24	p. 27
							300 A	RS3C30A0AM0	p. 24	p. 27
				No	Yes (without delay circuit)	No	25 A	RS3C02A0AA2	p. 24	p. 26
							50 A	RS3C05A0AA2	p. 24	p. 26
							100 A	RS3C10A0AA2	p. 24	p. 26
							150 A	RS3C15A0AL2	p. 24	p. 27
							300 A	RS3C30A0AM2	p. 24	p. 27
				Yes	Yes (without delay circuit)	Yes	25 A	RS3C02A0AAC	pp. 24, 44	p. 46
							50 A	RS3C05A0AAC	pp. 24, 44	p. 46
							100 A	RS3C10A0AAC	pp. 24, 44	p. 46
							150 A	RS3C15A0ALC	pp. 24, 44	p. 46
							300 A	RS3C30A0AMC	pp. 24, 44	p. 46
			Source (PNP)	Yes	No	No	25 A	RS3C02A0BA0	p. 24	p. 26
							50 A	RS3C05A0BA0	p. 24	p. 26
							100 A	RS3C10A0BA0	p. 24	p. 26
							150 A	RS3C15A0BL0	p. 24	p. 27
							300 A	RS3C30A0BM0	p. 24	p. 27
				No	Yes (without delay circuit)	No	25 A	RS3C02A0BA2	p. 24	p. 26
							50 A	RS3C05A0BA2	p. 24	p. 26
							100 A	RS3C10A0BA2	p. 24	p. 26
							150 A	RS3C15A0BL2	p. 24	p. 27
							300 A	RS3C30A0BM2	p. 24	p. 27
				Yes	Yes (without delay circuit)	Yes	25 A	RS3C02A0BAC	pp. 24, 44	p. 46
							50 A	RS3C05A0BAC	pp. 24, 44	p. 46
							100 A	RS3C10A0BAC	pp. 24, 44	p. 46
							150 A	RS3C15A0BLC	pp. 24, 44	p. 46
							300 A	RS3C30A0BMC	pp. 24, 44	p. 46
No	Yes (without delay circuit)	Yes	25 A	RS3C02A0BAC	pp. 24, 44	p. 46				
			50 A	RS3C05A0BAC	pp. 24, 44	p. 46				
			100 A	RS3C10A0BAC	pp. 24, 44	p. 46				
			150 A	RS3C15A0BLC	pp. 24, 44	p. 46				
			300 A	RS3C30A0BMC	pp. 24, 44	p. 46				

## Servo Amplifier R 3E Model EtherCAT Interface type

Main circuit power supply	Control circuit power supply	Encoder type	General-purpose output	Internal regenerative resistor	Safe Torque Off function*1	Safety*2	Amplifier capacity	Model no.	Page	
									Specifications	Dimensions
400 VAC system 380 to 480 VAC 3-phase	24 VDC	Absolute encoder	Photo relay output	Yes	Yes (without delay circuit)	No	25 A	RS3C02A2HA4	p. 38	p. 40
							50 A	RS3C05A2HA4	p. 38	p. 40
							100 A	RS3C10A2HA4	p. 38	p. 40
							150 A	RS3C15A2HL4	p. 38	p. 41
				No			300 A	RS3C30A2HM4	p. 38	p. 41
							25 A	RS3C02A2HAE	pp. 38, 44	p. 46
				Yes	Yes (without delay circuit)	Yes	50 A	RS3C05A2HAE	pp. 38, 44	p. 46
							100 A	RS3C10A2HAE	pp. 38, 44	p. 46
				150 A			RS3C15A2HLE	pp. 38, 44	p. 46	
				300 A			RS3C30A2HME	pp. 38, 44	p. 46	
No										

Our standard servo amplifiers conform to UL, c-UL, and EN standards as well as KC mark.

\*1 Safe Torque Off (STO) is a safety function defined in IEC/EN 61800-5-2:2016.

\*2 In addition to \*1, SS1 (Safe Stop 1), SS2 (Safe Stop 2), SOS (Safe Operating Stop), SLS (Safely-Limited Speed), SBC (Safe Brake Control), and SSM (Safe Speed Monitor) → p.44

# Standard Model Number List

For specifications on other models, contact us for details.

Input voltage **400 VAC**

## R2 Servo Motor

Standard specification **S**...Output shaft: Straight, Oil seal: None, Connecting method: Cannon plug**K**...Output shaft: With key, Oil seal: Yes, Connecting method: Cannon plug

Rated output	Motor flange size	Protection code	Holding brake (24 DCV)	Standard specification	CE and UL approved	Model no.		Page	
						Battery-less absolute encoder (Model No. HA035)	Single-turn absolute encoder (Model No. PA035S)	Specifications	Dimensions
550 W	130 mm sp.	IP65	No	<b>K</b>	Yes	R2CA13050DXR00M	R2CA13050DXH00M	p. 50	p. 60
			Yes	<b>K</b>	Yes	R2CA13050DCR00M	R2CA13050DCH00M	p. 50	p. 60
750 W	100 mm sp.	IP65	No	<b>S</b>	Yes	R2CA10075FXR03M	R2CA10075FXH03M	p. 50	p. 60
			Yes	<b>S</b>	Yes	R2CA10075FCR03M	R2CA10075FCH03M	p. 50	p. 60
1.0 kW	100 mm sp.	IP65	No	<b>S</b>	Yes	R2CA10100FXR03M	R2CA10100FXH03M	p. 50	p. 60
			Yes	<b>S</b>	Yes	R2CA10100FCR03M	R2CA10100FCH03M	p. 50	p. 60
1.2 kW	130 mm sp.	IP65	No	<b>K</b>	Yes	R2CA13120RXR00M	R2CA13120RXH00M	p. 50	p. 60
			Yes	<b>K</b>	Yes	R2CA13120RCR00M	R2CA13120RCH00M	p. 50	p. 60
			No	<b>K</b>	Yes	R2CA13120FXR00M	R2CA13120FXH00M	p. 51	p. 60
			Yes	<b>K</b>	Yes	R2CA13120FCR00M	R2CA13120FCH00M	p. 51	p. 60
1.8 kW	130 mm sp.	IP65	No	<b>K</b>	Yes	R2CA13180HXR00M	R2CA13180HXH00M	p. 51	p. 60
			Yes	<b>K</b>	Yes	R2CA13180HCR00M	R2CA13180HCH00M	p. 51	p. 60
			No	<b>K</b>	Yes	R2CA13180DXR00M	R2CA13180DXH00M	p. 51	p. 60
			Yes	<b>K</b>	Yes	R2CA13180DCR00M	R2CA13180DCH00M	p. 51	p. 60
2.0 kW	130 mm sp.	IP65	No	<b>K</b>	Yes	R2CA13200LXR00M	R2CA13200LXH00M	p. 52	p. 61
			Yes	<b>K</b>	Yes	R2CA13200LCR00M	R2CA13200LCH00M	p. 52	p. 61
			No	<b>K</b>	Yes	R2CA13200HXR00M	R2CA13200HXH00M	p. 52	p. 61
			Yes	<b>K</b>	Yes	R2CA13200HCR00M	R2CA13200HCH00M	p. 52	p. 61
3.5 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R2CA18350LXR00M	R2CA18350LXH00M	p. 52	p. 61
			Yes	<b>K</b>	Yes	R2CA18350LCR00M	R2CA18350LCH00M	p. 52	p. 61
			No	<b>K</b>	Yes	R2CA18350DXR00M	R2CA18350DXH00M	p. 53	p. 61
			Yes	<b>K</b>	Yes	R2CA18350DCR00M	R2CA18350DCH00M	p. 53	p. 61
4.5 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R2CA18450HXR00M	R2CA18450HXH00M	p. 53	p. 61
			Yes	<b>K</b>	Yes	R2CA18450HCR00M	R2CA18450HCH00M	p. 53	p. 61
5.5 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R2CA18550RXR00M	R2CA18550RXH00M	p. 53	p. 61
			Yes	<b>K</b>	Yes	R2CA18550RCR00M	R2CA18550RCH00M	p. 53	p. 61
			No	<b>K</b>	Yes	R2CA18550HXR00M	R2CA18550HXH00M	p. 54	p. 61
			Yes	<b>K</b>	Yes	R2CA18550HCR00M	R2CA18550HCH00M	p. 54	p. 61
7.5 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R2CA18750HXR00M	R2CA18750HXH00M	p. 54	p. 62
			Yes	<b>K</b>	Yes	R2CA18750HCR00M	R2CA18750HCH00M	p. 54	p. 62
11 kW	220 mm sp.	IP65	No	<b>K</b>	Yes	R2CA2211KBR00M	R2CA2211KBXH00M	p. 54	p. 62
			Yes	<b>K</b>	Yes	R2CA2211KBCR00M	R2CA2211KBCH00M	p. 54	p. 62
15 kW	220 mm sp.	IP65	No	<b>K</b>	Yes	R2CA2215KVXR00M	R2CA2215KVXH00M	p. 55	p. 62
			Yes	<b>K</b>	Yes	R2CA2215KVCR00M	R2CA2215KVCH00M	p. 55	p. 62
20 kW	220 mm sp.	IP65	No	<b>K</b>	No	R2CA2220KVXR00	R2CA2220KVXH00	p. 55	p. 63
			Yes	<b>K</b>	No	R2CA2220KVCR00	R2CA2220KVCH00	p. 55	p. 63
30 kW	275 mm sp.	IP65	No	<b>K</b>	No	R2CA2830KVXR00	R2CA2830KVXH00	p. 55	p. 63
			Yes	<b>K</b>	No	R2CA2830KVCR00	R2CA2830KVCH00	p. 55	p. 63

Input voltage **400 VAC**

## R1 Servo Motor

Standard specification **S**...Output shaft: Straight, Oil seal: None, Connecting method: Cannon plug

**K**...Output shaft: With key, Oil seal: Yes, Connecting method: Cannon plug

Rated output	Motor flange size	Protection code	Holding brake (24 DCV)	Standard specification	CE and UL approved	Model no.		Page	
						Battery-less absolute encoder (Model No. HA035)	Single-turn absolute encoder (Model No. PA035S)	Specifications	Dimensions
1.5 kW	100 mm sp.	IP65	No	<b>K</b>	Yes	R1CA10150VXR00M	R1CA10150VXH00M	p. 56	p. 64
			Yes	<b>K</b>	Yes	R1CA10150VCR00M	R1CA10150VCH00M	p. 56	p. 64
2.0 kW	100 mm sp.	IP65	No	<b>K</b>	Yes	R1CA10200VXR00M	R1CA10200VXH00M	p. 56	p. 64
			Yes	<b>K</b>	Yes	R1CA10200VCR00M	R1CA10200VCH00M	p. 56	p. 64
3.0 kW	130 mm sp.	IP65	No	<b>K</b>	Yes	R1CA13300VXR00M	R1CA13300VXH00M	p. 57	p. 64
			Yes	<b>K</b>	Yes	R1CA13300VCR00M	R1CA13300VCH00M	p. 57	p. 64
5.5 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R1CA18550HXR00M	R1CA18550HXXH00M	p. 57	p. 65
			Yes	<b>K</b>	Yes	R1CA18550HCR00M	R1CA18550HCH00M	p. 57	p. 65
7.5 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R1CA18750LXR00M	R1CA18750LXH00M	p. 58	p. 65
			Yes	<b>K</b>	Yes	R1CA18750LCR00M	R1CA18750LCH00M	p. 58	p. 65
11 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R1CA1811KRXR00M	R1CA1811KRXH00M	p. 58	p. 65
			Yes	<b>K</b>	Yes	R1CA1811KRCR00M	R1CA1811KRCH00M	p. 58	p. 65
15 kW	180 mm sp.	IP65	No	<b>K</b>	Yes	R1CA1815KBXR00M	R1CA1815KBXH00M	p. 59	p. 65
			Yes	<b>K</b>	Yes	R1CA1815KBCR00M	R1CA1815KBCH00M	p. 59	p. 65
21 kW	220 mm sp.	IP65	No	<b>K</b>	No	R1CA2220KVXR00	R1CA2220KVXH00	p. 59	p. 65



# Standard Model Number List

For specifications on other models, contact us for details.

Input voltage **400 VAC**

## Option

### R 3E Model Analog/Pulse Input type

Model no.	Category	Remarks	Page
AL-00385594	Servo amplifier connector, individual item	For controller connection (CN1)	pp. 70, 71
AL-00632607		For encoder connection (EN1, EN2) Note that this is not a set of two connectors, but a single connector.	pp. 70, 71
AL-00718251-01		For safety function connection [for short-circuiting (CN4)]	pp. 70, 71
AL-00723290	Servo amplifier connector set (For non-STO models)	CN1, EN1 (standard)	pp. 70, 71
AL-00966991		CN1, EN1, CNE with connector tool (standard)	p. 70
AL-00966993		CN1, EN1, EN2 (for fully closed-loop systems)	pp. 70, 71
AL-00966995		CN1, EN1, EN2, CNE with connector tool (for fully closed-loop systems)	p. 70
AL-00723159		CN1, EN1, CN4 (standard)	pp. 70, 71
AL-00967013	Servo amplifier connector set (For STO models)	CN1, EN1, CN4, CNE with connector tool (standard)	p. 70
AL-00967015		CN1, EN1, EN2, CN4 (for fully closed-loop systems)	pp. 70, 71
AL-00967017		CN1, EN1, EN2, CN4, CNE with connector tool (for fully closed-loop systems)	p. 70
AL-00911582-01	Communication cable between amplifiers for tandem operation	0.2 m	p. 81
AL-00911582-02		3.0 m	p. 81

### R 3E Model EtherCAT Interface types

Model no.	Category	Remarks	Page
AL-Y0012504-01	Servo amplifier connector, individual item	To connect to encoders (EN1, EN2) Note that this is not a set of two connectors, but a single connector.	pp. 72, 73
AL-00842383		For general-purpose I/O (CN2)	pp. 72, 73
AL-00849548-02		For safety function connection [for short-circuiting (CN4)]	pp. 72, 73
AL-01002534	Servo amplifier connector set (For non-STO models)	EN1, CN2 (standard)	pp. 72, 73
AL-01002536		EN1, EN2, CN2 (for fully closed-loop systems)	pp. 72, 73
AL-00977732	Servo amplifier connector set (For STO models)	EN1, CN4, CN2 (standard)	pp. 72, 73
AL-00977750		EN1, CNE with connector tool, CN4, CN2 (standard)	p. 72
AL-00977752		EN1, EN2, CN4, CN2 (for fully closed-loop systems)	pp. 72, 73
AL-00977754		EN1, EN2, CNE with connector tool, CN4, CN2 (for fully closed-loop systems)	p. 72

### R 3E Model EtherCAT Interface types

Model no.	Category	Remarks	Page
AL-00953863-01	Servo amplifier connector, individual item	For main circuit power supply connection (CNA)	pp. 70, 72
AL-00953864-01		For regenerative resistor connection (CNC)	pp. 70, 72
AL-00953865-01		Motor power (CNB)	pp. 70, 72
AL-00953866-01		Connector tool for CNA, CNB, and CNC	pp. 70, 72
AL-00961843-01		For control power supply input (CND)	pp. 70, 72
AL-00961844-01		Connector tool for CND	pp. 70, 72
AL-00953867-01		For holding brake power output (CNE)	pp. 70, 72
AL-00953868-01		Connector tool for CNE	pp. 70, 72
AL-00718252-01		For safety function connection [for wiring (CN4)]	pp. 70, 72
AL-Y0012189-01		For safety function connection [Safety only (SF-CN1, SF-CN2)] Note that this is not a set of two connectors, but a single connector.	pp. 70 to 73
AL-00896515-01	USB communication cable for setup software	1 m	p. 81
AL-00896515-02		2 m	p. 81
AL-00937694-01	Servo motor encoder cable	1 m	p. 81
AL-00937694-02		2 m	p. 81
AL-00937694-03		3 m	p. 81
AL-00937694-05		5 m	p. 81
AL-00937694-10		10 m	p. 81

# Input voltage 400 VAC

## Option

### Common to R 3E Model Analog/Pulse and EtherCAT Interface types

Model no.	Category	Remarks	Page
AL-00999243-01	Servo motor encoder cable For 275 mm sq. motors	1 m	p. 81
AL-00999243-02		2 m	p. 81
AL-00999243-03		3 m	p. 81
AL-00999243-05		5 m	p. 81
AL-00999243-10		10 m	p. 81
AL-00964811-01	Servo motor power cable For 100 mm sq. motors Without brake line	1 m	p. 74
AL-00964811-02		2 m	p. 74
AL-00964811-03		3 m	p. 74
AL-00964811-05		5 m	p. 74
AL-00964811-10		10 m	p. 74
AL-00964812-01	Servo motor power cable For 100 mm sq. motors With brake line	1 m	p. 74
AL-00964812-02		2 m	p. 74
AL-00964812-03		3 m	p. 74
AL-00964812-05		5 m	p. 74
AL-00964812-10		10 m	p. 74
AL-00965739-01	Servo motor power cable For 130 mm sq. motors Without brake line Note: Model numbers differ for different motors. See the respective pages for details.	1 m	p. 74
AL-00965739-02		2 m	p. 74
AL-00965739-03		3 m	p. 74
AL-00965739-05		5 m	p. 74
AL-00965739-10		10 m	p. 74
AL-00965740-01	Servo motor power cable For 130 mm sq. motors With brake line Note: Model numbers differ for different motors. See the respective pages for details.	1 m	p. 74
AL-00965740-02		2 m	p. 74
AL-00965740-03		3 m	p. 74
AL-00965740-05		5 m	p. 74
AL-00965740-10		10 m	p. 74
AL-00965741-01	Servo motor power cable For 130/180 mm sq. motors Without brake line Note: Model numbers differ for different motors. See the respective pages for details.	1 m	p. 75
AL-00965741-02		2 m	p. 75
AL-00965741-03		3 m	p. 75
AL-00965741-05		5 m	p. 75
AL-00965741-10		10 m	p. 75
AL-00965742-01	Servo motor power cable For 130/180 mm sq. motors With brake line Note: Model numbers differ for different motors. See the respective pages for details.	1 m	p. 75
AL-00965742-02		2 m	p. 75
AL-00965742-03		3 m	p. 75
AL-00965742-05		5 m	p. 75
AL-00965742-10		10 m	p. 75
AL-00965743-01	Servo motor power cable For 180 mm sq. motors Without brake line Note: Model numbers differ for different motors. See the respective pages for details.	1 m	p. 75
AL-00965743-02		2 m	p. 75
AL-00965743-03		3 m	p. 75
AL-00965743-05		5 m	p. 75
AL-00965743-10		10 m	p. 75
AL-00965744-01	Servo motor power cable For 180 mm sq. motors With brake line Note: Model numbers differ for different motors. See the respective pages for details.	1 m	p. 75
AL-00965744-02		2 m	p. 75
AL-00965744-03		3 m	p. 75
AL-00965744-05		5 m	p. 75
AL-00965744-10		10 m	p. 75
AL-00997919-01	Servo motor power cable For 180 mm sq. motors Without brake line Note: Model numbers differ for different motors. See the respective pages for details.	1 m	p. 76
AL-00997919-02		2 m	p. 76
AL-00997919-03		3 m	p. 76
AL-00997919-05		5 m	p. 76
AL-00997919-10		10 m	p. 76

# Standard Model Number List

For specifications on other models, contact us for details.

Input voltage **400 VAC**

## Option

### Common to R 3E Model Analog/Pulse and EtherCAT Interface types

Model no.	Category	Remarks	Page
AL-00997920-01	Servo motor power cable	1 m	p. 76
AL-00997920-02	For 180 mm sq. motors	2 m	p. 76
AL-00997920-03	With brake line	3 m	p. 76
AL-00997920-05	Note: Model numbers differ for different motors.	5 m	p. 76
AL-00997920-10	See the respective pages for details.	10 m	p. 76
AL-00997921-01	Servo motor power cable	1 m	p. 77
AL-00997921-02	For 180/220 mm sq. motors	2 m	p. 77
AL-00997921-03	Without brake line	3 m	p. 77
AL-00997921-05	Note: Model numbers differ for different motors.	5 m	p. 77
AL-00997921-10	See the respective pages for details.	10 m	p. 77
AL-00999240-01	Servo motor power cable	1 m	p. 77
AL-00999240-02	For 220/275 mm sq. motors	2 m	p. 77
AL-00999240-03	Without brake line	3 m	p. 77
AL-00999240-05	Note: Model numbers differ for different motors.	5 m	p. 77
AL-00999240-10	See the respective pages for details.	10 m	p. 77
AL-00997923-01	Servo motor cooling fan power cable	1 m	p. 82
AL-00997923-02	For 180/220 mm sq. motors	2 m	p. 82
AL-00997923-03		3 m	p. 82
AL-00997923-05		5 m	p. 82
AL-00997923-10		10 m	p. 82
AL-00999241-01	Servo motor cooling fan power cable	1 m	p. 82
AL-00999241-02	For 275 mm sq. motors	2 m	p. 82
AL-00999241-03		3 m	p. 82
AL-00999241-05		5 m	p. 82
AL-00999241-10		10 m	p. 82
AL-00918630-01	Servo motor brake cable	1 m	p. 82
AL-00918630-02	For 180/220 mm sq. motors	2 m	p. 82
AL-00918630-03		3 m	p. 82
AL-00918630-05		5 m	p. 82
AL-00918630-10		10 m	p. 82
AL-00999239-01	Servo motor brake cable	1 m	p. 82
AL-00999239-02	For 275 mm sq. motors	2 m	p. 82
AL-00999239-03		3 m	p. 82
AL-00999239-05		5 m	p. 82
AL-00999239-10		10 m	p. 82
AL-00999242-01	Servo motor cooling fan thermostat cable	1 m	p. 83
AL-00999242-02	For 275 mm sq. motors	2 m	p. 83
AL-00999242-03		3 m	p. 83
AL-00999242-05		5 m	p. 83
AL-00999242-10		10 m	p. 83
Q-MON-3	Analog monitor box	Set of a monitor box + 2 dedicated cables	p. 84
AL-00690525-01	Dedicated cable for analog monitor box	1 cable	p. 84
REGIST-500CW80B	External regenerative resistor	500 W, 80 $\Omega$	p. 84
REGIST-500CW40B		500 W, 40 $\Omega$	p. 84
REGIST-500CW20B		500 W, 20 $\Omega$	p. 84
REGIST-500CW14B		500 W, 14 $\Omega$	p. 84
REGIST-500CW7B		500 W, 7 $\Omega$	p. 84
AL-00962547-01	Front mounting brackets	For 25 A servo amplifiers	p. 84

# Servo Amplifiers

## R 3E Model

Analog/Pulse Input type EtherCAT Interface type

Servo Amplifier Capacity: 25 to 300 A

More evolved AC servo amplifiers that provide improved basic performance such as high responsiveness, and are more eco-efficient and easier to use.

Safe Torque Off function equipped models are also available. Safe Torque Off (STO) is a safety function defined in IEC/EN 61800-5-2:2016.

The product lineup also includes Safety models that have a wider variety of safety functions.



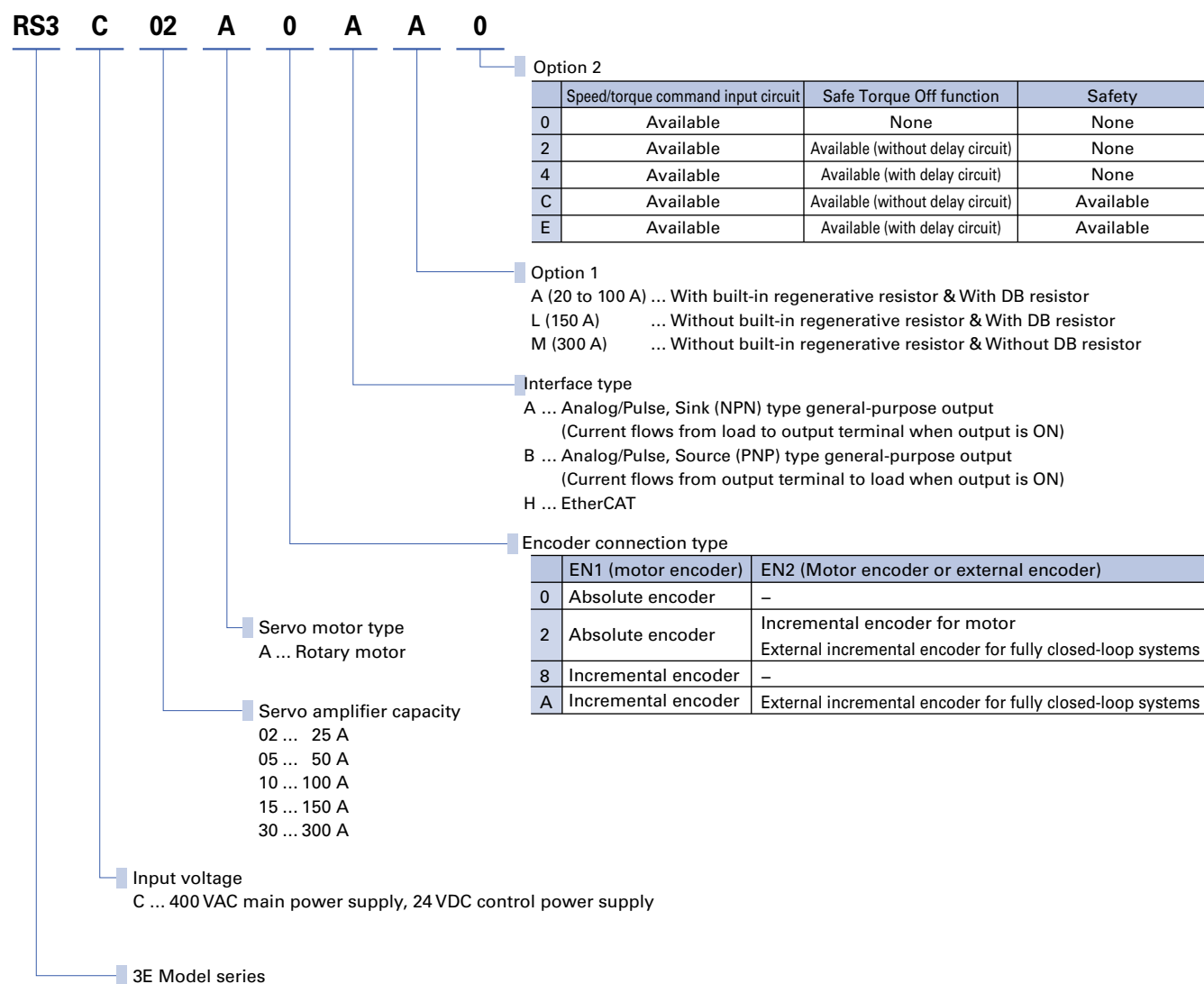
### How to read model numbers

Note that not all the possible combinations of the numbers and characters below are valid.

Also, some of the numbers/characters listed below are for optional models.

For model numbers valid as standard products, refer to "Standard Model Number List".

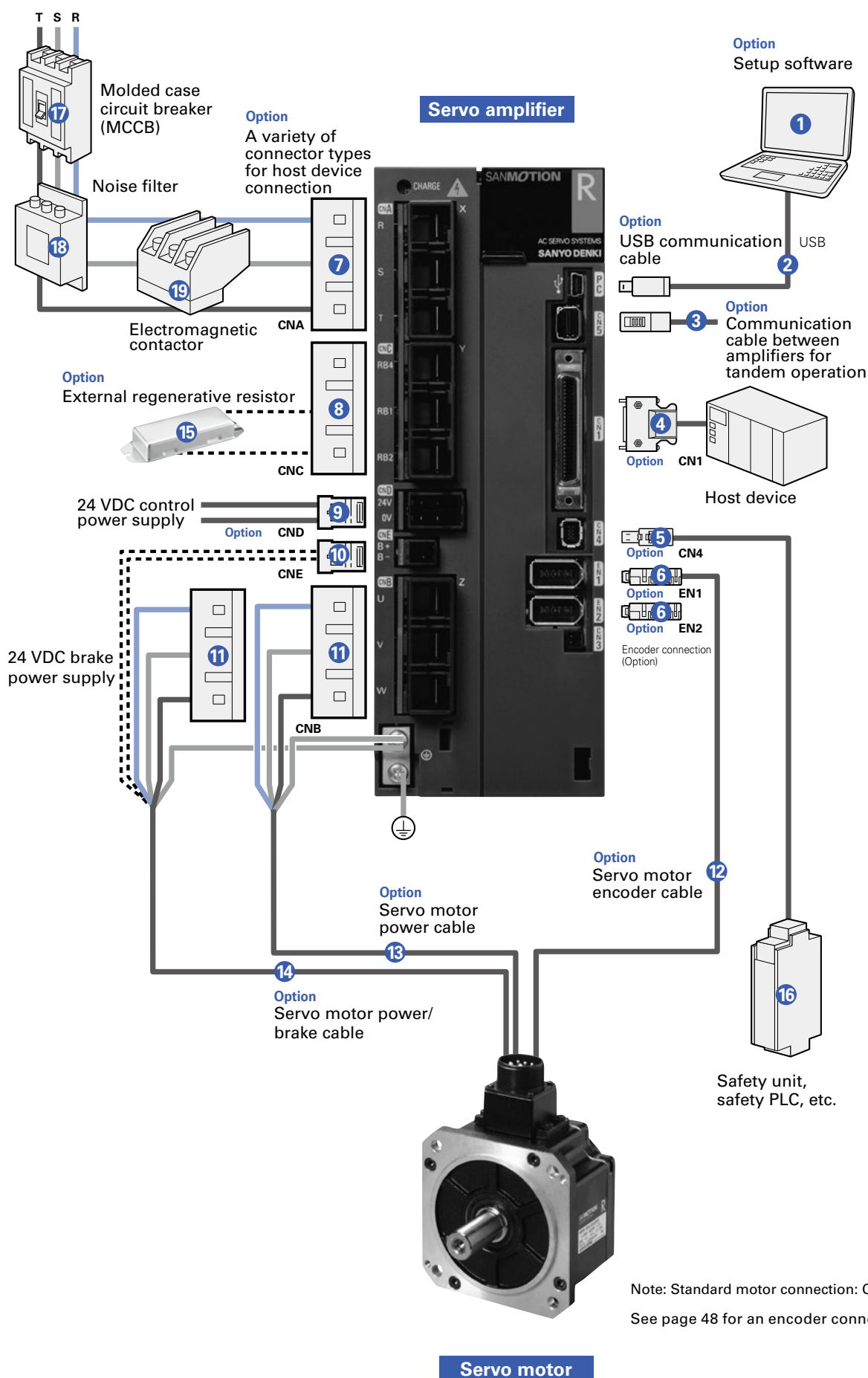
#### Servo amplifier



# System Configuration

See page 45 for the system configuration of the Safety models.

**25 to 100 A** The photograph shows the 30 A model.



## Options and Peripherals (25 to 100 A)

No.	Name	Model no.	Description	Page
①	Setup software	Can be downloaded from Product Information on our website.	Parameters can be set and monitored via communication with a PC.	p. 68
②	USB communication cable	AL-00896515-0□	PC communication cable for setup software	p. 81
③	Communication cable between amplifiers for tandem operation	AL-00911582-0□	Connects between amplifiers for tandem operation (CN5 ⇄ CN5)	p. 81
④	CN1 connector	AL-00385594	For controller connection	p. 70
⑤	CN4 connector	AL-00718251-01 (for short-circuiting), AL-00718252-01 (for wiring)	To be connect to safety device (for short-circuiting and wiring)	p. 70
⑥	EN1 connector	AL-00632607	For encoder connection	p. 70
	EN2 connector	AL-00632607	Note that this is not a set of two connectors, but a single connector.	p. 70
⑦	CNA connector *	AL-00953863-01	For main circuit power connection	p. 70
⑧	CNC connector *	AL-00953864-01	For regenerative resistor connections	p. 70
⑨	CND connector *	AL-00961843-01	For control circuit power supply connection	p. 70
⑩	CNE connector *	AL-00953867-01	For brake	p. 70
⑪	CNB connector *	AL-00953865-01	To connect to servo motor	p. 70
⑫	Servo motor cables	AL-00937694-□□	For encoder	p. 81
⑬		AL-0096□□□□-□□	For power	pp. 74, 75
⑭		AL-0096□□□□-□□	Power/brake cable	pp. 74, 75
⑮	External regenerative resistor	REGIST-500CW□□B	Used for special operations, such as high frequency applications that require greater power dissipation than that provided by the servo amplifier's built-in regenerative resistor	p. 84
⑯	Safety unit, safety PLC, etc.	To be provided by the customer	Connects I/O signals from the Safe Torque Off function to devices such as the safety unit and safety PLC.	—
⑰	Molded case circuit breaker (MCCB)	To be provided by the customer	Used to protect the power line.	—
⑱	Noise filter	To be provided by the customer	Used to prevent external noise from the power source line.	—
⑲	Electromagnetic contactor	To be provided by the customer	Used to switch the power on and off.	—

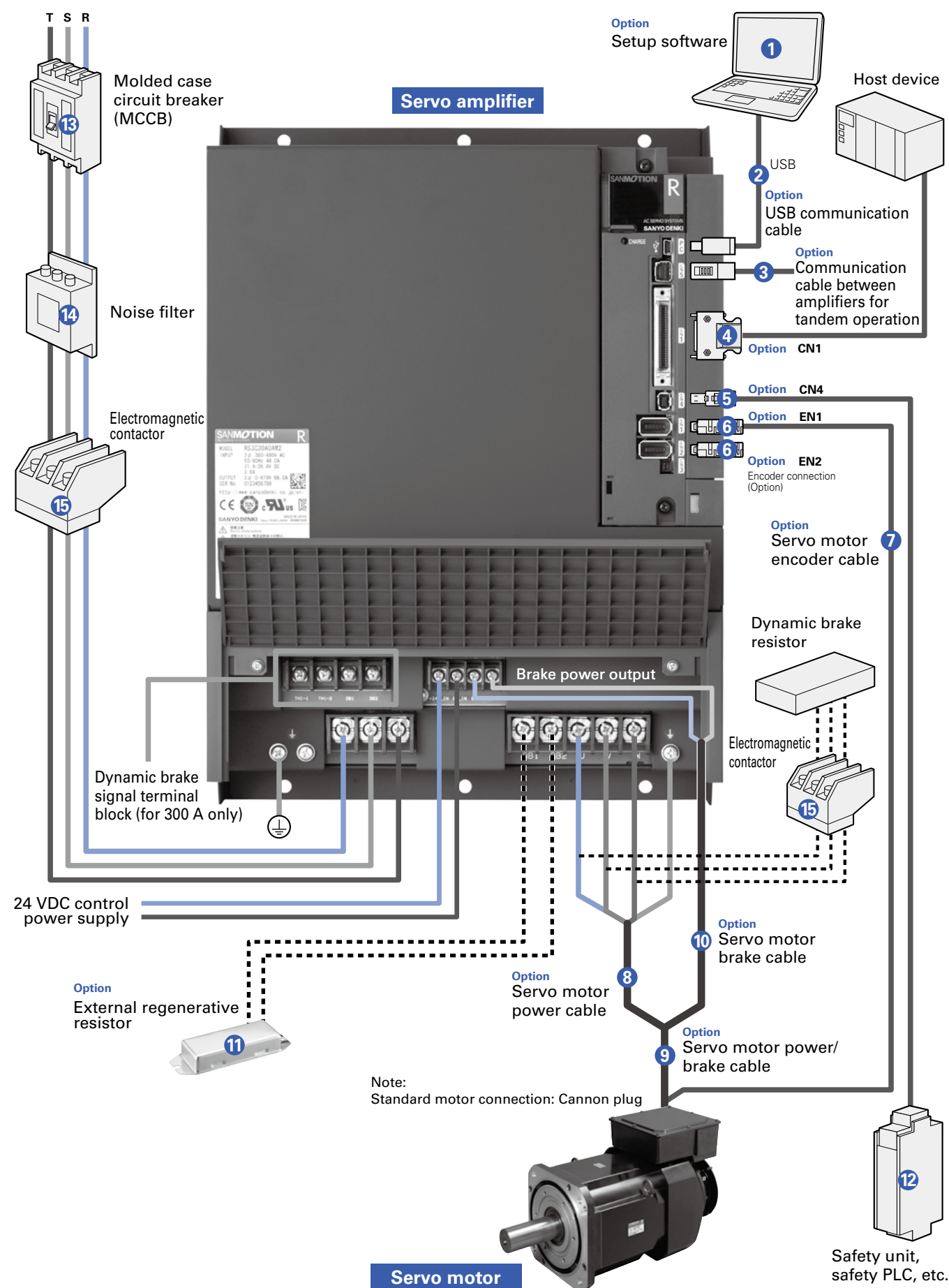
\* Wiring on the CNA to CNE connectors requires a connector tool. → p. 70

Connector sets are also available with set model numbers. See respective pages.

# System Configuration

See page 45 for the system configuration of the Safety models.

