

AC SERVO SERIES

S-FLAG



The Technology Evolution Accelerates

Under recent trends of factory automation, the manufacturing landscape is undergoing rapid transformation. The Sankyo AC Servo Motor is designed to play an essential, invaluable role supporting your high efficiency, high precision, energy-saving, and high-value applications. Responding to the demands of the increasingly sophisticated market, the performance of the AC Servo Series "S-FLAG" has evolved to fulfill all your application needs.

Our one-of-a-kind S-FLAG Multi-Axis Amplifier offers the most sophisticated and flexible axis configurations.

Sankyo - the company with the leading track record in manufacturing LCD panel-handling robots - is committed to serving you with comprehensive solutions alongside our multi-axis servos.



Accelerates Now!

AC SERVO SERIES

S-FLAG

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With our state-of-the-art technology, Sankyo consistently meets the increasingly diverse needs of our times, and delivers products to meet your expectations.

A wide range of customers have found S-FLAG invaluable for many industrial equipment and machinery needs. S-FLAG is now being applied in semiconductor manufacturing machines, processing machines, printing machines, textile machines, a large variety of automation machinery, as well as for LED panel-handling robots.

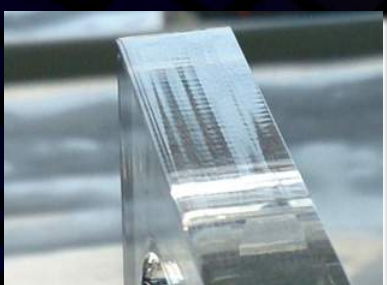




Learning in the Field and Constantly Evolving —— Amplifier Performance

Enhanced Servo Features

With the enhanced current control feature, our Servo-mounted machines are delivering improved performance on surface finishing. The occasional suboptimal stripe pattern results of the past are replaced now with smooth, beautiful mirror-like surfaces. The surface finish precision of metal processing machines and engraving machines has been greatly improved.

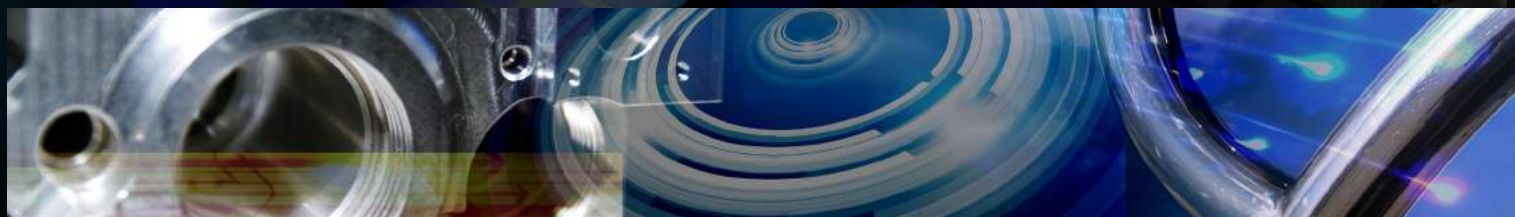


● Prior



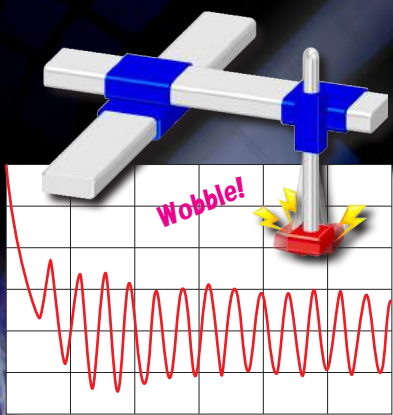
● Now

Better

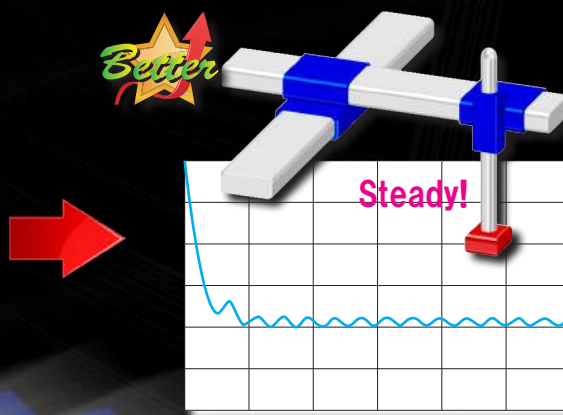


Enhanced Damping Filter

Our new stronger damping filter helps your machine better suppress machine tip wobbles. With the newly developed “γ-notch” filter, you may flexibly set responsiveness in frequency ranges higher than the notch frequency. Our new Servo offers shorter settling time for positioning, while maintaining the same damping features as before.



● Prior



● Now

Better

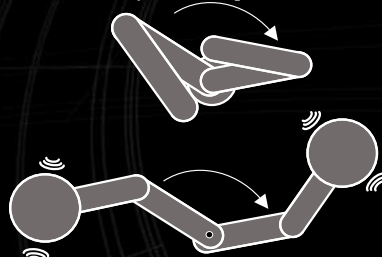




Inheriting State-of-the-Art Technology for Robot Control — Robust Control

The S-FLAG Servo Amplifier is equipped with servo control which takes advantage of our expertise in LCD and semiconductor robotics. Decoupling command responsiveness and disturbance compensation using observer-based model matching and feedforward, our Servo Amplifier offers control for two degrees of freedom.

Even under load fluctuations, you can expect smooth motion without needing to change tuning parameters. This control method is ideal for applications with high rigidity such as ball screw drives, where you will experience excellent command responsiveness.



[Robust Control]

Robust Control is a control method which maintains expected robustness and stability even when the actual specifications of robots are slightly different from the initially intended control model.



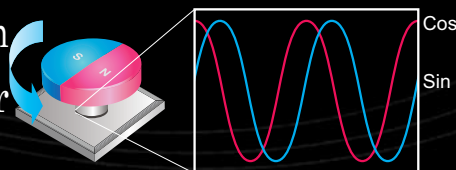
ROBOT CONTROL



Ultimate Toughness and Low Current Consumption — Magnetic Absolute Encoder

No other type of encoder matches the ultimate toughness of the magnetic rotary encoder - which is its greatest advantage. Magnetic rotary encoders are resistant to oil and dust, and exhibit robust power in harsh production environments. Sankyo's original 1 pole magnetic absolute encoder has a straightforward, hard-to-break structure, and its resolution is comparable to optical encoders. Our new encoder is your one-stop solution for the ever-challenging threesome of goals: "toughness in harsh environments", "resolution", and "cost".

Also, our encoder features battery-free single-turn absolute position detection. Furthermore, its current consumption upon battery backup is among the lowest in the industry.



MAGNETIC ENCODER



Backup Current Consumption
The industry's lowest level of $10\mu A$



Per in-house testing, our current consumption is less than a half of that used by a standard absolute encoder.



Ultimate Slenderness

— Design Driven by the Pursuit of the Thinnest

MULTIPLE AXIS SERVO
AC SERVO SERIES

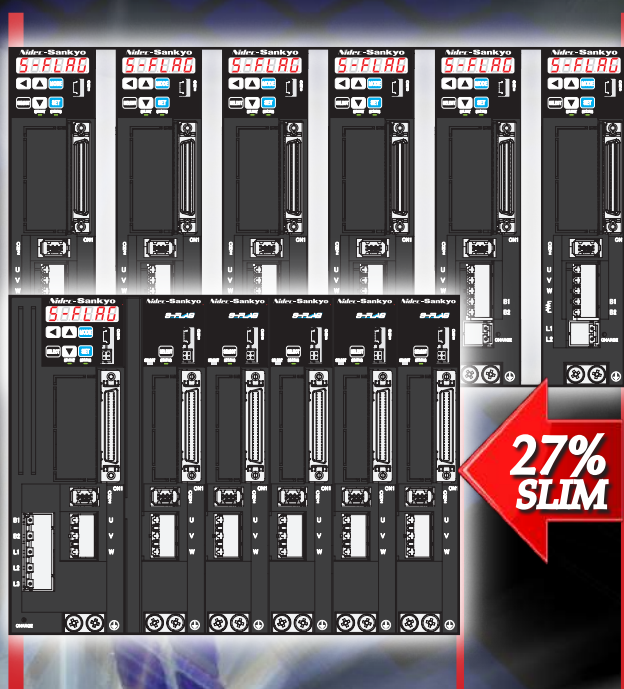
S-FLAG
MULTIPLAX

Our innovative multi-axis amplifier structure resembles the beauty of kimono collar layers. It is uniquely constructed from components fitting together like the pieces of a jigsaw puzzle. A single primary circuit power supply attached to the main amplifier also powers the sub-amplifiers arrayed side-by-side. Compared to conventional multi-axis amplifiers, our ingeniously designed multi-axis amplifier is superior in cost and space.



SLIMNESS

The "MULTIPLAX" logo stands for "Multiple Axis".



Space Requirement for Installation

(For 200W 6 axes)

6 single-axis servo amplifiers require

290mm

Single-Axis Amp Width Clearance b/w Amps
40 mm × 6 amps + 10 mm × 5 = 290 mm

6 multi-axis amplifiers require

212mm

MULTIPLE AXIS SERVO
AC SERVO SERIES
S-FLAG
MULTIPLAX



Main-Amplifier Width Sub-Amplifier Width
62 mm × 1 main-amp + 30 mm × 5 sub-amps = 212 mm

For the multi-axis amplifier, no clear space between amplifiers is needed.

Even better, for 10 axes

the installation area will be **32% less!**

Single-Axis Amplifier • • • 490mm

Multiple-Axis Amplifier • • • 332mm

See Page 31 for information about installation of the multi-axis amplifier.



Specialized Tool Based on Ergonomics — S-TUNE

S-TUNE

S-TUNE is a powerful PC tool that eases setup, tuning, state monitoring, and effective use of S-FLAG Servo Amplifier. Now with its enhanced features, S-TUNE is even more user-friendly and powerful.

With the greatly enhanced functionality, you can now setup our new damping filter from the intuitive interface, use an additional function “vibration noise frequency measurement (FFT)”, and get a log of the amplifier alarm. In addition, smooth startup of your machine is facilitated through an amplifier point table (that can be set up to 16 points), and the test run features.



FFT (Fast Fourier Transform)



Measures vibration and noise wave forms. Just click the “Display Frequency” button to view frequencies.



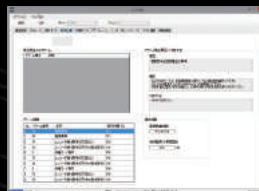
Filter Setting



You can set up the filter according to the measured vibration and noise frequency. New input screens “Position Command Filter” and “Torque Command Filter” make filter setup a matter of a few clicks.



Alarm Logging Function



Up to 10 alarm logs can be saved with incidents recorded in chronological order. Even the simple controller can perform practical positioning runs.



Point Table



Up to 16 points can be setup with S-TUNE. The simple controller can perform practical positioning runs.

SOFTWARE



System Requirements

Computer	
OS	Windows XP SP3(32bit) Windows 7 (32bit, 64bit) Windows 8 (64bit) Supported Languages: Japanese, English, Chinese (Simplified), Chinese (Traditional) or Korean
CPU	Pentium III 512 MHz or faster
Memory (RAM)	256 MB or more, 512 MB recommended
Hard disk space	512 MB or more available
Serial communication	USB port (USB 1.1 or later)
Display	
Resolution	1024 × 768 or higher
Color Depth	24 bit color (True Color) or better



Compliance with Standards

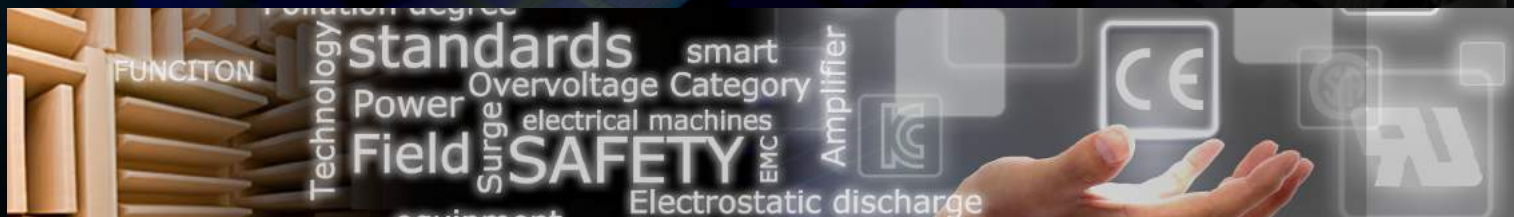


Standard		Motor	Amplifier
EC Directives	Low Voltage Directives (*)	EN 60034-1 EN 60034-11	EN 61800-5-1
	EMC Directives	EN 61000-6-2 EN 55011 Class A, Group1	
	Machinery Directives	(Not Applicable)	
UL Standards (*)		1004-1 1004-6 (File No. E 470950)	508C (File No. E 471456)
CSA Standards		C22.2 No.100-14	C22.2 No.14-13
Korean Radio Regulations (KC)		KN 11 KN 6100-6-2	
China Compulsory Certification (CCC)		(Not Covered)	

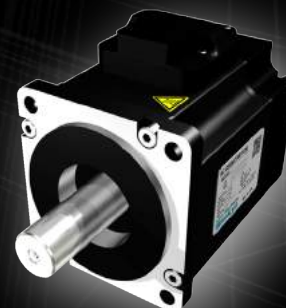
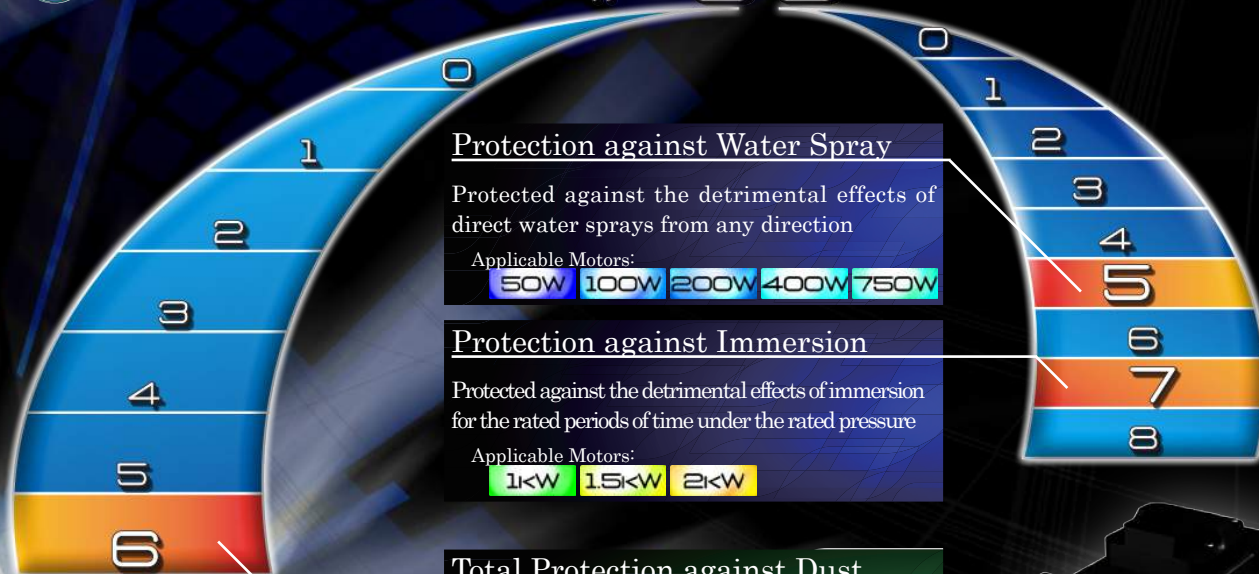
*) S-FLAG installation environment must meet the following standards.

- Overvoltage Category II
- Class I (equipment)
- Pollution degree 2 (circuit unit)

SAFETY STANDARD



Motor Protection Degree IP65



INCREASING PROTECTION



Delivering Greater Value for Your Needs

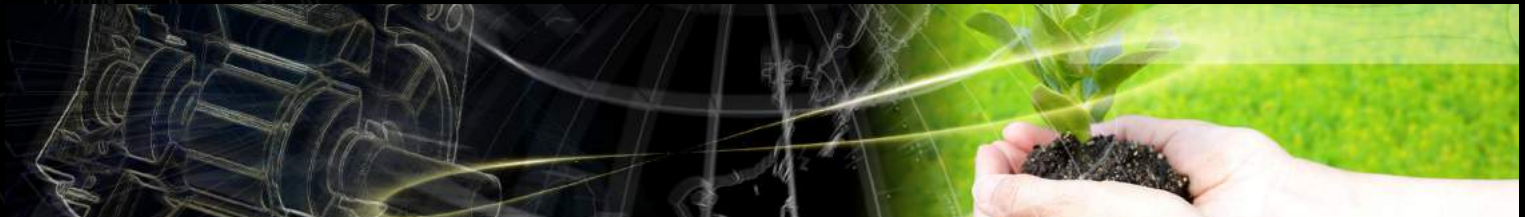
Customized Motors

We offer customized motors upon request.

We can deliver motor customization in a wide variety of ways, for example, varying the number of rotations, torque, size, shaft form, connectors, and so on. We offer the best solutions to maximize the value of your products. With our market-leading technology, we will satisfy your needs for custom motors - from design to production. We provide total support, quick responsiveness, and experience operating in diverse manufacturing sites. Let us enhance your production and your business - please contact us!



CUSTOMIZED MOTOR



Thorough Quality Control and Environmental Considerations

Quality

Customers trust us for the quality of our products. Let us serve you with our world-class quality control management.

Our company locations are all ISO9001 certified.

Environment

We acknowledge the importance of protecting and preserving the global environment for future generations. We continually work to reduce or eliminate any potentially negative environmental impact of our business operations. In the design stage, we devise products with resource conservation, energy savings, and recycling in mind. We produce and deliver eco-friendly products which minimize or eliminate the use of materials restricted under environmental regulations.

All of our locations are ISO14001 certified, and we promote continuous update and improvement of our environmental management systems.



OUR POLICY



Low Inertia



200W

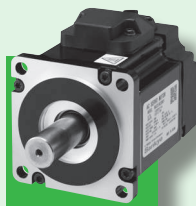
P.14

400W

P.16

750W

P.18



Middle Inertia

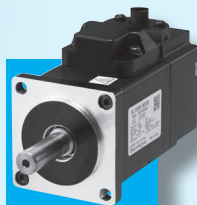


50W

P.12

100W

P.13



1kW

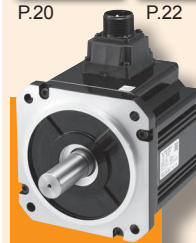
P.20

1.5kW

P.22

2kW

P.24



High Inertia



200W

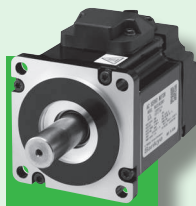
P.15

400W

P.17

750W

P.19

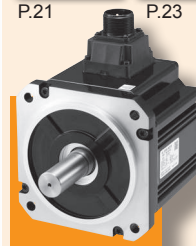


1kW

P.21

1.5kW

P.23



Inertia



Low Inertia



Middle Inertia



High Inertia

Flange Size



40mm x 40mm



60mm x 60mm



80mm x 80mm



130mm x 130mm

Rotational Speed

Rated Motor Speed / Max. [r/min]
2,000 / 3,000 [r/min]

3,000 / 4,500 [r/min]



3,000 / 5,000 [r/min]



3,000 / 6,000 [r/min]

IP Code



IP65



IP67

Features

- Suitable for applications with high speed rotations
- Can be used for most applications

Use Applications

- Embroidery machine
- Textile machine
- Packaging machine etc.

Features

- Suitable for applications with low mechanical rigidity such as drive belt machinery

Use Applications

- Removal robot
- Conveyer machine
- Processing machine

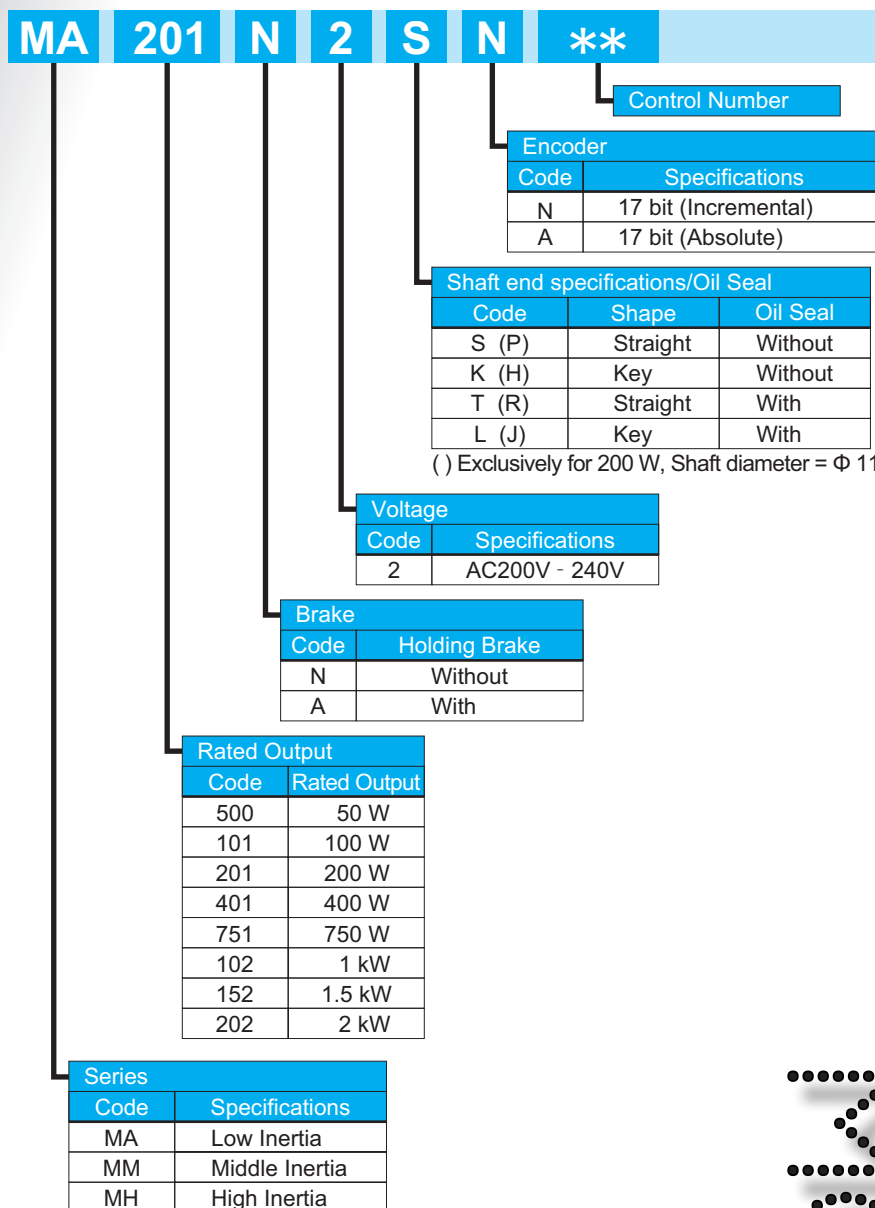
Features

- Suitable for applications with low mechanical rigidity such as drive belt machinery

Use Applications

- Removal robot
- Conveyer machine
- Processing machine

Model Number



INFORMATION

Customized motors are available upon your request.



Installing Precautions

- Never remove the encoder or dismantle the motor body.
- The motor shaft has anti-rust oil applied at the shipment. Please wipe off the oil before installing the motor.
- Make sure to perform centering (alignment) carefully and properly.
- Operating the motor without sufficient alignments might cause vibrations or a shorter service life of the motor.

Connecting with a mechanical system

- When connecting the motor to a load, use a coupling to absorb misalignments so that the motor shaft load remains within the rated load to the motor shaft.
- Improper use may cause a shorter service life of the motor bearing and damage the shaft.
- We recommend the use of flexible couplings.

Installation Orientations and Oil Seals

- The motor can be installed either vertically or horizontally. Please observe the following precautions.
 - Horizontal installation: Face the cable pull unit down in order to protect the motor against oil, water and dust.
 - Vertical installation : For a motor combined with a decelerator being on top of the motor shaft, use an oil sealed motor to prevent the decelerator oil from seeping into the motor.

Specifications

Motor Model: MM500 □ 2 □ □ * *



Basic Specifications

Item		Unit	Specifications
Rotor inertia		—	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.4
	With brake		0.6
Compatible amplifier model		—	DA2YZ□□
Voltage		V	AC200V - 240V
Rated output		W	50
Rated torque		N·m	0.16
Instantaneous maximum torque		N·m	0.56
Rated current (stall current)		A	0.68
Instantaneous maximum current		A	2.4
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.25
Induced voltage constant per phase		mV/(r/min)	8.8
Rated power rate	Without brake	kW/s	5.6
	With brake		4.7
Mechanical time constant	Without brake	ms	2.60
	With brake		3.06
Electrical time constant		ms	0.64
Rotor moment of inertia	Without brake	$\times 10^{-4}\text{kg}\cdot\text{m}^2$	0.045
	With brake		0.053

Brake Specifications

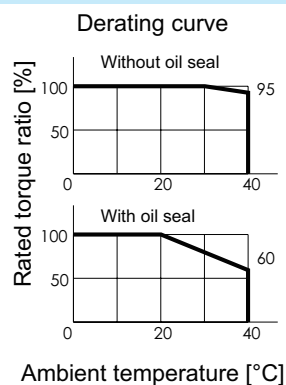
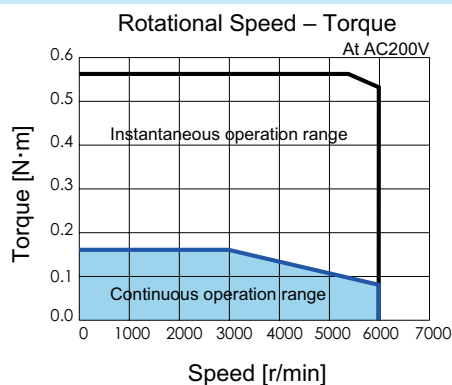
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC24V $\pm$ 10 %
Rated current	A	0.25
Static friction torque	N·m	≥ 0.16
Suction time	ms	≤ 35
Release time	ms	≤ 20
Release voltage	V	$\geq \text{DC1V}$

Allowable load

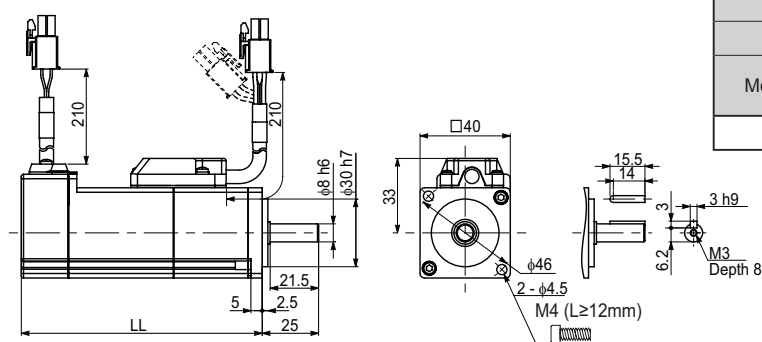
Item	Unit	Specifications
Radial	N	68
Thrust	N	58

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



(mm)

Brake	Without		With	
Oil seal	Without	With	Without	With
Motor model	MM500N2S	MM500N2T	MM500A2S	MM500A2T
	MM500N2K	MM500N2L	MM500A2K	MM500N2L
LL	66.4	72.0	106.8	112.4

The straight shaft products are not tapped end.