**150 to 300 A** The photograph shows the 300 A model.





## Options and Peripherals (150 A, 300 A)

No.	Name	Model no.	Description	Page
①	Setup software	Can be downloaded from Product Information on our website.	Parameters can be set and monitored via communication with a PC.	p. 68
②	USB communication cable	AL-00896515-0□	PC communication cable for setup software	p. 81
③	Communication cable between amplifiers for tandem operation	AL-00911582-0□	Connects between amplifiers for tandem operation (CN5 ⇄ CN5)	p. 81
④	CN1 connector	AL-00385594	For controller connection	p. 71
⑤	CN4 connector	AL-00718251-01 (for short-circuiting), AL-00718252-01 (for wiring)	To be connect to safety device (for short-circuiting and wiring)	p. 71
⑥	EN1 connector	AL-00632607	For encoder connection	p. 71
	EN2 connector	AL-00632607	Note that this is not a set of two connectors, but a single connector.	p. 71
⑦	Servo motor cables	AL-009□□□□□-□□	For encoder	p. 81
⑧		AL-009□□□□□-□□	For power	pp. 74 to 77
⑨		AL-009□□□□□-□□	Power/brake cable	pp. 74 to 77
⑩		AL-009□□□□□-□□	For brake	pp. 74 to 77
⑪	External regenerative resistor	REGIST-500CW□□B	Used for special operations, such as high frequency applications that require greater power dissipation than that provided by the servo amplifier's built-in regenerative resistor	p. 84
⑫	Safety unit, safety PLC, etc.	To be provided by the customer	Connects I/O signals from the Safe Torque Off function to devices such as the safety unit and safety PLC.	—
⑬	Molded case circuit breaker (MCCB)	To be provided by the customer	Used to protect the power line.	—
⑭	Noise filter	To be provided by the customer	Used to prevent external noise from the power source line.	—
⑮	Electromagnetic contactor	To be provided by the customer	Used to switch the power on and off.	—

Connector sets are also available with set model numbers. See respective pages.

## General Specifications

Control function	Position control, Speed control, Torque control (Parameter switching)	
Control system	IGBT: PWM control, sinusoidal drive	
Main Circuit Power Supply *	3-Phase: 380 to 480 VAC (+10, -15%), 50/60 Hz (±3 Hz)	
Control circuit power supply *	24 VDC ±10%	
Environment	Ambient temperature	0 to +55°C
	Storage temperature	-20 to +65°C
	Operation and Storage humidity	Below 90% RH (non-condensing)
	Operation altitude	Below 1000 m
	Vibration resistance	4.9 m/s <sup>2</sup>
	Impact resistance	19.6m/s <sup>2</sup>
Structure	With built-in tray type power supply (25 to 100 A), with built-in wall-mount power supply (150, 300 A)	



\* Power source voltage should be within the specified range below.  
Voltage range specifications: 323 to 528 VDC for main power supply, 21.6 to 26.4 VDC for control power supply  
The servo amplifier must be operated under the conditions of overvoltage category III as per EN 61800-5-1. For a 24 VDC control or interface power supply, use a DC power supply with reinforced insulation on I/O terminals.

### Performance

Speed control range	1:5000 (Internal speed command)
Frequency characteristics	2200 Hz (In high frequency sampling mode)
Permissible load moment of inertia	10 times the motor rotary inertia

### Built-in functions

Protection functions	Overcurrent, Current detection error, Overload, Regeneration error, Overheating, External error, Overvoltage, Main circuit power supply undervoltage, Main circuit power supply open phase, Control circuit power supply undervoltage, Encoder error, Overspeed, Speed control error, Speed feedback error, Excessive position deviation, Position command pulse error, Built-in memory error, Parameter error, Cooling fan error
Digital operator	Status display, Monitor display, Alarm display, Parameter setting, Test run, Adjustment mode
Dynamic brake	25 to 150 A: Built-in, 150 A, 300 A: None
Regenerative resistor	25 to 100 A: Built-in, 150 A, 300 A: None Note: Optional external regenerative resistors are available (10 to 600 A).
Monitor	Speed monitor (VMON) 2.0 V±10% (at 1000 min <sup>-1</sup> ), Torque (thrust force) command monitor (TCMON) 2.0 V±10% (at 100%)

### Safety standards

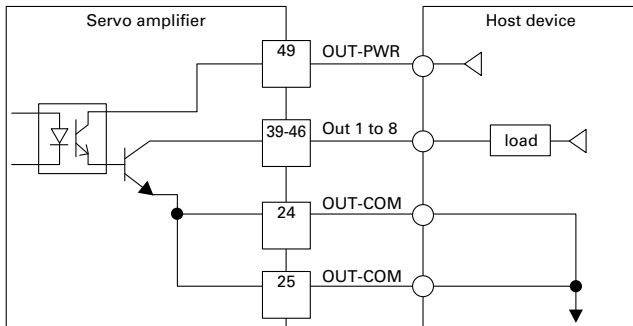
Servo amplifier type	Safety standards			
RS3C□□A□□□0	North American safety standards (UL, c-UL)		UL 61800-5-1	
	European directive	Low-voltage directive	IEC/EN 61800-5-1	
		EMC directive	IEC/EN 61800-3, IEC/EN 61326-3-1	
	KC Mark (Korea Certification Mark)		KN 61000-6-2, KN 61000-6-4	
RS3C□□A□□□2 (Safe Torque Off function) RS3C□□A□□□C (Safety)	North American safety standards (UL)		UL 61800-5-1	
	European directive	Low-voltage directive	IEC/EN 61800-5-1	
		EMC directive	IEC/EN 61800-3	IEC/EN 61000-6-2
			IEC/EN 61326-1	IEC 61000-6-7
	KC Mark (Korea Certification Mark)		IEC/EN 61000-6-4	
KC Mark (Korea Certification Mark)		KN 61000-6-2, KN 61000-6-4		

### Functional safety specifications

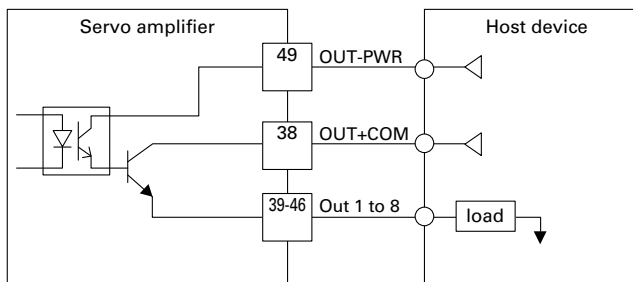
Servo amplifier type			IEC/EN 61800-5-2: 2016	Description	Safety level	
RS3C□□A□□□0	RS3C□□A□□□2 (Safe Torque Off function)	RS3C□□A□□□C (Safety)			EN 61508 IEC/EN 62061	ISO 13849-1: 2015 EN ISO 13849-1: 2015
—	○	○	STO (Safe Torque Off)	Safe torque off	SIL3 SILCL3	Cat.3 PL e
—	—	○	SS1 (Safe Stop 1)	Safe stop 1		
—	—	○	SS2 (Safe Stop 2)	Safe stop 2		
—	—	○	SOS (Safe Operating Stop)	Safe operating stop		
—	—	○	SLS (Safely-Limited Speed)	Safely-limited speed		
—	—	○	SBC (Safe Brake Control)	Safe brake control		
—	—	○	SSM (Safe Speed Monitor)	Safe speed monitor		

## ■ General-purpose output specifications

### Sink type (NPN)



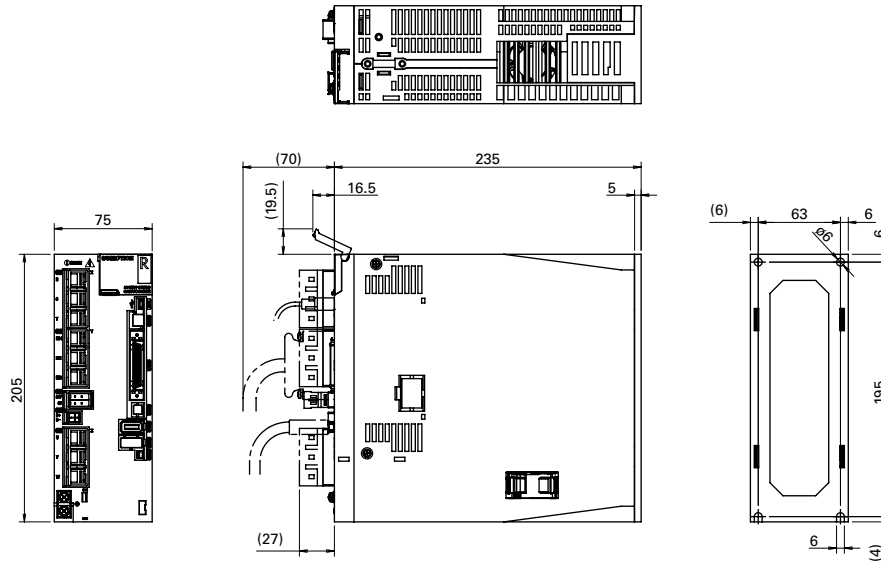
### Source type (PNP)



## Dimensions [Unit: mm] Refer to p. 46 for dimensional drawings of Safety.

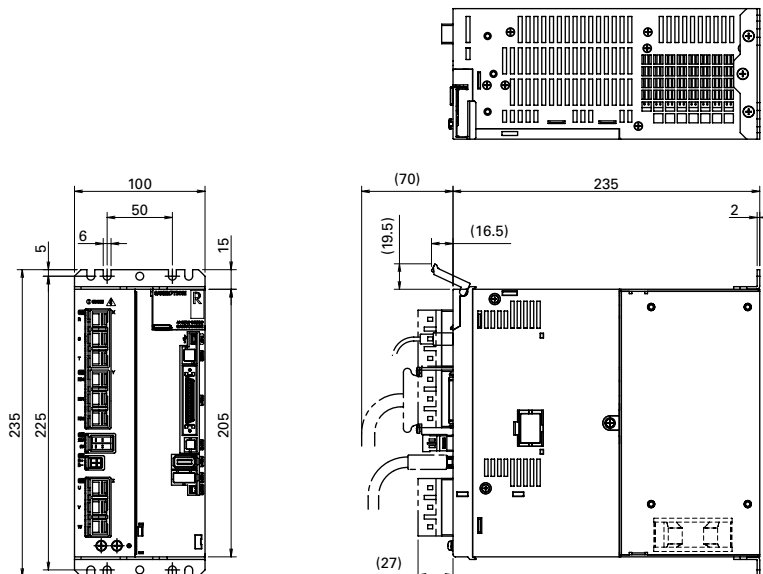
### 25 A

Mass: 2.5 kg



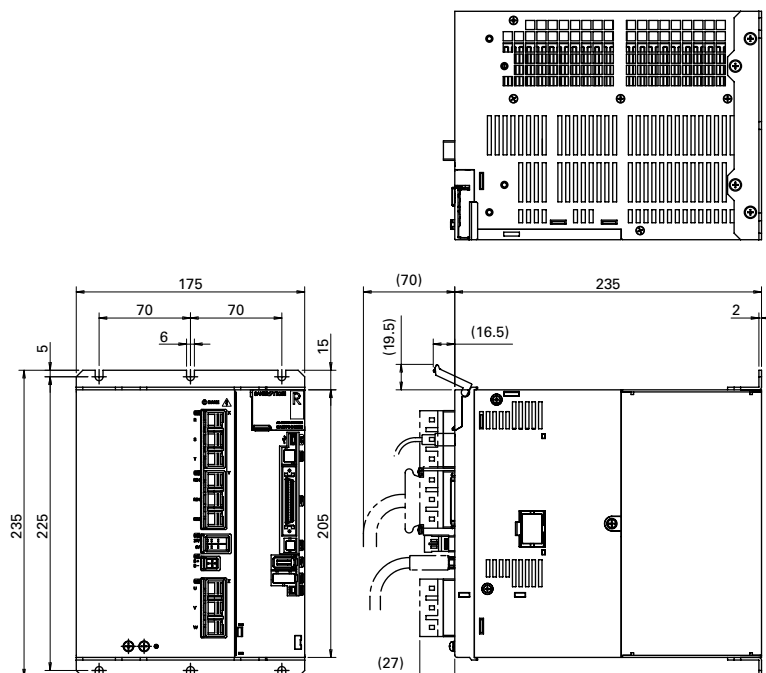
### 50 A

Mass: 4.7 kg



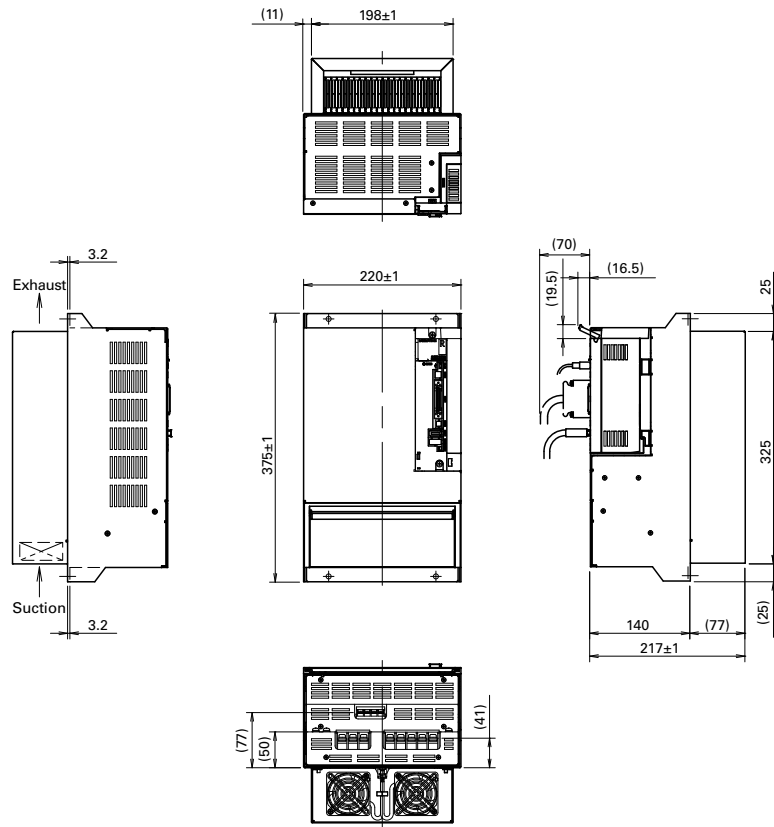
### 100 A

Mass: 8.5 kg



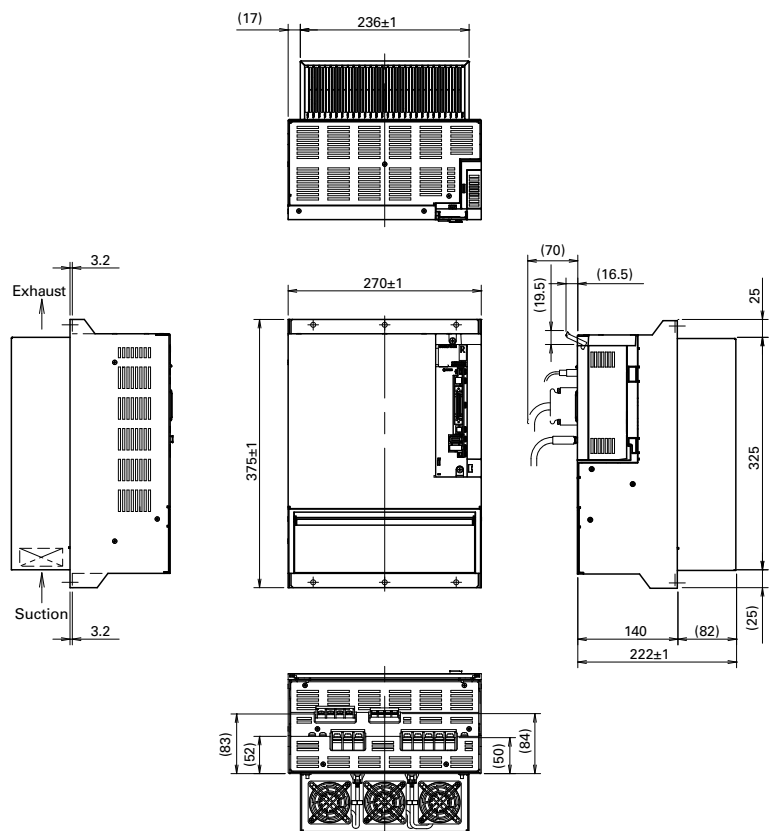
## 150 A

Mass: 11.0 kg  
(Safety: 11.1 kg)



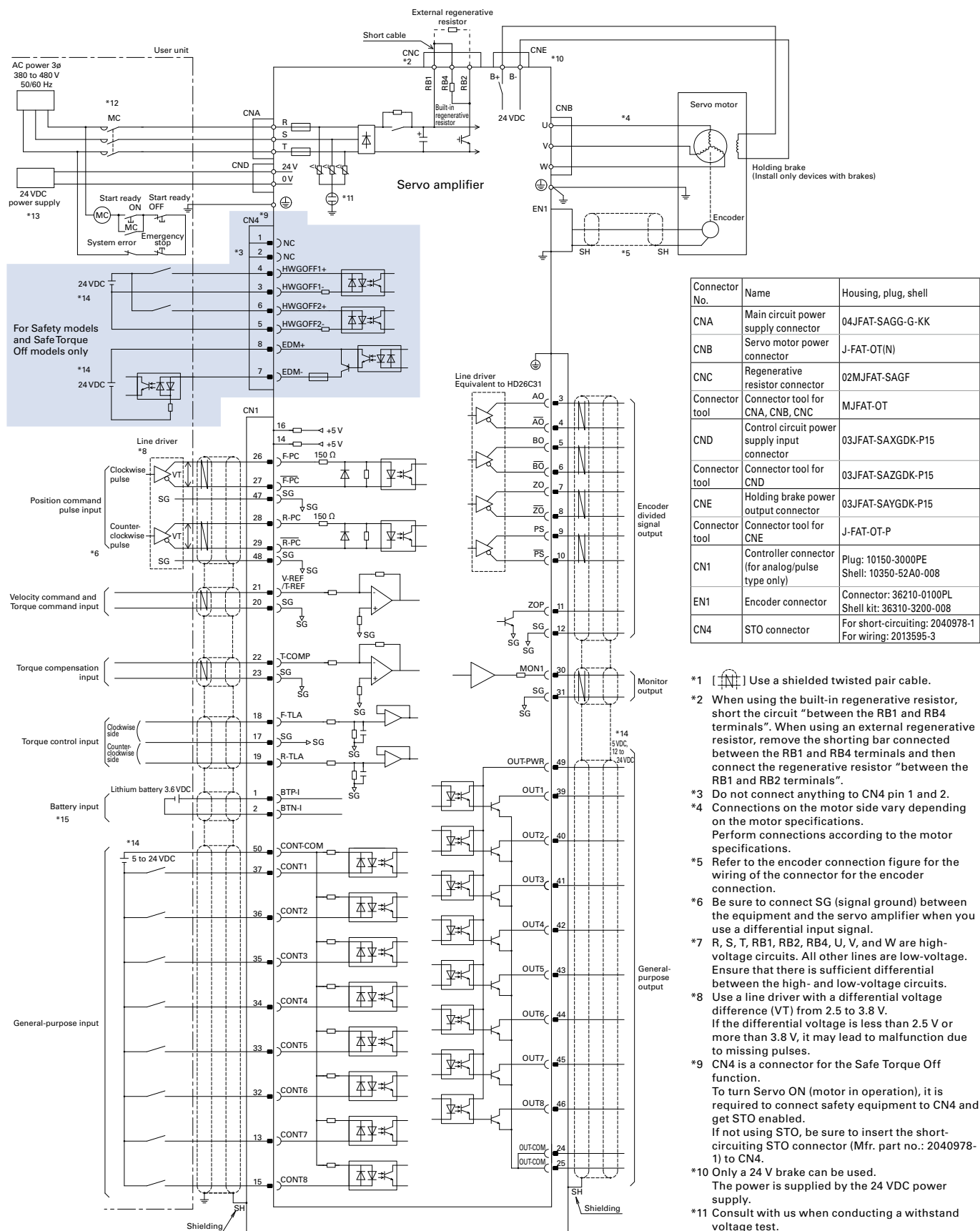
## 300 A

Mass: 18.0 kg  
(Safety: 18.1 kg)



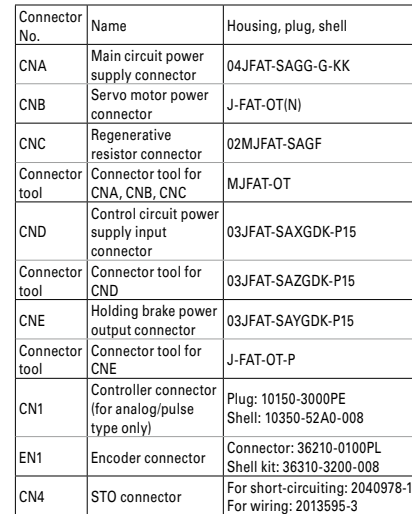
# External Wiring Diagram


## 25 to 100 A, Sink type (NPN) output



- \*1 [Shielded twisted pair cable] Use a shielded twisted pair cable.
- \*2 When using the built-in regenerative resistor, short the circuit "between the RB1 and RB4 terminals". When using an external regenerative resistor, remove the shorting bar connected between the RB1 and RB4 terminals and then connect the regenerative resistor "between the RB1 and RB2 terminals".
- \*3 Do not connect anything to CN4 pin 1 and 2.
- \*4 Connections on the motor side vary depending on the motor specifications. Perform connections according to the motor specifications.
- \*5 Refer to the encoder connection figure for the wiring of the connector for the encoder connection.
- \*6 Be sure to connect SG (signal ground) between the equipment and the servo amplifier when you use a differential input signal.
- \*7 R, S, T, RB1, RB2, RB4, U, V, and W are high-voltage circuits. All other lines are low-voltage. Ensure that there is sufficient differential between the high- and low-voltage circuits.
- \*8 Use a line driver with a differential voltage difference (VT) from 2.5 to 3.8 V. If the differential voltage is less than 2.5 V or more than 3.8 V, it may lead to malfunction due to missing pulses.
- \*9 CN4 is a connector for the Safe Torque Off function. To turn Servo ON (motor in operation), it is required to connect safety equipment to CN4 and get STO enabled. If not using STO, be sure to insert the short-circuiting STO connector (Mfr. part no.: 2040978-1) to CN4.
- \*10 Only a 24 V brake can be used. The power is supplied by the 24 VDC power supply.
- \*11 Consult with us when conducting a withstand voltage test.
- \*12 An earth leakage circuit breaker conforming either to UL, IEC, or EN standards is recommended.
- \*13 For the 24 VDC power supply, use a safety extra low voltage (SELV) power supply with reinforced insulation on I/O terminals.
- \*14 The external power supply is to be arranged by the customer.
- \*15 No wiring is required when using the battery-less absolute encoder.

## Servo Amplifiers

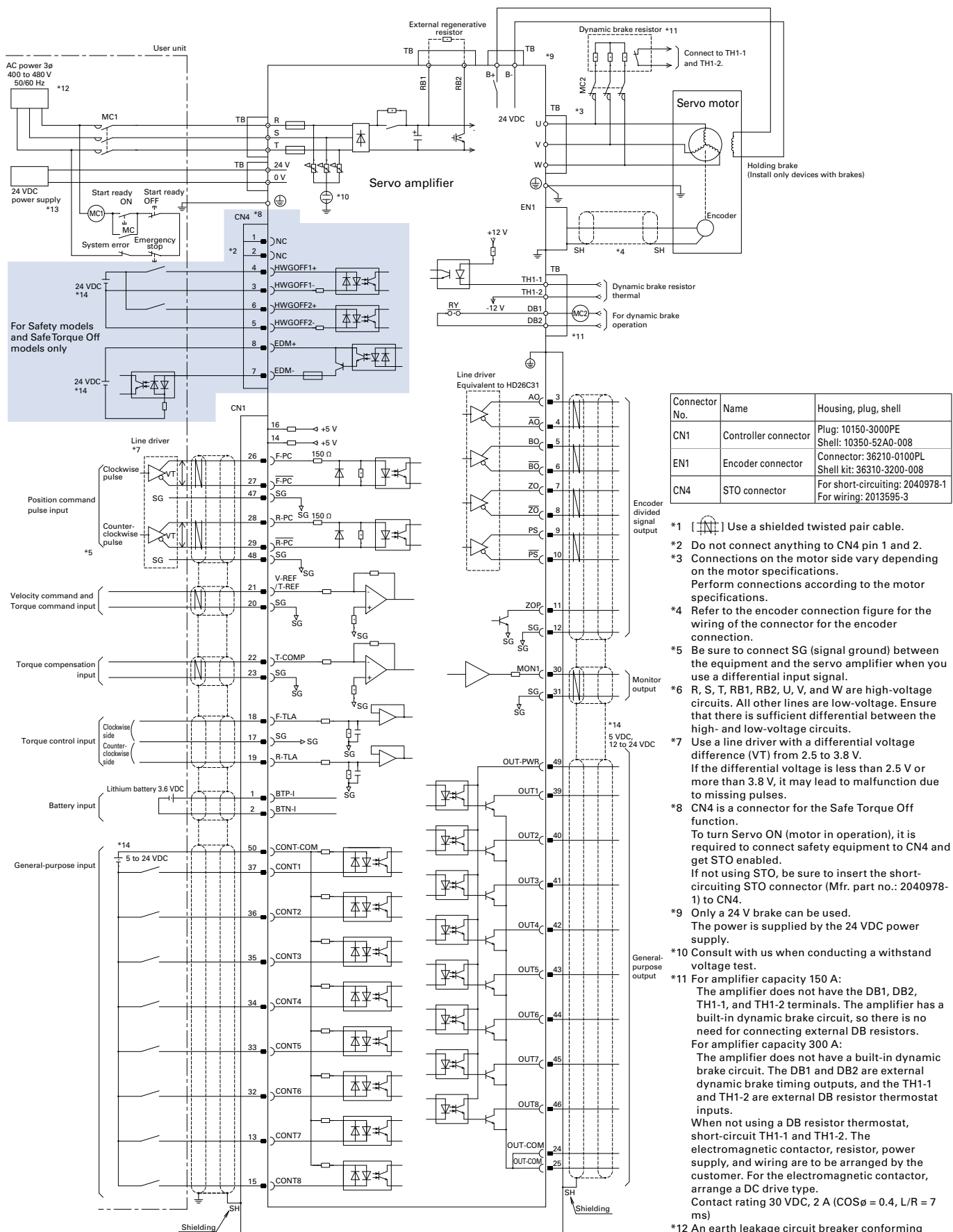


- \*1  Use a shielded twisted pair cable.
- \*2 When using the built-in regenerative resistor, short the circuit "between the RB1 and RB4 terminals". When using an external regenerative resistor, remove the shorting bar connected between the RB1 and RB4 terminals and then connect the regenerative resistor "between the RB1 and RB2 terminals".
- \*3 Do not connect anything to CN4 pin 1 and 2.
- \*4 Connections on the motor side vary depending on the motor specifications.  
Perform connections according to the motor specifications.
- \*5 Refer to the encoder connection figure for the wiring of the connector for the encoder connection.
- \*6 Be sure to connect SG (signal ground) between the equipment and the servo amplifier when you use a differential input signal.
- \*7 R, S, T, RB1, RB2, RB4, U, V, and W are high-voltage circuits. All other lines are low-voltage. Ensure that there is sufficient differential between the high- and low-voltage circuits.
- \*8 Use a line driver with a differential voltage difference (VT) from 2.5 to 3.8 V.  
If the differential voltage is less than 2.5 V or more than 3.8 V, it may lead to malfunction due to missing pulses.
- \*9 CN4 is a connector for the Safe Torque Off function.  
To turn Servo ON (motor in operation), it is required to connect safety equipment to CN4 and get STO enabled.  
If not using STO, be sure to insert the short-circuiting STO connector (Mfr. part no.: 2040978-1) to CN4.
- \*10 Only a 24 V brake can be used.  
The power is supplied by the 24 VDC power supply.
- \*11 Consult with us when conducting a withstand voltage test.
- \*12 An earth leakage circuit breaker conforming either to UL, IEC, or EN standards is recommended.
- \*13 For the 24 VDC power supply, use a safety extra low voltage (SELV) power supply with reinforced insulation on I/O terminals.
- \*14 The external power supply is to be arranged by the customer.
- \*15 No wiring is required when using the battery-less absolute encoder.



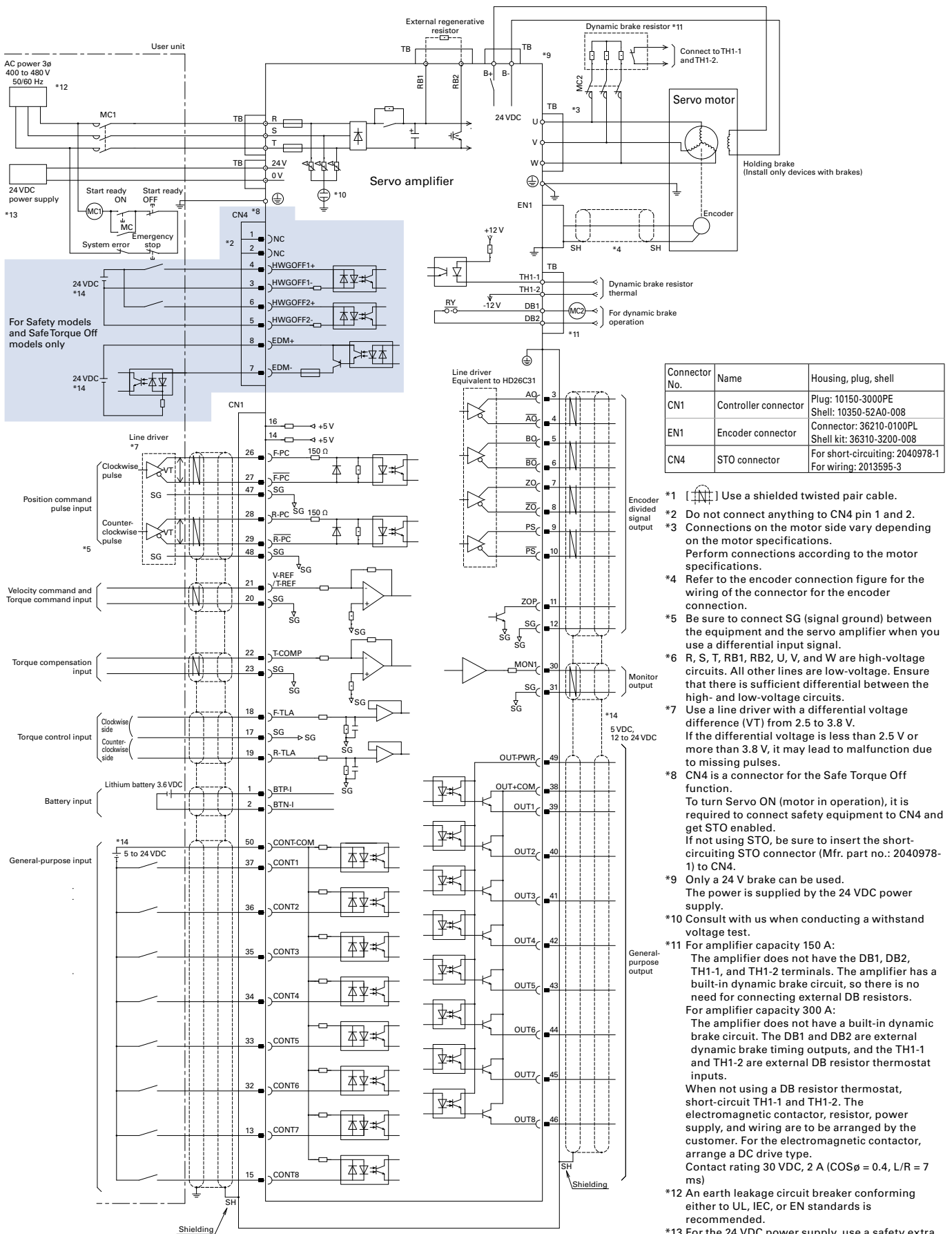
# External Wiring Diagram

## 150 A, 300 A, Sink type (NPN) output



- \*1 Use a shielded twisted pair cable.
- \*2 Do not connect anything to CN4 pin 1 and 2.
- \*3 Connections on the motor side vary depending on the motor specifications. Perform connections according to the motor specifications.
- \*4 Refer to the encoder connection figure for the wiring of the connector for the encoder connection.
- \*5 Be sure to connect SG (signal ground) between the equipment and the servo amplifier when you use a differential input signal.
- \*6 R, S, T, RB1, RB2, U, V, and W are high-voltage circuits. All other lines are low-voltage. Ensure that there is sufficient differential between the high- and low-voltage circuits.
- \*7 Use a line driver with a differential voltage difference (VT) from 2.5 to 3.8 V. If the differential voltage is less than 2.5 V or more than 3.8 V, it may lead to malfunction due to missing pulses.
- \*8 CN4 is a connector for the Safe Torque Off function. To turn Servo ON (motor in operation), it is required to connect safety equipment to CN4 and get STO enabled. If not using STO, be sure to insert the short-circuiting STO connector (Mfr. part no.: 2040978-1) to CN4.
- \*9 Only a 24 V brake can be used. The power is supplied by the 24 VDC power supply.
- \*10 Consult with us when conducting a withstand voltage test.
- \*11 For amplifier capacity 150 A: The amplifier does not have the DB1, DB2, TH1-1, and TH1-2 terminals. The amplifier has a built-in dynamic brake circuit, so there is no need for connecting external DB resistors. For amplifier capacity 300 A: The amplifier does not have a built-in dynamic brake circuit. The DB1 and DB2 are external dynamic brake timing outputs, and the TH1-1 and TH1-2 are external DB resistor thermostat inputs. When not using a DB resistor thermostat, short-circuit TH1-1 and TH1-2. The electromagnetic contactor, resistor, power supply, and wiring are to be arranged by the customer. For the electromagnetic contactor, arrange a DC drive type. Contact rating 30 VDC, 2 A (COS $\phi$  = 0.4, L/R = 7 ms).
- \*12 An earth leakage circuit breaker conforming either to UL, IEC, or EN standards is recommended.
- \*13 For the 24 VDC power supply, use a safety extra low voltage (SELV) power supply with reinforced insulation on I/O terminals.
- \*14 The external power supply is to be arranged by the customer.

## 150 A, 30 A, Source type (PNP) output

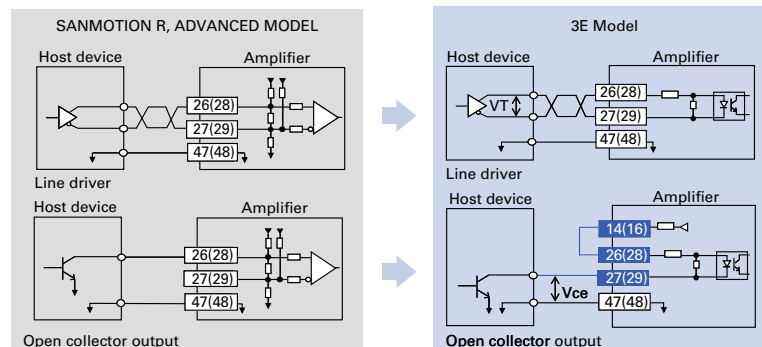


# Cautions for When Replacing with SANMOTION R 3E Model

If you are replacing our previous models with SANMOTION R 3E Model, please be aware of the following points:

## Position command pulse input

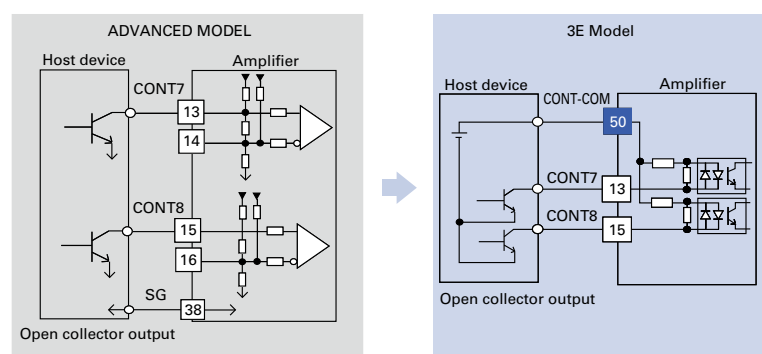
There are constraints on the specifications of the available position pulse signals for the SANMOTION R 3E Model. Also, if the host device output is open collector type, a wiring change is necessary.



Pulse output circuit of the host devices	Wiring compatibility	Constraint conditions
Differential output type (Line driver)	Yes	Voltage difference between differential signals (VT) : 2.5 to 3.8 V
Open collector type	No	Saturation voltage of the transistor (Vce): 1.5 V max.

## General-purpose input

For the SANMOTION R 3E Model, differential (line driver) output type cannot be used as a host device side output circuit. Furthermore, wiring change will be required even if open collector output is used.



General-purpose output circuit of the host devices	Wiring compatibility	Constraint conditions
Differential output type (Line driver)	–	Change to open collector type.
Open collector type	No (Refer to the figure)	Wire in the same way as CONT1 to 6.

## Setup software

The setup software for the SANMOTION R 3E Model series is SANMOTION MOTOR SETUP SOFTWARE.

The software is available for download from our website.

Beware that SANMOTION R Setup Software cannot be used.

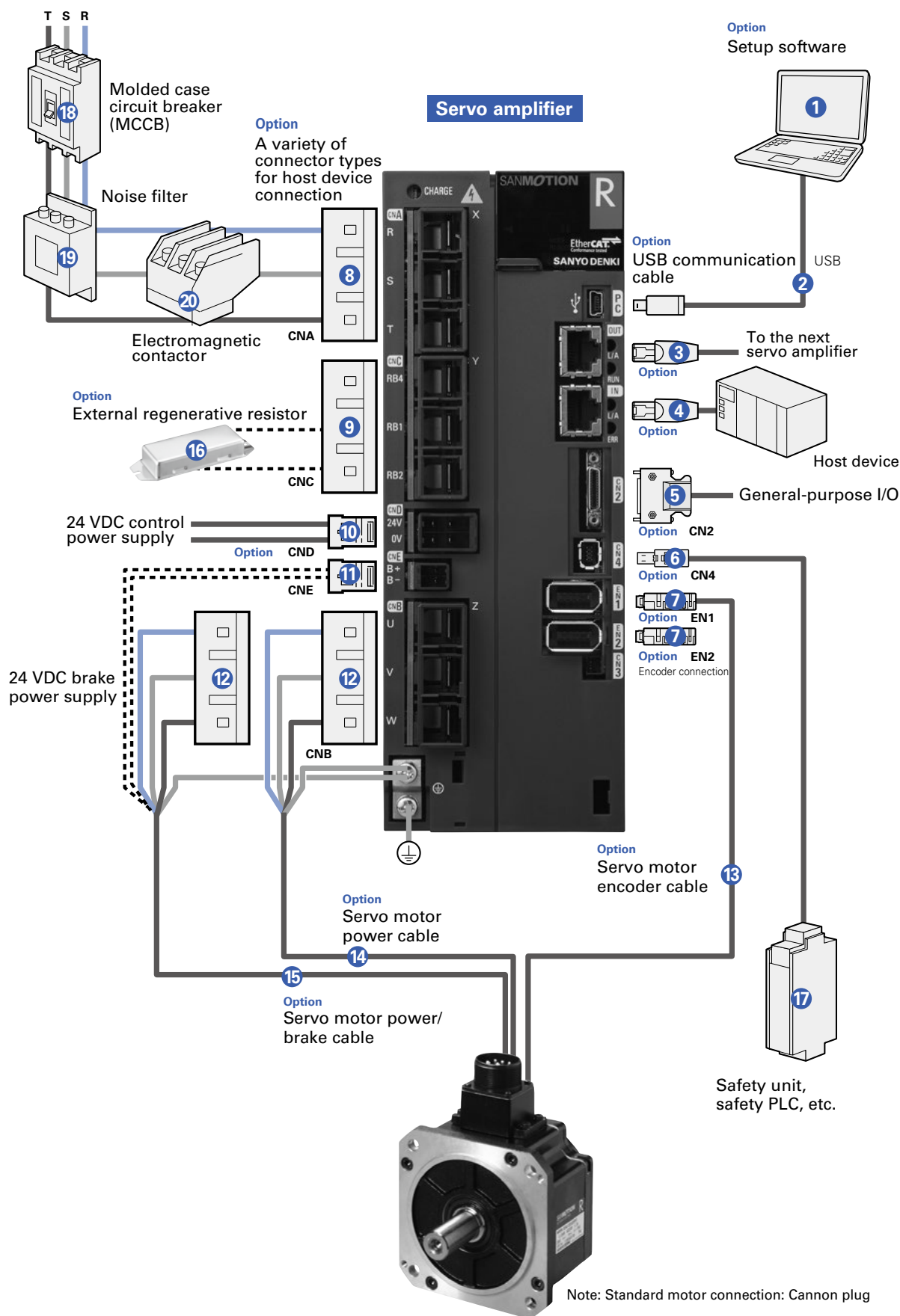
Use an optional product or a USB cable available on the market (with USB Mini-B connector on the servo amplifier side) for communication cable.



# System Configuration

See page 45 for the system configuration of the Safety models.

**25 to 100 A** The photograph shows the 50 A model.



## Options and Peripherals (25 to 100 A)

No.	Name	Model no.	Description	Page
①	Setup software	Can be downloaded from Product Information on our website.	Parameters can be set and monitored via communication with a PC.	p. 68
②	USB communication cable	AL-00896515-0□	PC communication cable for setup software	p. 81
③	OUT connector	To be provided by the customer	EtherCAT OUT (to the next servo amplifier)	—
④	IN connector	To be provided by the customer	EtherCAT IN (host device)	—
⑤	CN2 connector	AL-00842383	For general-purpose I/O	p. 72
⑥	CN4 connector	AL-00718252-01	To be connect to safety device	p. 72
⑦	EN1 connector	AL-Y0012504-01	For encoder connection	p. 72
	EN2 connector	AL-Y0012504-01	Note that this is not a set of two connectors, but a single connector.	p. 72
⑧	CNA connector *	AL-00953863-01	For main circuit power connection	p. 72
⑨	CNC connector *	AL-00953864-01	For regenerative resistor connections	p. 72
⑩	CND connector *	AL-00961843-01	For control circuit power supply connection	p. 72
⑪	CNE connector *	AL-00953867-01	For brake	p. 72
⑫	CNB connector *	AL-00953865-01	To connect to servo motor	p. 72
⑬	Servo motor cables	AL-00937694-□□	For encoder	p. 81
⑭		AL-0096□□□□-□□	For power	pp. 74, 75
⑮		AL-0096□□□□-□□	Power/brake cable	pp. 74, 75
⑯	External regenerative resistor	REGIST-500CW□□B	Used for special operations, such as high frequency applications that require greater power dissipation than that provided by the servo amplifier's built-in regenerative resistor	p. 84
⑰	Safety unit, safety PLC, etc.	To be provided by the customer	Connects I/O signals from the Safe Torque Off function to devices such as the safety unit and safety PLC.	—
⑱	Molded case circuit breaker (MCCB)	To be provided by the customer	Used to protect the power line.	—
⑲	Noise filter	To be provided by the customer	Used to prevent external noise from the power source line.	—
⑳	Electromagnetic contactor	To be provided by the customer	Used to switch the power on and off.	—

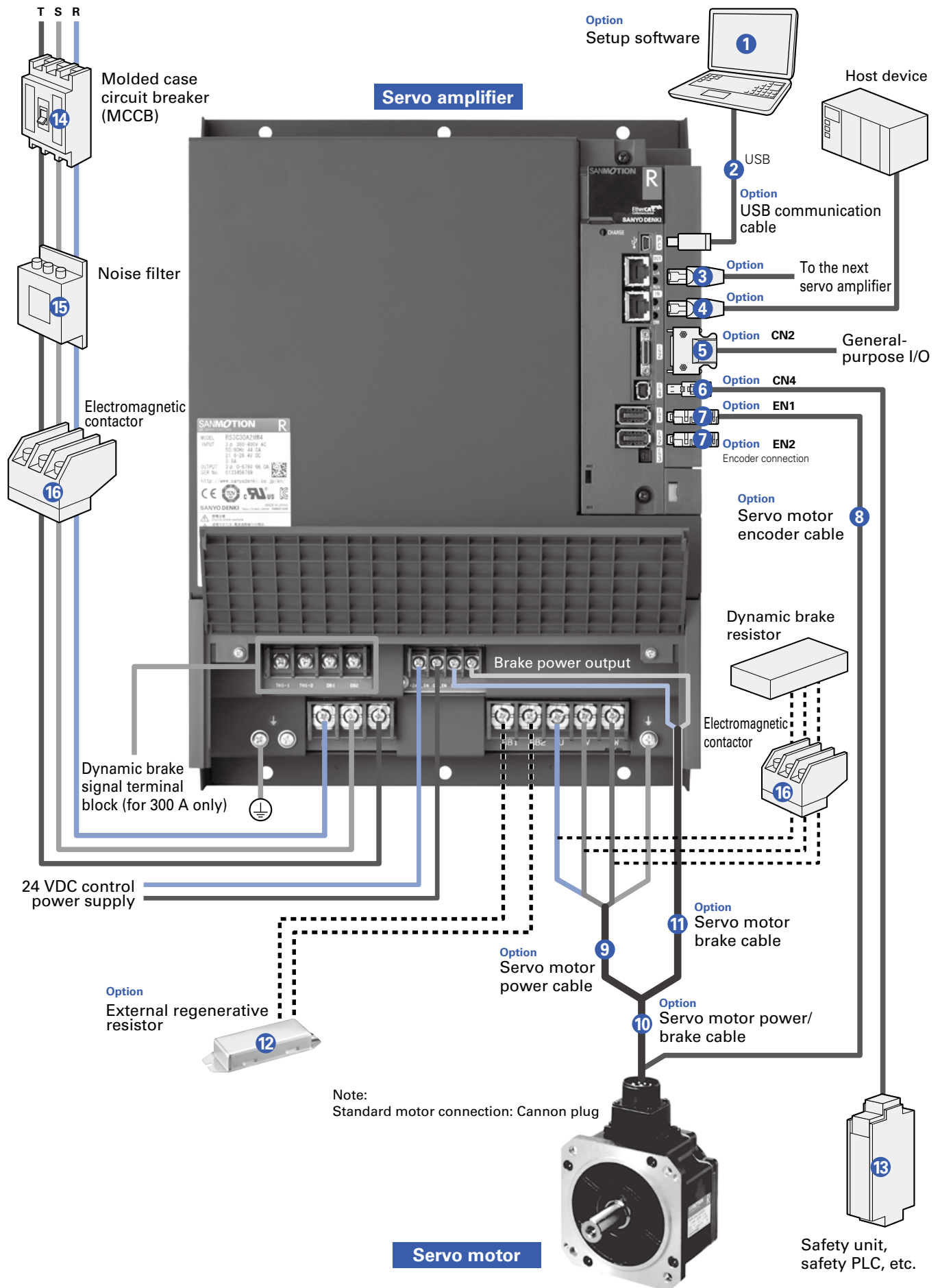
\* Wiring on the CNA to CNE connectors requires a connector tool. → p. 72

Connector sets are also available with set model numbers. See respective pages.

# System Configuration

See page 45 for the system configuration of the Safety models.

**150 to 300 A** The photograph shows the 300 A model.





## Options and Peripherals (150 A, 300 A)

No.	Name	Model no.	Description	Page
①	Setup software	Can be downloaded from Product Information on our website.	Parameters can be set and monitored via communication with a PC.	p. 68
②	USB communication cable	AL-00896515-0□	PC communication cable for setup software	p. 81
③	OUT connector	To be provided by the customer	EtherCAT OUT (to the next servo amplifier)	—
④	IN connector	To be provided by the customer	EtherCAT IN (host device)	—
⑤	CN2 connector	AL-00842383	For general-purpose I/O	p. 73
⑥	CN4 connector	AL-00718252-01	To be connect to safety device	p. 73
⑦	EN1 connector	AL-Y0012504-01	For encoder connection	p. 73
	EN2 connector	AL-Y0012504-01	Note that this is not a set of two connectors, but a single connector.	p. 73
⑧	Servo motor cables	AL-009□□□□□-□□	For encoder	p. 81
⑨		AL-009□□□□□-□□	For power	pp. 74 to 77
⑩		AL-009□□□□□-□□	Power/brake cable	pp. 74 to 77
⑪		AL-009□□□□□-□□	For brake	pp. 74 to 77
⑫	External regenerative resistor	REGIST-500CW□□B	Used for special operations, such as high frequency applications that require greater power dissipation than that provided by the servo amplifier's built-in regenerative resistor	p. 84
⑬	Safety unit, safety PLC, etc.	To be provided by the customer	Connects I/O signals from the Safe Torque Off function to devices such as the safety unit and safety PLC.	—
⑭	Molded case circuit breaker (MCCB)	To be provided by the customer	Used to protect the power line.	—
⑮	Noise filter	To be provided by the customer	Used to prevent external noise from the power source line.	—
⑯	Electromagnetic contactor	To be provided by the customer	Used to switch the power on and off.	—

Connector sets are also available with set model numbers. See respective pages.

## General Specifications

Control function	Position control, Speed control, Torque control (Parameter switching)	
Control system	IGBT: PWM control, sinusoidal drive	
Main Circuit Power Supply *	3-Phase: 380 to 480 VAC (+10, -15%), 50/60 Hz (±3 Hz)	
Control circuit power supply *	24 VDC ±10%	
Environment	Ambient temperature	0 to +55°C
	Storage temperature	-20 to +65°C
	Operation and Storage humidity	Below 90% RH (non-condensing)
	Operation altitude	Below 1000 m
	Vibration resistance	4.9 m/s <sup>2</sup>
	Impact resistance	19.6m/s <sup>2</sup>
Structure	With built-in tray type power supply (25 to 100 A), with built-in wall-mount power supply (150, 300 A)	



\* Power source voltage should be within the specified range below.  
Voltage range specifications: 323 to 528 VDC for main power supply, 21.6 to 26.4 VDC for control power supply  
The servo amplifier must be operated under the conditions of overvoltage category III as per EN 61800-5-1. For a 24 VDC control or interface power supply, use a DC power supply with reinforced insulation on I/O terminals.

### Performance

Speed control range	1:5000 (Internal speed command)
Frequency characteristics	2200 Hz (In high frequency sampling mode)
Permissible load moment of inertia	10 times the motor rotary inertia

### Built-in functions

Protection functions	Overcurrent, Current detection error, Overload, Regeneration error, Overheating, External error, Overvoltage, Main circuit power supply undervoltage, Main circuit power supply open phase, Control circuit power supply undervoltage, Encoder error, Overspeed, Speed control error, Speed feedback error, Excessive position deviation, Position command pulse error, Built-in memory error, Parameter error, Cooling fan error
Digital operator	Status display, Monitor display, Alarm display, Parameter setting, Test run, Adjustment mode
Dynamic brake	25 to 150 A: Built-in, 150 A, 300 A: None
Regenerative resistor	25 to 100 A: Built-in, 150 A, 300 A: None Note: Optional external regenerative resistors are available (10 to 600 A).
Monitor	Speed monitor (VMON) 2.0 V±10% (at 1000 min <sup>-1</sup> ), Torque (thrust force) command monitor (TCMON) 2.0 V±10% (at 100%)

### Safety standards

Servo amplifier type	Safety standards		
All the EtherCAT models	North American safety standards (UL)	UL 61800-5-1	
	European directive	Low-voltage directive	IEC/EN 61800-5-1
		EMC directive	IEC/EN 61800-3 IEC/EN 61326-1 IEC/EN 61000-6-4
			IEC/EN 61000-6-2 IEC 61000-6-7
	KC Mark (Korea Certification Mark)	KN 61000-6-2, KN 61000-6-4	

### Functional safety specifications

Servo amplifier type		IEC/EN 61800-5-2:2016	Description	Safety level	
RS3C□□A□H□4 (Safe Torque Off function)	RS3C□□A□H□E (Safety)			EN 61508 IEC/EN 62061	ISO 13849-1: 2015 EN ISO 13849-1: 2015
○	○	STO (Safe Torque Off)	Safe torque off	SIL3 SILCL3	Cat.3 PL e
—	○	SS1 (Safe Stop 1)	Safe stop 1		
—	○	SS2 (Safe Stop 2)	Safe stop 2		
—	○	SOS (Safe Operating Stop)	Safe operating stop		
—	○	SLS (Safely-Limited Speed)	Safely-limited speed		
—	○	SBC (Safe Brake Control)	Safe brake control		
—	○	SSM (Safe Speed Monitor)	Safe speed monitor		

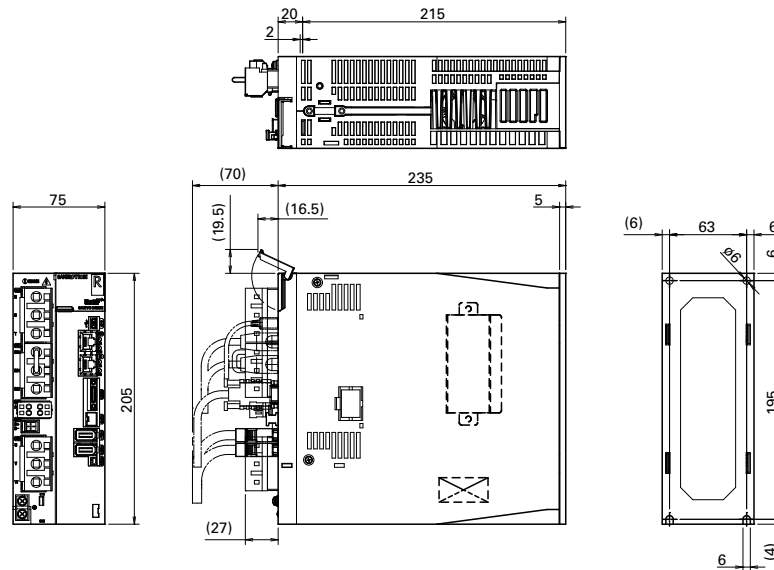
## ■ EtherCAT interface specifications

Physical layer	IEC61158-2, IEEE802.3u 100BASE-TX
Data link layer	IEC 61158-3/4 Type 12
Application layer	IEC 61158-5/6 Type 12
Device profile	IEC 61800-7 Profile Type 1 (CiA 402), CoE (CANopen over EtherCAT), FoE (File access over EtherCAT)
Communication port	RJ45 connector (2 ports)
Baud rate	100 Mbps (Full duplex)
Max. no. of nodes	65535 nodes
Transmission distance/ topology	Max. 100 m (between nodes)/Line
Communication cable	Cat5e twisted pair cable (straight or cross cable)
Communication object	SDO (Service Data Object), PDO (Process Data Object)
Minimum communication cycle	125 $\mu$ s (62.5 $\mu$ s: Speed and torque control only)
Possible number of PDO-mapped objects	Output: max. 31 objects, Input: max. 31 objects, Total: max. 62 objects Note: Varies with the communication cycle setting. Max. 20 for 125 $\mu$ s and max. 10 for 62.5 $\mu$ s settings.
Synchronization mode	SYNC0/1 event synchronization, Asynchronous, SM2 event synchronization
Operation mode	Profile Position mode, Profile Velocity mode, Profile Torque mode, Homing mode, Cyclic Synchronous Position mode, Cyclic Synchronous Velocity mode, Cyclic Synchronous Torque mode
LED indicator	Port 0/1 link display, RUN display, ERROR display
General-purpose I/O	Input x 7, output x 2 (total of 9)

# Dimensions [Unit: mm] Refer to p. 46 for dimensional drawings of Safety.

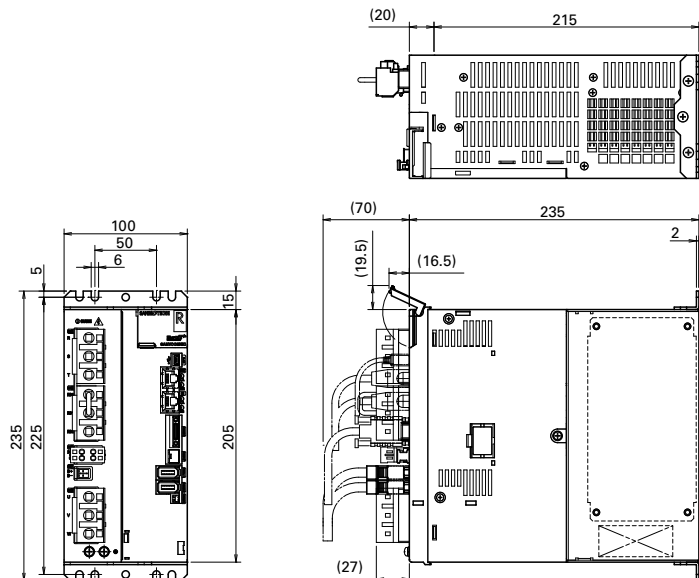
## 25 A

Mass: 2.5 kg



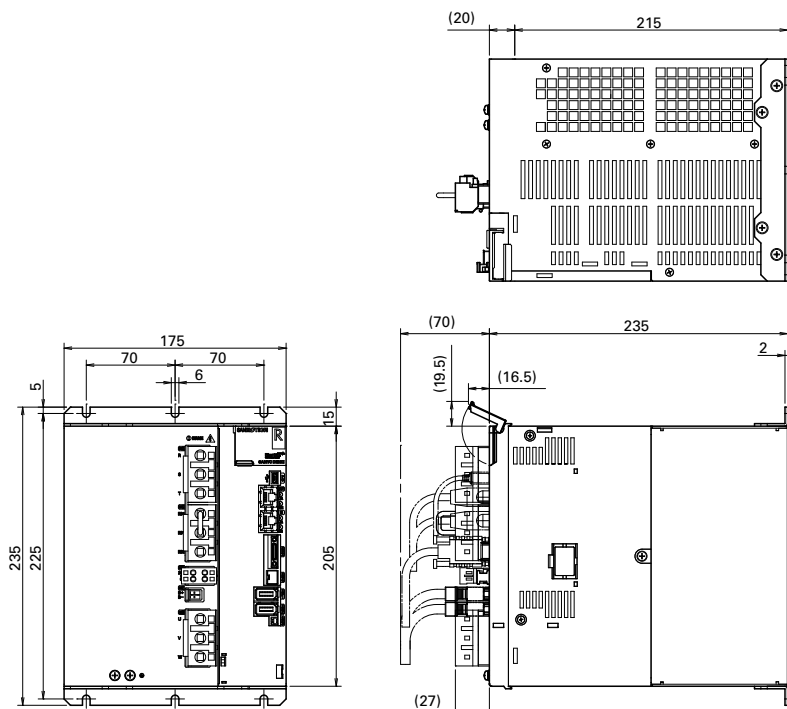
## 50 A

Mass: 4.7 kg

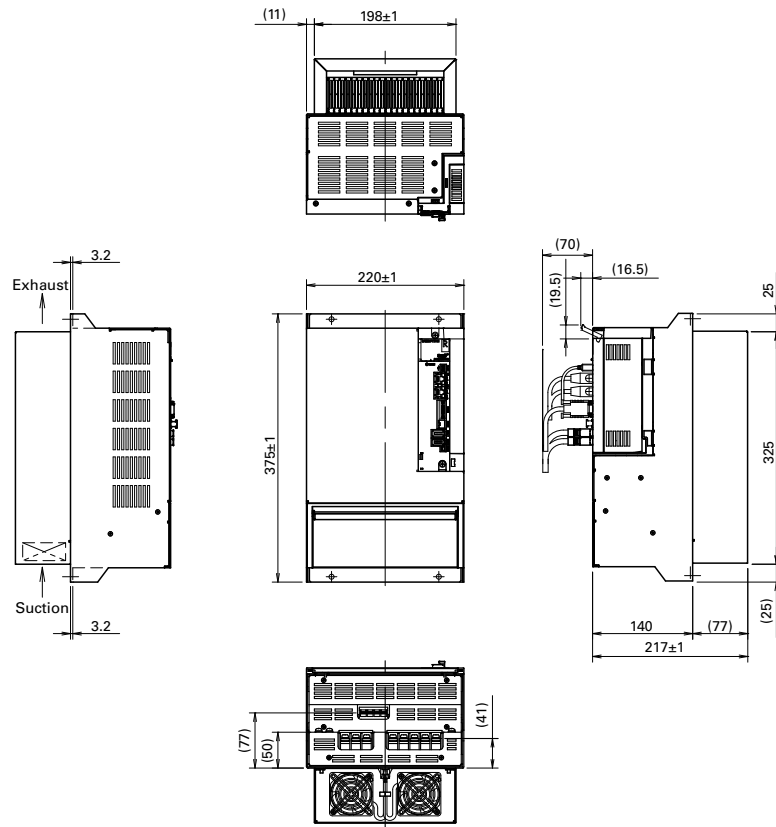


## 100 A

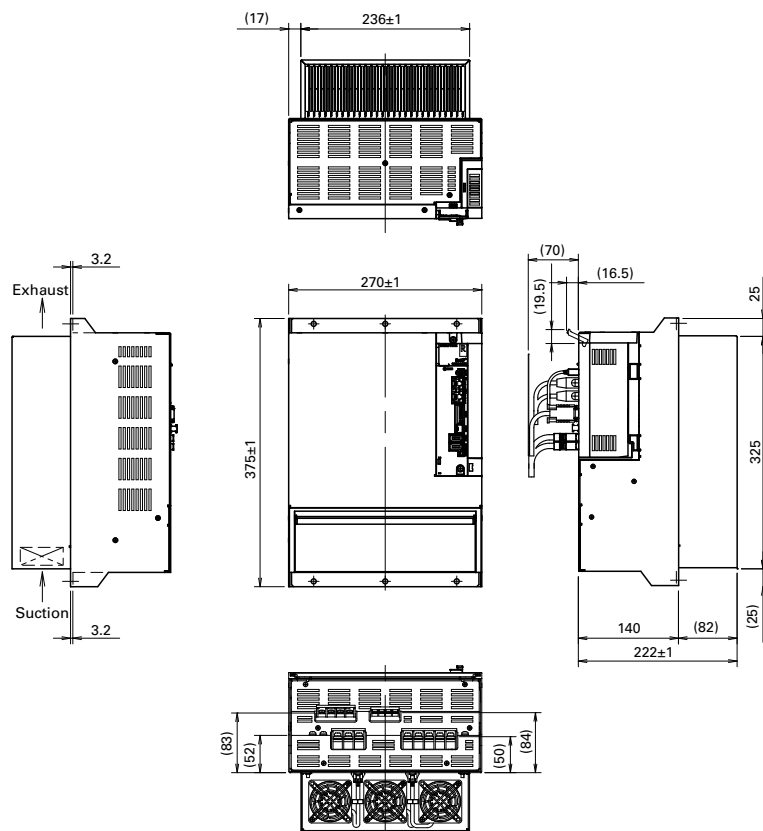
Mass: 8.5 kg



Mass: 11.0 kg  
(Safety: 11.1 kg)

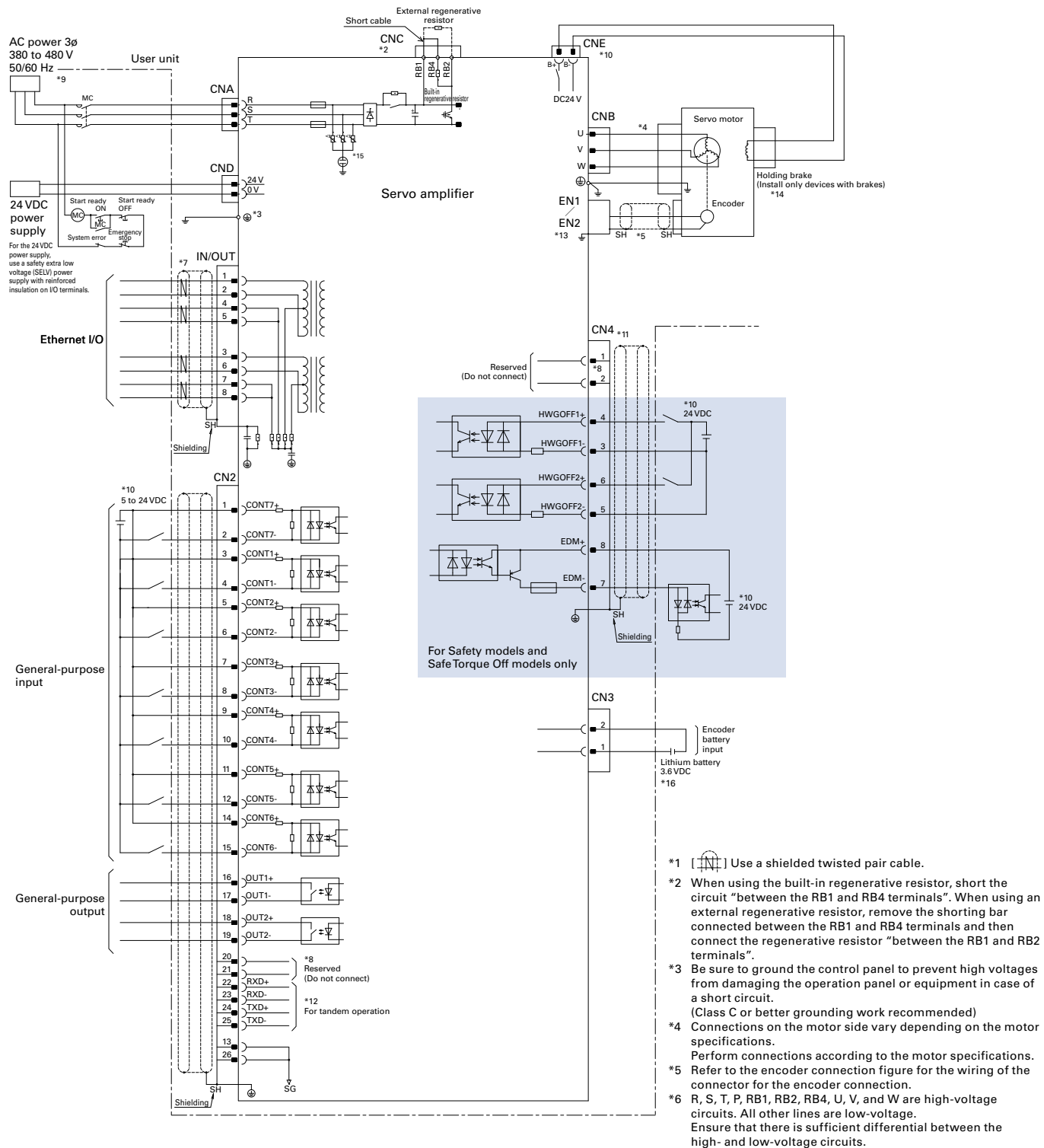


Mass: 18.0 kg  
(Safety: 18.1 kg)



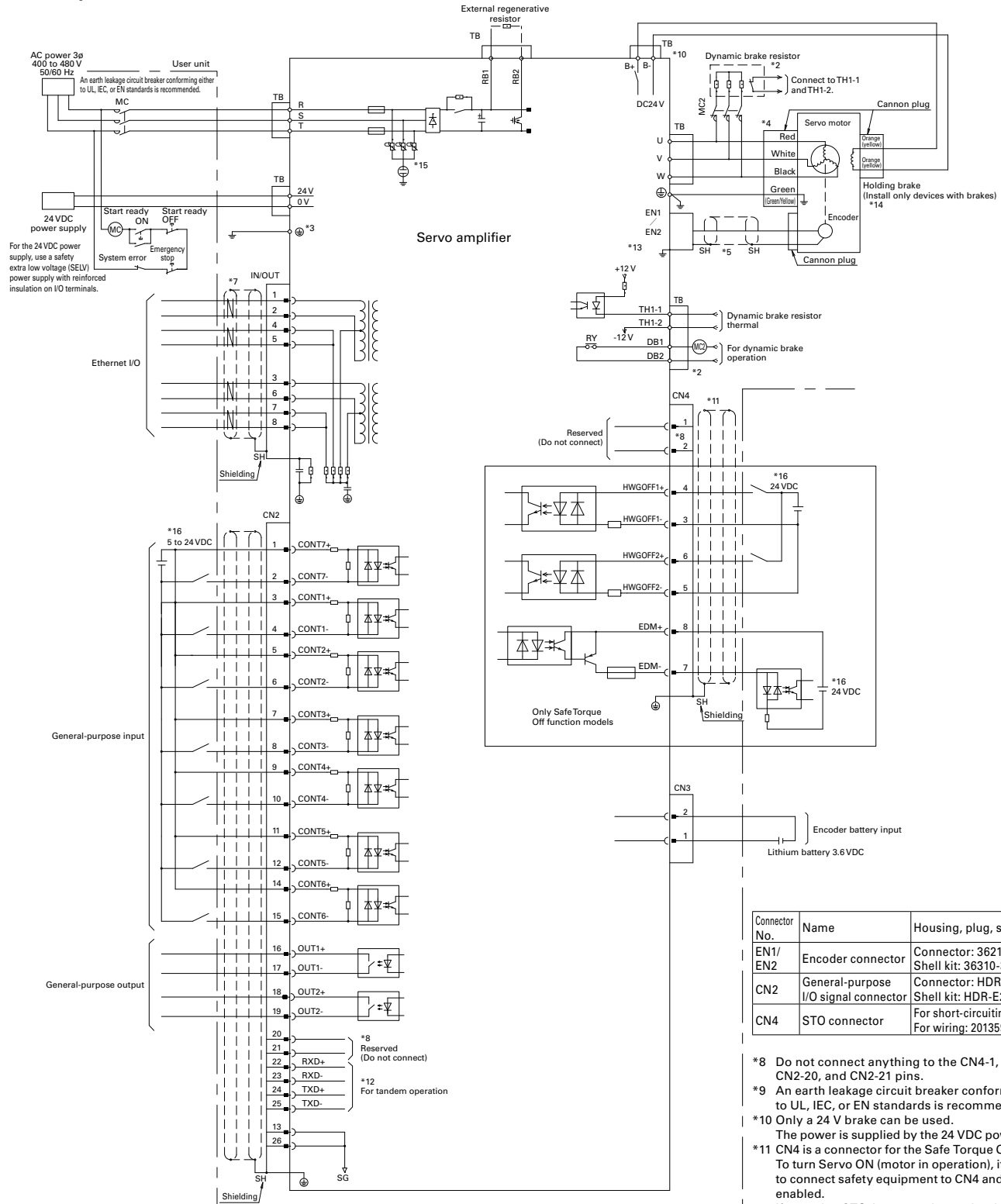
# External Wiring Diagram

25 to 100 A



Connector No.	Name	Housing, plug, shell
CNA	Main circuit power supply connector	03JFAT-SAXGDK-P15
CNB	Servo motor power connector	03JFAT-SAZGDK-P15
CNC	Regenerative resistor connector	03JFAT-SAYGDK-P15
Connector tool	Connector tool for CNA, CNB, CNC	J-FAT-OT-P
CND	Control circuit power supply input connector	04JFAT-SAGG-G-KK
Connector tool	Connector tool for CND	J-FAT-OT(N)
CNE	Holding brake power output connector	02MJFAT-SAGF
Connector tool	Connector tool for CNE	MJFAT-OT
EN1/EN2	Encoder connector	Connector: 36210-0100PL Shell kit: 36310-3200-008
CN2	General-purpose I/O connector (For EtherCAT model only)	Connector: HDR-E26MSG1+ Shell kit: HDR-E26LPH
CN4	STO connector	For short-circuiting: 1971153-2 For wiring: 2013595-3

## 150 A, 300 A



\*1 Use a shielded twisted pair cable.

\*2 For amplifier capacity 150 A:  
The amplifier does not have the DB1, DB2, TH1-1, and TH1-2 terminals. The amplifier has a built-in dynamic brake circuit, so there is no need for connecting external DB resistors.

For amplifier capacity 300 A:

The amplifier does not have a built-in dynamic brake circuit. The DB1 and DB2 are external dynamic brake timing outputs, and the TH1-1 and TH1-2 are external DB resistor thermostat inputs. When not using a DB resistor thermostat, short-circuit TH1-1 and TH1-2. The electromagnetic contactor, resistor, power supply, and wiring are to be arranged by the customer. For the electromagnetic contactor, arrange a DC drive type. Contact rating 30 VDC, 2 A ( $\cos\phi = 0.4$ ,  $L/R = 7$  ms).

\*3 Be sure to ground the control panel to prevent high voltages from damaging the operation panel or equipment in case of a short circuit. (Class C or better grounding work recommended)

\*4 Connections on the motor side vary depending on the motor specifications. The indications of red, white, black, green and orange apply when the motor power and brake lines are the lead type.

When they are the cannon plug type, perform connections according to the motor specifications.

\*5 Refer to the encoder connection figure for the wiring of the connector for the encoder connection.

\*6 R, S, T, RB1, RB2, U, V, and W are high-voltage circuits. All other lines are low-voltage. Ensure that there is sufficient differential between the high- and low-voltage circuits.

\*7 Use a category 5e (TIA standards) or above shielded twisted pair cable (STP).

\*8 Do not connect anything to the CN4-1, CN4-2, CN2-20, and CN2-21 pins.

\*9 An earth leakage circuit breaker conforming either to UL, IEC, or EN standards is recommended.

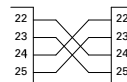
\*10 Only a 24 V brake can be used.

The power is supplied by the 24 VDC power supply. To turn Servo ON (motor in operation), it is required to connect safety equipment to CN4 and get STO enabled.

If not using STO, be sure to insert the short-circuiting STO connector (Mfr. part no.: 1971153-2) to CN4.

\*12 The CN2-22 to CN2-25 pins are used for tandem operations.

Connect compatible amplifiers as below.



\*13 When using an incremental encoder in a semi-closed system, connect to EN2.

\*14 If the holding brake has a 24 V rated voltage, it can be powered from the built-in holding brake power output terminals (B+ and B-) of the amplifier.

\*15 Consult with us when conducting a withstand voltage test.

\*16 The external power supply is to be arranged by the customer.