Specifications

Motor Model: MM101 □ 2 □ □ * *

100W

40

LM

60

IP 65

Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	Middle
Fitting flange size	mm	40 sq.
Approximate mass	Without brake	kg 0.5
	With brake	kg 0.8
Compatible amplifier model	—	DA2Z1□□
Voltage	V	AC200V - 240V
Rated output	W	100
Rated torque	N·m	0.32
Instantaneous maximum torque	N·m	1.12
Rated current (stall current)	A	0.95
Instantaneous maximum current	A	3.3
Rated revolving speed	r/min	3,000
Maximum revolving speed	r/min	6,000
Torque constant	N·m/A	0.36
Induced voltage constant per phase	mV/(r/min)	12.5
Rated power rate	Without brake	kW/s 13.6
	With brake	kW/s 12.3
Mechanical time constant	Without brake	ms 1.69
	With brake	ms 1.87
Electrical time constant	ms	0.76
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 0.074
	With brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 0.082

Brake Specifications

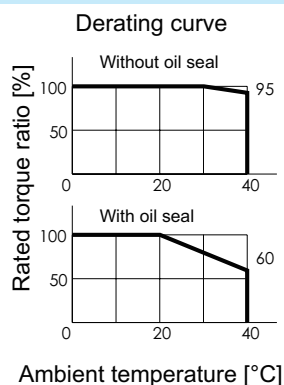
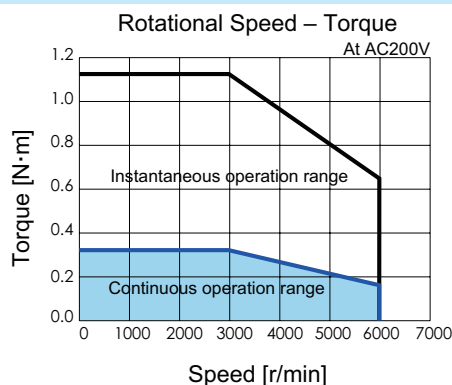
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC24V $\pm$ 10 %
Rated current	A	0.25
Static friction torque	N·m	≥ 0.32
Suction time	ms	≤ 35
Release time	ms	≤ 20
Release voltage	V	$\geq \text{DC1V}$

Allowable load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

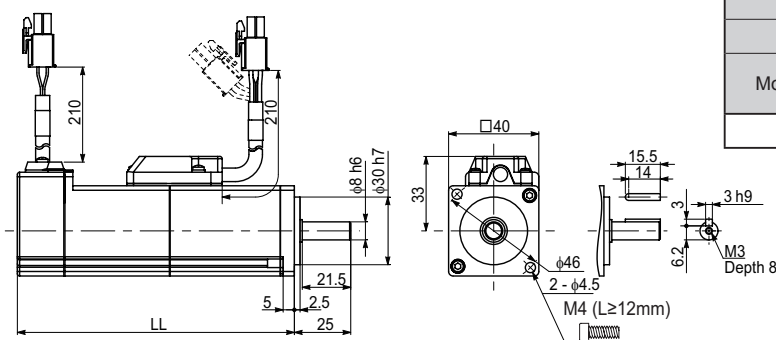
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Torque Characteristics



External Dementions

(mm)



Motor model	Without		With	
	Without	With	Without	With
LL	82.4	88.0	122.8	128.4

The straight shaft products are not tapped end.

Specifications

Motor Model: MA201 □ 2 □ □ * *



Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	Low
Fitting flange size	mm	60 sq.
Approximate mass	Without brake	kg 0.9
	With brake	1.4
Compatible amplifier model	—	DA212□□
Voltage	V	AC200V - 240V
Rated output	W	200
Rated torque	N·m	0.64
Instantaneous maximum torque	N·m	1.91
Rated current (stall current)	A	1.7
Instantaneous maximum current	A	5.1
Rated revolving speed	r/min	3,000
Maximum revolving speed	r/min	5,000
Torque constant	N·m/A	0.42
Induced voltage constant per phase	mV/(r/min)	14.5
Rated power rate	Without brake	kW/s 23.7
	With brake	19.3
Mechanical time constant	Without brake	ms 1.13
	With brake	1.39
Electrical time constant	ms	1.99
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 0.17
	With brake	0.21

Brake Specifications

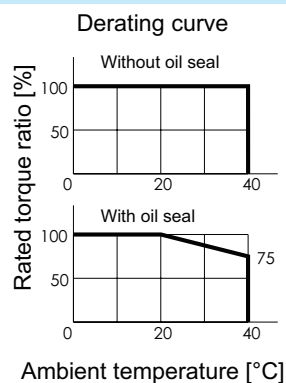
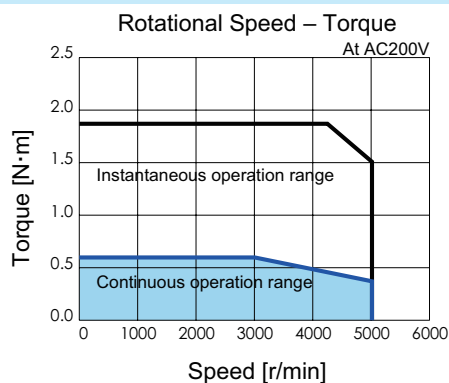
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24V $\pm$ 10 %
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Suction time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	$\geq \text{DC1V}$

Allowable load

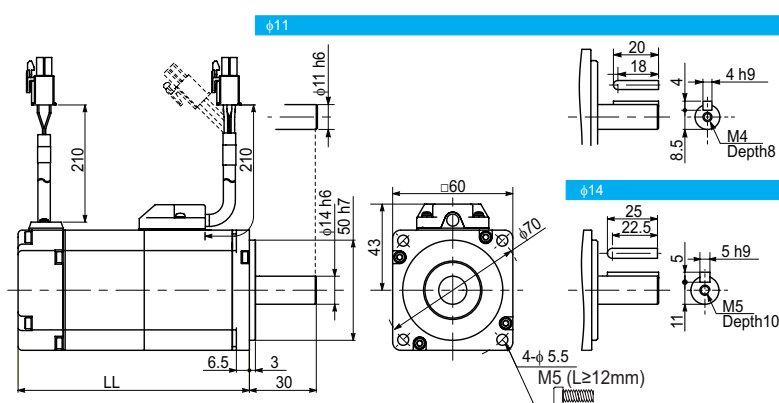
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dimensions



(mm)

Brake	Without	With
Motor model	MA201N	MA201A
LL	79.0	115.5

The straight shaft products are not tapped end.

Specifications

Motor Model: MH201 □ 2 □ □ * *



Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	High
Fitting flange size	mm	60 sq.
Approximate mass	Without brake	kg 1.0
	With brake	1.5
Compatible amplifier model	—	DA212□□
Voltage	V	AC200V - 240V
Rated output	W	200
Rated torque	N·m	0.64
Instantaneous maximum torque	N·m	1.91
Rated current (stall current)	A	1.7
Instantaneous maximum current	A	5.1
Rated revolving speed	r/min	3,000
Maximum revolving speed	r/min	5,000
Torque constant	N·m/A	0.42
Induced voltage constant per phase	mV/(r/min)	14.5
Rated power rate	Without brake	kW/s 9.2
	With brake	8.6
Mechanical time constant	Without brake	ms 2.91
	With brake	3.11
Electrical time constant	ms	1.99
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 0.44
	With brake	0.47

Brake Specifications

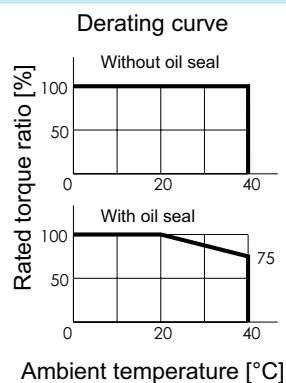
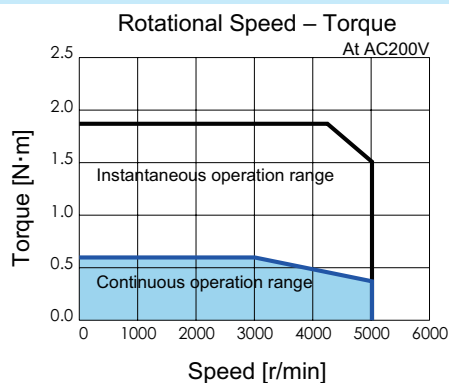
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V $\pm$ 10 %
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Suction time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	$\geq \text{DC1V}$

Allowable load

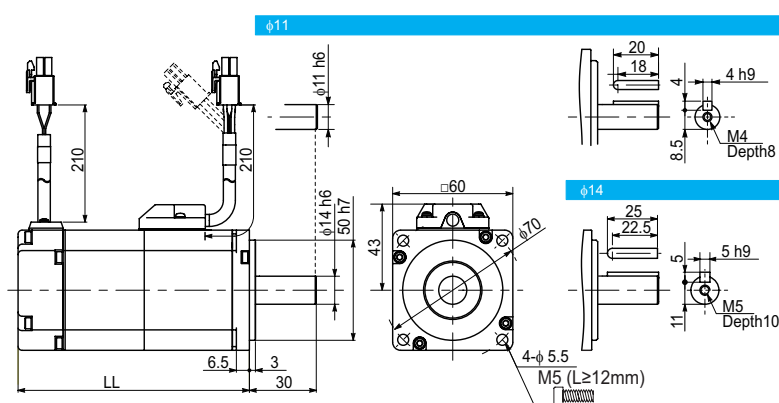
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



(mm)

Brake	Without	With
Motor model	MH201N	MH201A
LL	98.5	135.0

The straight shaft products are not tapped end.

Specifications

Motor Model: MA401 □ 2 □ □ * *

400W

60

HL

50

IP 65

Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	Low
Fitting flange size	mm	60 sq.
Approximate mass	Without brake	kg 1.3
	With brake	1.8
Compatible amplifier model	—	DA224□□
Voltage	V	AC200V - 240V
Rated output	W	400
Rated torque	N·m	1.27
Instantaneous maximum torque	N·m	3.82
Rated current (stall current)	A	2.7
Instantaneous maximum current	A	8.1
Rated revolving speed	r/min	3,000
Maximum revolving speed	r/min	5,000
Torque constant	N·m/A	0.50
Induced voltage constant per phase	mV/(r/min)	17.4
Rated power rate	Without brake	kW/s 55.9
	With brake	50.7
Mechanical time constant	Without brake	ms 0.70
	With brake	0.77
Electrical time constant	ms	2.47
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 0.29
	With brake	0.32

Brake Specifications

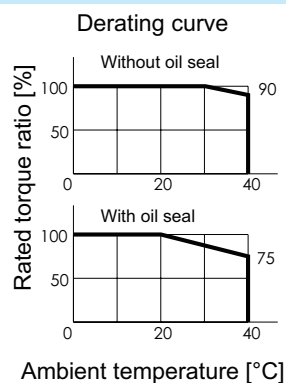
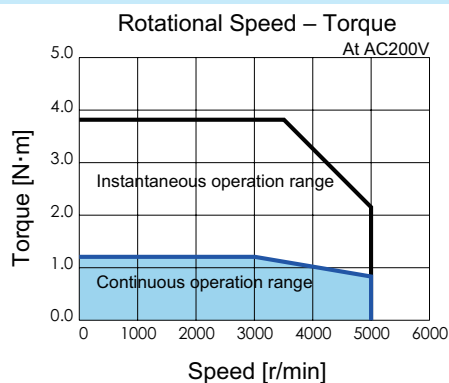
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V $\pm$ 10 %
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Suction time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	$\geq \text{DC1V}$

Allowable load

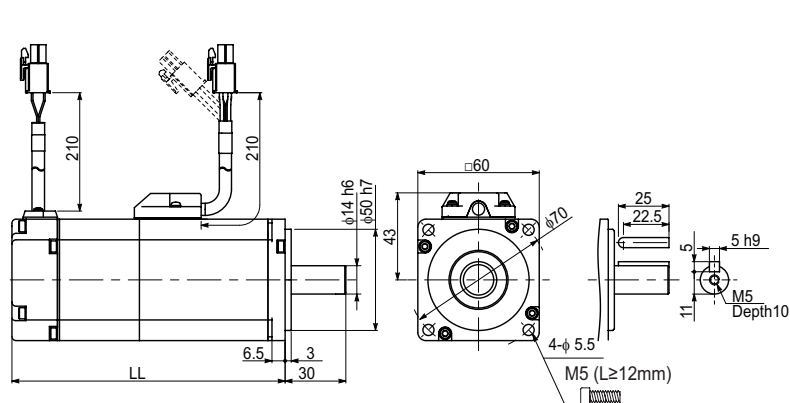
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



Brake	Without	With
Motor model	MA401N	MA401A
LL	98.5	135.0

The straight shaft products are not tapped end.

Specifications

Motor Model: MH401 □ 2 □ □ * *

400W

60

H

50

IP 65

Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	High
Fitting flange size	mm	60 sq.
Approximate mass	Without brake	kg 1.5
	With brake	2.0
Compatible amplifier model	—	DA224□□
Voltage	V	AC200V - 240V
Rated output	W	400
Rated torque	N·m	1.27
Instantaneous maximum torque	N·m	3.82
Rated current (stall current)	A	2.7
Instantaneous maximum current	A	8.1
Rated revolving speed	r/min	3,000
Maximum revolving speed	r/min	5,000
Torque constant	N·m/A	0.50
Induced voltage constant per phase	mV/(r/min)	17.4
Rated power rate	Without brake	kW/s 23.2
	With brake	21.9
Mechanical time constant	Without brake	ms 1.69
	With brake	1.78
Electrical time constant	ms	2.47
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 0.70
	With brake	0.74

Brake Specifications

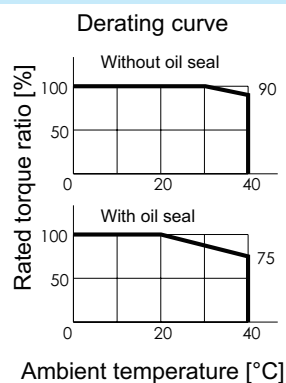
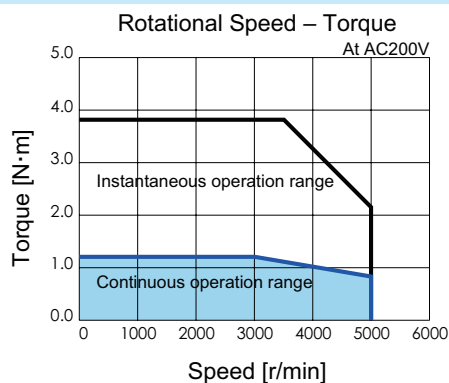
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC24V $\pm$ 10%
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Suction time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	$\geq \text{DC1V}$

Allowable load

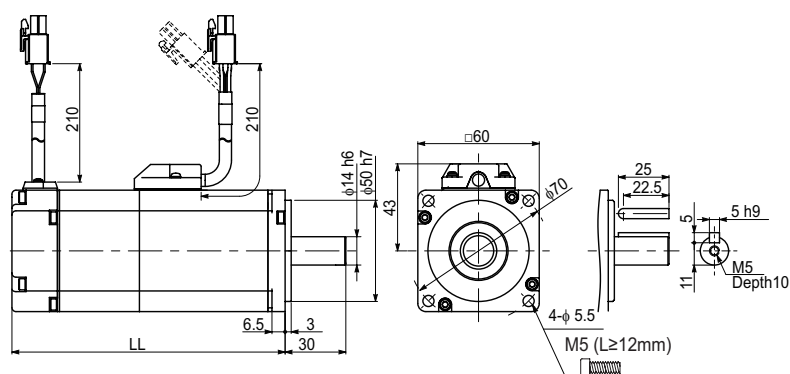
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



(mm)

Brake	Without	With
Motor model	MH401N	MH401A
LL	118.0	154.5

The straight shaft products are not tapped end.