# Safety

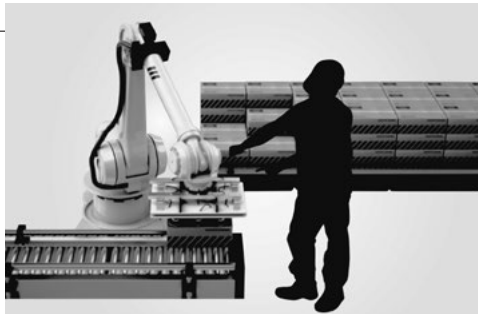
Broadly compatible with functional safety, enabling easy integration of safety functions in a device.

Functional safety IEC/EN 61800-5-2:2016, STO (Safe Torque Off), SS1 (Safe Stop 1), SS2 (Safe Stop 2), SOS (Safe Operating Stop), SLS (Safely-Limited Speed), SBC (Safe Brake Control), and SSM (Safe Speed Monitor)

The product lineup includes both Analog/Pulse and EtherCAT types.

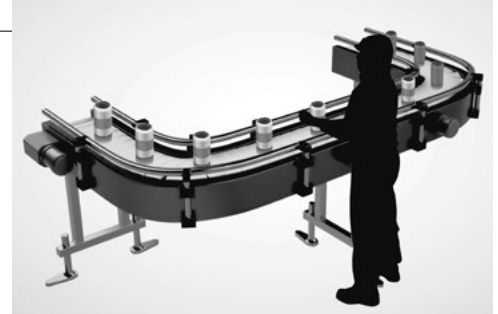
■ **Application Examples** Combination with safety components or controllers may be needed for some applications.

Industrial robots



- By setting a stop area around a robot, the SS1 function can slow down and stop the robot (once stopped the motor power is shut off) when a worker enters the area.
- By setting a speed limit area, the SLS function can limit the robot's operation speed to a safe level while a worker is within the area.

Conveyor line



- The STO function can shut off the power of motors without shutting off the conveyor power, enabling workers to safely perform maintenance and other works. Furthermore, the conveyor operation can be resumed right away for improved work efficiency.
- The SLS function can limit the machine operation speed at safe levels, enabling workers to do inspection and setup works without shutting off the conveyor operation.

## General Specifications

Refer to respective pages that describe Analog/Pulse and EtherCAT types for detailed specifications such as performance, built-in functions, and general-purpose output.

### ■ Safety standards

Servo amplifier type	Safety standards				
All Safety models	North American safety standards (UL)		UL 61800-5-1		
	European directive	Low-voltage directive	IEC/EN 61800-5-1		
		EMC directive	IEC/EN 61800-3	IEC/EN 61000-6-2	
			IEC/EN 61326-1	IEC 61000-6-7	
		IEC/EN 61000-6-4			
	KC Mark (Korea Certification Mark)		KN 61000-6-2, KN 61000-6-4		

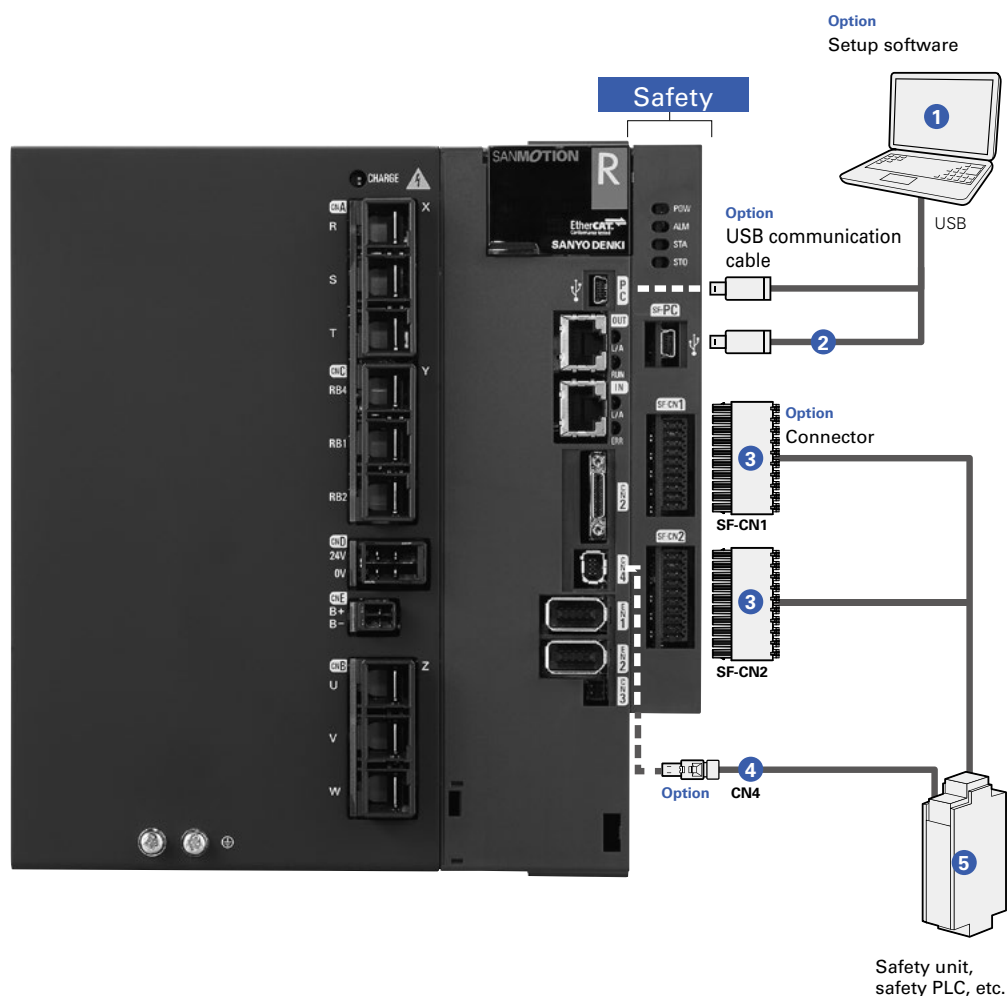
### ■ Functional safety specifications

Servo amplifier type	IEC/EN 61800-5-2:2016	Description	Safety level	
			EN 61508 IEC/EN 62061	ISO 13849-1:2015 EN ISO 13849-1:2015
All Safety models	STO (Safe Torque Off)	Safe torque off	SIL3 SILCL3	Cat.3 PL e
	SS1 (Safe Stop 1)	Safe stop 1		
	SS2 (Safe Stop 2)	Safe stop 2		
	SOS (Safe Operating Stop)	Safe operating stop		
	SLS (Safely-Limited Speed)	Safely-limited speed		
	SBC (Safe Brake Control)	Safe brake control		
	SSM (Safe Speed Monitor)	Safe speed monitor		

# System Configuration

For unlisted part names, refer to respective pages of Analog/Pulse and EtherCAT models.

**25 to 300 A** The photograph shows the 100 A model.



## Options and Peripherals (25 to 300 A)

No.	Name	Model no.	Description	Page
①	Setup software	Can be downloaded from Product Information on our website.	Parameters can be set and monitored via communication with a PC.	p. 68
②	USB communication cable	AL-00896515-0□	PC communication cable for setup software	p. 81
③	SF-CN1 connector	AL-Y0012189-01	To connect safety device Note that this is not a set of two connectors, but a single connector.	pp. 70 to 73
	SF-CN2 connector			
④	CN4 connector	AL-00718251-01 (For short-circuiting; analog/pulse type), AL-00849548-02 (For short-circuiting; EtherCAT type), AL-00718252-01 (For connecting)	To be connect to safety device (for short-circuiting and wiring)	pp. 70 to 73
⑤	Safety unit, safety PLC, etc.	To be provided by the customer	Connects input and output signals of each safety function to such devices as safety units and safety PLCs.	—

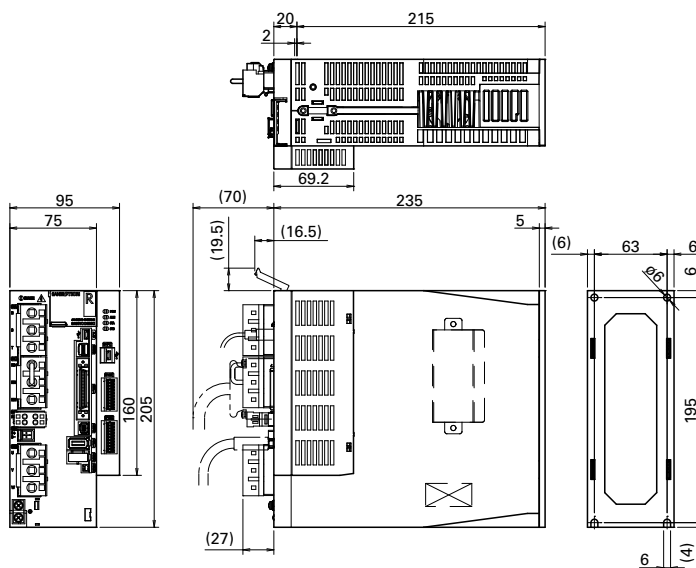
## Dimensions

[Unit: mm]

Below are the dimensions of the Safety module combined with analog/pulse type servo amplifiers.  
The combinations with EtherCAT type amplifiers have the same dimensions and different connectors.

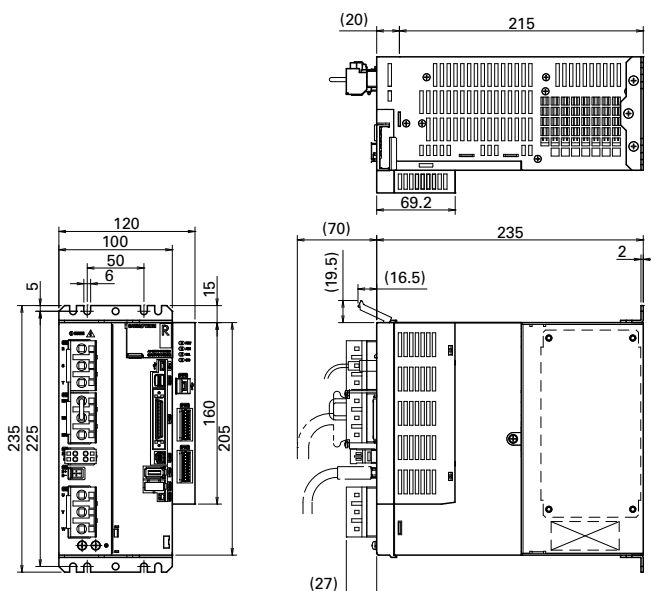
### 25 A

Mass: 2.6 kg



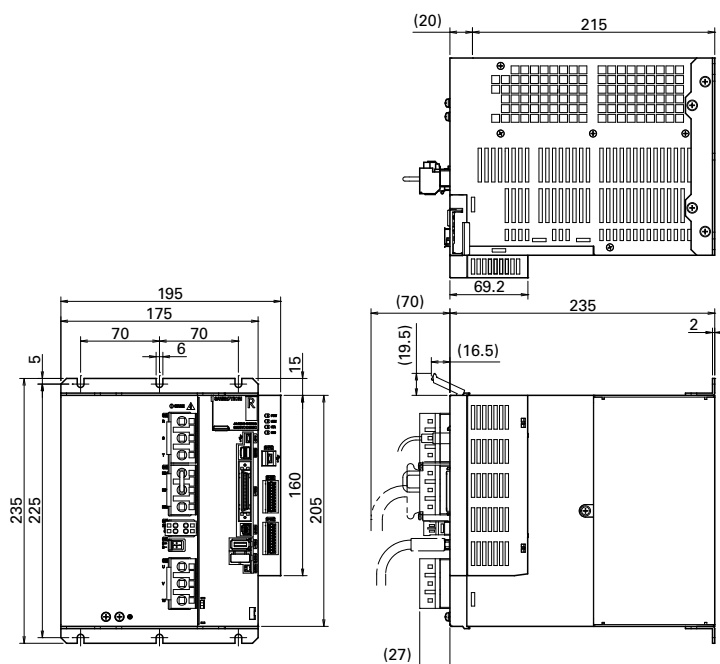
### 50 A

Mass: 4.8 kg



### 100 A

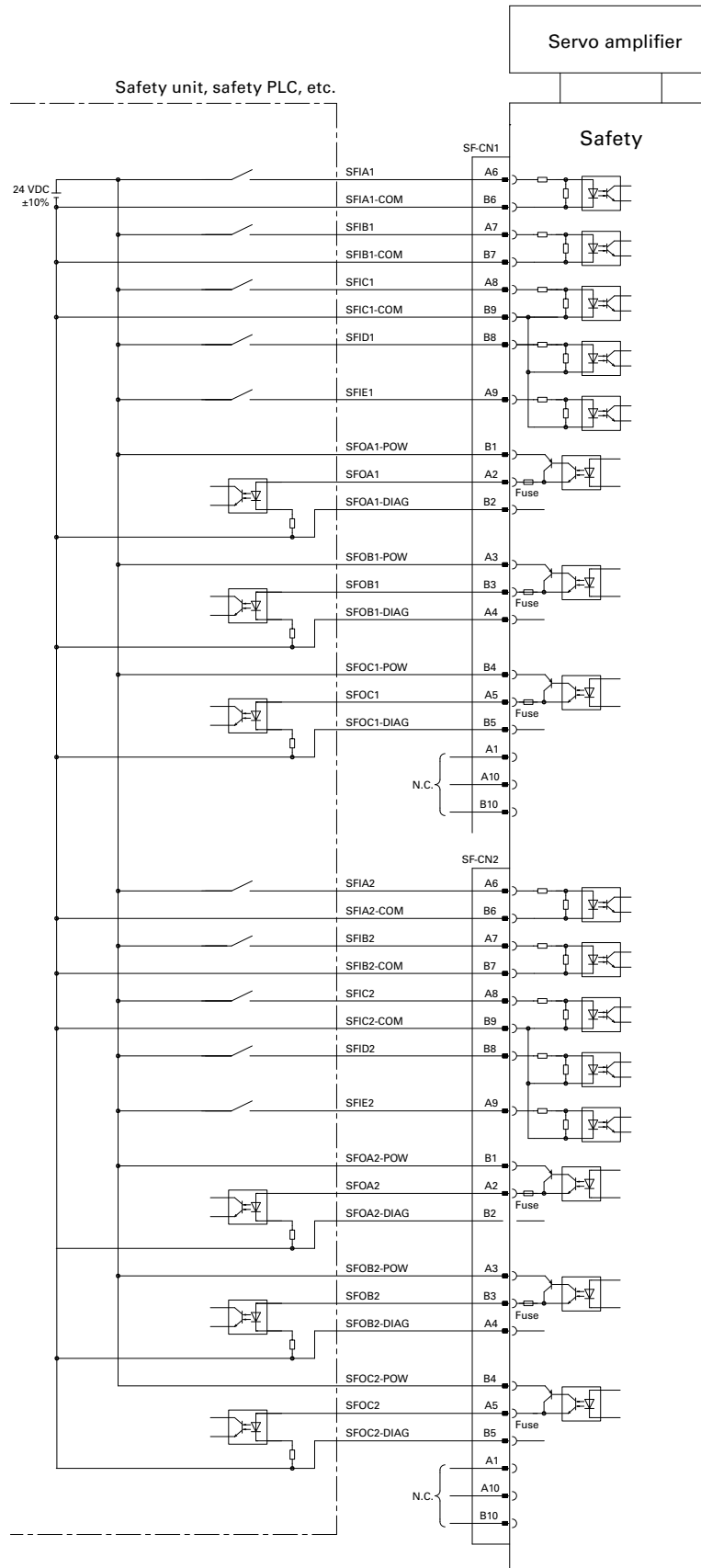
Mass: 8.6 kg



Note: The dimensions of 150 A and 300 A amplifiers are the same as those with analog/pulse or EtherCAT interface.

# External Wiring Diagram Safety

For connection diagrams of the servo amplifier part, refer to respective pages of Analog/Pulse and EtherCAT models.



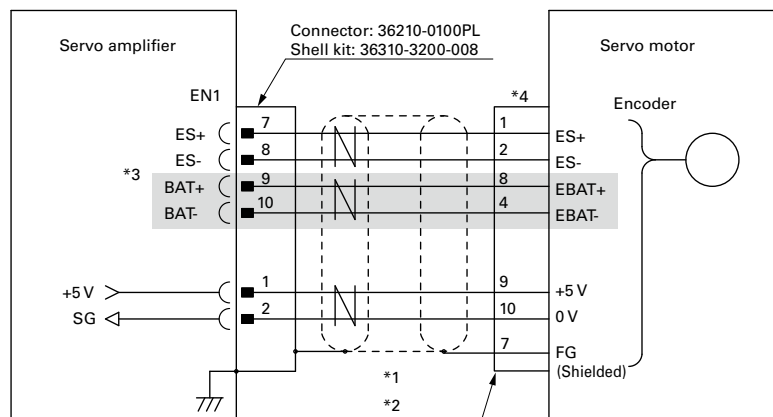
# Encoder Wiring Diagram

## Absolute encoder

Battery-less absolute encoder [Model No. HA035]

Single-turn absolute encoder [Model No. PA035S]

Option: Battery-backup absolute encoder [Model No. PA035C]



Plug model no.	
Motor: Not R2CA2830KV	Motor: R2CA2830KV
JN2DS10SL1-R JN2FS10SL1-R	5557-10R
JN2DS10SL2-R JN2FS10SL2-R	
JN2DS10SL3-R JN2FS10SL3-R	

\*1 Use a shielded twisted pair cable.

\*2 Maximum cable lengths by conductor size of the power supply cable (5 V, SG) are shown in the table below.

Conductor size	Conductor resistance (Ω/km) *at 20°C	Length (m)
AWG	26	150 or less
	24	100 or less
	22	60 or less
	20	40 or less
	18	25 or less
SQ (mm <sup>2</sup> )	0.15	150 or less
	0.2	100 or less
	0.3	65 or less
	0.5	40 or less
	0.75	28 or less

\* Conductor resistance differs by conductor specifications.

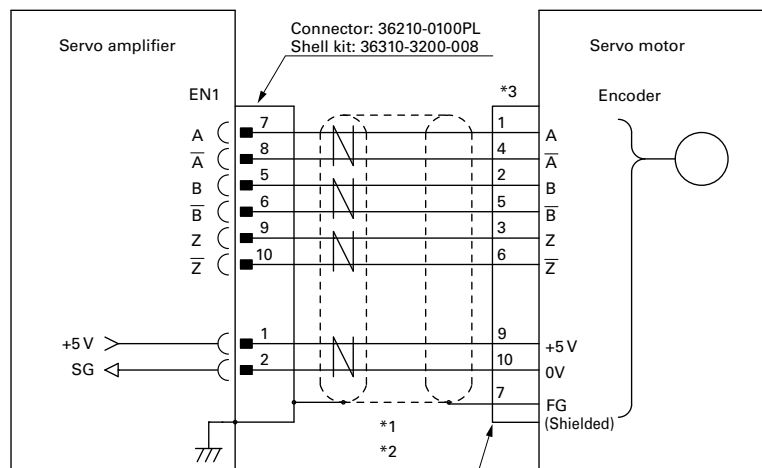
\*3 Battery lines (EBAT+, EBAT-) are necessary only when a battery-backup absolute encoder is used.

\*4 The plug pin numbering is as below.

Motor	ES+	ES-	EBAT-	EBAT+	+5 V	0 V	FG
Not R2CA2830KV	1	2	8*3	4*3	9	10	7
R2CA2830KV	1	2	5*3	9*3	7	8	10

## Option: Incremental encoder

Wire-saving incremental encoder



Plug model no.	
Motor: Not R2CA2830KV	Motor: R2CA2830KV
JN2DS10SL1-R JN2FS10SL1-R	5557-10R
JN2DS10SL2-R JN2FS10SL2-R	
JN2DS10SL3-R JN2FS10SL3-R	

\*1 Use a shielded twisted pair cable.

\*2 Maximum cable lengths by conductor size of the power supply cable (5 V, SG) are shown in the table below.

Conductor size	Conductor resistance (Ω/km) *at 20°C	Length (m)
AWG	26	150 or less
	24	100 or less
	22	60 or less
	20	40 or less
	18	25 or less
SQ (mm <sup>2</sup> )	0.15	150 or less
	0.2	100 or less
	0.3	65 or less
	0.5	40 or less
	0.75	28 or less

\* Conductor resistance differs by conductor specifications.

\*3 The plug pin numbering is as below.

Motor	A	A-bar	B	B-bar	Z	Z-bar	+5 V
Not R2CA2830KV	1	4	2	5	3	6	9
R2CA2830KV	1	2	3	4	5	6	7

Motor	0 V	FG
Not R2CA2830KV	10	7
R2CA2830KV	8	10

# Servo Motors

## R2-R1

## Rotary Motor

Output capacity: 550 W to 30 kW

Rotary servo motors with a wide range of products.

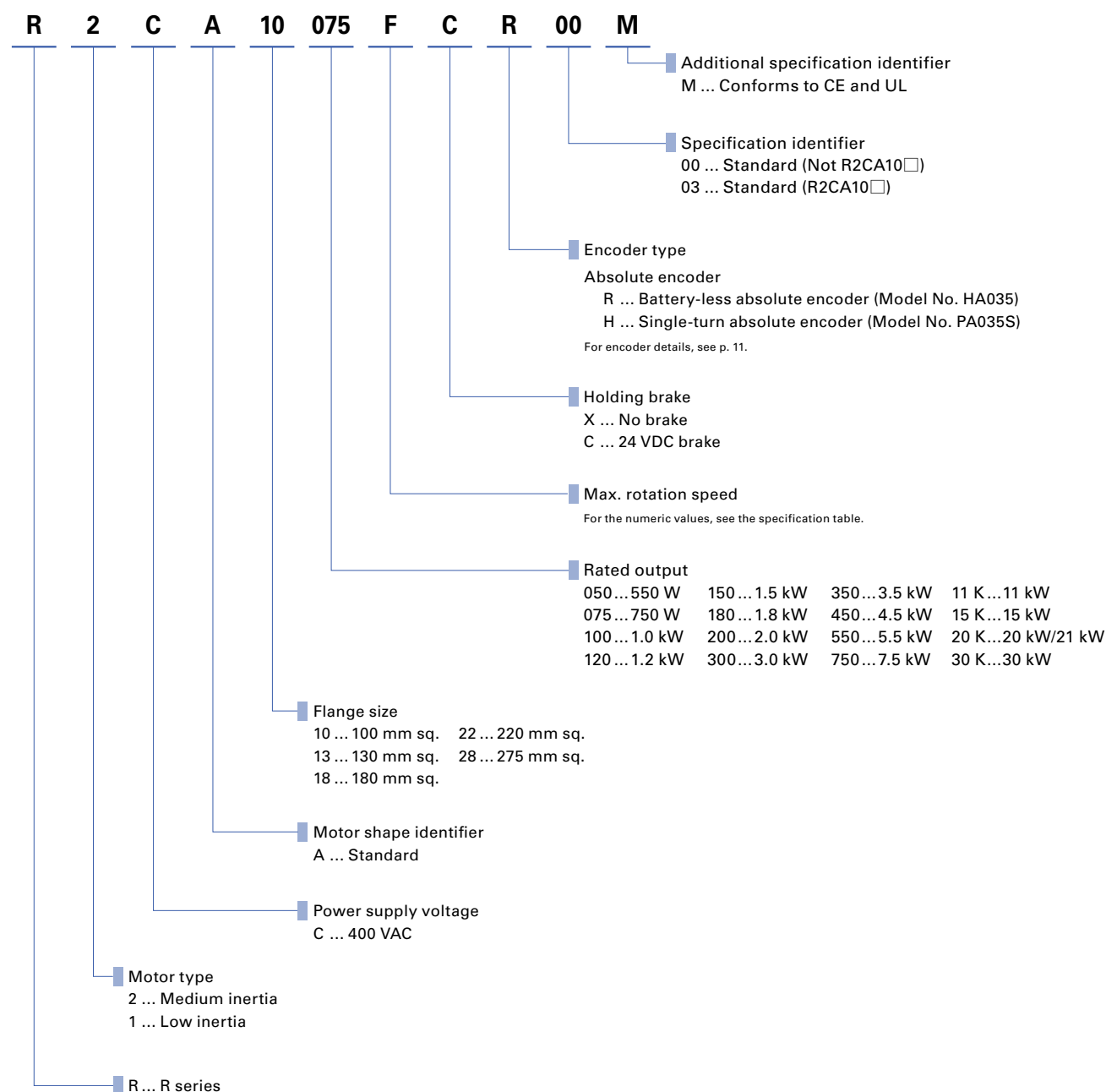


### How to read model numbers

Note that not all the possible combinations of the numbers and characters below are valid.

Also, some of the numbers/characters listed below are for optional models.

For model numbers valid as standard products, refer to "Standard Model Number List".



## Specifications

# R2 Servo Motors

Medium Inertia and Low Ripple **RoHS**

Input voltage **400 VAC**

Servo Amplifier Model no.				RS3C02□□ (25 A)		RS3C05□□ (50 A)	RS3C02□□ (25 A)
Servo Motor Model no.	《 》 indicates flange size			R2CA13050D 《130 mm sq.》	R2CA10075F 《100 mm sq.》	R2CA10100F 《100 mm sq.》	R2CA13120R 《130 mm sq.》
	Status	Symbol	Unit				
Rated Output	★	PR	kW	0.55	0.75	1.0	1.2
Rated Speed	★	NR	min <sup>-1</sup>	2000	3000	3000	2000
Maximum Speed	★	N <sub>max</sub>	min <sup>-1</sup>	5000	6000	6000	3000
Rated Torque	★	TR	N·m	2.6	2.39	3.18	5.7
Continuous Stall Torque	★	TS	N·m	3.0	2.55	3.92	6.0
Peak Stall Torque	★	TP	N·m	9.0	8.6	14.3	20.0
Rated Armature Current	★	IR	Arms	3.2	3.1	5.7	3.6
Armature Stall Current	★	IS	Arms	3.5	3.2	6.8	3.7
Peak Armature Stall Current	★	IP	Arms	12.0	11.3	25.7	12.9
Torque Constant	☆	KT	N·m/Arms	0.92	0.868	0.584	1.69
Voltage Constant for each Phase	☆	KE <sub>φ</sub>	mV/min <sup>-1</sup>	32.2	30.3	20.4	59.1
Phase Resistance	☆	R <sub>φ</sub>	Ω	1.17	1.55	0.35	1.5
Rated Power Rate	★	QR	kW/s	22	23	25.9	54
Electrical Time Constant	☆	te	ms	12	6.9	8.3	13
Mechanical Time Constant (Not including Encoder)	☆	tm	ms	1.3	1.5	1.2	0.94
Rotor Inertia		J <sub>M</sub>	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	3.1	2.5	3.9	6.0
Encoder Inertia *1		J <sub>S</sub>	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.0042*1			
Servo Motor Mass *1		We	kg	4.5 (6)	3.9 (4.8)	4.7 (5.8)	6.1 (8)
Brake Static Friction Torque		Tb	N·m	3.5 min.	3.92 min.	3.92 min.	9.0 min.
Brake Rated Voltage		Vb	V	90 VDC/24 VDC ±10%			
Brake Rated Current		Ib	A	0.15/0.41	0.09/0.30		0.17/0.51
Rotor Moment of Inertia (Brake)		Jb	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.5	0.343		0.5
Servo amplifier power supply capacity (rating)			kVA	1.0	1.3	1.8	2.0
CE and UL approved servo motors *2				Yes			
Servo motor protection code				IP65			
Size of aluminum plates for heat radiation during measurement				305×305×20 mm	305×305×12 mm		400×400×20 mm
Page for motor dimensions				p. 60			

★ Speed-torque characteristics curves and values in the row with a black star symbol (★) are the values when combined with a standard servo amplifier and after thermal equilibrium is established. All values are typical values.

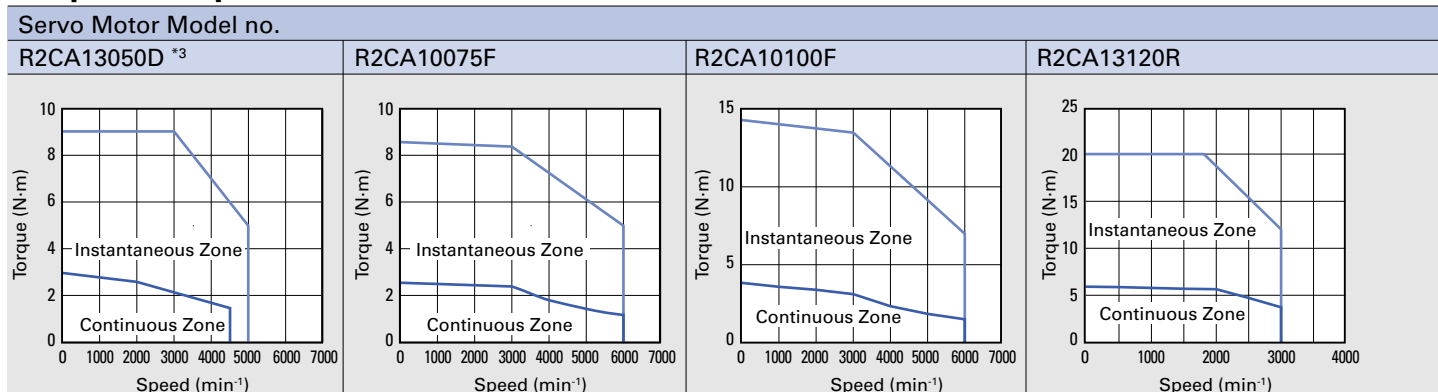
☆ Indicates a typical value when the winding temperature is 20°C. All values are typical values.

\*1 The values for "Encoder inertia" and "servo motor mass" are with a [HA035] battery-less absolute encoder. Contact us for details on other encoders. Values inside ( ) are with a brake attached.

\*2 Our standard servo amplifiers are CE and UL approved.

## Speed-Torque Characteristics

The instantaneous zone characteristics drop for power supply voltages below 400 VAC.



\*3 Run motors so that the average speed does not exceed its maximum speed in the continuous zone.

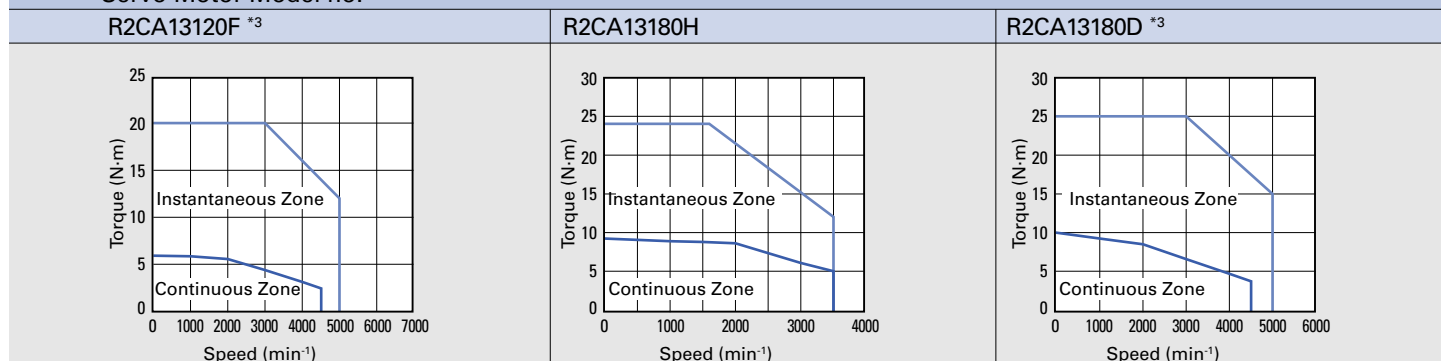


RS3C05□□《50 A》	RS3C02□□《25 A》	RS3C05□□《50 A》	Servo Amplifier Model no.			
R2CA13120F 《130 mm sq.》	R2CA13180H 《130 mm sq.》	R2CA13180D 《130 mm sq.》	Servo Motor Model no. 《 》 indicates flange size			
			Unit	Symbol	Status	
1.2	1.8	1.8	kW	PR	★	Rated Output
2000	2000	2000	min <sup>-1</sup>	NR	★	Rated Speed
5000	3500	5000	min <sup>-1</sup>	N <sub>max</sub>	★	Maximum Speed
5.7	8.6	8.6	N·m	TR	★	Rated Torque
6.0	9.2	10.0	N·m	TS	★	Continuous Stall Torque
20.0	24.0	25.0	N·m	TP	★	Peak Stall Torque
7.5	4.8	10.2	Arms	IR	★	Rated Armature Current
7.8	4.8	11.0	Arms	IS	★	Armature Stall Current
27.7	12.9	29.2	Arms	IP	★	Peak Armature Stall Current
0.79	2.10	0.94	N·m/Arms	K <sub>T</sub>	☆	Torque Constant
27.7	73.2	32.8	mV/min <sup>-1</sup>	K <sub>Eφ</sub>	☆	Voltage Constant for each Phase
0.34	1.35	0.27	Ω	R <sub>φ</sub>	☆	Phase Resistance
54	82	82	kW/s	Q <sub>R</sub>	★	Rated Power Rate
13	15	14	ms	te	☆	Electrical Time Constant
0.97	0.83	0.83	ms	tm	☆	Mechanical Time Constant (Not including Encoder)
6.0	9.0	9.0	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>M</sub>		Rotor Inertia
0.0042* <sup>1</sup>			×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>S</sub>		Encoder Inertia * <sup>1</sup>
6.1 (8)	8 (9.2)	8 (9.2)	kg	We		Servo Motor Mass * <sup>1</sup>
9.0 min.	9.0 min.	9.0 min.	N·m	Tb		Brake Static Friction Torque
90 VDC/24 VDC ±10%			V	Vb		Brake Rated Voltage
0.17/0.51	0.17/0.51	0.17/0.51	A	Ib		Brake Rated Current
0.5	0.5	0.5	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	Jb		Rotor Moment of Inertia (Brake)
2.3	2.9	3.3	kVA			Servo amplifier power supply capacity (rating)
Yes						CE and UL approved servo motors * <sup>2</sup>
IP65						Servo motor protection code
400×400×20 mm	470×470×20 mm					Size of aluminum plates for heat radiation during measurement
p. 60						Page for motor dimensions

#### Servo Motor Operating Ambient Conditions

Operating temperature and humidity	Temp.: 0 to 40°C. Humidity: 90% max. (non-condensing)
Vibration resistance	24.5 m/s <sup>2</sup>
Shock resistance	98 m/s <sup>2</sup> , 2 times
Operation altitude	1000 m or lower above sea level
Installation location	Indoor (without direct sunlight) Location where no substance that gives adverse effects on the device and motor, such as corrosive gas, flammable gas, or dust exists

#### Servo Motor Model no.



## Specifications

# R2 Servo Motors

Medium Inertia and Low Ripple **RoHS**

Input voltage **400 VAC**

Servo Amplifier Model no.				RS3C02□□《25 A》	RS3C05□□《50 A》	
Servo Motor Model no. 《 》 indicates flange size				R2CA13200L 《130 mm sq.》	R2CA13200H 《130 mm sq.》	R2CA18350L 《180 mm sq.》
	Status	Symbol	Unit			
Rated Output	★	PR	kW	2.0	2.0	3.5
Rated Speed	★	NR	min <sup>-1</sup>	2000	2000	2000
Maximum Speed	★	N <sub>max</sub>	min <sup>-1</sup>	3000	5000	3000
Rated Torque	★	TR	N·m	9.5	9.5	17.0
Continuous Stall Torque	★	TS	N·m	12.0	12.0	22.0
Peak Stall Torque	★	TP	N·m	30.0	30.0	49.0
Rated Armature Current	★	IR	Arms	4.6	8.0	9.6
Armature Stall Current	★	IS	Arms	4.6	9.6	12.0
Peak Armature Stall Current	★	IP	Arms	12.0	26.5	29.2
Torque Constant	☆	KT	N·m/Arms	2.83	1.34	1.96
Voltage Constant for each Phase	☆	KE <sub>φ</sub>	mV/min <sup>-1</sup>	98.7	46.8	68.4
Phase Resistance	☆	R <sub>φ</sub>	Ω	1.70	0.44	0.35
Rated Power Rate	★	QR	kW/s	74	74	72
Electrical Time Constant	☆	te	ms	15	18	19
Mechanical Time Constant (Not including Encoder)	☆	tm	ms	0.78	0.90	1.1
Rotor Inertia		J <sub>M</sub>	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	12.2	12.2	40
Encoder Inertia *1		J <sub>S</sub>	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.012*1		
Servo Motor Mass *1		We	kg	10 (12)	10 (12)	15.5 (20)
Brake Static Friction Torque		Tb	N·m	12 min.	12 min.	22 min.
Brake Rated Voltage		Vb	V	90 VDC/24 VDC ±10%		
Brake Rated Current		Ib	A	0.17/0.66	0.17/0.66	0.32/1.2
Rotor Moment of Inertia (Brake)		Jb	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.5	0.5	5.1
Servo amplifier power supply capacity (rating)			kVA	3.3	3.7	6.0
CE and UL approved servo motors *2				Yes		
Servo motor protection code				IP65		
Size of aluminum plates for heat radiation during measurement				470×470×20 mm		
Page for motor dimensions				p. 61		

★ Speed-torque characteristics curves and values in the row with a black star symbol (★) are the values when combined with a standard servo amplifier and after thermal equilibrium is established. All values are typical values.