Specifications

Motor Model: MA751 □ 2 □ □ * *



Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	Low
Fitting flange size	mm	80 sq.
Approximate mass	Without brake	kg 2.5
	With brake	3.3
Compatible amplifier model	—	DA238□□
Voltage	V	AC200V - 240V
Rated output	W	750
Rated torque	N·m	2.39
Instantaneous maximum torque	N·m	7.1
Rated current (stall current)	A	4.2
Instantaneous maximum current	A	12.6
Rated revolving speed	r/min	3,000
Maximum revolving speed	r/min	4,500
Torque constant	N·m/A	0.61
Induced voltage constant per phase	mV/(r/min)	21.3
Rated power rate	Without brake	kW/s 61.9
	With brake	51.3
Mechanical time constant	Without brake	ms 0.55
	With brake	0.66
Electrical time constant	ms	4.30
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 0.92
	With brake	1.11

Brake Specifications

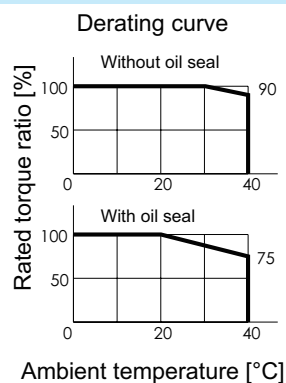
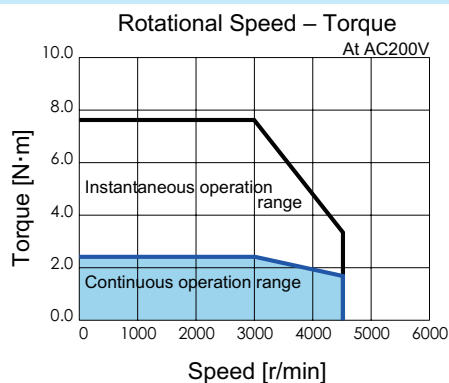
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V $\pm$ 10 %
Rated current	A	0.4
Static friction torque	N·m	≥ 2.39
Suction time	ms	≤ 70
Release time	ms	≤ 20
Release voltage	V	$\geq \text{DC1V}$

Allowable load

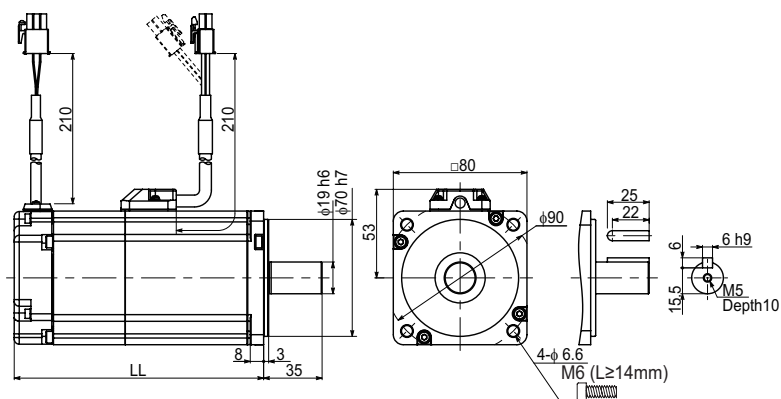
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dimensions



(mm)

Brake	Without	With
Motor model	MA751N	MA751A
LL	112.3	149.3

The straight shaft products are not tapped end.

Specifications

Motor Model: MH751 □ 2 □ □ * *

750W

80mm

H

45mm

IP65

Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	High
Fitting flange size	mm	80 sq.
Approximate mass	Without brake	kg 2.7
	With brake	3.5
Compatible amplifier model	—	DA238□□
Voltage	V	AC200V - 240V
Rated output	W	750
Rated torque	N·m	2.39
Instantaneous maximum torque	N·m	7.1
Rated current (stall current)	A	4.2
Instantaneous maximum current	A	12.6
Rated revolving speed	r/min	3,000
Maximum revolving speed	r/min	4,500
Torque constant	N·m/A	0.61
Induced voltage constant per phase	mV/(r/min)	21.3
Rated power rate	Without brake	kW/s 35.2
	With brake	31.5
Mechanical time constant	Without brake	ms 0.96
	With brake	1.08
Electrical time constant	ms	4.30
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{kg} \cdot \text{m}^2$ 1.62
	With brake	1.81

Brake Specifications

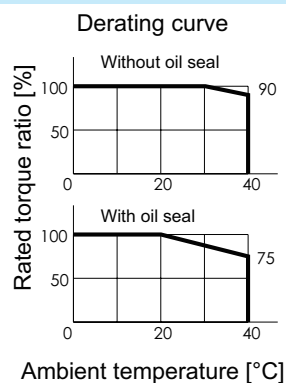
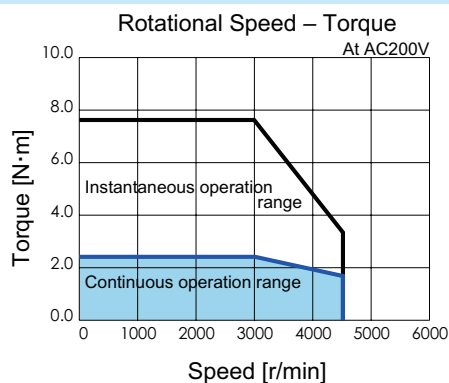
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V $\pm$ 10 %
Rated current	A	0.4
Static friction torque	N·m	≥ 2.39
Suction time	ms	≤ 70
Release time	ms	≤ 20
Release voltage	V	$\geq \text{DC1V}$

Allowable load

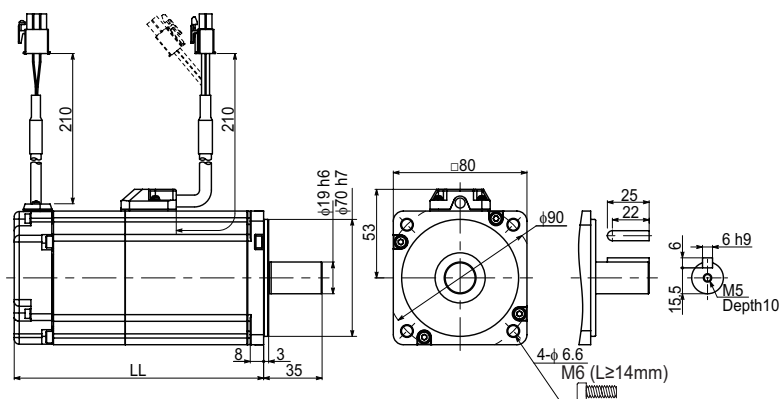
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



(mm)

Brake	Without	With
Motor model	MH751N	MH751A
LL	127.3	164.3

The straight shaft products are not tapped end.

Specifications

Motor Model: MM102 □ 2 □ □ * *

1kW



Basic Specifications

Item		Unit	Specifications
Rotor inertia		—	Middle
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	5.6
	With brake		7.0
Compatible amplifier model		—	DA24A□□
Voltage		V	AC200V - 240V
Rated output		W	1,000
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	5.6
Instantaneous maximum current		A	16.8
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.88
Induced voltage constant per phase		mV/(r/min)	30.9
Rated power rate	Without brake	kW/s	50.0
	With brake		36.5
Mechanical time constant	Without brake	ms	0.76
	With brake		1.05
Electrical time constant		ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4}\text{kg}\cdot\text{m}^2$	4.56
	With brake		6.24

Brake Specifications

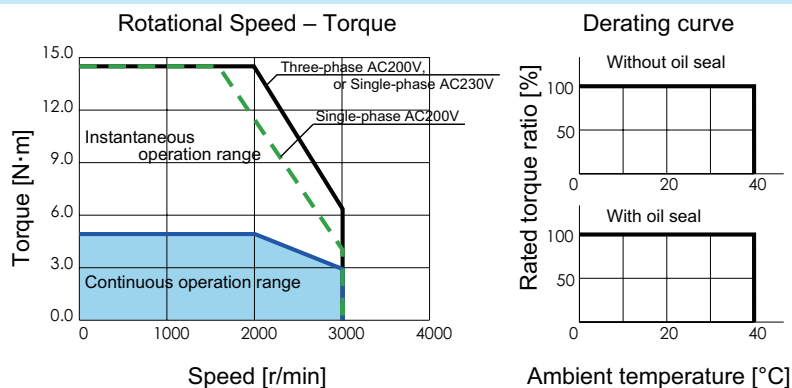
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V $\pm$ 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Suction time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	$\geq \text{DC1V}$

Allowable load

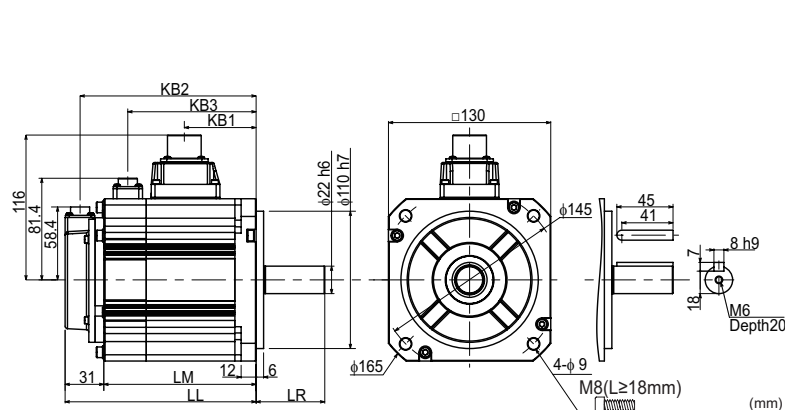
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



Brake	Without	With
Motor model	MM102N	MM102A
LL	128.0	153.0
LM	97.0	122.0
LR	55.0	
KB1	57.5	
KB2	116.0	141.0
KB3	—	102.8

The straight shaft products are not tapped end.

Specifications

Motor Model: MH102 □ 2 □ □ * *

1kW



Basic Specifications

Item	Unit	Specifications
Rotor inertia	—	High
Fitting flange size	mm	130 sq.
Approximate mass	Without brake	kg 7.6
	With brake	9.0
Compatible amplifier model	—	DA24A□□
Voltage	V	AC200V - 240V
Rated output	W	1,000
Rated torque	N·m	4.77
Instantaneous maximum torque	N·m	14.3
Rated current (stall current)	A	5.6
Instantaneous maximum current	A	16.8
Rated revolving speed	r/min	2,000
Maximum revolving speed	r/min	3,000
Torque constant	N·m/A	0.88
Induced voltage constant per phase	mV/(r/min)	30.9
Rated power rate	Without brake	kW/s 9.2
	With brake	8.6
Mechanical time constant	Without brake	ms 4.17
	With brake	4.43
Electrical time constant	ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4} \text{ kg} \cdot \text{m}^2$ 24.9
	With brake	26.4

Brake Specifications

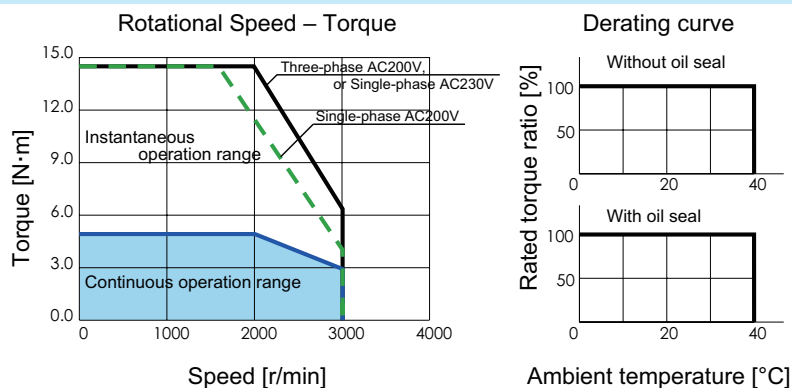
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V $\pm$ 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Suction time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	$\geq \text{DC1V}$

Allowable load

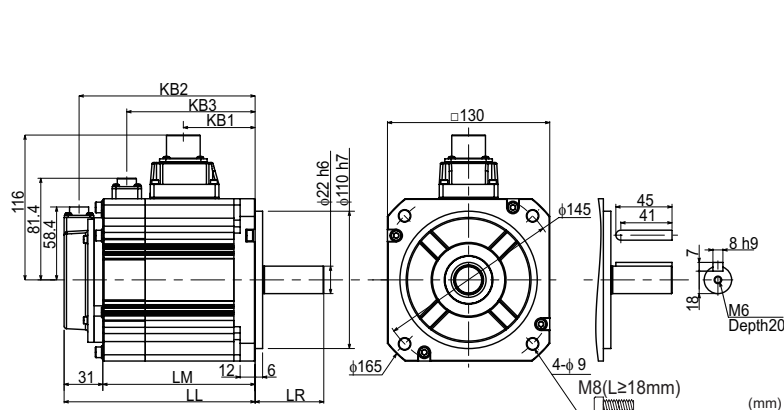
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



Brake	Without	With
Motor model	MH102N	MH102A
LL	163.0	188.0
LM	132.0	157.0
LR	70.0	
KB1	92.5	
KB2	151.0	176.0
KB3	—	137.8

The straight shaft products are not tapped end.