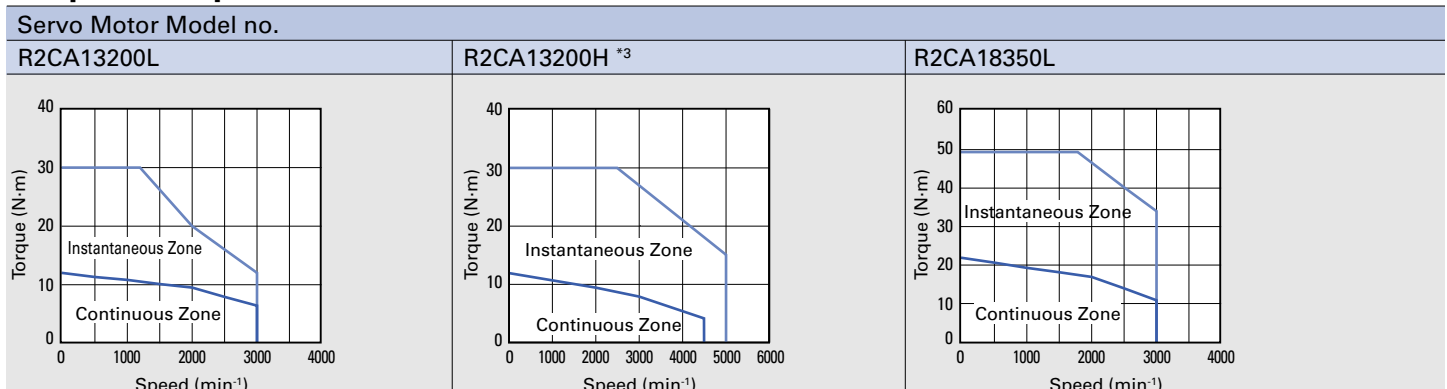
☆ Indicates a typical value when the winding temperature is 20°C. All values are typical values.

\*1 The values for "Encoder inertia" and "servo motor mass" are with a [HA035] battery-less absolute encoder.  
Contact us for details on other encoders.  
Values inside ( ) are with a brake attached.

\*2 Our standard servo amplifiers are CE and UL approved.

## Speed-Torque Characteristics

The instantaneous zone characteristics drop for power supply voltages below 400 VAC.



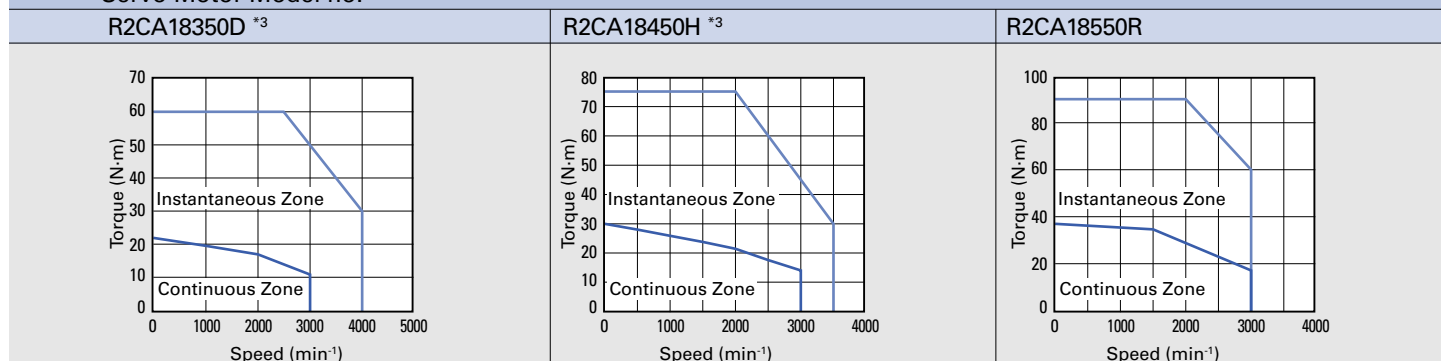
\*3 Run motors so that the average speed does not exceed its maximum speed in the continuous zone.

RS3C10□□《100 A》			Servo Amplifier Model no.		
R2CA18350D 《180 mm sq.》	R2CA18450H 《180 mm sq.》	R2CA18550R 《180 mm sq.》	Servo Motor Model no. 《 》 indicates flange size		
			Unit	Symbol	Status
3.5	4.5	5.5	kW	PR	★ Rated Output
2000	2000	1500	min <sup>-1</sup>	NR	★ Rated Speed
4000	3500	3000	min <sup>-1</sup>	N <sub>max</sub>	★ Maximum Speed
17.0	21.5	35.0	N·m	TR	★ Rated Torque
22.0	30.0	37.3	N·m	TS	★ Continuous Stall Torque
60.0	75.0	90.0	N·m	TP	★ Peak Stall Torque
14.8	12.8	18.3	Arms	IR	★ Rated Armature Current
18.2	17.0	19.5	Arms	IS	★ Armature Stall Current
52.8	48	52.8	Arms	IP	★ Peak Armature Stall Current
1.42	1.89	2.15	N·m/Arms	KT	☆ Torque Constant
49.7	65.8	74.9	mV/min <sup>-1</sup>	KE <sub>θ</sub>	☆ Voltage Constant for each Phase
0.17	0.23	0.19	Ω	R <sub>θ</sub>	☆ Phase Resistance
72	92	180	kW/s	QR	★ Rated Power Rate
18	18	19	ms	te	☆ Electrical Time Constant
1.0	0.97	0.84	ms	tm	☆ Mechanical Time Constant (Not including Encoder)
40	50	68	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	JM	Rotor Inertia
0.012 <sup>*1</sup>			×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	JS	Encoder Inertia <sup>*1</sup>
15.5 (20)	20 (24)	26 (31)	kg	We	Servo Motor Mass <sup>*1</sup>
22 min.	32 min.	42 min.	N·m	Tb	Brake Static Friction Torque
90 VDC/24 VDC ±10%			V	Vb	Brake Rated Voltage
0.32/1.2	0.27/1.0	0.27/1.0	A	Ib	Brake Rated Current
5.1	5.1	5.1	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	Jb	Rotor Moment of Inertia (Brake)
6.0	7.6	9.5	kVA		Servo amplifier power supply capacity (rating)
Yes					CE and UL approved servo motors <sup>*2</sup>
IP65					Servo motor protection code
470×470×20 mm		540×540×20 mm			Size of aluminum plates for heat radiation during measurement
p. 61					Page for motor dimensions

#### Servo Motor Operating Ambient Conditions

Operating temperature and humidity	Temp.: 0 to 40°C. Humidity: 90% max. (non-condensing)
Vibration resistance	24.5 m/s <sup>2</sup>
Shock resistance	98 m/s <sup>2</sup> , 2 times
Operation altitude	1000 m or lower above sea level
Installation location	Indoor (without direct sunlight) Location where no substance that gives adverse effects on the device and motor, such as corrosive gas, flammable gas, or dust exists

#### Servo Motor Model no.



## Specifications

# R2 Servo Motors

Medium Inertia and Low Ripple **RoHS**

Input voltage **400 VAC**

Servo Amplifier Model no.				RS3C15□□《150 A》		
Servo Motor Model no.	《 》 indicates flange size			R2CA18550H 《180 mm sq.》	R2CA18750H 《180 mm sq.》	R2CA2211KB 《220 mm sq.》
	Status	Symbol	Unit			
Rated Output	★	PR	kW	5.5	7.5	11
Rated Speed	★	NR	min <sup>-1</sup>	1500	1500	1500
Maximum Speed	★	N <sub>max</sub>	min <sup>-1</sup>	3000	3000	2500
Rated Torque	★	TR	N·m	35	48	70
Continuous Stall Torque	★	TS	N·m	37.5	54.9	80
Peak Stall Torque	★	TP	N·m	107	140	176
Rated Armature Current	★	IR	Arms	23.6	27.5	32
Armature Stall Current	★	IS	Arms	24.7	30.6	34
Peak Armature Stall Current	★	IP	Arms	77.5	83	83
Torque Constant	☆	KT	N·m/Arms	1.67	1.97	2.63
Voltage Constant for each Phase	☆	KE <sub>φ</sub>	mV/min <sup>-1</sup>	58.4	68.8	91.7
Phase Resistance	☆	R <sub>φ</sub>	Ω	0.125	0.115	0.078
Rated Power Rate	★	QR	kW/s	180	235	275
Electrical Time Constant	☆	te	ms	19	21	28
Mechanical Time Constant (Not including Encoder)	☆	tm	ms	0.91	0.87	0.6
Rotor Inertia		J <sub>M</sub>	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	68	98	178
Encoder Inertia *1		J <sub>S</sub>	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.012		
Servo Motor Mass *1		We	kg	26 (31)	34 (38)	55 (65)
Brake Static Friction Torque		Tb	N·m	42 min.	54.9 min.	90 min.
Brake Rated Voltage		Vb	V	90 VDC/24 VDC ±10%		
Brake Rated Current		Ib	A	0.27/1.0	0.37/1.4	0.44/1.7
Rotor Moment of Inertia (Brake)		Jb	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	5.1	4.5	24
Servo amplifier power supply capacity (rating)			kVA	7.0	9.4	13.6
Cooling fan power		P <sub>F</sub>	W	—	—	—
CE and UL approved servo motors *2				Yes		
Servo motor protection code				IP65		
Size of aluminum plates for heat radiation during measurement				540×540×20 mm		610×610×30 mm
Page for motor dimensions				p. 61	p. 62	

★ Speed-torque characteristics curves and values in the row with a black star symbol (★) are the values when combined with a standard servo amplifier and after thermal equilibrium is established. All values are typical values.

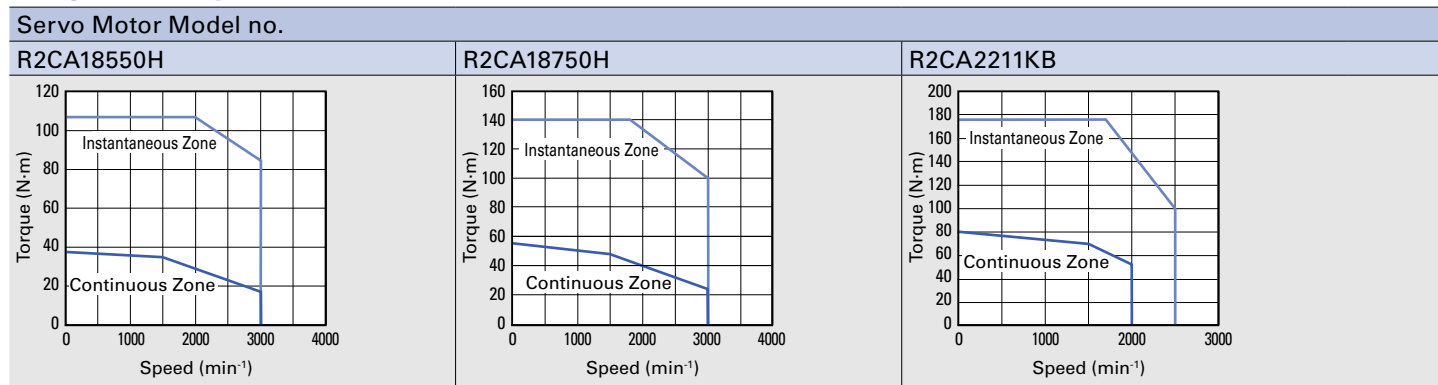
☆ Indicates a typical value when the winding temperature is 20°C. All values are typical values.

\*1 The values for "Encoder inertia" and "servo motor mass" are with a [HA035] battery-less absolute encoder. Contact us for details on other encoders. Values inside ( ) are with a brake attached.

\*2 Our standard servo amplifiers are CE and UL approved.

## Speed-Torque Characteristics

The instantaneous zone characteristics drop for power supply voltages below 400 VAC.



\*3 Run motors so that the average speed does not exceed its maximum speed in the continuous zone.

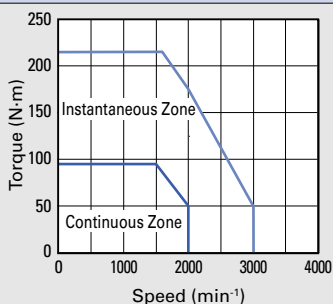
RS3C15□□《150 A》	RS3C30□□《300 A》		Servo Amplifier Model no.			
R2CA2215KV 《220 mm sq.》	R2CA2220KV 《220 mm sq.》	R2CA2830KV 《275 mm sq.》	Servo Motor Model no. 《 》 indicates flange size			
			Unit	Symbol	Status	
15	20	30	kW	PR	★	Rated Output
1500	1500	1500	min <sup>-1</sup>	NR	★	Rated Speed
2000	2300	2000	min <sup>-1</sup>	N <sub>max</sub>	★	Maximum Speed
95	125	191.1	N·m	TR	★	Rated Torque
95	125	191.1	N·m	TS	★	Continuous Stall Torque
215	280	480	N·m	TP	★	Peak Stall Torque
34	63.8	61.9	Arms	IR	★	Rated Armature Current
34	61.2	55.8	Arms	IS	★	Armature Stall Current
83	155	155	Arms	IP	★	Peak Armature Stall Current
3.1	2.28	3.8	N·m/Arms	KT	☆	Torque Constant
108.1	79.5	132.7	mV/min <sup>-1</sup>	KE <sub>θ</sub>	☆	Voltage Constant for each Phase
0.065	0.037	0.057	Ω	R <sub>θ</sub>	☆	Phase Resistance
313	543	865	kW/s	QR	★	Rated Power Rate
30	30	44	ms	te	☆	Electrical Time Constant
0.58	0.62	0.5	ms	tm	☆	Mechanical Time Constant (Not including Encoder)
288	288	422	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>M</sub>		Rotor Inertia
0.012			x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>S</sub>		Encoder Inertia * <sup>1</sup>
74 (91)	90 (100)	110 (127)	kg	We		Servo Motor Mass * <sup>1</sup>
170 min.		191.2 min.	N·m	Tb		Brake Static Friction Torque
24 VDC ±10%			V	Vb		Brake Rated Voltage
1.5	1.5	2.6	A	Ib		Brake Rated Current
12	12	11.8	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	Jb		Rotor Moment of Inertia (Brake)
18.4	27.5	36.2	kVA			Servo amplifier power supply capacity (rating)
—	65/65 180 to 253 VAC 3-phase 50 Hz/60 Hz		W	PF		Cooling fan power
Yes	To be certified later					CE and UL approved servo motors * <sup>2</sup>
IP65	IP65 (excluding cooling fan and terminal block)					Servo motor protection code
610×610×30 mm						Size of aluminum plates for heat radiation during measurement
p. 62	p. 63					Page for motor dimensions

#### Servo Motor Operating Ambient Conditions

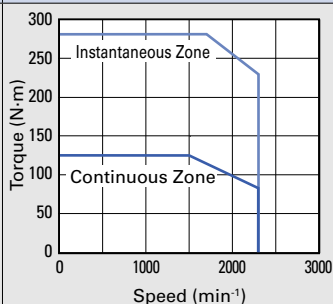
Operating temperature and humidity	Temp.: 0 to 40°C. Humidity: 90% max. (non-condensing)
Vibration resistance	24.5 m/s <sup>2</sup>
Shock resistance	98 m/s <sup>2</sup> , 2 times
Operation altitude	1000 m or lower above sea level
Installation location	Indoor (without direct sunlight) Location where no substance that gives adverse effects on the device and motor, such as corrosive gas, flammable gas, or dust exists

#### Servo Motor Model no.

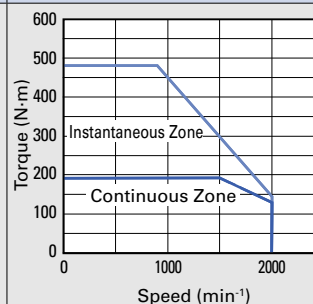
##### R2CA2215KV



##### R2CA2220KV



##### R2CA2830KV



# Specifications

## R1 Servo Motors Low Inertia and High Power Rate RoHS

Input voltage **400 VAC**

Servo Amplifier Model no.				RS3C02□□《25 A》	RS3C05□□《50 A》
Servo Motor Model no.	《 》 indicates flange size			R1CA10150V 《100 mm sq.》	R1CA10200V 《100 mm sq.》
	Status	Symbol	Unit		
Rated Output	★	P <sub>R</sub>	kW	1.5	2.0
Rated Speed	★	N <sub>R</sub>	min <sup>-1</sup>	3000	3000
Maximum Speed	★	N <sub>max</sub>	min <sup>-1</sup>	5000	5000
Rated Torque	★	T <sub>R</sub>	N·m	4.77	6.37
Continuous Stall Torque	★	T <sub>S</sub>	N·m	4.77	6.37
Peak Stall Torque	★	T <sub>P</sub>	N·m	14.3	20.0
Rated Armature Current	★	I <sub>R</sub>	Arms	4.5	6.3
Armature Stall Current	★	I <sub>S</sub>	Arms	4.3	6.1
Peak Armature Stall Current	★	I <sub>P</sub>	Arms	14.1	20.7
Torque Constant	☆	K <sub>T</sub>	N·m/Arms	1.17	1.15
Voltage Constant for each Phase	☆	K <sub>Eφ</sub>	mV/min <sup>-1</sup>	40.8	40.1
Phase Resistance	☆	R <sub>φ</sub>	Ω	1.25	0.95
Rated Power Rate	★	Q <sub>R</sub>	kW/s	108	169
Electrical Time Constant	☆	t <sub>e</sub>	ms	5.9	6.3
Mechanical Time Constant (Not including Encoder)	☆	t <sub>m</sub>	ms	0.58	0.52
Rotor Inertia		J <sub>M</sub>	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	2.1	2.4
Encoder Inertia *1		J <sub>S</sub>	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.0042	
Servo Motor Mass *1		W <sub>e</sub>	kg	5.0 (6.6)	5.7 (7.2)
Brake Static Friction Torque		T <sub>b</sub>	N·m	9.3 min.	
Brake Rated Voltage		V <sub>b</sub>	V	24 VDC ±10%	
Brake Rated Current		I <sub>b</sub>	A	0.70	
Rotor Moment of Inertia (Brake)		J <sub>b</sub>	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.30	
Servo amplifier power supply capacity (rating)			kVA	2.5	3.7
Cooling fan power		P <sub>F</sub>	W	—	—
CE and UL approved servo motors *2				Yes	
Servo motor protection code				IP65	
Size of aluminum plates for heat radiation during measurement				400×400×20 mm	470×470×20 mm
Page for motor dimensions				p. 64	

★ Speed-torque characteristics curves and values in the row with a black star symbol (★) are the values when combined with a standard servo amplifier and after thermal equilibrium is established. All values are typical values.

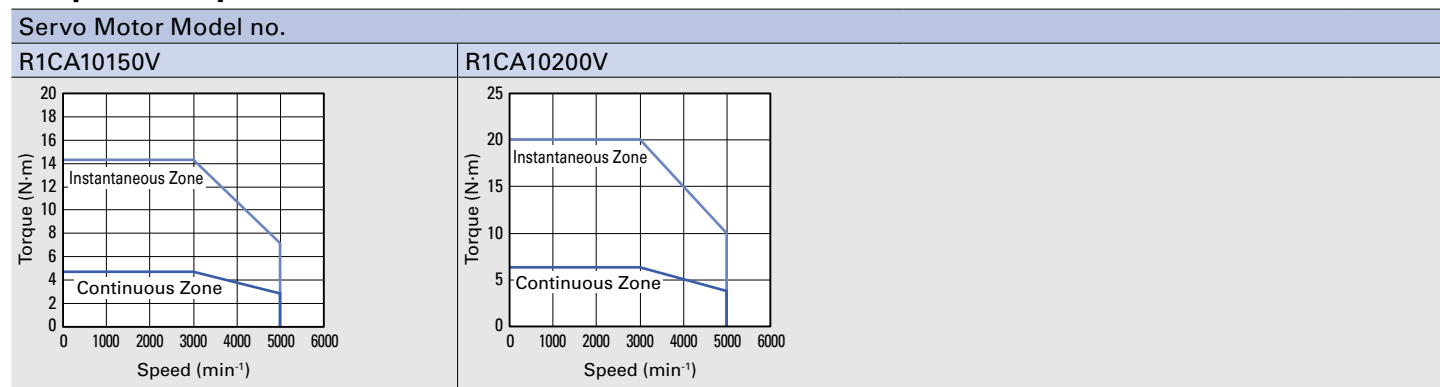
☆ Indicates a typical value when the winding temperature is 20°C. All values are typical values.

\*1 The values for "Encoder inertia" and "servo motor mass" are with a [HA035] battery-less absolute encoder. Contact us for details on other encoders. Values inside ( ) are with a brake attached.

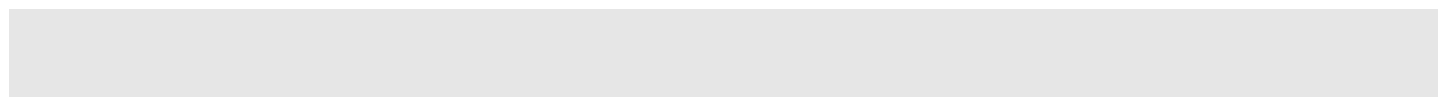
\*2 Our standard servo amplifiers are CE and UL approved.

## Speed-Torque Characteristics

The instantaneous zone characteristics drop for power supply voltages below 400 VAC.



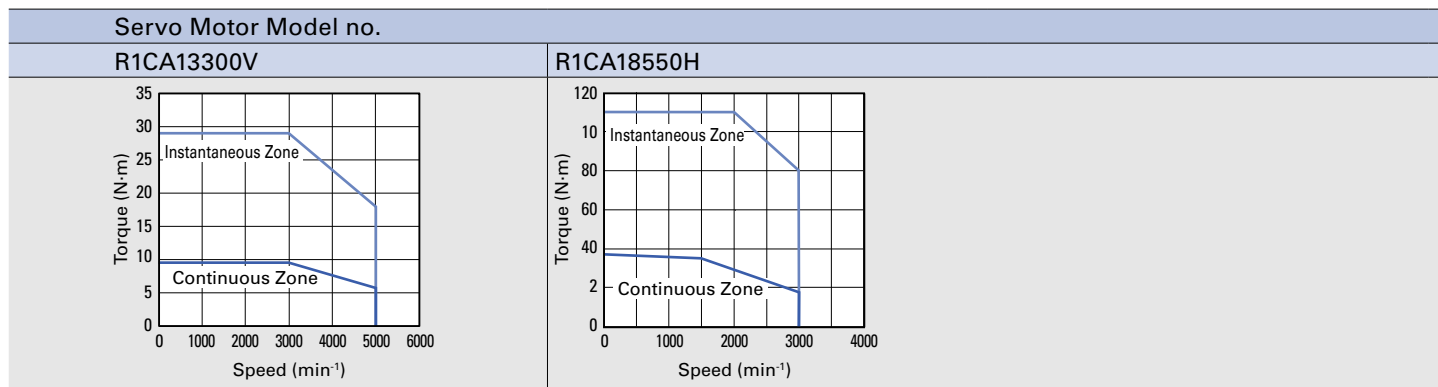
\*3 Run motors so that the average speed does not exceed its maximum speed in the continuous zone.



RS3C05□□《50 A》	RS3C15□□《150 A》	Servo Amplifier Model no.		
R1CA13300V 《130 mm sq.》	R1CA18550H 《180 mm sq.》	Servo Motor Model no. 《 》 indicates flange size		
		Unit	Symbol	Status
3.0	5.5	kW	P <sub>R</sub>	★ Rated Output
3000	1500	min <sup>-1</sup>	N <sub>R</sub>	★ Rated Speed
5000	3000	min <sup>-1</sup>	N <sub>max</sub>	★ Maximum Speed
9.55	35	N·m	T <sub>R</sub>	★ Rated Torque
9.55	37	N·m	T <sub>S</sub>	★ Continuous Stall Torque
29.0	110	N·m	T <sub>P</sub>	★ Peak Stall Torque
8.7	23	Arms	I <sub>R</sub>	★ Rated Armature Current
8.3	23.2	Arms	I <sub>S</sub>	★ Armature Stall Current
28.0	78	Arms	I <sub>P</sub>	★ Peak Armature Stall Current
1.23	1.75	N·m/Arms	K <sub>T</sub>	☆ Torque Constant
42.8	61	mV/min <sup>-1</sup>	K <sub>Eφ</sub>	☆ Voltage Constant for each Phase
0.36	0.125	Ω	R <sub>φ</sub>	☆ Phase Resistance
134	371	kW/s	Q <sub>R</sub>	★ Rated Power Rate
11	22	ms	te	☆ Electrical Time Constant
0.49	0.4	ms	tm	☆ Mechanical Time Constant (Not including Encoder)
6.8	33	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>M</sub>	☆ Rotor Inertia
0.012		×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>s</sub>	☆ Encoder Inertia * <sup>1</sup>
9.7 (11.8)	33 (38)	kg	We	☆ Servo Motor Mass * <sup>1</sup>
12 min.	53.9 min.	N·m	T <sub>b</sub>	☆ Brake Static Friction Torque
24 VDC ±10%	90 VDC/24 VDC ±10%	V	V <sub>b</sub>	☆ Brake Rated Voltage
0.66	0.37/1.4	A	I <sub>b</sub>	☆ Brake Rated Current
0.50	5.7	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>b</sub>	☆ Rotor Moment of Inertia (Brake)
5.2	7.0	kVA		☆ Servo amplifier power supply capacity (rating)
—	30/26 200 VAC ±10% Single-phase 50 Hz/60 Hz For CE/UL compliant products: 31/29 180 to 253 VAC Single-phase 50 Hz/60 Hz	W	P <sub>F</sub>	☆ Cooling fan power
Yes				☆ CE and UL approved servo motors * <sup>2</sup>
IP65	IP65 (excluding the cooling fan)			☆ Servo motor protection code
470×470×20 mm	540×540×20 mm			☆ Size of aluminum plates for heat radiation during measurement
p. 64	p. 65			☆ Page for motor dimensions

#### Servo Motor Operating Ambient Conditions

Operating temperature and humidity	Temp.: 0 to 40°C. Humidity: 90% max. (non-condensing)
Vibration resistance	[1 to 3 kW] In operation: 49 m/s <sup>2</sup> or less, at standstill: 24.5 m/s <sup>2</sup> or less [5.5 kW] 24.5 m/s <sup>2</sup> or less
Shock resistance	98 m/s <sup>2</sup> , 2 times
Operation altitude	1000 m or lower above sea level
Installation location	Indoor (without direct sunlight) Location where no substance that gives adverse effects on the device and motor, such as corrosive gas, flammable gas, or dust exists





## Specifications

# R1 Servo Motors

Low Inertia and High Power Rate **RoHS**

Input voltage **400 VAC**

Servo Amplifier Model no.				RS3C15□□《150 A》	
Servo Motor Model no.	《 》 indicates flange size			R1CA18750L 《180 mm sq.》	R1CA1811KR 《180 mm sq.》
	Status	Symbol	Unit		
Rated Output	★	P <sub>R</sub>	kW	7.5	11
Rated Speed	★	N <sub>R</sub>	min <sup>-1</sup>	1500	1500
Maximum Speed	★	N <sub>max</sub>	min <sup>-1</sup>	3000	2500
Rated Torque	★	T <sub>R</sub>	N·m	48	70
Continuous Stall Torque	★	T <sub>S</sub>	N·m	48	70
Peak Stall Torque	★	T <sub>P</sub>	N·m	135	195
Rated Armature Current	★	I <sub>R</sub>	Arms	26.3	28.3
Armature Stall Current	★	I <sub>S</sub>	Arms	25.1	27.5
Peak Armature Stall Current	★	I <sub>P</sub>	Arms	83	83
Torque Constant	☆	K <sub>T</sub>	N·m/Arms	2.1	2.82
Voltage Constant for each Phase	☆	K <sub>Eφ</sub>	mV/min <sup>-1</sup>	73.3	98.5
Phase Resistance	☆	R <sub>φ</sub>	Ω	0.117	0.145
Rated Power Rate	★	Q <sub>R</sub>	kW/s	549	766
Electrical Time Constant	☆	t <sub>e</sub>	ms	25	23
Mechanical Time Constant (Not including Encoder)	☆	t <sub>m</sub>	ms	0.33	0.35
Rotor Inertia		J <sub>M</sub>	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	42	64
Encoder Inertia *1		J <sub>S</sub>	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	0.012	
Servo Motor Mass *1		W <sub>e</sub>	kg	39 (44)	52 (59)
Brake Static Friction Torque		T <sub>b</sub>	N·m	53.9 min.	75 min.
Brake Rated Voltage		V <sub>b</sub>	V	90 VDC/24 VDC ±10%	24 VDC ±10%
Brake Rated Current		I <sub>b</sub>	A	0.37/1.4	1.5
Rotor Moment of Inertia (Brake)		J <sub>b</sub>	x10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	5.7	8.0
Servo amplifier power supply capacity (rating)			kVA	9.5	13.8
Cooling fan power		P <sub>F</sub>	W	30/26 200 VAC ±10% Single-phase 50 Hz/60 Hz For CE/UL compliant products: 31/29 180 to 253 VAC Single-phase 50 Hz/60 Hz	
CE and UL approved servo motors *2				Yes	
Servo motor protection code				IP65 (excluding the cooling fan)	
Size of aluminum plates for heat radiation during measurement				540×540×20 mm	610×610×30 mm
Page for motor dimensions				p. 65	

★ Speed-torque characteristics curves and values in the row with a black star symbol (★) are the values when combined with a standard servo amplifier and after thermal equilibrium is established. All values are typical values.

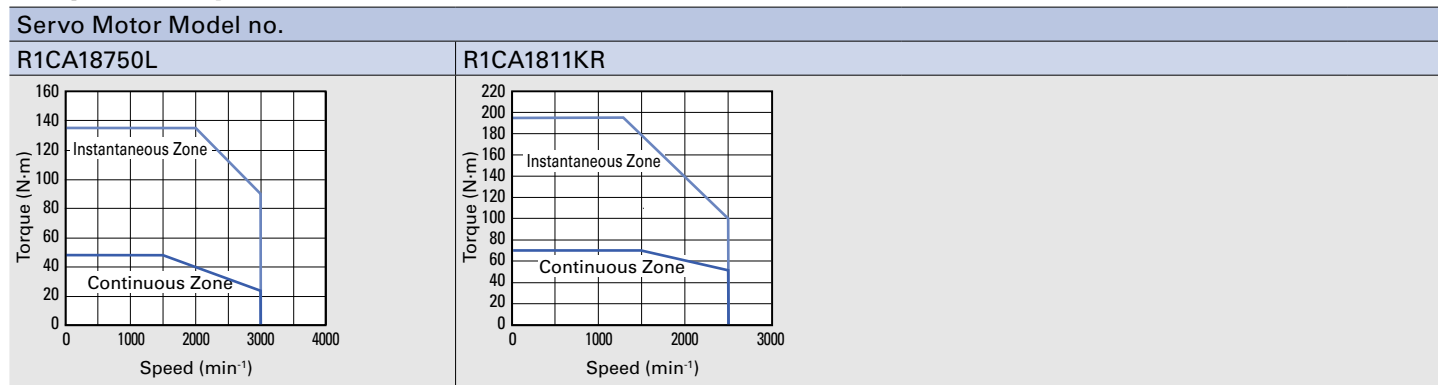
☆ Indicates a typical value when the winding temperature is 20°C. All values are typical values.

\*1 The values for "Encoder inertia" and "servo motor mass" are with a [HA035] battery-less absolute encoder.  
Contact us for details on other encoders.  
Values inside ( ) are with a brake attached.

\*2 Our standard servo amplifiers are CE and UL approved.

## Speed-Torque Characteristics

The instantaneous zone characteristics drop for power supply voltages below 400 VAC.



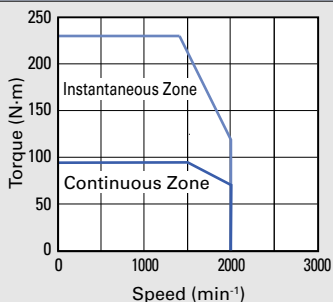
RS3C15□□《150 A》	RS3C30□□《300 A》	Servo Amplifier Model no.		
R1CA1815KB 《180 mm sq.》	R1CA2220KV 《220 mm sq.》	Servo Motor Model no. 《 》 indicates flange size		
		Unit	Symbol	Status
15	21	kW	P <sub>R</sub>	★ Rated Output
1500	1500	min <sup>-1</sup>	N <sub>R</sub>	★ Rated Speed
2000	2000	min <sup>-1</sup>	N <sub>max</sub>	★ Maximum Speed
95.5	135	N·m	T <sub>R</sub>	★ Rated Torque
95.5	135	N·m	T <sub>S</sub>	★ Continuous Stall Torque
230	380	N·m	T <sub>P</sub>	★ Peak Stall Torque
31.3	51	Arms	I <sub>R</sub>	★ Rated Armature Current
30.2	49	Arms	I <sub>S</sub>	★ Armature Stall Current
83	152	Arms	I <sub>P</sub>	★ Peak Armature Stall Current
3.37	2.98	N·m/Arms	K <sub>T</sub>	☆ Torque Constant
117.8	104	mV/min <sup>-1</sup>	K <sub>Eφ</sub>	☆ Voltage Constant for each Phase
0.15	0.06	Ω	R <sub>φ</sub>	☆ Phase Resistance
1060	1740	kW/s	Q <sub>R</sub>	★ Rated Power Rate
24	43	ms	te	☆ Electrical Time Constant
0.34	0.21	ms	tm	☆ Mechanical Time Constant (Not including Encoder)
86	105	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>M</sub>	Rotor Inertia
0.012		×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>s</sub>	Encoder Inertia * <sup>1</sup>
64 (73)	107	kg	We	Servo Motor Mass * <sup>1</sup>
120 min.	—	N·m	T <sub>b</sub>	Brake Static Friction Torque
24 VDC ±10%	—	V	V <sub>b</sub>	Brake Rated Voltage
1.9	—	A	I <sub>b</sub>	Brake Rated Current
9.7	—	×10 <sup>-4</sup> kg·m <sup>2</sup> (GD <sup>2</sup> /4)	J <sub>b</sub>	Rotor Moment of Inertia (Brake)
18.2	24.2	kVA		Servo amplifier power supply capacity (rating)
30/26 200 VAC ±10% Single-phase 50 Hz/60 Hz For CE/UL compliant products: 31/29 180 to 253 VAC Single-phase 50 Hz/60 Hz		W	P <sub>F</sub>	Cooling fan power
Yes	To be certified later			CE and UL approved servo motors * <sup>2</sup>
IP65 (excluding the cooling fan)	IP65 (excluding cooling fan and terminal block)			Servo motor protection code
610×610×30 mm				Size of aluminum plates for heat radiation during measurement
p. 65				Page for motor dimensions

Servo Motor Operating Ambient Conditions

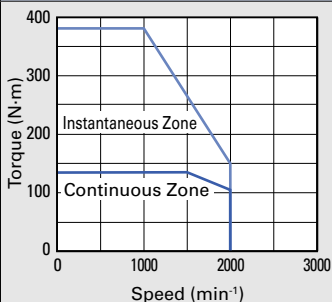
Operating temperature and humidity	Temp.: 0 to 40°C. Humidity: 90% max. (non-condensing)
Vibration resistance	24.5 m/s <sup>2</sup>
Shock resistance	98 m/s <sup>2</sup> , 2 times
Operation altitude	1000 m or lower above sea level
Installation location	Indoor (without direct sunlight) Location where no substance that gives adverse effects on the device and motor, such as corrosive gas, flammable gas, or dust exists

Servo Motor Model no.

R1CA1815KB



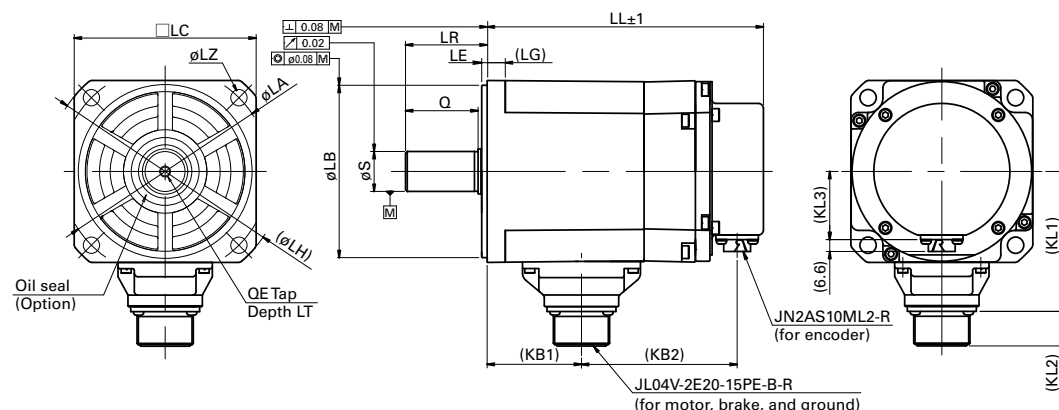
R1CA2220KV



## Dimensions [Unit: mm]

### 100 mm sq.

#### R2 Servo Motor 750 W to 1.0 kW



This drawing is for a motor equipped with a battery-less absolute encoder with brake.

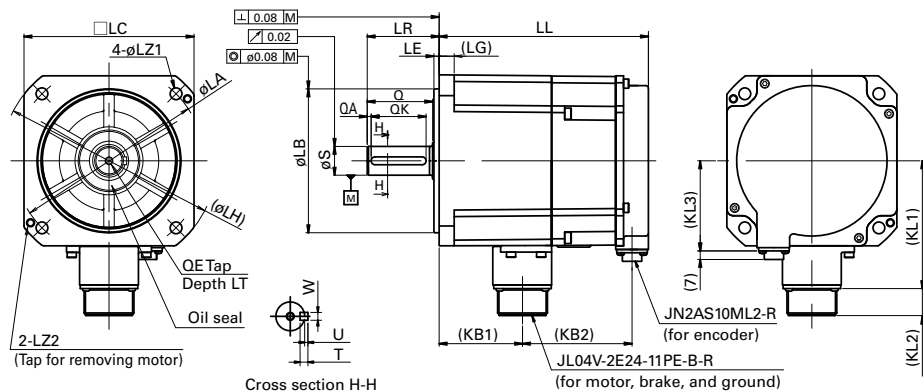
	Battery-less absolute encoder Single-turn absolute encoder															
	W/out brake			With brake												
Model no.	LL	KB2	KL3	LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ	LR
R2CA10075	134.8	68.3	37.6	152.3	85.8	37.6	10	77.8	19.1	115	0 95 -0.035	3	130	100	4-ø9	45
R2CA10100	151.8			169.3												

Model no.	S	Q	KB1	QE	LT
R2CA10075	0 22 -0.013	40	52	M6	20
R2CA10100			69		

### 130 mm sq.

#### R2 Servo Motor 550 W to 1.8 kW

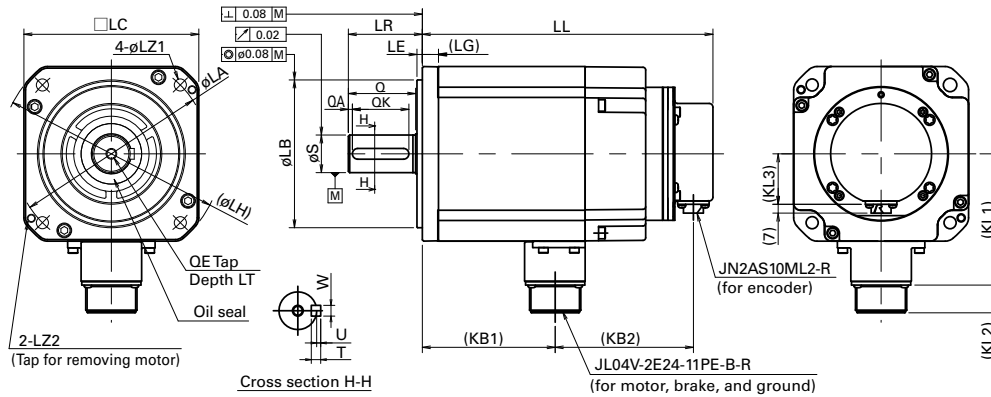


This drawing is for a motor equipped with a battery-less absolute encoder with brake.

	Battery-less absolute encoder Single-turn absolute encoder																
	W/out brake			With brake													
Model no.	LL	KB2	KL3	LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1	LZ2	LR
R2CA13050	103	44	69	139.5	81	69	12	98	21	145	0 110 -0.035	4	165	130	9	M6	55
R2CA13120	120.5			160	84												
R2CA13180	138			179	86												

Model no.	S	Q	QA	QK	W	T	U	KB1	QE	LT
R2CA13050	0 22 -0.013	50	3	42	0 6 -0.030	6	2.5	46	M6	20
R2CA13120								64		
R2CA13180								81		

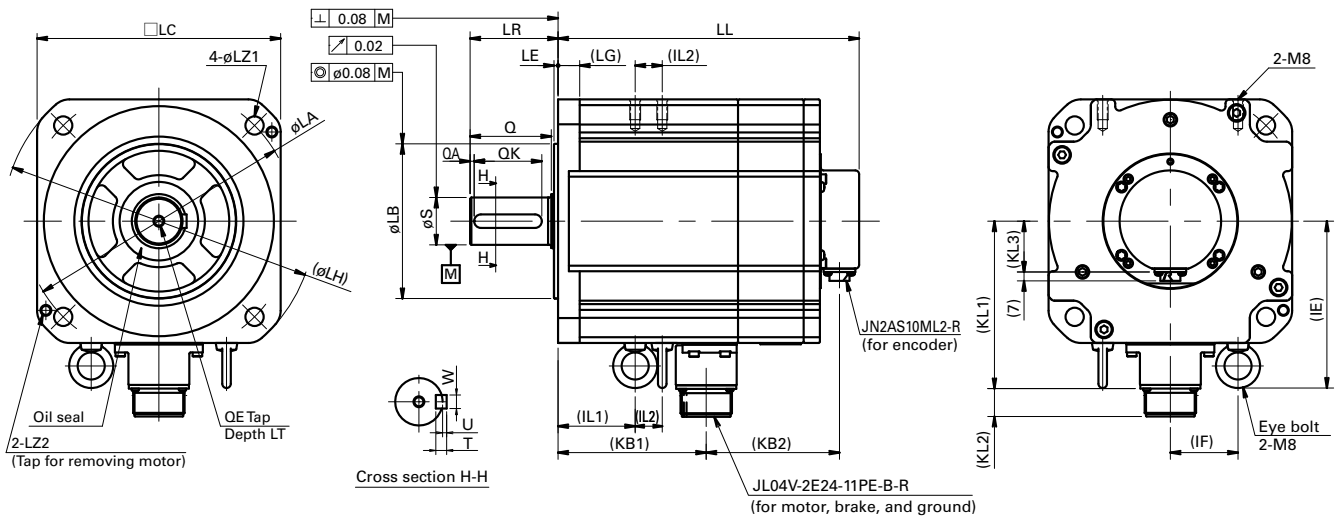
## 130 mm sq. R2 Servo Motor 2 kW



This drawing is for a motor equipped with a battery-less absolute encoder with brake.

Model no.	Battery-less absolute encoder			Single-turn absolute encoder													
	W/out brake			With brake			LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC
R2CA13200	171	57	38	216	103	38	12	98	21	145	110	0	4	165	130	9	M6
Model no.	S	Q	QA	QK	W	T	U	KB1	QE	LT							
R2CA13200	28	50	3	42	8	7	3	99	M8	25							

## 180 mm sq. R2 Servo Motor 3.5 to 5.5 kW

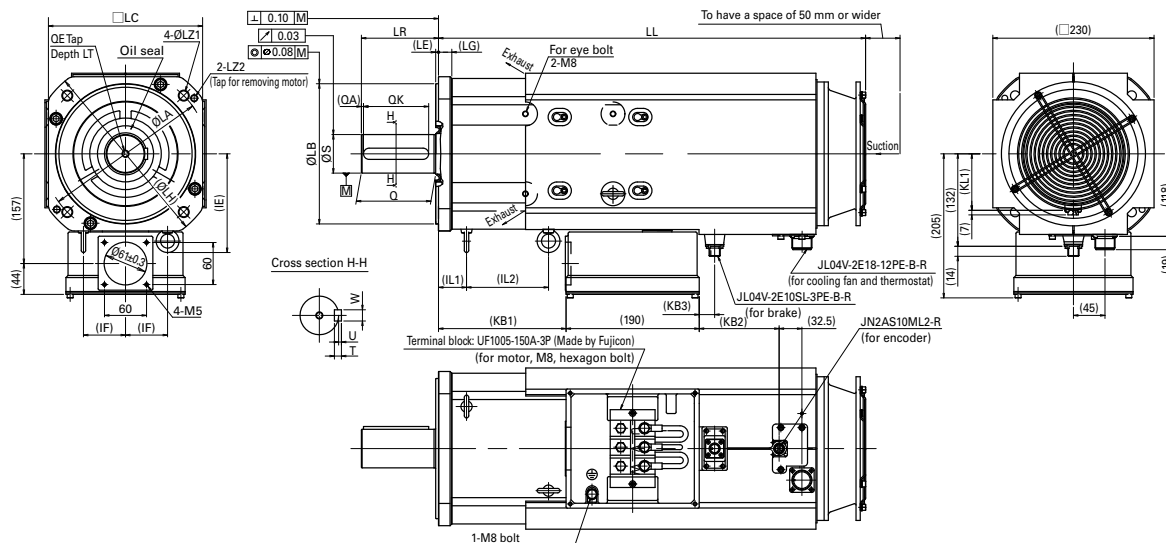


This drawing is for a motor equipped with a battery-less absolute encoder with brake.

Model no.	Battery-less absolute encoder			Single-turn absolute encoder													
	W/out brake			With brake			LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC
R2CA18350	159			206													
R2CA18450	176	52	38	223	99	38	16	123	21	200	114.3	0	3	230	180	13.5	M8
R2CA18550	228			274													
Model no.	QA	QK	W	T	U	KB1	QE	LT	IE	IF	IL1	IL2					
R2CA18350						92	M8				47						
R2CA18450	3	50	10	8	3	109		25	123	50	57	20					
R2CA18550		67	12			161	M10				63	41					



## 220 mm sq. R2 Servo Motor 20 kW



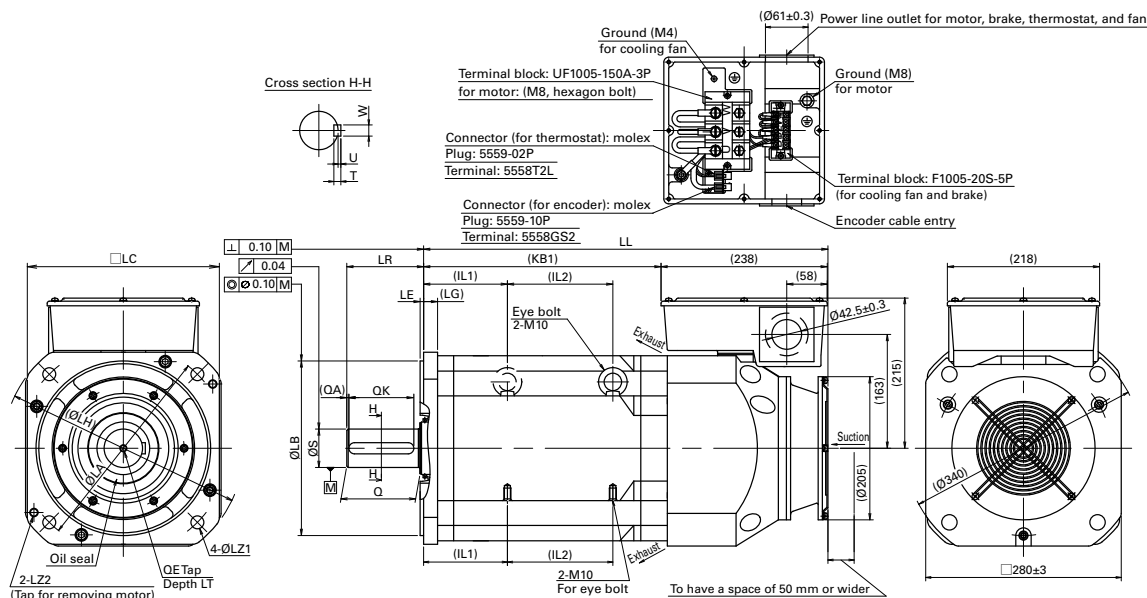
This drawing is for a motor equipped with a battery-less absolute encoder with brake.

Model no.	Battery-less absolute encoder Single-turn absolute encoder				W/out brake				With brake							
	LL	KB2	KB3	KL1	LL	KB2	KB3	KL1	LG	LA	LB	LE	LH			
R2CA2220K	550	10	—	81	609	114	22	81	19	235	0 200 -0.046	4	270			

Model no.	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT	IE	IF	IL1	IL2
R2CA2220K	220	13.5	M10	110	0 55 -0.019	106	3	93	0 16 -0.043	10	4	182	M10	25	142	60	40	117

## 275 mm sq. R2 Servo Motor 30 kW



This drawing is for a motor equipped with a battery-less absolute encoder with brake.

Model no.	Battery-less absolute encoder Single-turn absolute encoder				W/out brake				With brake							
	LL	KB1	IL2	LL	KB1	IL2	LG	LA	LB	LE	LH					
R2CA2830K	479	240	50	579	340	151	20	300	0 200 -0.052	5	345					

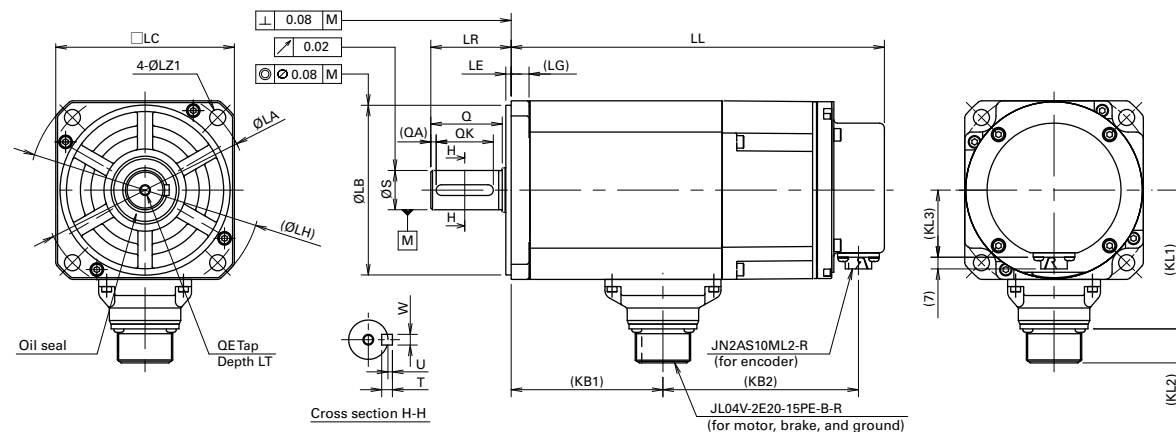
  

Model no.	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	QE	LT	IL1
R2CA2830K	275	18.5	M12	110	0 55 -0.019	105	3	93	0 16 -0.043	10	4	M10	25	120

# Dimensions [Unit: mm]

## 100 mm sq.

### R1 Servo Motor 1.5 to 2.0 kW



This drawing is for a motor equipped with a battery-less absolute encoder with brake.

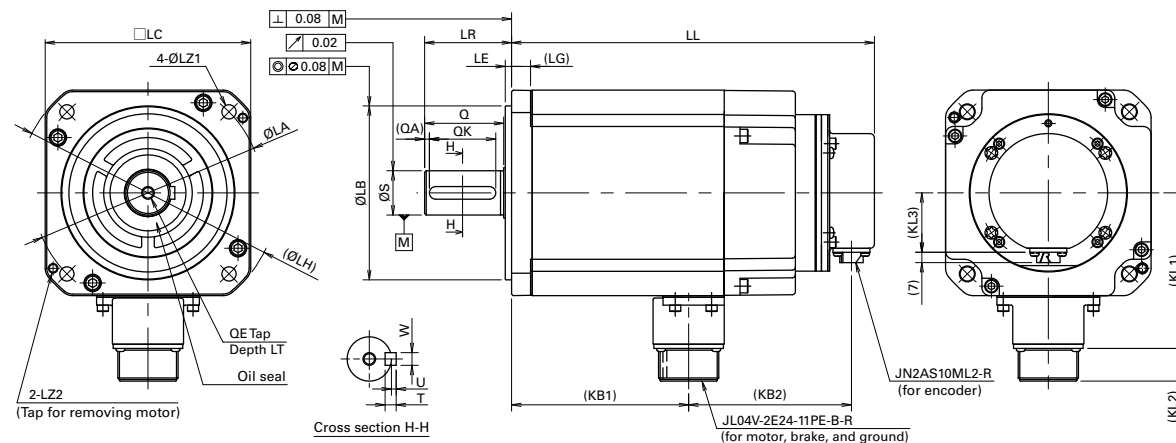
Model no.	Battery-less absolute encoder			Single-turn absolute encoder											
	W/out brake			With brake											
Model no.	LL	KB2	KL3	LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1
R1CA10150	168	68	38	209	109	38	10	78	19	115	0	3	130	100	9
R1CA10200	179			220							95 -0.035				

Model no.	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT
R1CA10150	45	0	40	3	32	0	6	2.5	85	M6	20
R1CA10200		22 -0.013				6 -0.03			96		

## 130 mm sq.

### R1 Servo Motor 3.0 kW



This drawing is for a motor equipped with a battery-less absolute encoder with brake.

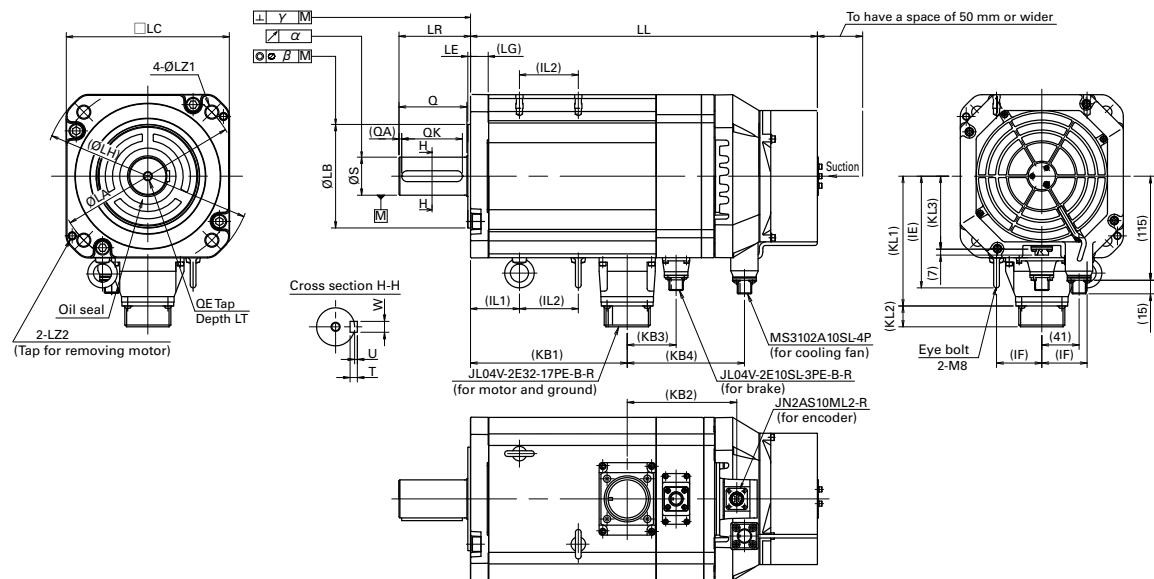
Model no.	Battery-less absolute encoder			Single-turn absolute encoder											
	W/out brake			With brake											
Model no.	LL	KB2	KL3	LL	KB2	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1
R1CA13300	184	57	38	230	103	38	12	98	21	145	0	4	165	130	9
											110 -0.035				

Model no.	LR	S	Q	QA	QK	W	T	U	KB1	QE	LT
R1CA13300	55	0	50	3	42	0	7	3	112	M8	25
		28 -0.013				8 -0.036					



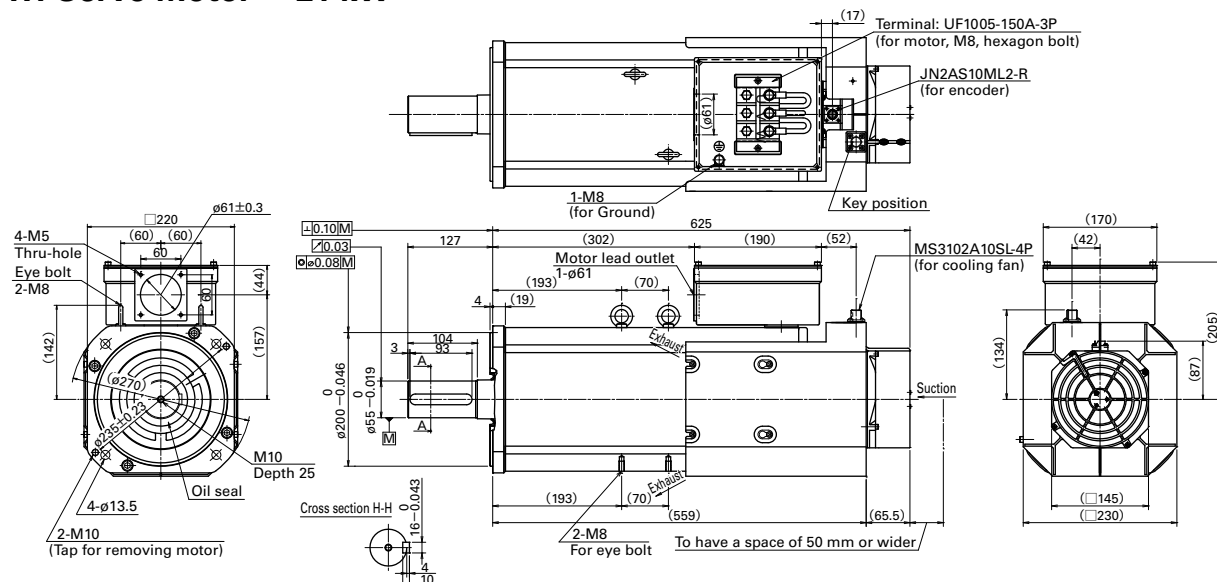
## 180 mm sq. R1 Servo Motor 5.5 to 15 kW



This drawing is for a motor equipped with a battery-less absolute encoder with brake.

	Battery-less absolute encoder Single-turn absolute encoder																						
	W/out brake					With brake																	
Model no.	LL	KB2	KB3	KB4	KL3	LL	KB2	KB3	KB4	KL3	LG	KL1	KL2	LA	LB	LE	LH	LC	LZ1	LZ2			
R1CA18550	333	80.5	—	79.5	81	383	130.5	54	129.5	81	19.5	143	23	200	0 114.3 -0.035	3	230	180	13.5	M8			
R1CA18750	368					418																	
R1CA1811K	438					517					149										79	158	19
R1CA1815K	516					628					182										110	191	
Model no.	LR	S	Q	QA	QK	W	T	U	KB1	$\alpha$	$\beta$	$\gamma$	QE	LT	IE	IF	IL1	IL2					
R1CA18550	79	0 42 -0.016	75	3	67	0 12 -0.043	8	3	173	0.02	0.08	0.10	M10	25	124	50	54	65					
R1CA18750									208								68	85					
R1CA1811K									278	68							163						
R1CA1815K									0 55 -0.019	0 16 -0.043							10	4	356	92	210		

## 220 mm sq. R1 Servo Motor 21 kW



This drawing is for a motor equipped with a battery-less absolute encoder with brake.



# Options

## Setup Software

This software allows you to set servo system parameters from a PC.  
It also allows you to easily start up and run tests for the servo system.  
The software can be downloaded from Product Information on our website.  
URL: <https://www.sanyodenki.com>

### ■Setup software title

SANMOTION MOTOR SETUP SOFTWARE

### ■Main functions

Parameter settings (settings by group, settings by function)

Diagnosis (alarm display, warning display, alarm cancellation)

Test run execution (speed JOG, positioning operation, motor home position search, absolute encoder clearance)

Servo tuning (notch filter tuning, FF vibration control frequency tuning)

Various measurement functions (operating waveform display, machinery frequency response measurement)

Use a USB communication cable (Mini-B) to connect the USB port on the PC and the servo amplifier.

### ■Supported OS

Windows 7 / 8 / 10

Note: See our website for details on supported OS versions.

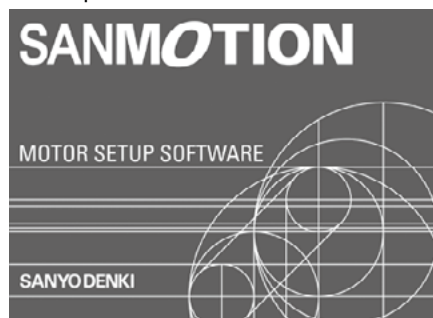
Please note the following points when replacing our conventional SANMOTION R servo amplifiers with the SANMOTION R 3E Model amplifiers.

Be noted that the SANMOTION R Setup Software cannot be used.

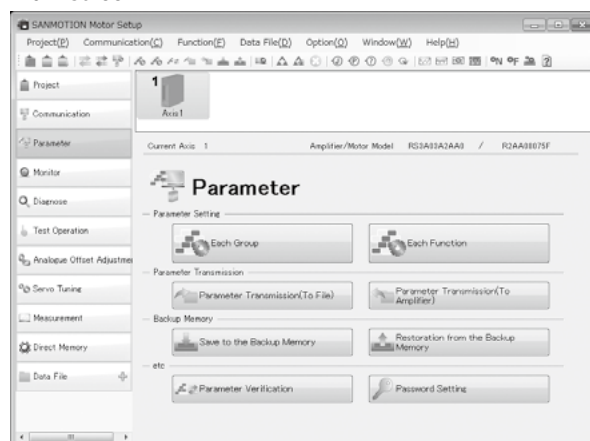
Use our optional or commercially available USB cable (with Mini USB connector on the amplifier side).

## Examples of setting screens and functions with SANMOTION R 3E Model

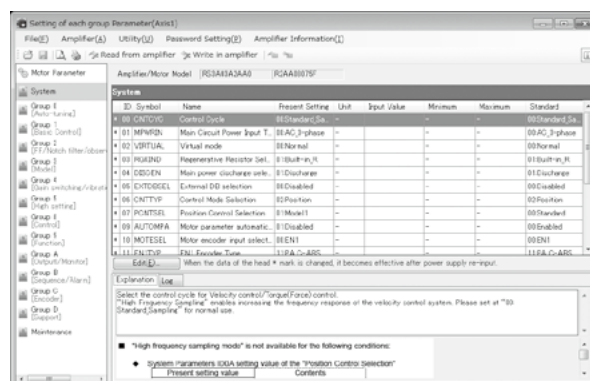
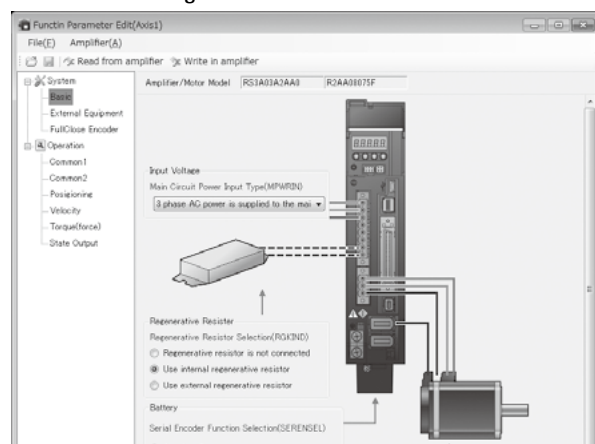
### Start-up screen



### Main screen



### Parameter Setting screen

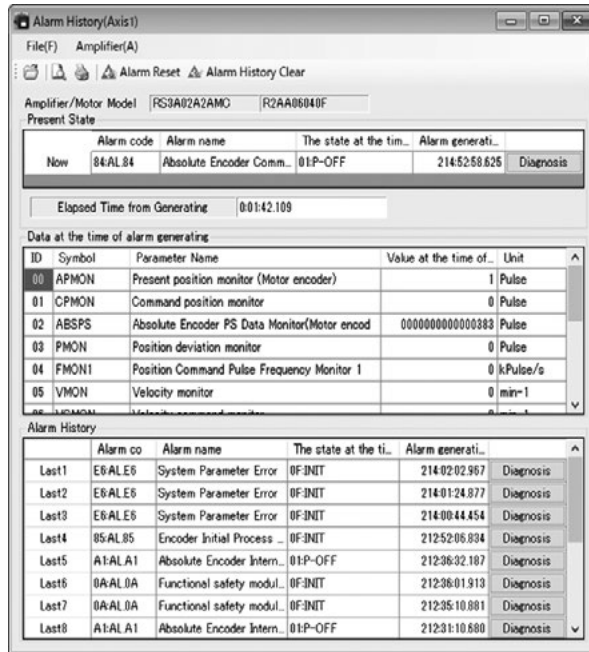


Parameter setting for each group  
Parameters can be set, saved, and more.

### Function Parameter Edit

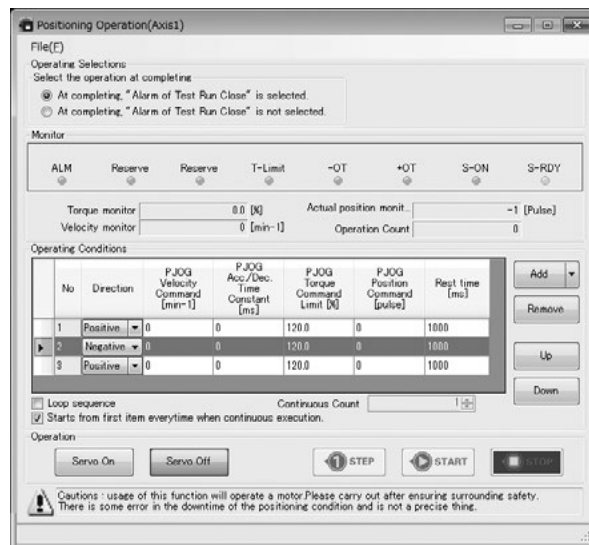
Minimum required parameter setting by function can be done.

## Diagnosis screen



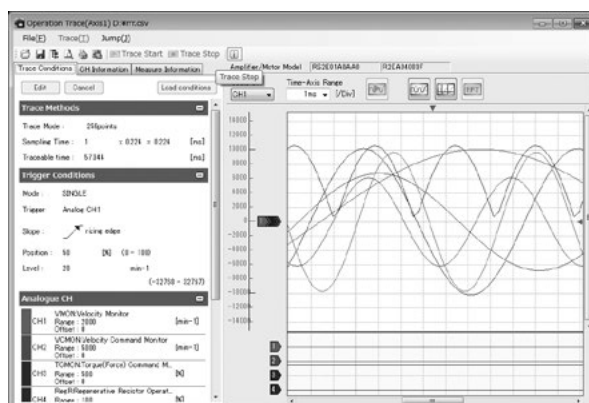
The current and previous 15 alarm occurrences can be checked.

Test run



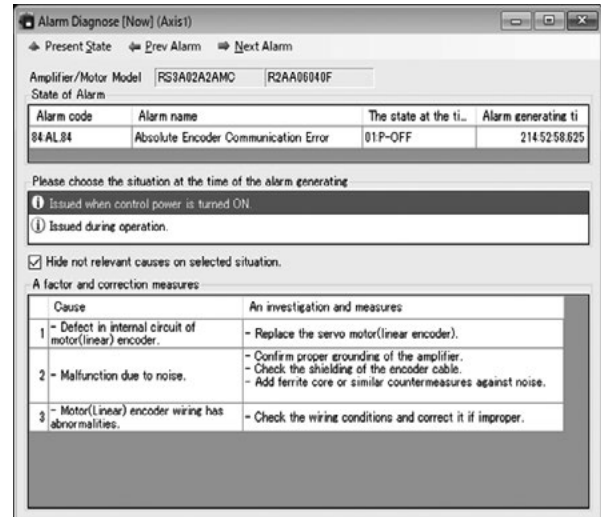
Simple test run of servo motor by issuing velocity commands and position commands from a PC. (Position JOG in operation shown in screen)

## Measurement



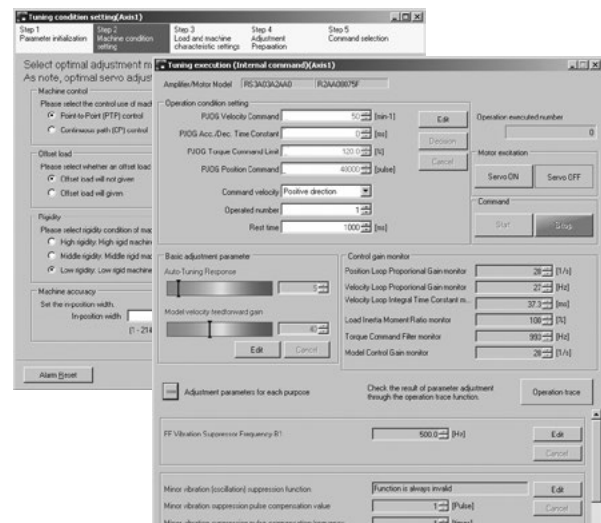
## Operation Trace

Graphically displays servo motor's speed, torque and internal status.

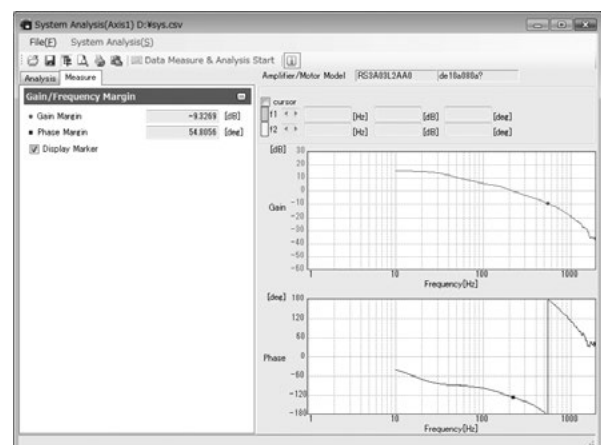


Causes and corrective actions can be checked based on alarm status.

## Servo adjustment assist



By setting the mechanical conditions, easy servo adjustment is available with the optimal tuning mode.



## System Analysis

Analyzes servo system frequency characteristics.

# Connector to Connect Servo Amplifier

## ■ Analog/Pulse input type

### 25 to 100 A

#### Individual connectors

Connector no.	Description	Model no.	Manufacturer model no.	Manufacturer
CN1	For controller connection	AL-00385594	10150-3000PE and 10350-52A0-008	3M Japan Limited
EN1, EN2	For encoder connection	AL-00632607	36210-0100PL and 36310-3200-008	
CN4*	To connect safety device (for short-circuiting)	AL-00718251-01	2040978-1	Tyco Electronics Japan G.K.
CN4	To connect safety device (for wiring)	AL-00718252-01	2013595-3	
CNA	For main circuit power supply connection	AL-00953863-01	03JFAT-SAXGDK-P15	J.S.T. Mfg. Co.,Ltd.
CNB	To connect to servo motor	AL-00953865-01	03JFAT-SAZGDK-P15	
CNC	For regenerative resistor connection	AL-00953864-01	03JFAT-SAYGDK-P15	
Connector tool	For CNA, CNB, and CNC	AL-00953866-01	J-FAT-OT-P	
CND	For control circuit power supply connection	AL-00961843-01	04JFAT-SAGG-G-KK	
Connector tool	For CND	AL-00961844-01	J-FAT-OT(N)	
CNE	For holding brake power output	AL-00953867-01	02MJFAT-SAGF	
Connector tool	For CNE	AL-00953868-01	MJFAT-OT	Phoenix Contact.K.K
SF-CN1, SF-CN2	To connect safety device (Safety only)	AL-Y0012189-01	DFMC 0,5/10-ST-2,54	

\* When CN4 is not wired, be sure to insert a safety device connector (for short-circuiting) to CN4 on the servo amplifier. This item is optional and not included with an analog/pulse type amplifier.

#### Connector sets (For non-STO models)

Servo amplifier model no.		RS3C□□A0□A0 RS3C□□A8□A0		RS3C□□A2□A0 RS3C□□AA□A0	
Built-in regenerative resistor		Yes		Yes	
Connector set no.		AL-00723290	AL-00966991	AL-00966993	AL-00966995
Connectors included in the set	CN1: For controller connection	Yes		Yes	
	EN1: For encoder connection	Yes		Yes	
	EN2: For encoder connection	No		Yes	
	CNE: For holding brake power output	No	Yes	No	Yes
	Connector tool: For CNE	No	Yes	No	Yes
Remarks		For fully-closed control systems			

#### Connector sets (For STO models and Safety models)

Servo amplifier model no.		RS3C□□A0□A□ RS3C□□A8□A□		RS3C□□A2□A0 RS3C□□AA□A0	
Built-in regenerative resistor		Yes		Yes	
Connector set no.		AL-00723159	AL-00967013	AL-00967015	AL-00967017
Connectors included in the set	CN1: For controller connection	Yes		Yes	
	EN1: For encoder connection	Yes		Yes	
	EN2: For encoder connection	No		Yes	
	CN4: To connect safety device (for wiring)	Yes		Yes	
	CNE: For holding brake power output	No	Yes	No	Yes
	Connector tool: For CNE	No	Yes	No	Yes
Remarks		For fully-closed control systems			

## ■ Analog/Pulse input type

### 150 A, 300 A

#### Individual connectors

Connector no.	Description	Model no.	Manufacturer model no.	Manufacturer
CN1	For controller connection	AL-00385594	10150-3000PE and 10350-52A0-008	3M Japan Limited
EN1, EN2	For encoder connection	AL-00632607	36210-0100PL and 36310-3200-008	
CN4*	To connect safety device (for short-circuiting)	AL-00718251-01	2040978-1	Tyco Electronics Japan G.K.
CN4	To connect safety device (for wiring)	AL-00718252-01	2013595-3	
SF-CN1, SF-CN2	To connect safety device (Safety only)	AL-Y0012189-01	DFMC 0,5/10-ST-2,54	Phoenix Contact.K.K

\* When CN4 is not wired, be sure to insert a safety device connector (for short-circuiting) to CN4 on the servo amplifier. This item is optional and not included with an analog/pulse type amplifier.