Specifications

Motor Model: MM152□2□□* *



Basic Specifications

Item		Unit	Specifications
Rotor inertia		—	Middle
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.0
	With brake		8.4
Compatible amplifier model		—	DA26B□□
Voltage		V	AC200V - 240V
Rated output		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(r/min)	28.4
Rated power rate	Without brake	kW/s	76.9
	With brake		61.4
Mechanical time constant	Without brake	ms	0.60
	With brake		0.75
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}\text{kg}\cdot\text{m}^2$	6.67
	With brake		8.35

Brake Specifications

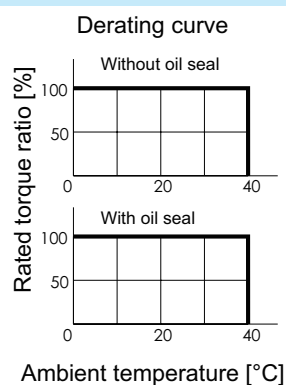
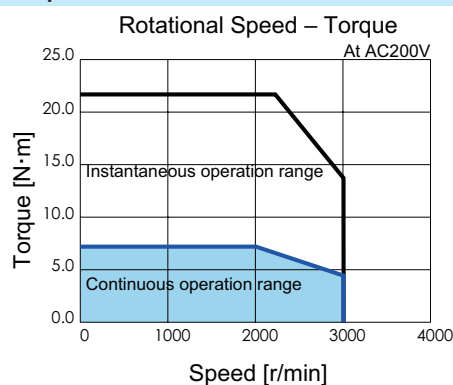
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Suction time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	≥ DC1V

Allowable load

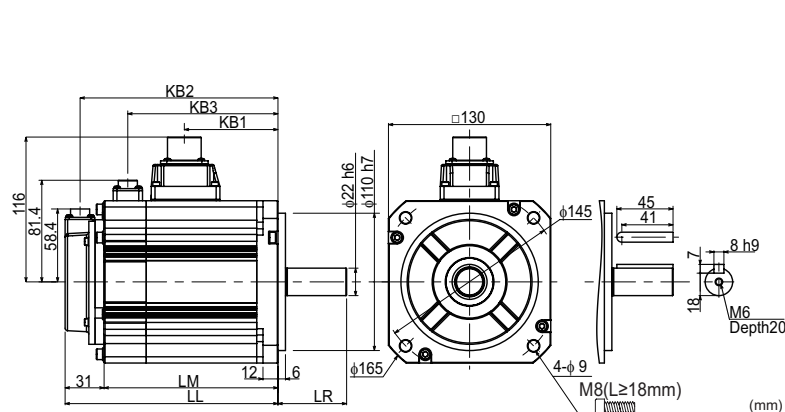
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



(mm)		
Brake	Without	With
Motor model	MM152N	MM152A
LL	145.5	170.5
LM	114.5	139.5
LR	55.0	
KB1	75.0	
KB2	133.5	158.5
KB3	—	120.3

The straight shaft products are not tapped end.

Specifications

Motor Model: MH152 □ 2 □ □ * *

1.5kW



Basic Specifications

Item		Unit	Specifications
Rotor inertia		—	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	9.0
	With brake		10.4
Compatible amplifier model		—	DA26B□□
Voltage		V	AC200V - 240V
Rated output		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(r/min)	28.4
Rated power rate	Without brake	kW/s	13.8
	With brake		13.3
Mechanical time constant	Without brake	ms	3.32
	With brake		3.46
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}\text{kg} \cdot \text{m}^2$	37.12
	With brake		38.65

Brake Specifications

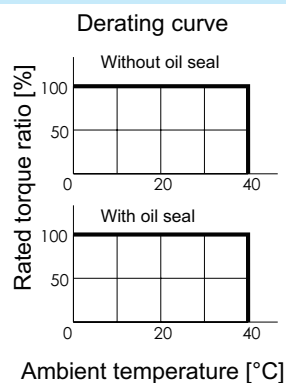
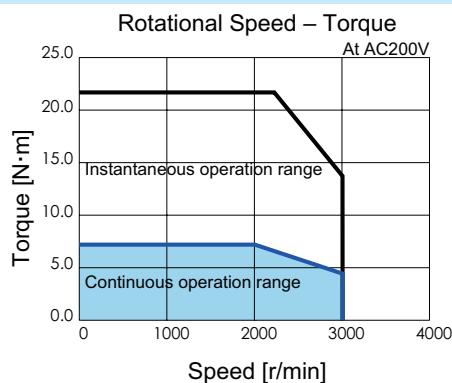
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC 24 V $\pm$ 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Suction time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	$\geq \text{DC1V}$

Allowable load

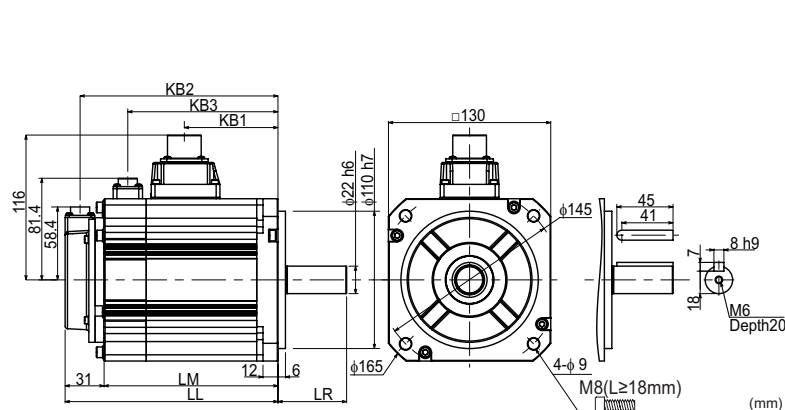
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



Brake	Without	With
Motor model	MM152N	MM152A
LL	180.5	205.5
LM	149.5	174.5
LR	70.0	
KB1	110.0	
KB2	168.5	19.35
KB3	—	155.3

The straight shaft products are not tapped end.

Specifications

Motor Model: MM202 □ 2 □ □ * *



Basic Specifications

Item		Unit	Specifications
Rotor inertia		—	Middle
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	8.4
	With brake		9.8
Compatible amplifier model		—	DA28C□□
Voltage		V	AC200V - 240V
Rated output		W	2,000
Rated torque		N·m	9.55
Instantaneous maximum torque		N·m	28.6
Rated current (stall current)		A	11.9
Instantaneous maximum current		A	35.7
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.85
Induced voltage constant per phase		mV/(r/min)	29.6
Rated power rate	Without brake	kW/s	104.9
	With brake		87.9
Mechanical time constant	Without brake	ms	0.58
	With brake		0.69
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}\text{kg}\cdot\text{m}^2$	8.70
	With brake		10.38

Brake Specifications

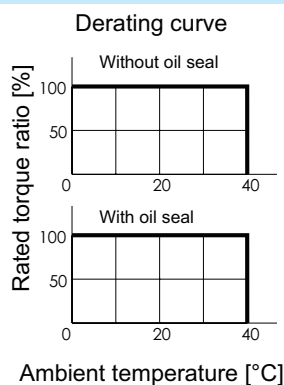
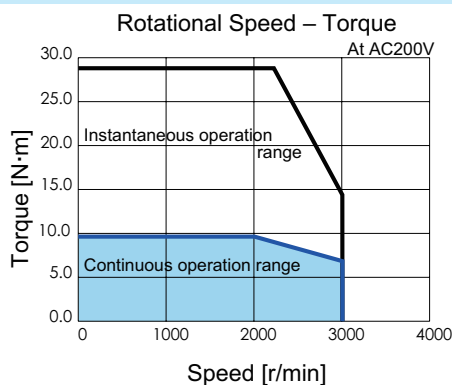
Item	Unit	Specifications
Usage	—	Holding
Rated voltage	V	DC24V $\pm$ 10%
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Suction time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	$\geq \text{DC1V}$

Allowable load

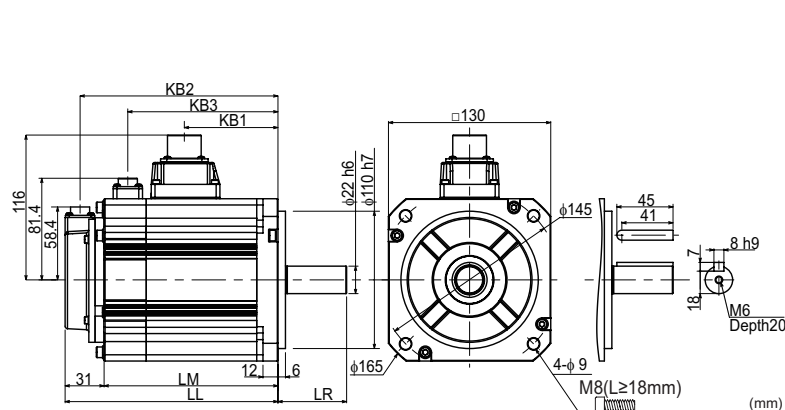
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

The motor specifications and sizes are subject to change without notice. For your design references, check our instruction manual. Please read it very carefully and use the product properly.

Torque Characteristics



External Dementions



Brake	Without	With
Motor model	MM202N	MM202A
LL	163.0	188.0
LM	132.0	157.0
LR	55.0	
KB1	92.5	
KB2	151.0	176.0
KB3	—	137.8

The straight shaft products are not tapped end.

Motor Basic Specifications

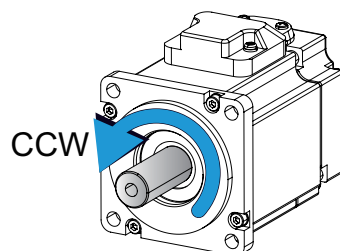
Item	Specifications
Ambient temperature for operation	0 - 40 °C
Ambient humidity for operation	20 - 85 %RH (no condensation)
Ambient temperature for storage	-20 - 65 °C (no condensation) (not subjected to direct sunlight) 80 °C for 72 hours
Ambient humidity for storage	20 - 85 %RH (no condensation)
Atmosphere for operation / storage	Indoors (not subject to direct sunlight) , Free from corrosive gases, flammable gases, oil mist, dust, flammables, grinding fluid
Insulation resistance	≥ 5 MΩ at 1,000 VDC
Dielectric strength	AC 1500 V for one minute across the primary and FG
Operating altitude	≤ 1,000 m
Vibration class	V15 (JEC 2121)
Vibration Resistance	49 m/s ² (5 G)
Impact Resistance	98 m/s ² (10 G)
Protective structure	IP65 (50 W - 750 W) , IP67 (1 kW - 2 kW)
Electric shock protection	Class I (Mandatory grounding)
Overvoltage category	II
Installation Environment	Pollution degree 2

Encoder Specifications

Item		Specifications	
Motor model		M□□□□□□□□N* *	M□□□□□□□□A* *
Resolution		Incremental 17 bit	Absolute 17 bit
Environmental requirements	Ambient operating temperature	0 - 85 °C	
	External disturbance magnetic field	±2 mT (20 G) or below	
Electrical specifications	Power supply	Voltage	DC 4.5 - 5.5V (Power supply ripple ≤ 5 %)
		Current consumption	160 mA typ. (Not including rush current)
	External battery	Voltage	— DC 2.4 - 4.2V
		Current consumption	— 10 μA typ. (*1)
	Multi-turn count		— 65,536 counts
	Maximum revolving speed		6,000 r/min
	Count-up direction		CCW (*2)
Communication specification	Transmission method		Differential transform
	Communication speed		Half-duplex asynchronous serial communication 2.5 Mbps

*1) Measurement conditions
room temperature, the motor not in motion, battery voltage of 3.6 V.

*2) CCW when viewed from the load side shaft end



Precautions

Using the motor with rotations of 180 degrees or less will reduce the encoder's rotational accuracy.

For a motor equipped with a brake, follow the brake voltage and polarity specifications.

If the brake voltage is less than 12V or the polarity is reversed, the encoder's rotational accuracy will be reduced.

Single-Axis Amplifiers

Rated output

50W
100W
200W
400W



Rated output

750W



Rated output

1kW



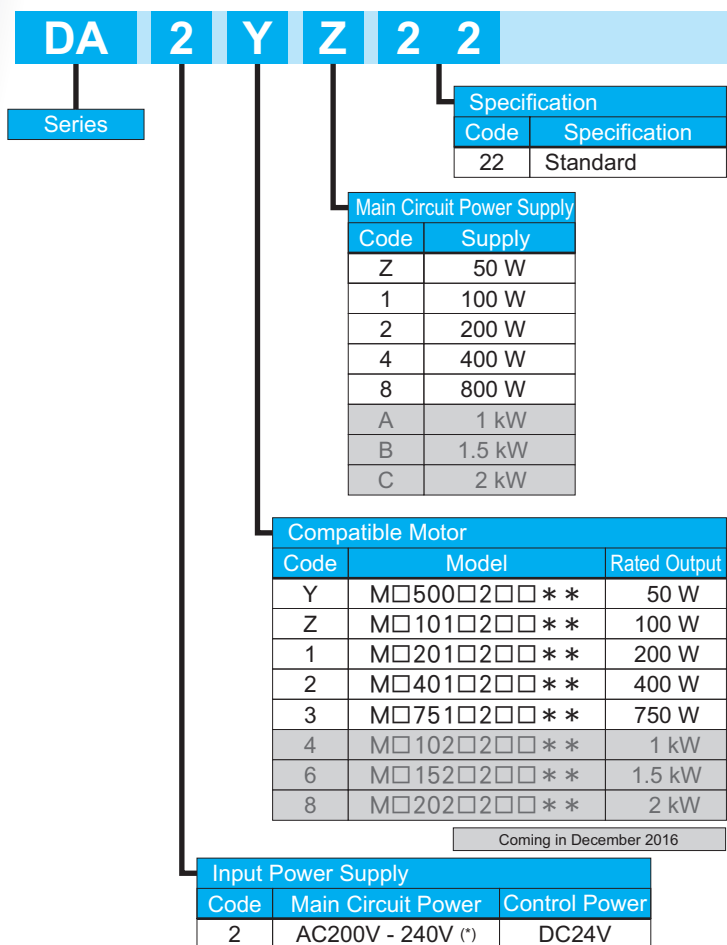
Rated output

1.5kW

2kW



Model Number Designation



(*) Single- or Three-phase option depends on compatible motor.
 50 W - 750 W : Single-phase
 1 kW : Single-phase/Three-phase
 1.5 kW, 2 kW : Three-phase

Amplifier/Motor Combinations

Rated Output	Amplifier Model	Motor Model
50 W	DA2YZ22	MM500□2□□ * *
100 W	DA2Z122	MM101□2□□ * *
200 W	DA21222	M□201□2□□ * *
400 W	DA22422	M□401□2□□ * *
750 W	DA23822	M□751□2□□ * *
1 kW	DA24A22	MM102□2□□ * *
1.5 kW	DA26B22	MM152□2□□ * *
2 kW	DA28C22	M□202□2□□ * *

Multi-Axis Main Amplifiers

Rated output

 50W
 100W
 200W
 400W
 750W

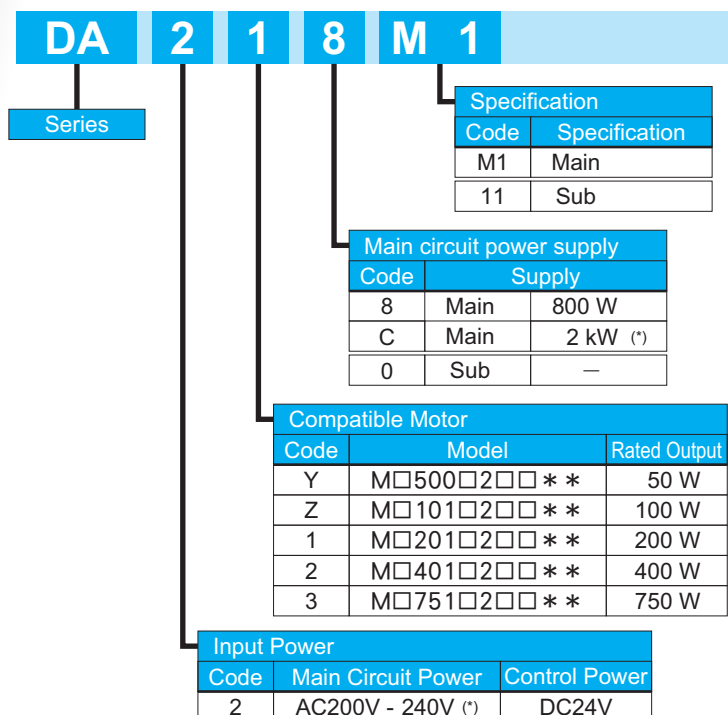

Main circuit power supply 800 W

Rated output

 50W
 100W
 200W
 400W
 750W


Main circuit power supply 2 kW

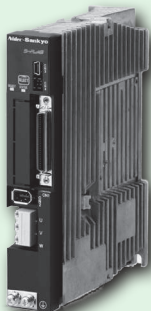
Model Number Designation



(*) Single-phase can be used for main circuit power where total output of the connecting motors is up to 1 kW. Use three-phase for 1 kW or above.