#### Connector sets (For non-STO models)

Servo amplifier model no.	RS3C□□A0□□0 RS3C□□A8□□0		RS3C□□A2□□0 RS3C□□AA□□0	
Built-in regenerative resistor	No		No	
Connector set no.	AL-00723290		AL-00966993	
Connectors included in the set	CN1: For controller connection	Yes	Yes	
	EN1: For encoder connection	Yes	Yes	
	EN2: For encoder connection	No	Yes	
Remarks			For fully-closed control systems	

#### Connector sets (For STO models and Safety models)

Servo amplifier model no.	RS3C□□A0□□□ RS3C□□A8□□□		RS3C□□A2□□□ RS3C□□AA□□□	
Built-in regenerative resistor	No		No	
Connector set no.	AL-00723159		AL-00967015	
Connectors included in the set	CN1: For controller connection	Yes	Yes	
	EN1: For encoder connection	Yes	Yes	
	EN2: For encoder connection	No	Yes	
	CN4: To connect safety device (for wiring)	Yes	Yes	
Remarks			For fully-closed control systems	

## Connector to Connect Servo Amplifier

### ■ EtherCAT interface type

#### 25 to 100 A

##### Individual connectors

Connector no.	Description	Model no.	Manufacturer model no.	Manufacturer
IN, OUT	Ethernet For controller connection	Not available Use a CAT5e standard-compliant shielded type modular plug (RJ-45).		
EN1,EN2	For encoder connection	AL-Y0012504-01	545991016	Molex Japan Co., Ltd.
CN2	For general-purpose I/O signal	AL-00842383	HDR-E26MSG1+ and HDR-E26LPH	HONDA TSUSHIN KOGYO CO., LTD
CN4*	To connect safety device (for short-circuiting)	AL-00849548-02	1971153-2	Tyco Electronics Japan G.K.
CN4	To connect safety device (for wiring)	AL-00718252-01	2013595-3	
CNA	For main circuit power supply connection	AL-00953863-01	03JFAT-SAXGDK-P15	J.S.T. Mfg. Co.,Ltd.
CNB	To connect to servo motor	AL-00953865-01	03JFAT-SAZGDK-P15	
CNC	For regenerative resistor connection	AL-00953864-01	03JFAT-SAYGDK-P15	
Connector tool	For CNA, CNB, and CNC	AL-00953866-01	J-FAT-OT-P	
CND	For control circuit power supply connection	AL-00961843-01	04JFAT-SAGG-G-KK	
Connector tool	For CND	AL-00961844-01	J-FAT-OT(N)	
CNE	For holding brake power output	AL-00953867-01	02MJFAT-SAGF	
Connector tool	For CNE	AL-00953868-01	MJFAT-OT	Phoenix Contact.K.K
SF-CN1, SF-CN2	To connect safety device (Safety only)	AL-Y0012189-01	DFMC 0,5/10-ST-2,54	

\* When CN4 is not wired, be sure to insert a safety device connector (for short-circuiting) to CN4 on the servo amplifier. One will be included with a servo amplifier.

##### Connector sets

Servo amplifier model no.		RS3C□□A□HA□					
Built-in regenerative resistor		Yes					
Connector set no.		AL-00977732	AL-00977750	AL-01002534	AL-00977752	AL-00977754	AL-01002536
Connectors included in the set	EN1: For encoder connection	Yes			Yes		
	EN2: For encoder connection	No			Yes		
	CNE: For holding brake power output	No	Yes	No	No	Yes	No
	Connector tool: For CNE	No	Yes	No	No	Yes	No
	CN4: To connect safety device (for wiring)	Yes	Yes	No	Yes	Yes	No
	CN2: For general-purpose I/O	Yes			Yes		
Remarks					For fully-closed control systems		



## ■ EtherCAT interface type

### 150 A, 300 A

#### Individual connectors

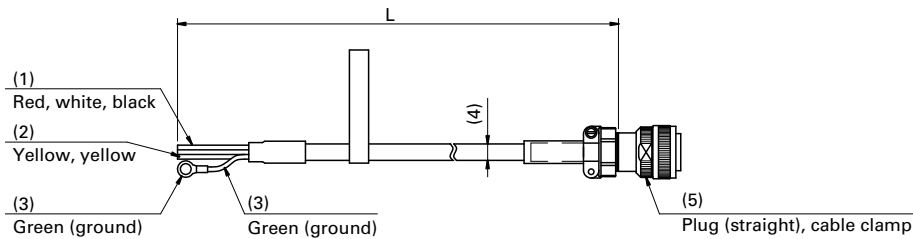
Connector no.	Description	Model no.	Manufacturer model no.	Manufacturer
IN, OUT	Ethernet For controller connection	Not available Use a CAT5e standard-compliant shielded type modular plug (RJ-45).		
EN1,EN2	For encoder connection	AL-Y0012504-01	545991016	Molex Japan Co., Ltd.
CN2	For general-purpose I/O signal	AL-00842383	HDR-E26MSG1+ and HDR-E26LPH	HONDA TSUSHIN KOGYO CO., LTD
CN4*	To connect safety device (for short-circuiting)	AL-00849548-02	1971153-2	Tyco Electronics Japan G.K.
CN4	To connect safety device (for wiring)	AL-00718252-01	2013595-3	
SF-CN1, SF-CN2	To connect safety device (Safety only)	AL-Y0012189-01	DFMC 0,5/10-ST-2,54	Phoenix Contact.K.K

\* When CN4 is not wired, be sure to insert a safety device connector (for short-circuiting) to CN4 on the servo amplifier. One will be included with a servo amplifier.

#### Connector sets

Servo amplifier model no.		RS3C□□A□H□□			
Built-in regenerative resistor		No			
Connector set no.		AL-00977732	AL-01002534	AL-00977752	AL-01002536
Connectors included in the set	EN1: For encoder connection	Yes		Yes	
	EN2: For encoder connection	No		Yes	
	CN4: To connect safety device (for wiring)	Yes	No	Yes	No
	CN2: For general-purpose I/O	Yes		Yes	
Remarks				For fully-closed control systems	

# Servo Motor Power Cable



- (1) Connect power line to the servo amplifier's connector CNB.  
(2) Connect brake line to the servo amplifier's connector CNE.

This item is also listed in the Power Connector to Connect Motor, Electric Wire Size table in the next chapter.

Note: Only straight plugs are available for this cable.

Cables with angled plugs are not available.

## For 100 mm sq. motors, power/brake cable

Motors:

R2CA10075F, R2CA10100F, R1CA10150V, R1CA10200V

Cable length: L (m)	Model no.	
	Power cable	Power/brake cable
1	AL-00964811-01	AL-00964812-01
2	AL-00964811-02	AL-00964812-02
3	AL-00964811-03	AL-00964812-03
5	AL-00964811-05	AL-00964812-05
10	AL-00964811-10	AL-00964812-10

Model no.		AL-00964811-□□	AL-00964812-□□																																				
(1) Power	Wire gauge	AWG16	AWG16																																				
	Terminal	—	—																																				
(2) Brake	Wire gauge	—	AWG20																																				
	Terminal	—	—																																				
(3) Ground	Wire gauge	AWG16	AWG16																																				
	Terminal	N2-M4	N2-M4																																				
(4) Cable diameter		ø11.6 mm	ø11.6 mm																																				
(5) Plug/Clamp		JL04V-6A20-15SE-EB-R / JL04-2022CK(14)-R	JL04V-6A20-15SE-EB-R / JL04-2022CK(14)-R																																				
Connection	<table><tr><td>Pin no.</td><td>Lead wire color</td><td>Signal name</td></tr><tr><td>A</td><td>Red</td><td>U</td></tr><tr><td>B</td><td>White</td><td>V</td></tr><tr><td>C</td><td>Black</td><td>W</td></tr><tr><td>D</td><td>Green</td><td>GND</td></tr></table>		Pin no.	Lead wire color	Signal name	A	Red	U	B	White	V	C	Black	W	D	Green	GND	<table><tr><td>Pin no.</td><td>Lead wire color</td><td>Signal name</td></tr><tr><td>A</td><td>Red</td><td>U</td></tr><tr><td>B</td><td>White</td><td>V</td></tr><tr><td>C</td><td>Black</td><td>W</td></tr><tr><td>D</td><td>Green</td><td>GND</td></tr><tr><td>E</td><td>Yellow</td><td>Brake</td></tr><tr><td>F</td><td>Yellow</td><td>Brake</td></tr></table>	Pin no.	Lead wire color	Signal name	A	Red	U	B	White	V	C	Black	W	D	Green	GND	E	Yellow	Brake	F	Yellow	Brake
	Pin no.	Lead wire color	Signal name																																				
	A	Red	U																																				
	B	White	V																																				
	C	Black	W																																				
	D	Green	GND																																				
	Pin no.	Lead wire color	Signal name																																				
A	Red	U																																					
B	White	V																																					
C	Black	W																																					
D	Green	GND																																					
E	Yellow	Brake																																					
F	Yellow	Brake																																					

## For 130 mm sq. motors, power/brake cable

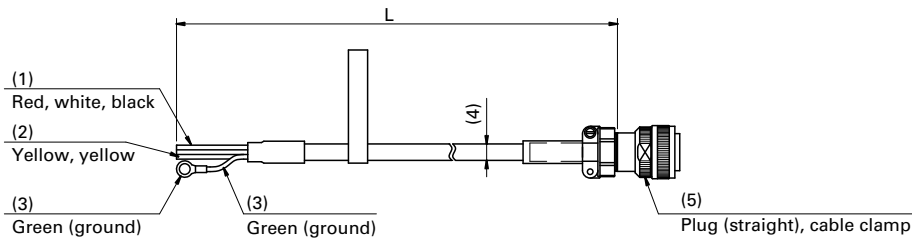
Motors:

R2CA13050D, R2CA13120R, R2CA13120F, R2CA13180H,

R2CA13200L, R2CA13200H, R1CA13300V

Cable length: L (m)	Model no.	
	Power cable	Power/brake cable
1	AL-00965739-01	AL-00965740-01
2	AL-00965739-02	AL-00965740-02
3	AL-00965739-03	AL-00965740-03
5	AL-00965739-05	AL-00965740-05
10	AL-00965739-10	AL-00965740-10

Model no.		AL-00965739-□□	AL-00965740-□□																																				
(1) Power	Wire gauge	AWG16	AWG16																																				
	Terminal	—	—																																				
(2) Brake	Wire gauge	—	AWG20																																				
	Terminal	—	—																																				
(3) Ground	Wire gauge	AWG16	AWG16																																				
	Terminal	N2-M4	N2-M4																																				
(4) Cable diameter		ø11.6 mm	ø11.6 mm																																				
(5) Plug/Clamp		JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R	JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R																																				
Connection	<table><tr><th>Pin no.</th><th>Lead wire color</th><th>Signal name</th></tr><tr><td>D</td><td>Red</td><td>U</td></tr><tr><td>E</td><td>White</td><td>V</td></tr><tr><td>F</td><td>Black</td><td>W</td></tr><tr><td>G</td><td>Green</td><td>GND</td></tr></table>		Pin no.	Lead wire color	Signal name	D	Red	U	E	White	V	F	Black	W	G	Green	GND	<table><tr><th>Pin no.</th><th>Lead wire color</th><th>Signal name</th></tr><tr><td>D</td><td>Red</td><td>U</td></tr><tr><td>E</td><td>White</td><td>V</td></tr><tr><td>F</td><td>Black</td><td>W</td></tr><tr><td>G</td><td>Green</td><td>GND</td></tr><tr><td>A</td><td>Yellow</td><td>Brake</td></tr><tr><td>B</td><td>Yellow</td><td>Brake</td></tr></table>	Pin no.	Lead wire color	Signal name	D	Red	U	E	White	V	F	Black	W	G	Green	GND	A	Yellow	Brake	B	Yellow	Brake
	Pin no.	Lead wire color	Signal name																																				
	D	Red	U																																				
	E	White	V																																				
	F	Black	W																																				
	G	Green	GND																																				
	Pin no.	Lead wire color	Signal name																																				
D	Red	U																																					
E	White	V																																					
F	Black	W																																					
G	Green	GND																																					
A	Yellow	Brake																																					
B	Yellow	Brake																																					



- (1) Connect power line to the servo amplifier's connector CNB.  
 (2) Connect brake line to the servo amplifier's connector CNE.

This item is also listed in the Power Connector to Connect Motor, Electric Wire Size table in the next chapter.  
 Note: Only straight plugs are available for this cable.  
 Cables with angled plugs are not available.

## For 130/180 mm sq. motors, power/brake cable

Motors: R2CA13180D, R2CA18350L

Cable length: L (m)	Model no.	
	Power cable	Power/brake cable
1	AL-00965741-01	AL-00965742-01
2	AL-00965741-02	AL-00965742-02
3	AL-00965741-03	AL-00965742-03
5	AL-00965741-05	AL-00965742-05
10	AL-00965741-10	AL-00965742-10

Model no.		AL-00965741-□□	AL-00965742-□□
(1) Power	Wire gauge	AWG14	AWG14
	Terminal	—	—
(2) Brake	Wire gauge	—	AWG20
	Terminal	—	—
(3) Ground	Wire gauge	AWG14	AWG14
	Terminal	N2-M4	N2-M4
(4) Cable diameter		ø12.5 mm	ø12.5 mm
(5) Plug/Clamp		JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R	JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R

Connection	Pin no.	Lead wire color	Signal name
	D	Red	U
	E	White	V
	F	Black	W
	G	Green	GND
	Pin no.	Lead wire color	Signal name
	D	Red	U
	E	White	V
	F	Black	W
	G	Green	GND
	A	Yellow	Brake
	B	Yellow	Brake

## For 180 mm sq. motors, power/brake cable

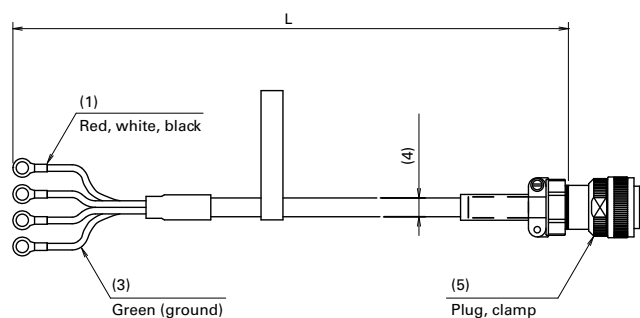
Motors: R2CA18350D, R2CA18450H, R2CA18550R

Cable length: L (m)	Model no.	
	Power cable	Power/brake cable
1	AL-00965743-01	AL-00965744-01
2	AL-00965743-02	AL-00965744-02
3	AL-00965743-03	AL-00965744-03
5	AL-00965743-05	AL-00965744-05
10	AL-00965743-10	AL-00965744-10

Model no.		AL-00965743-□□	AL-00965744-□□
(1) Power	Wire gauge	AWG12	AWG12
	Terminal	—	—
(2) Brake	Wire gauge	—	AWG20
	Terminal	—	—
(3) Ground	Wire gauge	AWG12	AWG12
	Terminal	N5.5-S4	N5.5-S4
(4) Cable diameter		ø14 mm	ø14 mm
(5) Plug/Clamp		JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R	JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R

Connection	Pin no.	Lead wire color	Signal name
	D	Red	U
	E	White	V
	F	Black	W
	G	Green	GND
	Pin no.	Lead wire color	Signal name
	D	Red	U
	E	White	V
	F	Black	W
	G	Green	GND
	A	Yellow	Brake
	B	Yellow	Brake

## Servo Motor Power Cable

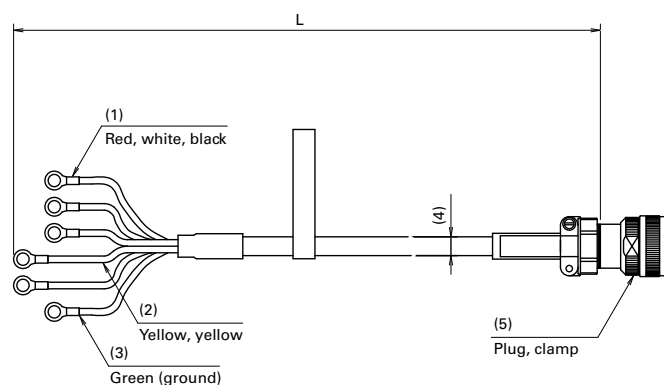


### For 180 mm sq. motors, power cable

Motors: R2CA18550H

Cable length: L (m)	Model no. Power cable
1	AL-00997919-01
2	AL-00997919-02
3	AL-00997919-03
5	AL-00997919-05
10	AL-00997919-10

Model no.		AL-00997919-□□
(1) Power	Wire gauge	AWG10
	Terminal	N5.5-5
(2) Brake	Wire gauge	—
	Terminal	—
(3) Ground	Wire gauge	AWG10
	Terminal	N5.5-5
(4) Cable diameter		ø15 mm
(5) Plug/Clamp		JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R
Connection		
	Pin no.	Lead wire color
	D	Red
	E	White
	F	Black
	G	Green
	Signal name	U
		V
		W
		GND

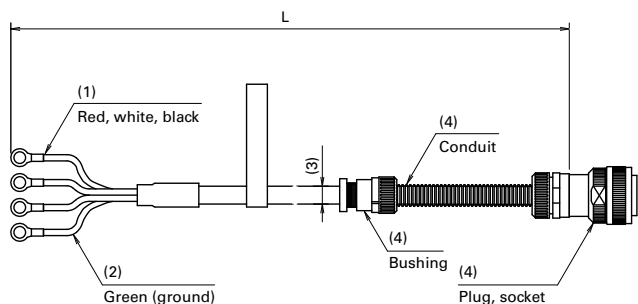


### For 180 mm sq. motors, power/brake cable

Motors: R2CA18550H

Cable length: L (m)	Model no. Power/brake cable
1	AL-00997920-01
2	AL-00997920-02
3	AL-00997920-03
5	AL-00997920-05
10	AL-00997920-10

Model no.		AL-00997920-□□																					
(1) Power	Wire gauge	AWG10																					
	Terminal	N5.5-5																					
(2) Brake	Wire gauge	AWG20																					
	Terminal	N1.25-4																					
(3) Ground	Wire gauge	AWG10																					
	Terminal	N5.5-5																					
(4) Cable diameter		ø15 mm																					
(5) Plug/Clamp		JL04V-6A24-11SE-EB-R / JL04-2428CK(17)-R																					
Connection		<table><tr><th>Pin no.</th><th>Lead wire color</th><th>Signal name</th></tr><tr><td>D</td><td>Red</td><td>U</td></tr><tr><td>E</td><td>White</td><td>V</td></tr><tr><td>F</td><td>Black</td><td>W</td></tr><tr><td>G</td><td>Green</td><td>GND</td></tr><tr><td>A</td><td>Yellow</td><td>Brake</td></tr><tr><td>B</td><td>Yellow</td><td>Brake</td></tr></table>	Pin no.	Lead wire color	Signal name	D	Red	U	E	White	V	F	Black	W	G	Green	GND	A	Yellow	Brake	B	Yellow	Brake
		Pin no.	Lead wire color	Signal name																			
		D	Red	U																			
		E	White	V																			
		F	Black	W																			
		G	Green	GND																			
		A	Yellow	Brake																			
		B	Yellow	Brake																			

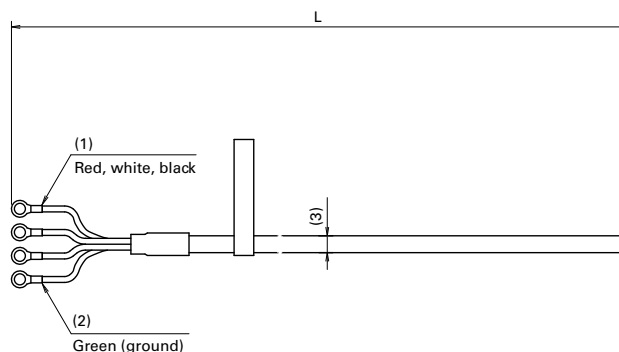


## For 180/220 mm sq. motors, power cable

Motors: R2CA18750H, R2CA2211KB, R2CA2215KV,  
R1CA18550H, R1CA18750L, R1CA1811KR, R1CA1815KB

Cable length: L (m)	Model no. Power cable
1	AL-00997921-01
2	AL-00997921-02
3	AL-00997921-03
5	AL-00997921-05
10	AL-00997921-10

Model no.	AL-00997921-□□	
(1) Power	Wire gauge	AWG8
	Terminal	R8-5
(2) Ground	Wire gauge	AWG8
	Terminal	R8-5
(3) Cable diameter	ø17 mm	
(4) Plug/Clamp/Conduit/ Bushing	JL04V-6A32-17SE-EB-R/N2KM2532/ NS25/N2HBI2519	
Connection	Pin no.	Lead wire color
	A	Red
	B	White
	C	Black
	D	Green
		Signal name
		U
		V
		W
		GND



## For 220/275 mm sq. motors, power cable

Motors: R2CA2220KV, R2CA2830KV, R1CA2220KV

Cable length: L (m)	Model no. Power/brake cable
1	AL-00999240-01
2	AL-00999240-02
3	AL-00999240-03
5	AL-00999240-05
10	AL-00999240-10

Model no.	AL-00999240-□□	
(1) Power	Wire gauge	AWG 5, 6 equivalent
	Terminal	R14-5
(2) Ground	Wire gauge	AWG 5, 6 equivalent
	Terminal	R14-5
(3) Cable diameter	ø19 mm	
Connection	Lead wire color	Signal name
	Red	U
	White	V
	Black	W
	Green	GND

# Power Connector to Connect Motor, Electric Wire Size

Manufacturer: Japan Aviation Electronics Industry, Limited

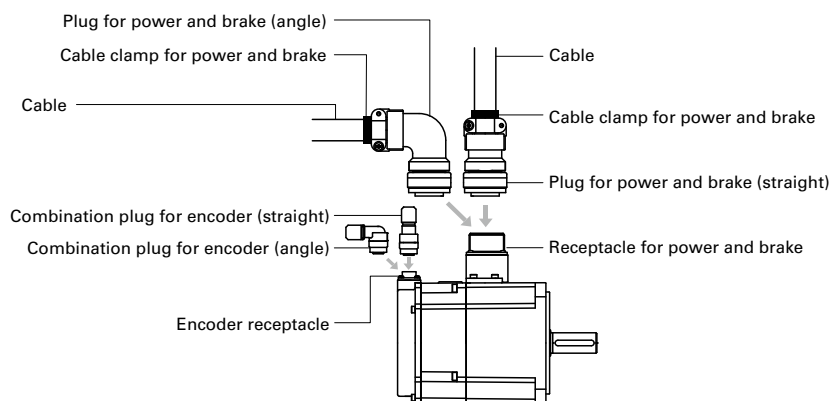
The connectors listed below are single items. Note that cables are not included.

Flange size size (mm)	Motor model no.	For power standard specification		For power waterproofing specification TÜV standard plug		For brake standard specification waterproof specification TÜV standard plug	
		(1) Plug (manufacturer model no.) (2) Cable clamp (manufacturer model no.) (3) Plug + cable clamp (SANYO DENKI part numbers)		(1) Plug (manufacturer model no.) (2) Cable clamp (manufacturer model no.) (3) Plug + cable clamp (SANYO DENKI part numbers)		(1) Plug (manufacturer model no.) (2) Cable clamp (manufacturer model no.) (3) Plug + cable clamp (SANYO DENKI part numbers)	
		Straight	Angle	Straight	Angle	Straight	Angle
100 sq.	R2CA10075F	(1) N/MS3106B20-15S (2) N/MS3057-12A	(1) N/MS3108B20-15S (2) N/MS3057-12A	(1) JL04V-6A20-15SE-EB-R (2) JL04-2220CK(14)-R (3) 332706X5	(1) JL04V-8A20-15SE-EBH-R (2) JL04-2220CK(14)-R (3) 332707X5	Same part number as for power	
	R2CA10100F	(3) MS06B20-15S-12	(3) MS08B20-15S-12				
130 sq.	R2CA13050D	(1) N/MS3106B24-11S (2) N/MS3057-16A (3) MS06B24-11S-16	(1) N/MS3108B24-11S (2) N/MS3057-16A (3) MS08B24-11S-16	(1) JL04V-6A24-11SE-EB-R (2) JL04-2428CK(17)-R (3) 332706X10	(1) JL04V-8A24-11SE-EBH-R (2) JL04-2428CK(17)-R (3) 332707X10	Same part number as for power	
	R2CA13120R						
	R2CA13120F						
	R2CA13180H						
	R2CA13180D						
	R2CA13200L						
	R2CA13200H						
180 sq.	R2CA18350L	(1) N/MS3106B24-11S (2) N/MS3057-16A (3) MS06B24-11S-16	(1) N/MS3108B24-11S (2) N/MS3057-16A (3) MS08B24-11S-16	(1) JL04V-6A24-11SE-EB-R (2) JL04-2428CK(17)-R (3) 332706X10	(1) JL04V-8A24-11SE-EBH-R (2) JL04-2428CK(17)-R (3) 332707X10	Same part number as for power	
	R2CA18350D						
	R2CA18450H						
	R2CA18550R						
	R2CA18550H						
	R2CA18750H						
220 sq.	R2CA2211KB	(1) N/MS3106B32-17S (2) N/MS3057-20A (3) MS06B32-17S-20	(1) N/MS3108B32-17S (2) N/MS3057-20A (3) MS08B32-17S-20	(1) JL04V-6A32-17SE-R (Conduit) (3) JL04V-6A32-17SE	—	(1) JL04V-6A10SL-3SE-EB-R (2) JL04-1012CK(05)-R (3) 332706X1	(1) JL04V-8A10SL-3SE-EBH-R (2) JL04-1012CK(05)-R (3) 332707X1
	R2CA2215KV						
	R2CA2220KV	Terminal block; therefore, plug is not necessary					
	275 sq.	R2CA2830KV	Terminal block; therefore, plug is not necessary				
100 sq.	R1CA10150V	(1) N/MS3106B20-15S (2) N/MS3057-12A	(1) N/MS3108B20-15S (2) N/MS3057-12A	(1) JL04V-6A20-15SE-EB-R (2) JL04-2220CK(14)-R (3) 332706X5	(1) JL04V-8A20-15SE-EBH-R (2) JL04-2220CK(14)-R (3) 332707X5	Same part number as for power	
	R1CA10200V	(3) MS06B20-15S-12	(3) MS08B20-15S-12				
130 sq.	R1CA13300V	(1) N/MS3106B24-11S (2) N/MS3057-16A (3) MS06B24-11S-16	(1) JL04V-8A24-11SE-EBH-R (2) JL04-2428CK(17)-R (3) 332707X10	(1) JL04V-6A24-11SE-EB-R (2) JL04-2428CK(17)-R (3) 332706X10	(1) JL04V-8A24-11SE-EBH-R (2) JL04-2428CK(17)-R (3) 332707X10	Same part number as for power	
180 sq.	R1CA18550H	(1) N/MS3106B32-17S (2) N/MS3057-20A (3) MS06B32-17S-20	(1) N/MS3108B32-17S (2) N/MS3057-20A (3) MS08B32-17S-20	(1) JL04V-6A32-17SE-R (Conduit) (3) JL04V-6A32-17SE	—	(1) JL04V-6A10SL-3SE-EB-R (2) JL04-1012CK(05)-R (3) 332706X1	(1) JL04V-8A10SL-3SE-EBH-R (2) JL04-1012CK(05)-R (3) 332707X1
	R1CA18750L						
	R1CA1811KR						
	R1CA1815KB						
220 sq.	R1CA2220KV	Terminal block; therefore, plug is not necessary				—	

- See the catalogs and instruction manuals of the connector manufacturer (Japan Aviation Electronics Industry, Limited) for how to handle the items and precautions.
- Conduit is not provided.

Flange size (mm)	Motor model no.	Pin layout symbol					Applicable amplifier capacity	Recommended motor power wire size (U, V, W, GND)		Wire size of main power supply (R, S, T, GND)			
		U phase	V phase	W phase	Ground	Brake		mm <sup>2</sup>	AWG No.	mm <sup>2</sup>	AWG No.		
100 sq.	R2CA10075F	A	B	C	D	E, F	25 A	1.25	#16	1.25	#16		
	R2CA10100F						50 A	2	#14	2	#14		
130 sq.	R2CA13050D	D	E	F	G, H	A, B	25 A	1.25	#16	1.25	#16		
	R2CA13120R						50 A	2	#14	2	#14		
	R2CA13120F						25 A	1.25	#16	1.25	#16		
	R2CA13180H						50 A	2	#14	2	#14		
	R2CA13180D						25 A	1.25	#16	1.25	#16		
	R2CA13200L						50 A	2	#14	2	#14		
	R2CA13200H						50 A	2	#14	2	#14		
180 sq.	R2CA18350L	D	E	F	G, H	A, B	100 A	3.5	#12	2	#14		
	R2CA18350D						150 A	5.5	#10	5.5	#10		
	R2CA18450H							8	#8				
	R2CA18550R						300 A					14	#6
	R2CA18550H												
	R2CA18750H												
220 sq.	R2CA2211KB	A	B	C	D	A, B*	150 A	8	#8	5.5	#10		
	R2CA2215KV												
	R2CA2220KV											Terminal block	
275 sq.	R2CA2830KV	Terminal block					300 A	14	#6	14	#6		
100 sq.	R1CA10150V	A	B	C	D	E, F	25 A	1.25	#16	1.25	#16		
	R1CA10200V						50 A	2	#14	2	#14		
130 sq.	R1CA13300V	D	E	F	G, H	A, B	50 A	2	#14	2	#14		
180 sq.	R1CA18550H	A	B	C	D	A, B*	150 A	8	#8	5.5	#10		
	R1CA18750L												
	R1CA1811KR												
	R1CA1815KB												
220 sq.	R1CA2220KV	Terminal block					—	300 A	14	#6	14	#6	

\* The brake connector is separated.



## Encoder Connector

The connectors listed below are single items. Note that cables are not included.

Combination plug for encoder (with rubber bushing)		Encoder receptacle model number (motor side)	Applicable cable diameter (bushing color phase)	Pin Layout Symbol	Remarks
Straight	Angle				
JN2DS10SL1-R	JN2FS10SL1-R	JN2AS10ML2-R	ø5.7 to 7.3 mm (Black)	See the encoder wiring diagram for each servo amplifier.	Japan Aviation Electronics Industry, Limited
JN2DS10SL2-R	JN2FS10SL2-R		ø6.5 to 8.0 mm (Gray)		
JN2DS10SL3-R	JN2FS10SL3-R		ø3.5 to 5.0 mm (Brick)		
5557-10R		5559-10P	—		Molex Japan Co., Ltd.

Select the correct plug and contact for the cable size to use. Our ordering numbers are the same as the manufacturer part numbers.

### Applicable contact for encoder plug<sup>\*1, 2</sup>

Contact size	Category	Applicable contact		Remarks
		Socket contact model no.	Applicable wire size	
#22	Manual crimp tool type <sup>*3, 4</sup>	JN1-22-20S-R-PKG100	AWG #20	Japan Aviation Electronics Industry, Limited
		JN1-22-22S-PKG100	AWG #21 to #25	
		JN1-22-26S-PKG100	AWG #26 to #28	
	Solder type	JN1-22-22F-PKG100	AWG #20	
#28	Manual crimp tool type <sup>*3, 4</sup>	5556T2L	AWG #22 to #28	Molex Japan Co., Ltd.
		5556GS2		

<sup>\*1</sup> Select the correct plug and contact for the cable size to use. Our ordering numbers are the same as the manufacturer part numbers.

<sup>\*2</sup> When removing an inserted contact, use a removal tool. Use a commercially available one.

<sup>\*3</sup> For part numbers of manual crimp tools, see the instruction manuals issued by the connector manufacturer.

<sup>\*4</sup> For semi-automatic crimp tools, purchase from the respective manufacturers.

For precautions or how to handle connectors and contacts, refer to the catalogs and instruction manuals of the respective manufacturers.

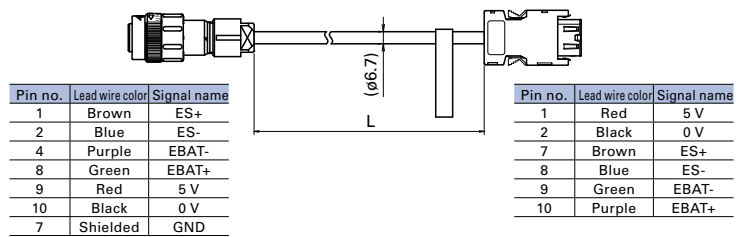


# Cable

## ■ Servo motor encoder cable

Motor: Not R2CA2830KV

Cable length: L (m)	Model no.
1	AL-00937694-01
2	AL-00937694-02
3	AL-00937694-03
5	AL-00937694-05
10	AL-00937694-10

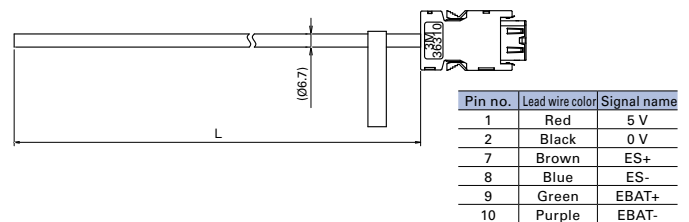


Type	Connector model no.	Remarks
Motor side connector	Straight plug: JN2DS10SL2-R Contact: JN1-22-22F-PKG100	Japan Aviation Electronics Industry, Limited
Amplifier side connector	Receptacle: 36210-0100PL Shell kit: 36310-3200-008	3M Japan Limited

Note: Only straight plugs are available for this cable.  
Cables with angled plugs are not available.

Motor: R2CA2830KV

Cable length: L (m)	Model no.
1	AL-00999243-01
2	AL-00999243-02
3	AL-00999243-03
5	AL-00999243-05
10	AL-00999243-10



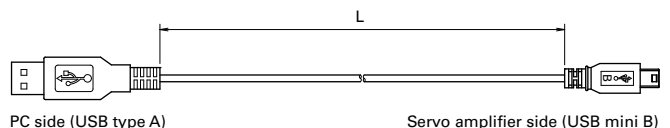
Type	Connector model no.	Remarks
Motor side connector	—	Connector not processed
Amplifier side connector	Receptacle: 36210-0100PL Shell kit: 36310-3200-008	3M Japan Limited

Note: A cable with a plug on the motor side needs to be prepared by the customer.

## ■ USB communication cable for setup software

PC communication cable for setup software

Cable length: L (m)	Model no.
1.0	AL-00896515-01
2.0	AL-00896515-02

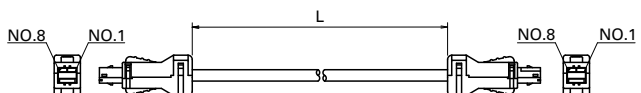


Specifications and external drawings may be changed without prior notice.

## ■ Communication cable between amplifiers for tandem operation

Connects between amplifiers for tandem operation. (CN5⇔CN5)

Cable length: L (m)	Model no.
0.2	AL-00911582-01
3.0	AL-00911582-02



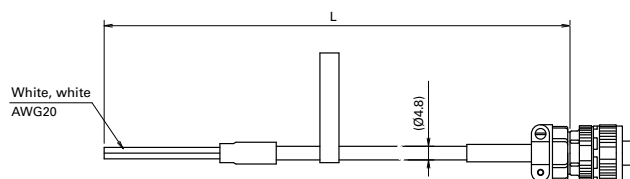
Note: Dedicated for Analog/Pulse type amplifiers. Cannot be used with EtherCAT amplifiers.

## Cable

### ■ Servo motor cooling fan power cable

Motors: R1CA18550H, R1CA18750L, R1CA1811KR, R1CA1815KB, R1CA2220KV

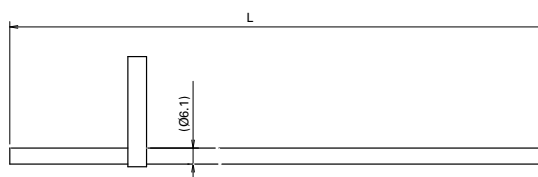
Cable length: L (m)	Model no.
	Power cable
1	AL-00997923-01
2	AL-00997923-02
3	AL-00997923-03
5	AL-00997923-05
10	AL-00997923-10



Type	Connector model no.	Remarks
Motor side connector	Plug: N/MS3106B10SL-4S Clamp: N/MS3057-4A	Japan Aviation Electronics Industry, Limited

Motor: R2CA2830KV

Cable length: L (m)	Model no.
	Power cable
1	AL-00999241-01
2	AL-00999241-02
3	AL-00999241-03
5	AL-00999241-05
10	AL-00999241-10

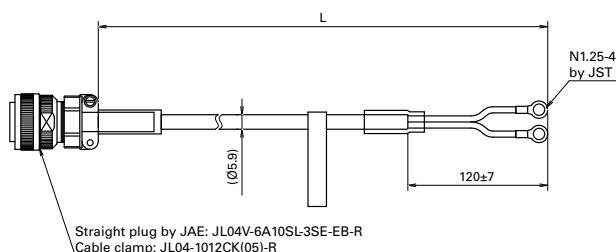


Type	Connector model no.	Remarks
Motor side crimp terminal	—	Both end terminals not crimped

### ■ Servo motor brake cable

Motors: R2CA18750H, R2CA2211KB, R2CA2215KV, R2CA2220KV  
R1CA18550H, R1CA18750L  
R1CA1811KR, R1CA1815KB

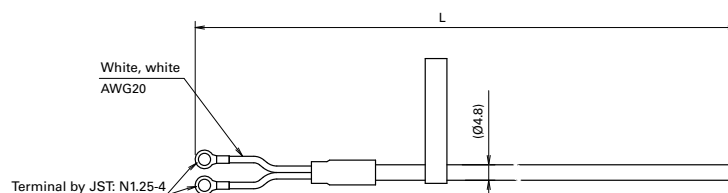
Cable length: L (m)	Model no.
	Power cable
1	AL-00918630-01
2	AL-00918630-02
3	AL-00918630-03
5	AL-00918630-05
10	AL-00918630-10



Type	Connector model no.	Remarks
Motor side connector	Plug: JL04V-6A10SL-3SE-EB-R Clamp: JL04-1012CK(05)-R	Japan Aviation Electronics Industry, Limited

Motor: R2CA2830KV

Cable length: L (m)	Model no.
	Power cable
1	AL-00999239-01
2	AL-00999239-02
3	AL-00999239-03
5	AL-00999239-05
10	AL-00999239-10

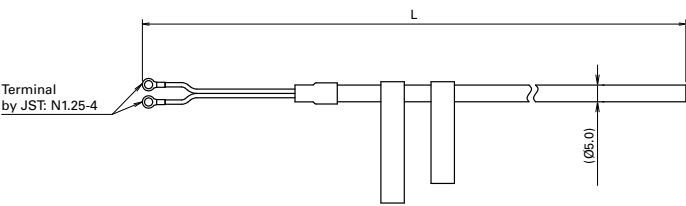


Type	Connector model no.	Remarks
Motor side crimp terminal	—	Motor side terminal not crimped

■ Servo motor cooling fan thermostat cable

Motor: R2CA2830KV

Cable length: L (m)	Model no.
	Power cable
1	AL-00999242-01
2	AL-00999242-02
3	AL-00999242-03
5	AL-00999242-05
10	AL-00999242-10



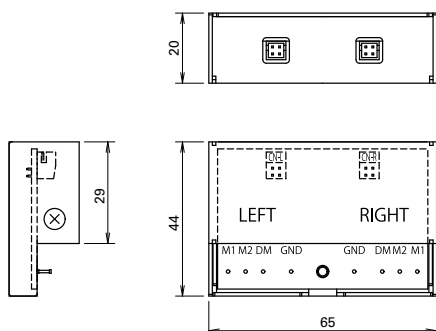
Type	Connector model no.	Remarks
Motor side connector	—	Motor side terminal not crimped

## Analog Monitor

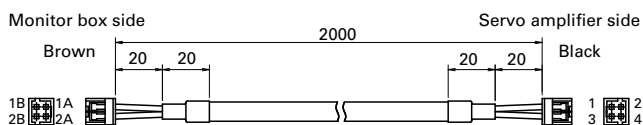
This is an analog monitor that can display velocity waveforms on an oscilloscope for the purpose of system tuning or maintenance.

Name	Description	Model no.
1) Monitor box	Monitor box body 2 dedicated cables	Q-MON-3
2) Dedicated cable	1 dedicated cable	AL-00690525-01

### 1) Monitor box (Q-MON-3)



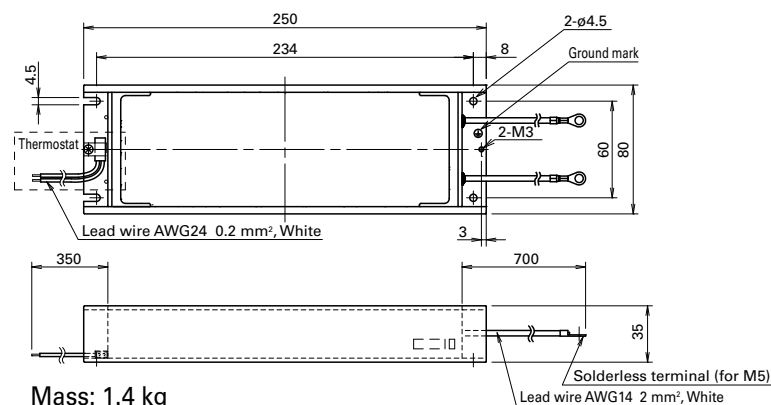
### 2) Dedicated cable (AL-00690525-01)



\*1 Dedicated cables per above 2) (AL-00690525-01) are included with the monitor box (Q-MON-3).

\*2 Power is supplied from the servo amplifier.

## External Regenerative Resistor



Mass: 1.4 kg

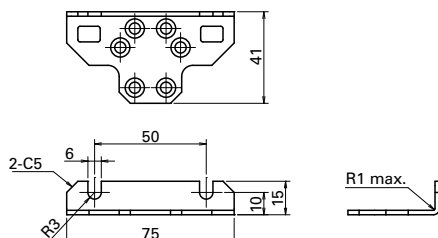
Model no.	Rated power [PR]	Resistance	Detected temperature of thermostat (Contact specifications)
REGIST-500CW80B	500 W	80 $\Omega$	100°C $\pm$ 5°C (contact b)
REGIST-500CW40B	500 W	40 $\Omega$	100°C $\pm$ 5°C (contact b)
REGIST-500CW20B	500 W	20 $\Omega$	100°C $\pm$ 5°C (contact b)
REGIST-500CW14B	500 W	14 $\Omega$	100°C $\pm$ 5°C (contact b)
REGIST-500CW7B	500 W	7 $\Omega$	100°C $\pm$ 5°C (contact b)

## Front Mounting Brackets

This is a pair of metal brackets for mounting a 25 A servo amplifier on the front face (the face with connectors). 50 and 100 A models can be mounted on the front face too by removing the attached back-mounting brackets from the amplifier and using them for front-mounting.

Applicable servo amplifiers	Model no.	Set contents
25 A (RS3C02)	AL-00962547-01	Top/bottom mounting brackets: 1 each Clamping screws: 6

Top and bottom mounting brackets are identical



# Servo Motor Capacity Selection (Rotary Motor)

This is a method of calculating the required capacity of servo motors from the mechanical specifications. Here we have introduced the basic selection procedure focusing on a ball screw (flat) mechanism.

## Selection procedure

### 1. Creation of operation patterns

Create the operation patterns.

### 2. Calculation of conversion of motor shaft moment of load inertia $J_L$

Calculate the moment of load inertia from the machine configuration.

### 3. Calculation of load torque $T_L$ for motor shaft conversion

Calculate the load torque from the machine configuration.

### 4. Provisional selection of servo motor capacity

Provisionally select a motor in which the load moment of inertia ( $J_L$ ) is 10 times or less than the rotor moment of inertia ( $J_M$ ) of servo motor, while the load torque ( $T_L$ ) is 80% or less ( $T_R \times 0.8$ ) of rated torque of motor ( $T_R$ ).

$$J_L \leq J_M \times 10$$

$$T_L \leq T_R \times 0.8$$

### 5. Calculation of acceleration/deceleration torque

Calculate the required acceleration/deceleration torque from the operation patterns.

### 6. Calculation of effective torque

Calculate the effective torque from the torque patterns.

### 7. Judgment

Determine whether the acceleration and deceleration torque ( $T_a, T_b$ ) are 80% ( $T_p \times 0.8$ ) or less than the peak stall torque ( $T_p$ ) of the servo motor; and the effective torque ( $T_{rms}$ ) is 80% ( $T_R \times 0.8$ ) or less than the rated torque ( $T_R$ ) of the servo motor.

$$T_a \leq T_p \times 0.8$$

$$T_b \leq T_p \times 0.8$$

$$T_{rms} \leq T_R \times 0.8$$

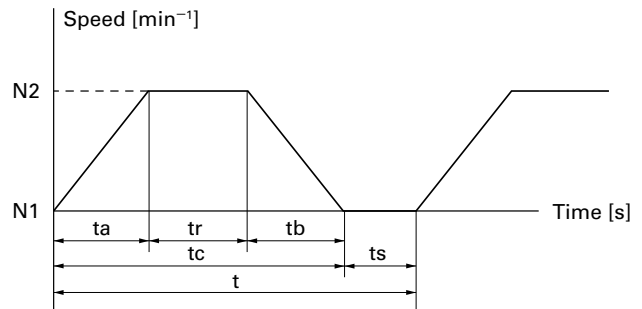
If the judgment results cannot be applied in the aforementioned equation, reconsider the servo motor capacity, for example increasing the capacity.

### 8. Calculation of regenerative power

Calculate the regenerative power and select an external regenerative resistor if necessary.

## 1. Creation of operation patterns

First, determine the equipment mechanism, dimensions of all parts, positioning amount, positioning time, gear ratio, etc. An operation pattern is the determined driving force plotted on the speed/time axis.



$t_a$  = Acceleration time [s]

$t_b$  = Deceleration time [s]

$t_r$  = Constant speed-time [s]

$t_s$  = Downtime [s]

$t$  = 1 cycle [s]

## 2. Calculation of conversion of motor shaft moment of load inertia $J_L$

Load moment of inertia is the quantity showing inertia of a rotating object.

Given below is the calculation method used in case of ball screw (flat) mechanism.

### ■ Ball screw moment of inertia

$$J_{L1} = \left( \frac{1}{G} \right)^2 \times \frac{\pi \times \rho \times D^4 \times L}{32} \quad [\text{kg} \cdot \text{m}^2]$$

G: Gear ratio

$\rho$ : Ball screw specific gravity [ $\text{kg}/\text{m}^3$ ] [Iron:  $7.8 \times 10^3$ ]

D: Ball screw diameter [m]

L: Ball screw length [m]

### ■ Work + table moment of inertia

$$J_{L2} = \left( \frac{1}{G} \right)^2 \times W \times \left( \frac{P}{2\pi} \right)^2 \quad [\text{kg} \cdot \text{m}^2]$$

G: Gear ratio

W: Work + table mass [kg]

P: Ball screw pitch [m]

### ■ Conversion of motor shaft moment of load inertia.

$$J_L = J_{L1} + J_{L2}$$

\* Moments of inertia of reducer and coupling are assumed to be negligible and have therefore been omitted.

# Servo Motor Capacity Selection (Rotary Motor)

## 3. Calculation of load torque $T_L$ for motor shaft conversion

Load torque is the power generated from the friction of the driving part or from the gravity that is converted on the motor shaft. When activated, this torque always acts as the load.

Given below is the calculation method used in the case of a ball screw (flat) mechanism.

$$T_L = \frac{(F + \mu W)}{\eta} \times \frac{P}{2\pi} \times \frac{1}{G} \times 9.8 \quad [\text{N}\cdot\text{m}]$$

F: External force [kg]  
 $\eta$ : Machine efficiency  
 $\mu$ : Coefficient of friction  
W: Work + table mass [kg]  
P: Ball screw lead [m]  
G: Gear ratio

## 4. Provisional selection of servo motor capacity

Provisionally select the motors that apply to the following 2 conditions.

- Load moment of inertia ( $J_L$ ) calculated in step 2 is 10 times or less than the rotor moment of inertia ( $J_M$ ) of servo motor  
 $J_L \leq J_M \times 10$
- Load torque ( $T_L$ ) calculated in step 3 is 80% or less ( $T_R \times 0.8$ ) of rated torque ( $T_R$ ) of servo motor  
 $T_L \leq T_R \times 0.8$

## 5. Calculation of acceleration/deceleration torque

Acceleration/deceleration torque is necessary for accelerating and decelerating the motor and load.

■ Method of obtaining acceleration torque ( $T_a$ )

$$T_a = \frac{2\pi(N_2 - N_1) \times (J_L + J_M)}{60 \times t_a} + T_L \quad [\text{N}\cdot\text{m}]$$

$N_2$ : Servo motor rotary speed after acceleration [ $\text{min}^{-1}$ ]  
 $N_1$ : Servo motor rotary speed before acceleration [ $\text{min}^{-1}$ ]  
 $J_L$ : Conversion of motor shaft moment of load inertia [ $\text{kg}\cdot\text{m}^2$ ]  
 $J_M$ : Conversion of servo motor moment of rotor inertia [ $\text{kg}\cdot\text{m}^2$ ]  
 $T_L$ : Calculation of load torque for motor shaft conversion [ $\text{N}\cdot\text{m}$ ]  
 $t_a$ : Acceleration time [s]

■ Method of obtaining deceleration torque ( $T_b$ )

$$T_b = \frac{2\pi(N_2 - N_1) \times (J_L + J_M)}{60 \times t_b} - T_L \quad [\text{N}\cdot\text{m}]$$

$N_2$ : Servo motor rotary speed before deceleration [ $\text{min}^{-1}$ ]  
 $N_1$ : Servo motor rotary speed after deceleration [ $\text{min}^{-1}$ ]  
 $J_L$ : Conversion of motor shaft moment of load inertia [ $\text{kg}\cdot\text{m}^2$ ]  
 $J_M$ : Conversion of servo motor moment of rotor inertia [ $\text{kg}\cdot\text{m}^2$ ]  
 $T_L$ : Calculation of load torque for motor shaft conversion [ $\text{N}\cdot\text{m}$ ]  
 $t_b$ : Deceleration time [s]

## 6. Calculation of effective torque

Effective torque is the value per unit time obtained from root mean square of load torque / acceleration torque / deceleration torque .

$$T_{rms} = \sqrt{\frac{(T_a^2 \times t_a) + (T_L^2 \times t_r) + (T_b^2 \times t_b)}{t}} \quad [\text{N}\cdot\text{m}]$$

## 7. Judgment

Our company's judgment criteria are as follows.

- Load torque load factor  $T_L \leq T_R \times 0.8$   
(Load torque is 80% or less of rated torque)
- Acceleration torque load factor  $T_a \leq T_p \times 0.8$   
(Acceleration torque is 80% or less of peak stall torque)  
 $T_p$ : Peak stall torque
- Deceleration torque load factor  $T_b \leq T_p \times 0.8$   
(Deceleration torque is 80% or less of peak torque at stall)  
 $T_p$ : Peak stall torque
- Effective torque load factor  $T_{rms} \leq T_R \times 0.8$   
(Effective torque is 80% less than rated torque)
- Moment of inertia ratio  $J_L \leq J_M \times 10$   
(Load moment of inertia is 10 times or less than the rotor moment of inertia of motor)

Rise in motor temperature can be suppressed by keeping a large margin in torque load factor. The moment of inertia ratio can be controlled at 10 times or more, for example, by slowly rotating the table mechanism. Testing with an actual machine is recommended.

## 8. Calculation of regenerative power

Calculate the regenerative efficient power (PM) to determine the regenerative resistor to be used. From the calculation results, determine whether a built-in regenerative resistor can be used.

■ Method of obtaining regenerative efficient power (PM) of horizontal drive shaft  
Derive the regenerative energy.

$$EM = E_{hb} = \frac{1}{2} \times N \times 3 \times K_{\phi} \times \frac{T_b}{KT} \times t_b - \left( \frac{T_b}{KT} \right)^2 \times 3 \times R_{\phi} \times t_b$$

EM: Regenerative energy in case of horizontal drive shaft [J]  
 $E_{hb}$ : Regenerative energy during deceleration [J]  
 $K_{\phi}$ : Induced voltage constant [ $\text{V}_{rms}/\text{min}^{-1}$ ] (motor constant)  
KT: Torque constant [ $\text{N}\cdot\text{m}/\text{Arms}$ ] (motor constant)  
N: Motor rotary speed [ $\text{min}^{-1}$ ]  
 $R_{\phi}$ : Armature resistance [ $\Omega$ ] (motor constant)  
 $t_b$ : Deceleration time [s]  
 $T_b$ : Deceleration torque [ $\text{N}\cdot\text{m}$ ]

Derive the regenerative efficient power from regenerative energy.

$$PM = \frac{EM}{t}$$

PM: Regenerative efficient power [W]

EM: Regenerative energy [J]

t: Cycle time [s]

■ Selection of regenerative resistor

Select a regenerative resistor that meets the following conditions.

- In case of servo amplifiers with a built-in regenerative resistor:  
Permissible regenerative power [PR] that is less than efficient regenerative power [PM] and can be used with built-in regenerative resistors
- In case of external regenerative resistor:  
Permissible regenerative power [PRO] that is less than efficient regenerative power [PM] and can be used with external regenerative resistors

Note that we have servo amplifier models both with and without built-in regenerative resistors for absorbing regenerative power. Select the model accordingly.

# Selection Data for Each Mechanism

Typical examples of mechanisms and items that require selection are shown below. Provide this information when placing an order.

Ball screw			Rack & pinion		
External force	F	N	External force	F	N
W: Work + table mass	W	kg	Work + rack mass	W	kg
Ball screw diameter	D	m	Pinion diameter	D	m
Ball screw length	L	m	Pinion thickness	L	m
Ball screw lead	P	m	Pinion material specific gravity	$\rho$	kg/m <sup>3</sup>
Ball screw material specific gravity	$\rho$	kg/m <sup>3</sup>	Coefficient of friction	$\mu$	
Coefficient of friction	$\mu$		Gear ratio *	G	
Gear ratio *	G		Machine efficiency	$\eta$	
Machine efficiency	$\eta$				

Belt drive			Roll feed		
External force	F	N	Sheet tension	F	N
Work + belt mass	W	kg	Roll diameter	D	m
Pulley diameter	D	m	Roll width	L	m
Pulley width	L	m	Roll material specific gravity	$\rho$	kg/m <sup>3</sup>
Pulley material specific gravity	$\rho$	kg/m <sup>3</sup>	Roll moment of inertia	J	kg·m <sup>2</sup>
Pulley moment of inertia	J	kg·m <sup>2</sup>	Gear ratio *	G	
Gear ratio *	G		Machine efficiency	$\eta$	
Machine efficiency	$\eta$				

Rotary table		
Table mass	W	kg
Table diameter	Dt	m
Table support diameter	Dh	m
Table moment of inertia	J	kg·m <sup>2</sup>
Support part coefficient of friction	$\mu$	
Gear ratio *	G	
Machine efficiency	$\eta$	

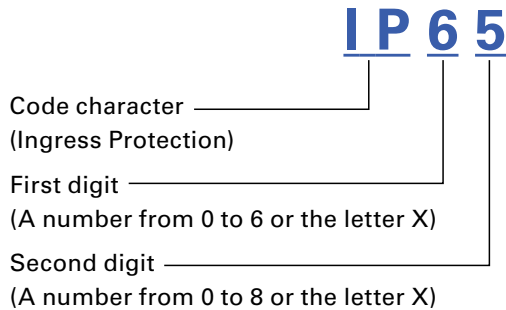
\* Derivation of gear ratio (G)

$$G = \frac{\text{Ball screw gear teeth (G2)}}{\text{Motor gear teeth (G1)}}$$

# Motor Protection Rating

## Protection rating

SANYO DENKI servo motor protection ratings are determined in accordance with IEC Standard (IEC 60529, IEC 60034-5) and JIS Standard (JIS C 0920, JIS C 4034-5)



The protection rating (IP code), is defined by IEC (International Electrotechnical Commission) 60529 "DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP Code)."  
Note: IEC 60529

First digit	Description	Definition
0	No protection	—
1	Protection against solid objects > 50 mm	A spherical 50 mm diameter solid probe shall not completely penetrate
2	Protection against solid objects > 12.5 mm	A spherical 12.5 mm diameter solid probe shall not completely penetrate
3	Protection against solid objects > 2.5 mm	A spherical 2.5 mm diameter solid probe shall not penetrate at all
4	Protection against solid objects > 1 mm	A spherical 1 mm diameter solid probe shall not penetrate at all
5	Protection against a level of dust that could hinder operation or impair safety	Although it is impossible to completely prevent the penetration of dust, there should be no intrusion of an amount of dust that could impede the prescribed operation and safety of the electrical equipment
6	Complete protection against dust	Completely protected against dust

Second digit	Description	Definition
0	No protection	—
1	Protected against vertically falling drops of water	Vertically dripping water shall have no harmful effect.
2	Protected against vertically falling drops of water even if inclined up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at an angle up to 15° from its normal position.
3	Protected against spraying water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect.
4	Protected against splashing water	Water splashing against the enclosure from any direction shall have no harmful effect.
5	Protected against water jets	Water projected by a nozzle against enclosure from any direction shall have no harmful effects.
6	Protected against powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects.
7	Protected against temporary immersion in water	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time.
8	Protected against submersion in water	The equipment is suitable for continuous immersion in water under conditions which negotiated with stakeholders. The test conditions are expected to be greater than the requirements for IPx7, and other environmental effects may be added.

- According to the standard, "the liquid used for the test is to be fresh water," and liquids other than water such as oil are not included in the test conditions.  
Separate evaluation is necessary when used in environments where machine tool cutting oil is present.  
Our servo motors have a proven track record for machine tool applications, and we can respond with options, so please contact us as necessary.
- For the second digit, values of 6 and under indicate compliance with all lower conditions, however when the second digit is 7 it does not indicate protection against jets (indicated by a second digit of 5 or 6)  
Select a protection rating suitable for your environment.



# Safety Precautions

The products in this catalog are designed to be used with general industrial devices.

Pay sufficient attention to the following:

- Read the Instruction Manual carefully prior to installation, assembly, or operation for the correct usage. The Instruction Manual is available for download from our website.
- Refrain from modifying or processing the product in any way.
- Contact your point of sale or specialized service provider for installation or maintenance services of the product.
- Consult with us when using the product for the following uses, as these require special considerations for operations, maintenance, and management such as redundancy and emergency power generators.

- ❶ Use in medical equipment or other devices that may directly affect people's lives or cause bodily injury
- ❷ Use in transportation systems or transport-related equipment such as trains or elevators, that may affect people's lives or cause bodily injury
- ❸ Use in computer systems that may have a major impact on society or on the public
- ❹ Use in other devices that have a significant impact on human safety or on maintaining public operations

- Consult with us when using the product in an environment where vibrations occur, such as in a moving vehicle or during transportation.
- Use the product only after becoming thoroughly proficient with relevant product knowledge, safety information, and precautions.

## Warning Labels on Products

Products bear the following Warning Labels to indicate the situations as below, depending on the model.



This label is attached in the vicinity of high-voltage portions such as charging or cover-protected parts, to indicate locations with risk of electric shock.



This label is attached in the vicinity of grounding terminals to indicate that grounding is required.

## Safety Ranks of the Cautions

The following five safety symbols are used in the manual.



**DANGER**

Indicates immediate hazards that will cause severe bodily injury or death as a result of failure to follow the instructions.




**WARNING**

Indicates hazards that could cause severe bodily injury or death as a result of failure to follow the instructions.



**CAUTION**

Indicates possible hazards that could cause moderate bodily injury or only property damage as a result of failure to follow the instructions.

Note that even items with the  CAUTION symbol could potentially lead to serious outcomes, depending on the situation. They all indicate important situations, so be sure to observe them.



**PROHIBITED**

Indicates actions that must not be taken.



**MANDATORY**

Indicates actions that must be taken.

## **WARNING**

### **Precautions on Use**

1. Do not use the product in explosive environments. Failure to follow this may cause injury or fire.
2. Do not work on wiring, maintenance servicing, or inspection with the power on. After turning off the power, wait at least 15 minutes and confirm extinction of CHARGE-LED for the main circuit power supply, and then start working. Failure to follow this may cause electric shock or product damage.
3. Make sure to ground protective grounding terminals of servo amplifiers to equipment or control board. The grounding terminals of servo motors must be connected to protective grounding terminals of servo amplifiers. Failure to follow this may cause electrical shock.
4. Never touch inside of servo amplifiers with hands. Electrical shock may result.
5. Do not damage, apply excessive stresses, put heavy things on, or tuck down cables. Failure to follow this may cause electrical shock.
6. Never touch the rotating part of servo motors during operation. Failure to follow this may cause injury.

## **CAUTION**

### **Precautions on Use**

1. Use servo amplifiers and servo motors in specified combinations. Failure to follow this may cause fire or product malfunctions.
2. Only technically qualified personnel should transport, install, wire, operate, or perform maintenance and inspection on the product. Failure to follow this may cause electric shock, injury, or fire.
3. Never install the product in a location exposed to water, in a corrosive or flammable gas atmosphere, or in the vicinity of flammable materials. Failure to follow this may cause fire or product malfunctions.
4. Be careful of the high temperatures generated by the servo amplifier/motor and the peripherals. Failure to follow this may cause burns.
5. Never touch regenerative resistors, servo motors, and the radiation fin of servo amplifiers as such equipment reach high temperatures in operation and remain hot for a while after the power is turned off. Failure to follow this may cause burns.
6. When designing a safety system that utilizes Safe Torque Off function, it must be designed by individuals who have specialized knowledge on relevant safety standards after reading and understanding the descriptions of the Instruction Manual. Failure to follow this may cause injury or product failures.
7. Be sure to read the Instruction Manual in advance, and follow the instructions when performing installation, operation, maintenance, and inspection work. Failure to follow this may cause electric shock, injury, or fire.
8. Do not use servo amplifiers and servo motors outside their specified operating ranges. Failure to follow this may cause electric shock, injury, or product damage.
9. For use in high inertial moment or high-speed applications that require high regenerative power that exceeds the capability of the wires in the regenerative resistor, consult us.

### **Transportation**

10. When transporting, do not hold the cables, servo motor shafts, or detector parts. Failure to follow this may cause product damage or injury.
11. Handle the product with care during transportation to prevent it from dropping or falling. Failure to follow this may cause injury.

### **Installation**

12. Do not stand on the product or place heavy objects on top of it. Failure to follow this may cause injury.
13. Make sure that the mounting orientation is correct. Failure to follow this may cause fire or product malfunctions.
14. Do not drop the product or subject it to excessive shock of any kind. Failure to follow this may cause product failures.
15. Do not obstruct the air intake and exhaust vents. Failure to follow this may cause fire.
16. Follow the Instruction Manual and give sufficient spacing within the servo amplifier control board. Failure to follow this may cause fire or product malfunctions.
17. Unpack the box right side up. Failure to follow this may cause injury.
18. Verify that the product you receive is the same product you ordered. Failure to follow this may cause injury or product damage.
19. Take care of falling or overturning of the product during installation. Use eyebolts, if included, for transporting servo motors. Failure to follow this may cause injury.
20. Install the product to incombustible materials such as metals. Failure to follow this may cause fire.
21. For anti-collision devices, use ones that can withstand the maximum output of the system. Failure to follow this may cause injury.

### **Wiring**

22. Perform wiring correctly and securely. Failure to follow this may cause injury.
23. Perform wiring work according to the wiring diagrams or the Instruction Manual. Failure to follow this may cause electric shock or fire.
24. Perform wiring work according to local standards of electrical installations. Failure to follow this may cause motor burnout or fire.

25. Do not connect commercial power supply to the U, V and W terminals of servo motors. Failure to follow this may cause fire or product malfunctions.
26. Install safety devices such as circuit breakers in preparation for short circuiting of external wiring. Failure to follow this may cause fire.
27. Do not bind or band the power cable, input/output signal cable and/or encoder cable together or pass through the same duct or conduit. Failure to follow this may cause faulty operation.
28. When connecting an inductive load such as a relay to the control output signal of the servo amplifier, be sure to connect a surge absorbing diode. Be aware that reverse-connecting the diode polarity may cause servo amplifier malfunctions.
29. Do not connect an AC or 90 VDC power supply to 24 VDC servo motor brakes. Furthermore, do not connect 400 VAC power supply to 200 VAC servo motor cooling fans. Failure to follow this may cause motor burnout or fire.
30. Arrange a relay sequence taking into consideration the delay in hold braking caused by surge absorbers for holding brake relays. Failure to follow this may result in falls or injury.
31. Do not use half-wave rectifier circuits in power supplies of 24 VDC or 90 VDC brakes. Failure to follow this may cause excessive heating or product failures.

### **Controls & Operations**

32. Do not perform drastic setting changes as such changes may cause unstable operation. Failure to follow this may cause injury.
33. Test-run a servo motor with the motor position fixed in isolation from the machinery system. Install the motor to the machinery system only after verifying the motor operation. Failure to follow this may cause injury.
34. The holding brake cannot be used as a dynamic brake for achieving the safety of machinery. For that purpose, install stop devices. Failure to follow this may cause injury.
35. In the case of an alarm, make sure to eliminate the cause and ensure safety before resuming operations. Failure to follow this may cause injury.
36. Verify that the input power supply voltage is within the specified range. Failure to follow this may cause product failures.
37. After a power interruption, avoid getting close to a stopped device as it may restart suddenly. (Design a safety system to prepare for such an event.) Failure to follow this may cause injury.
38. Do not use servo amplifiers or servo motors that have failed, damaged, or burnt out. Failure to follow this may cause injury or fire.
39. Immediately stop operation in case of anomaly. Failure to follow this may cause electric shock, injury, or fire.
40. When using servo motors in vertical axes, install safety devices to prevent a workpiece from falling even in the event of an alarm. Failure to follow this may cause injury or product damage.

### **Maintenance & Inspection**

41. Parts and components used in servo amplifiers (such as electrolytic capacitors, cooling fans, lithium batteries for encoders, fuses, relays, and the like) deteriorate by aging. Considering the standard replacement period, replace these parts and components with new ones for preventive maintenance. Failure to follow this may cause product failures. Contact us when replacing such parts and components.
42. Never touch terminals and connectors while electricity is supplied. Failure to follow this may cause electrical shock.
43. Since the frame of servo amplifiers becomes high in temperature, be careful when conducting maintenance and inspection work. Failure to follow this may cause burns.
44. Contact us for repairs. Disassembling the product by yourself may result in product failures and render it inoperable.

## **PROHIBITED**

### **Storage**

1. Avoid storing the product in places exposed to rain or water drops, or in an environment with hazardous gas or liquid. Failure to follow this may cause malfunctions.

### **Controls & Operations**

2. Brakes equipped with servo motors are intended for holding and must not be used for dynamic braking. Failure to follow this may cause product damage or malfunctions.
3. Do not apply static electricity or excessively high voltage to servo motor encoder cables. Failure to follow this may cause malfunctions.
4. Never rotate servo motors continuously by external force when the amplifier is at "Servo OFF", because it will heat up the motor's standardly-equipped dynamic brake resistor, which is dangerous. Failure to follow this may cause fire or burns.
5. Never use the product with voltages exceeding the specified input voltage range. Failure to follow this may cause component failures, product damage, or injury.
6. Do not turn the power supply on and off frequently. Turning the power supply on and off more than 30 times a day or 5 times per hour may cause premature malfunctions of internal components.

### **Maintenance & Inspection**

7. Do not disassemble or repair the product by yourself. Failure to follow this may cause fire or electric shock.
8. Do not perform measurements of insulation resistance or dielectric voltage. Failure to follow this may cause product damage.

9. Never plug or unplug connectors with the power on (hot swapping) as the resulting surge voltage may cause electronic components malfunctions. Failure to follow this may cause electric shock or product damage.
10. Do not remove the product name plate.

## ⚠ MANDATORY

### Storage

1. Store the product where it is not exposed to direct sunlight, and within the specified temperature and humidity ranges [-20 to +65°C, below 90% RH (non-condensing)]. Failure to follow this may cause product malfunctions.
2. If servo amplifiers have been stored for a long period (3 years or longer), contact us. The capacitance of electrolytic capacitors can decrease due to the long period storage, which may cause malfunctions.
3. If servo motors have been stored for a long period (3 years or longer), contact us. Check on bearings and brakes will be needed.

### Transportation

4. Follow the instructions written on the package box and avoid excessively stacking the boxes. Failure to follow this may cause injury.
5. For transporting servo motors, use the included eyebolts. Do not use them for transporting the device in which servo motors are embedded in. Failure to follow this may cause injury or product failures.

### Wiring

6. Install an external emergency stop circuit that can stop machinery and cut off the power instantaneously. Also, install an external protective circuit to the amplifier to cut off the power from the main circuit in the case of an alarm. Failure to follow this may cause injury, fire, motor runaway, motor burnout, or secondary damage.

### Controls & Operations

7. Install an external emergency stop circuit that can stop machinery and cut off the power instantaneously. Also, install an external protective circuit to the amplifier to cut off the power from the main circuit in the case of an alarm. Failure to follow this may cause injury, fire, motor runaway, motor burnout, or secondary damage.
8. Protection devices are not supplied with servo motors. Prepare an overvoltage protection device, earth leakage breaker, overheat protection device, and emergency stop device to ensure safe operation. Failure to follow this may cause injury or fire.
9. Use the products within the specified temperature and humidity ranges.  
For servo amplifiers: temperature: 0 to 55°C; humidity: 90% RH or less (no condensation)  
For servo motors: temperature: 0 to 40°C; humidity: 90% RH or less (no condensation)  
Failure to follow this may cause burnout or malfunction.

### Disposal

10. Dispose of servo amplifiers and servo motors as industrial waste.

## Harmonic Suppression Measures Guidelines

Harmonic current generated by equipment such as servo amplifiers can potentially have adversely impact on other power consumers, if it flows out. For that reason, the "How to Calculate Harmonic Current of Servo Amplifiers for Specific Users" was stipulated by the Japan Ministry of International Trade and Industry (current Ministry of Economy, Trade and Industry).

Servo amplifiers used by specific power consumers fall in the category of "harmonic wave generating devices" that are subject to these guidelines. Those power consumers who are subject to these guidelines must determine whether or not any measures for harmonics suppression are required and if so, the measures must be implemented to ensure that the harmonic current emissions are within the limit values stipulated by the contract demand. Implementation of harmonic suppression measures are recommended to prevent impediments arising from harmonics, even for users not subject to the guidelines.

Servo amplifiers we supply are equivalent to the circuit classification shown in Table 1 of the "Application Guide for Evaluation of Harmonic Currents Emitted by Consumers of Middle- or High-Voltage Power Supply".

Refer to the document described below for calculation method of harmonic currents.

- "How to Calculate Harmonic Current of Servo Amplifiers for Specific Power Consumers" (JEM-TR225), Japan Electrical Manufacturers' Association

Determine whether or not any harmonics suppression measures are required on the converter (AC-DC converter) side if the servo amplifier has a DC input power supply of DC type.

When countermeasures must be implemented for harmonic suppression of servo amplifiers, connect a harmonic suppression reactor.  
Contact us for the harmonic suppression reactor.

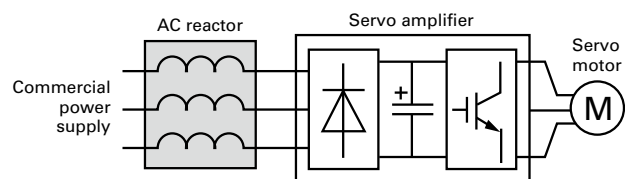


Table 1

Servo amplifier model no.	Power supply	Circuit classification	Circuit type				Conversion factor Ki
RS3C02□□ RS3C05□□ RS3C10□□ RS3C15□□ RS3C30□□	3-Phase	3	3-Phase bridge (Condenser smooth)	3-1	6-pulse converter without reactor		K31=3.4
				3-2	6-pulse converter with reactor (AC side)		K32=1.8

### References

- "Guidelines of Harmonics Reduction for Consumers of High or Ultra-High Voltage Power" (September 1994) Japan Ministry of International Trade and Industry (current Japan Ministry of Economy, Trade and Industry)
- "Technical Guidelines for Suppressing Harmonics" (JEAG 9702-2013), The Japan Electric Association
- "Measures for Suppressing Servo Amplifier Harmonics" (February 2015), Japan Electrical Manufacturers' Association
- "How to Calculate Harmonic Current of Servo Amplifiers for Specific Power Consumers" (JEM-TR225), Japan Electrical Manufacturers' Association
- "Guidelines for Suppressing Servo Amplifier (input current of 20 A or less) Harmonics" (JEM-TR227), Japan Electrical Manufacturers' Association

## Notes before Purchase

The products in this catalog are designed to be used with general industrial devices.

Always follow the following precautions.

- Read the accompanying Instruction Manual carefully prior to using the product.
- If applying to medical devices and other equipment affecting people's lives, please contact us beforehand and take appropriate safety measures.
- If applying to equipment that can have significant effects on society and the general public, please contact us beforehand.

· Do not use this product in an environment where vibration is present, such as in a moving vehicle or shipping vessel.

· Do not perform any retrofitting, re-engineering, or modification to this equipment.

· The products presented in this catalog are meant to be used for general industrial applications. If using for special applications related to aviation and space, nuclear power, electric power, submarine repeaters, and the like, please contact us beforehand.