Multi-Axis Sub Amplifier

Rated output

 50W
 100W
 200W


No main circuit power supply

Rated output

 400W
 750W


No main circuit power supply

Combination of the Amplifier and the Motor

Main circuit power supply	Rated output	Amplifier model	Motor model
800 W	50 W	DA2Y8M1	MM500□2□□ * *
	100 W	DA2Z8M1	MM101□2□□ * *
	200 W	DA218M1	M□201□2□□ * *
	400 W	DA228M1	M□401□2□□ * *
	750 W	DA238M1	M□751□2□□ * *
2 kW	50 W	DA2YCM1	MM500□2□□ * *
	100 W	DA2ZCM1	MM101□2□□ * *
	200 W	DA21CM1	M□201□2□□ * *
	400 W	DA22CM1	M□401□2□□ * *
	750 W	DA23CM1	M□751□2□□ * *
—	50 W	DA2Y011	MM500□2□□ * *
	100 W	DA2Z011	MM101□2□□ * *
	200 W	DA21011	M□201□2□□ * *
	400 W	DA22011	M□401□2□□ * *
	750 W	DA23011	M□751□2□□ * *



Single-Axis Amplifiers

Item		Specifications							
Model		DA2YZ22	DA2Z122	DA21222	DA22422	DA23822	DA24A22	DA26B22	DA28C22
Compatible Motor		M□500	M□101	M□201	M□401	M□751	M□102	M□152	M□202
External dimensions		(See "Dimensions" beginning on page 32.)							
Weight (Kg)		0.7				0.8	1.0	1.6	
Input power	Main circuit power	Single-phase AC200V - 240V ± 10 % 50 / 60 Hz					Three-phase AC200V - 240V ± 10 % 50 / 60 Hz		
	Control power	DC24V ±10 %							
	Control power Current Consumption (mA Typ.)	170			210	260	350		
		(Rush current apprpx.1.4 A)							
Control type		Three-phase PWM inverter sine-wave driven							
Output Rating	Rated current (A)	0.7	1.0	1.7	2.7	4.3	5.6	9.9	12.2
	Output frequencies (Hz)	0 - 400		0 - 333		0 - 300	0 - 250		

Multi-Axis Amplifiers

Item			Specifications				
Model	Main circuit power supply	-	DA2Y011	DA2Z011	DA21011	DA22011	DA23011
		800 W	DA2Y8M1	DA2Z8M1	DA218M1	DA228M1	DA238M1
		2 kW	DA2YCM1	DA2ZCM1	DA21CM1	DA22CM1	DA23CM1
Compatible motor			M□500	M□101	M□201	M□401	M□751
External dimensions			(See "Dimensions" beginning on page 34.)				
Weight (Kg)			0.7				0.8
Input power	Main circuit power (*)		Single-phase (800 W) or Three-phase (2 kW) AC200V - 240V ±10 % 50 / 60 Hz				
	Control power		DC24V ± 10 %				
	Control power Current Consumption (mA Typ.)	170			210		260
		(Rush current apprpx.1.4 A)					
Control type			Three-phase PWM inverter sine-wave driven				
Output Rating	Rated current (A)		0.7	1.0	1.7	2.7	4.3
	Output frequencies (Hz)		0 - 400		0 - 333		0 - 300

*) Sub amplifiers do not require main circuit power supply.

Basic Specifications of Single-Axis and Multi-Axis Amplifiers

Item		Specifications
Encoder feedback		17 bit single-turn absolute (The product can function as a multi-turn absolute type when batteries are added.)
Control signal	Input	8-point (24 VDC system, photo-coupler input insulation) inputs whose functions are switched by the control mode
	Output	8-point (24 VDC system, open-collector output insulation) outputs whose functions are switched by the control mode
Analog signal	Input	1-point (± 10 V) input whose functions can be switched by the control mode
Pulse signal	Input	RS-422 differential Open-collector
	Output	Encoder feedback pulse (A-/B-/Z-phase), RS-422 differential output Z-phase pulse through open-collector as well
Communication function		USB : connection to PC with "S-TUNE" installed RS-485 : host remote control communication (multi-drop compatible)
Amplifier status display function		Amplifier status display function 6 digits of seven-segment display on Setup Panel Normal/Error display on STATUS LED Green light when Power ON Normal, Red light when Power ON Error, Dim when Power OFF
Regeneration function		A regenerative resistor may be installed externally
Dynamic brake		None Only the model DA2□□22 can have a dynamic brake unit "AP03101" attached externally.
Control mode		Position control, Speed control, Torque control

Environmental Specification of Single-Axis and Multi-Axis Amplifiers

Item		Specifications
Ambient temperature	For operation	0 - 55°C
	For storage	-20 - 65°C
Ambient humidity	For operation	$\leq 20 - 85\%$ RH (no condensation)
	For storage	
Atmosphere for operation and storage		Indoors (not subject to direct sunlight); free from corrosive gases, flammable gases, oil mist, or dust
Altitude		$\leq 1,000$ m
Vibration		≤ 5.8 m/s ² (0.6 G) 10 - 60 Hz (no continuous operation allowed at frequency of resonance)
Dielectric strength		1AC 1,500 V for one minute across the primary and FG
Electric shock protection		Class I (mandatory grounding)
Overvoltage category		II
Installation Environment		Pollution degree 2

Single-Axis Amplifiers, Multi-Axis Amplifiers, Common Functions

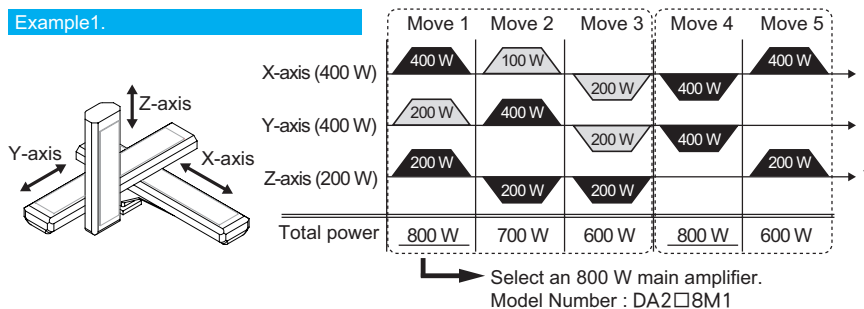
Item			Specifications
Position Control Mode	Pulse input	Control input	Servo ON, alarm reset, command input not allowed, emergency stop, deviation counter clear, 2-stage torque limit, CCW/CW run not allowed, ABS data demand, homing start
		Control output	under torque limit Alarm status, servo status, servo ready, under torque limit, brake release, positioning complete, motion complete, alarm, dynamic brake release, ABS data transmitting, homing complete
		Maximum command pulse frequency	RS -422 differential: 4 Mpps Open-collector: 200 kpps
		Input pulse signal form	Pulse + Direction, A-/B-phase quadrature encoder pulse, CW + CCW pulse
		Command pulse-paired ratio	ratio A/B $1/1,000 < A/B < 1,000$ Setting range A : 1 - 65,535 B : 1 - 65,535
	Internal position	Control input	Servo ON, alarm reset, deviation counter clear, motion start point selection 16, home position sensor input, homing start
		Control output	Alarm status, servo status, servo ready, under torque limit, brake release, homing complete, motion complete
		Operation mode	Point table, communication operation
	Smoothing filter		FIR Filter
	Damping control		Enabled
Speed control mode	Analog speed	Control input	Servo ON, alarm reset, command input inhibit (zero torque command), 2-stage torque limit, CCW/CW run prohibited
		Control output	Alarm status, servo status, servo ready, under torque limit, brake release
		Speed command input	Input voltage -10 V - +10 V (max speed is reached at ± 10 V)
	Internal speed	Control input	Servo ON, alarm reset, start 1 (CCW), start 2 (CW), 8-stage speed command 2-stage torque limit
		Control output	Alarm status, servo status, servo ready, under torque limit, brake release
	Smoothing filter		IIR Filter, FIR Filter
Torque Control Mode	Analog torque	Control input	Servo ON, alarm reset, command input not allowed (zero clamp command) 2-stage torque limit, CCW/CW run prohibited
		Control output	Alarm status, servo status, servo ready, under torque limit, brake release
		Torque command input	Input voltage, -10 V - +10 V (max speed is reached at ± 10 V)
	Smoothing filter		IIR Filter
Common Features	Speed observer		Available
	Auto-tuning		Available
	Encoder output Division/Multiplication		Available
	Tuning & Function Setup		Available through the S-FLAG setup software "S-TUNE" Tuning with the setup panel on the amplifier front side
	Protective functions	By hardware	Overvoltage, low voltage, Overcurrent, Abnormal temperature, Overload, Encoder error
		By software	Overspeed, Position deviation too high, Parameter errors
	Alarm Log		Can be referenced with the setup software S-TUNE

Determining Power Supply Capacity of a Multi-Axis Amplifier

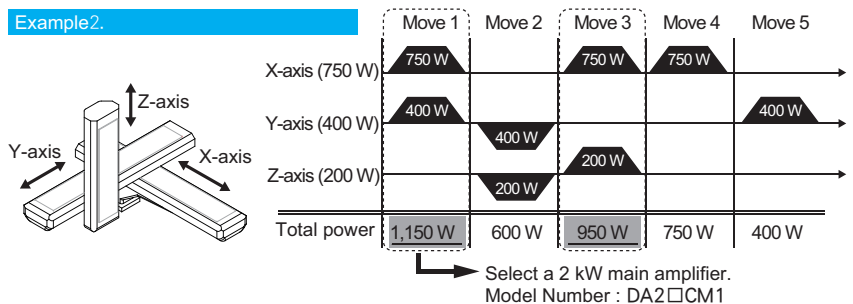
Determine the power supply capacity of the main amplifier using the following guideline.

1. Capacity larger than the total motor output of all axes.
2. At least the maximum overall consumption voltage derived from motion profiles.
Example 1 (Move 1 - 3)
3. At least the maximum total power output of the axes which become powering-state simultaneously.
Example 1 (Move 4 - 5) and Example 2

Example1.



Example2.



1. Maximum power supply capacity

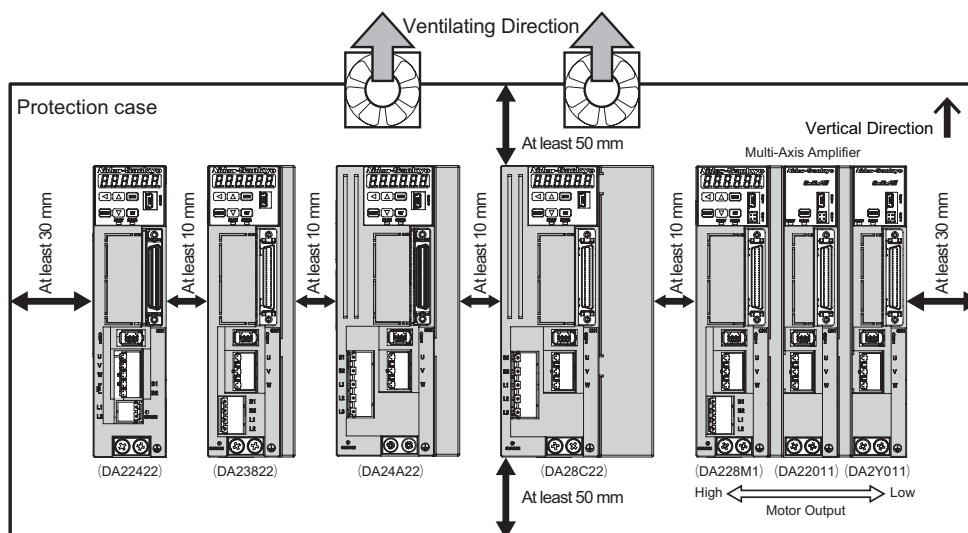
The max capacity of the main amplifier is 2kW. If you need higher than 2kW, build another multi-axis system.

2. Regenerative resistor for a multi-axis amplifier

Main amplifiers are loaded with a high-capacity smoothing condenser. Please check regenerative state.

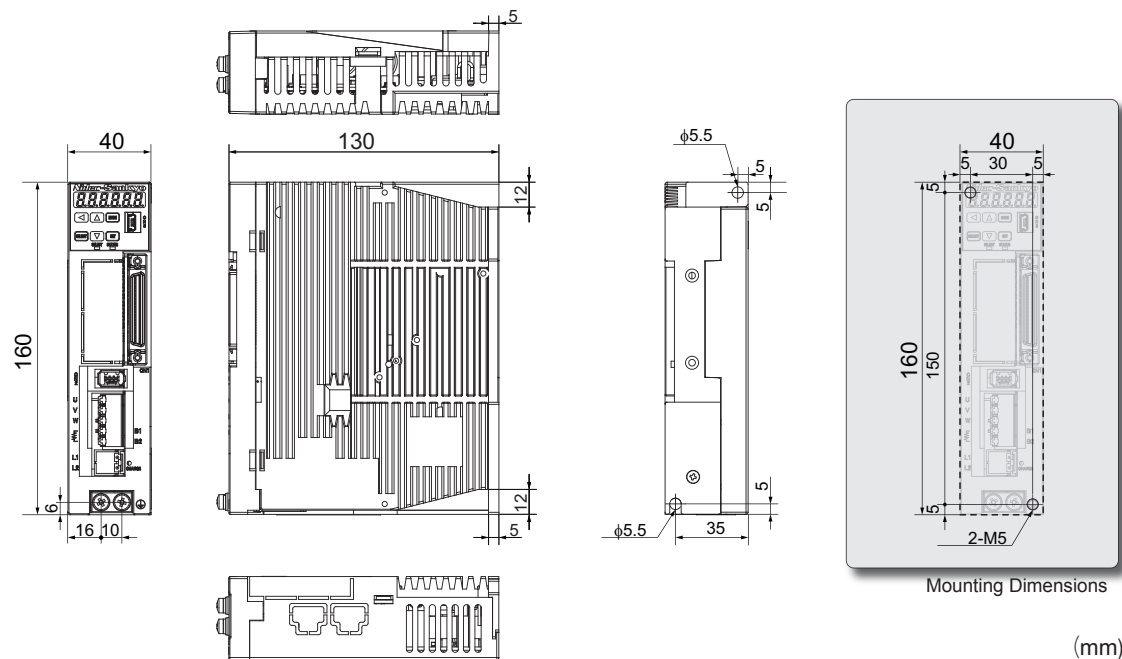
- You may not need a regenerative resistor.
- You may suppress heat generation from the regenerative resistor.

Installing Amplifiers

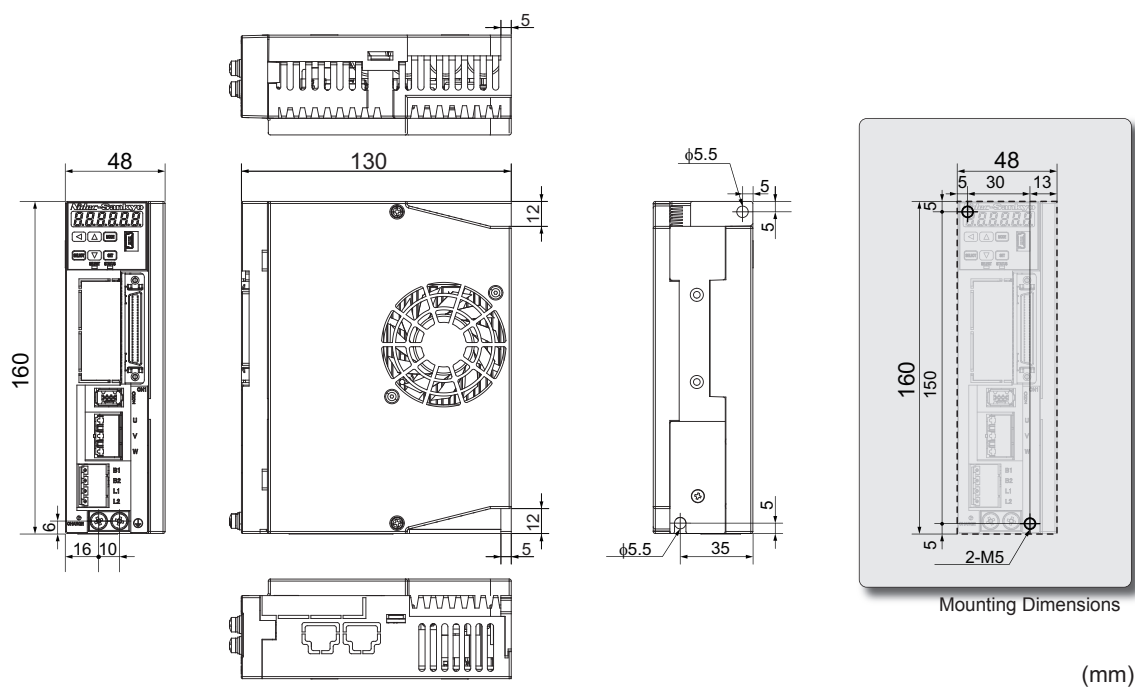


- Mount amplifiers vertically with M5 bolts at two fixing holes for 50 W to 750 W and three for 1 kW to 2 kW each.
- When mounting amplifiers to enclosure (e.g., a protection case), use a cooling fan or a cooler, so that the ambient temperature of each circuit board installed inside will not rise above 55 °C.
- The surface temperature of a heat sink could rise 30 °C higher than ambient temperatures.
- Wiring materials must be heat-resistant. Heat sensitive devices and wires must be installed away from the amplifier.
- The service life of the amplifiers is determined by the ambient temperature of the internal electrolytic capacitor.
Electrolytic capacitors have service life of approximately 5 to 6 years when used under the following conditions: the annual average temperature of 30 °C, the load rate of 80 %, and the average daily operation of up to 20 hours.

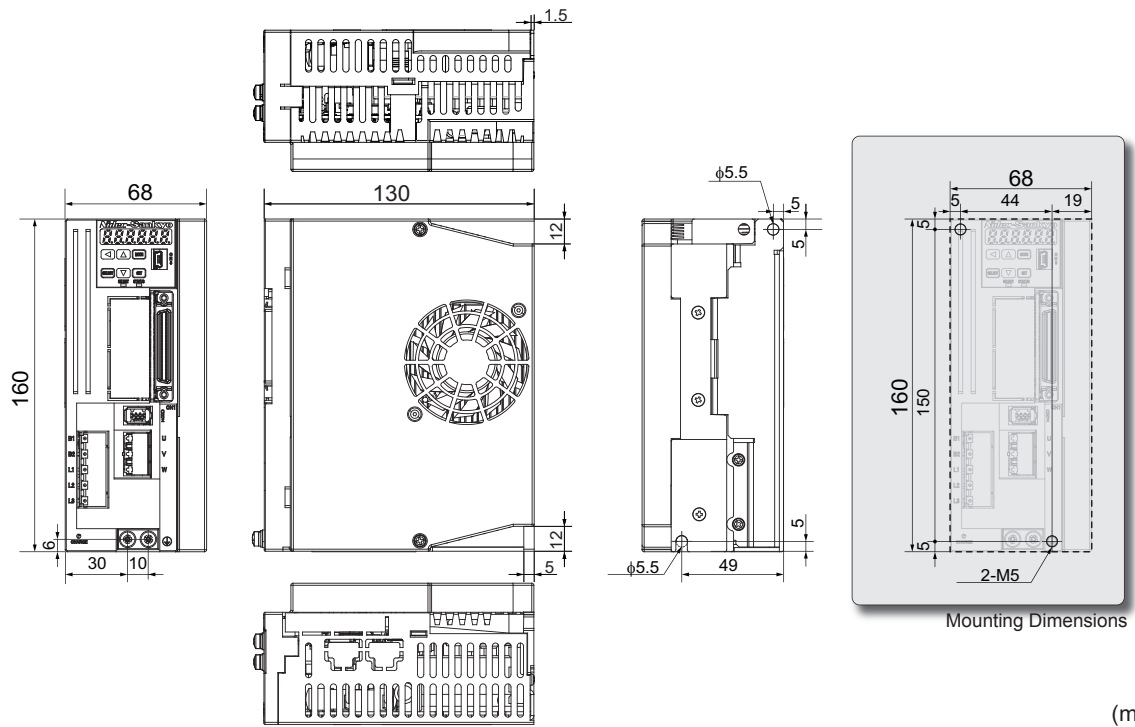
Single-Axis Amplifiers 50 W - 400 W (DA2YZ22, DA2Z122, DA21222, DA22422)



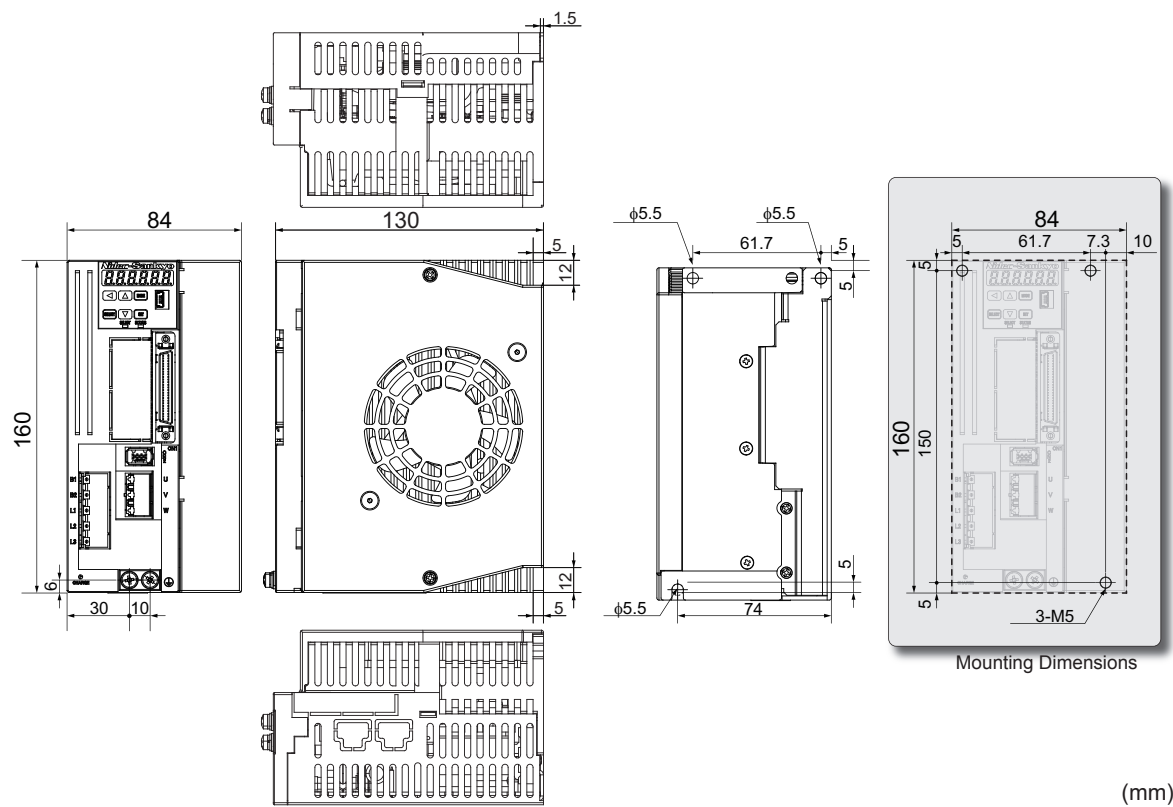
Single-Axis Amplifiers 750 W (DA23822)



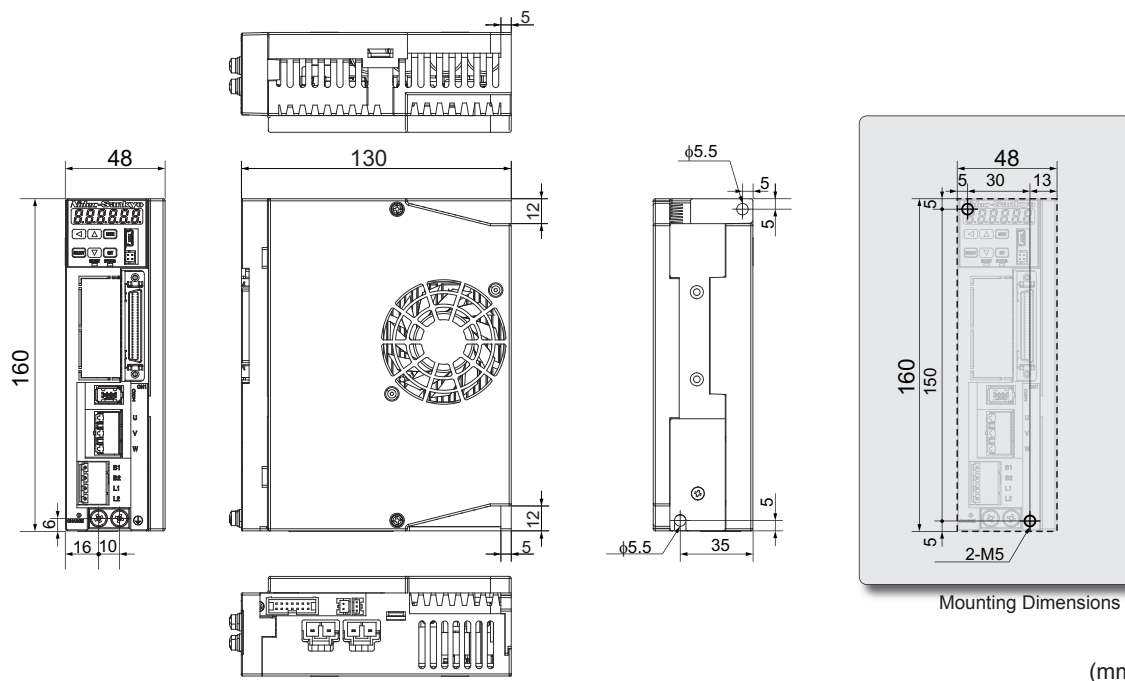
Single-Axis Amplifiers 1 kW (DA24A22)



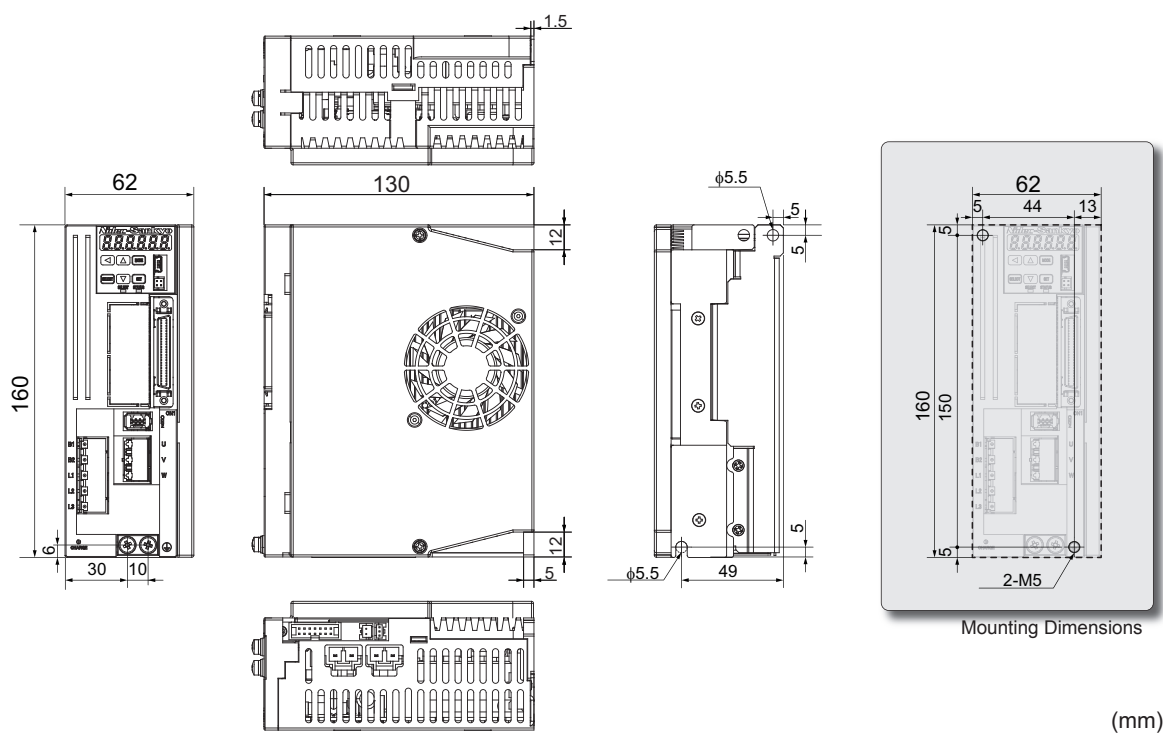
Single-Axis Amplifiers 1.5 kW, 2 kW (DA26B22, DA28C22)



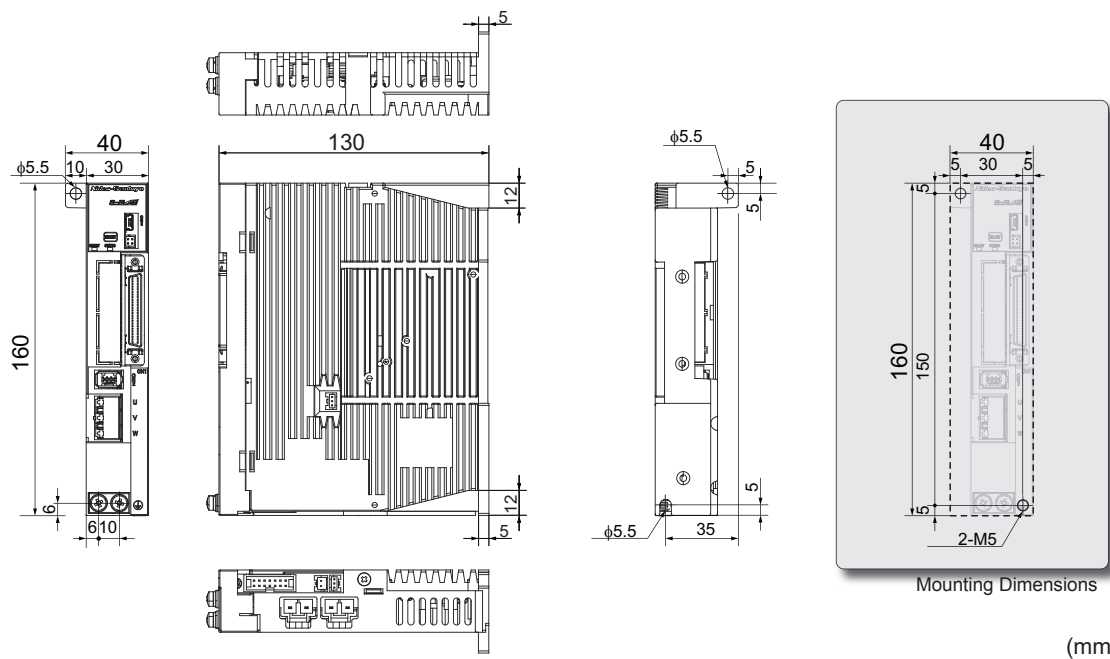
Multi-Axis Main Amplifiers 50 W - 750 W (DA2 □ 8M1) Main circuit power supply 800 W



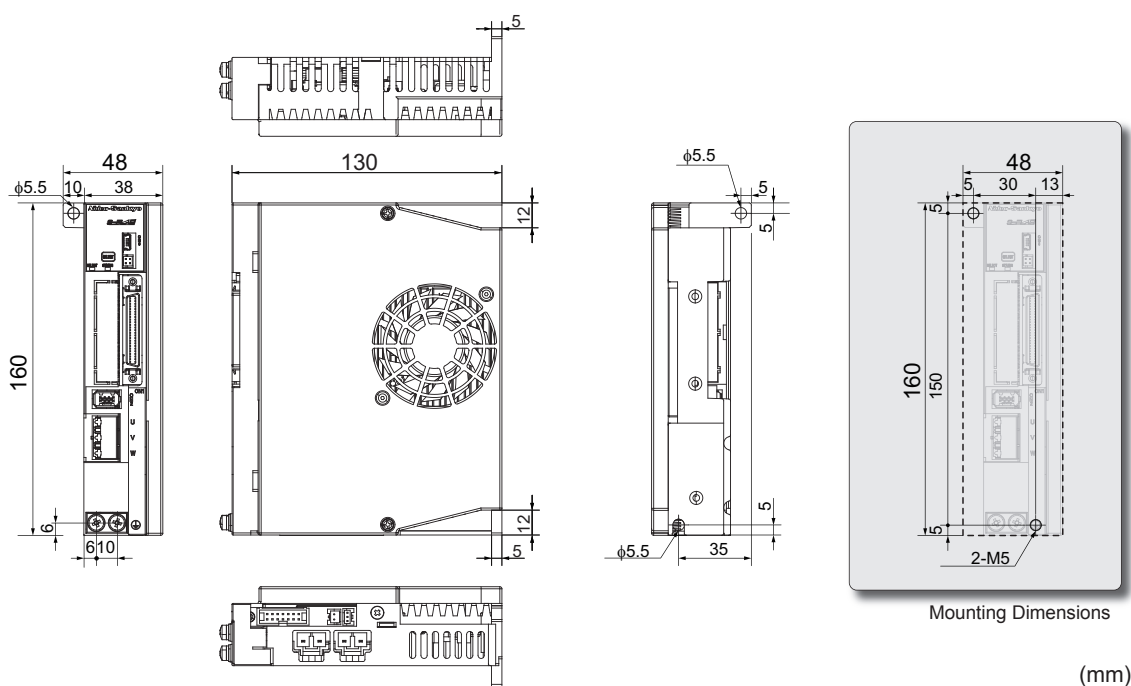
Multi-Axis Main Amplifiers 50 W - 750 W (DA2 □ CM1) Main circuit power supply 2 kW



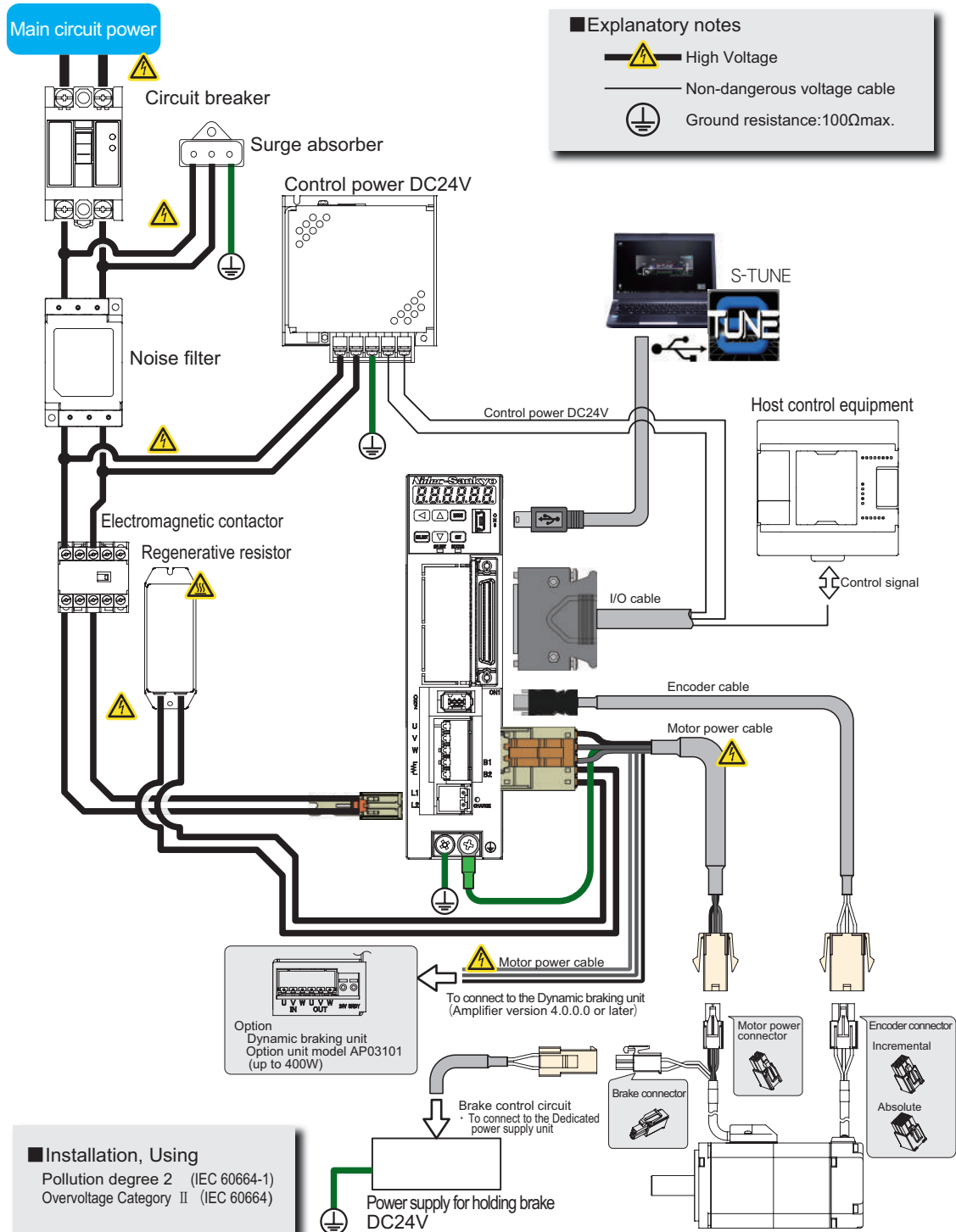
Multi-Axis Sub Amplifiers 50 W - 200 W (DA2Y011, DA2Z011, DA21011)



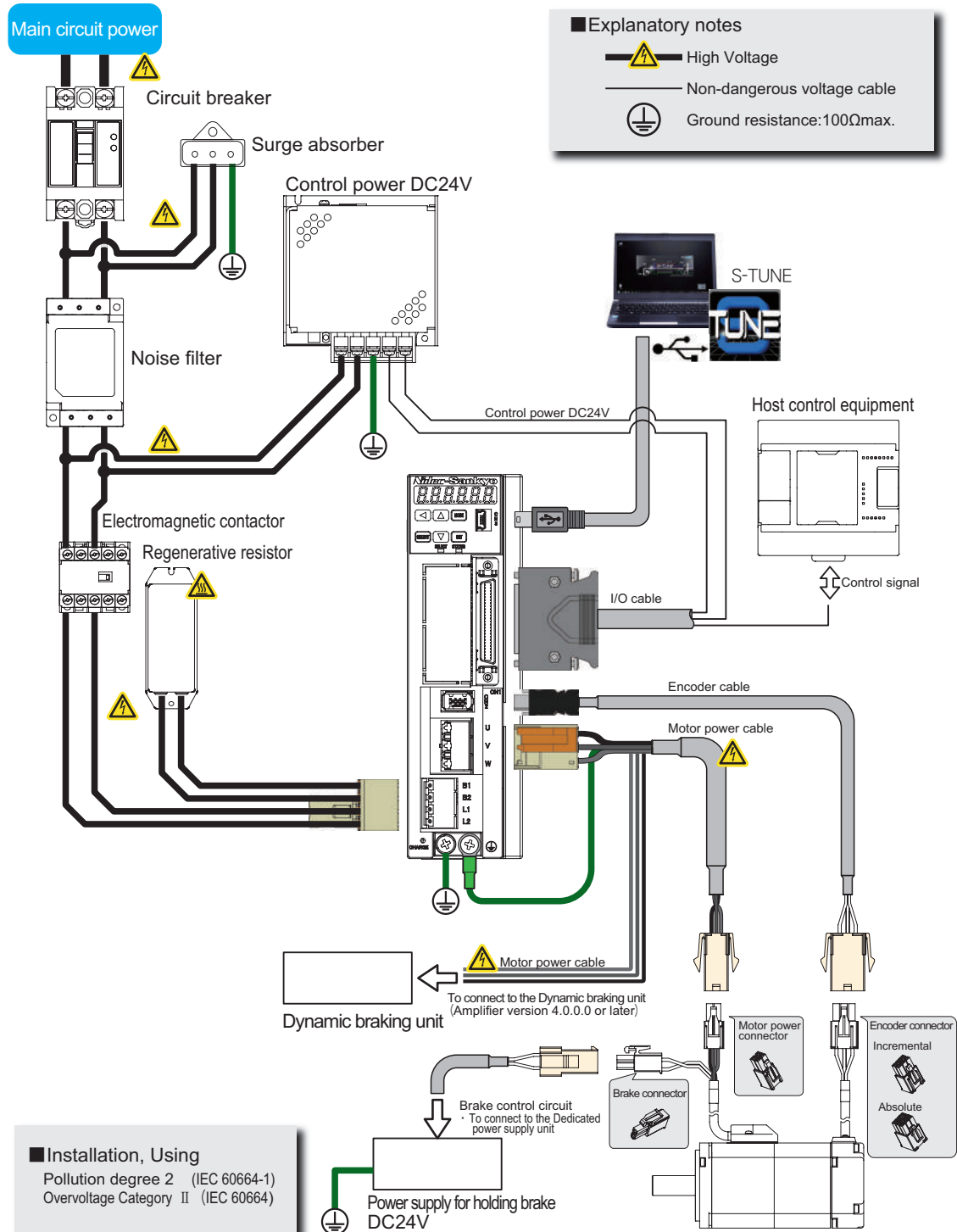
Multi-Axis Sub Amplifiers 400 W, 750 W (DA22011, DA23011)



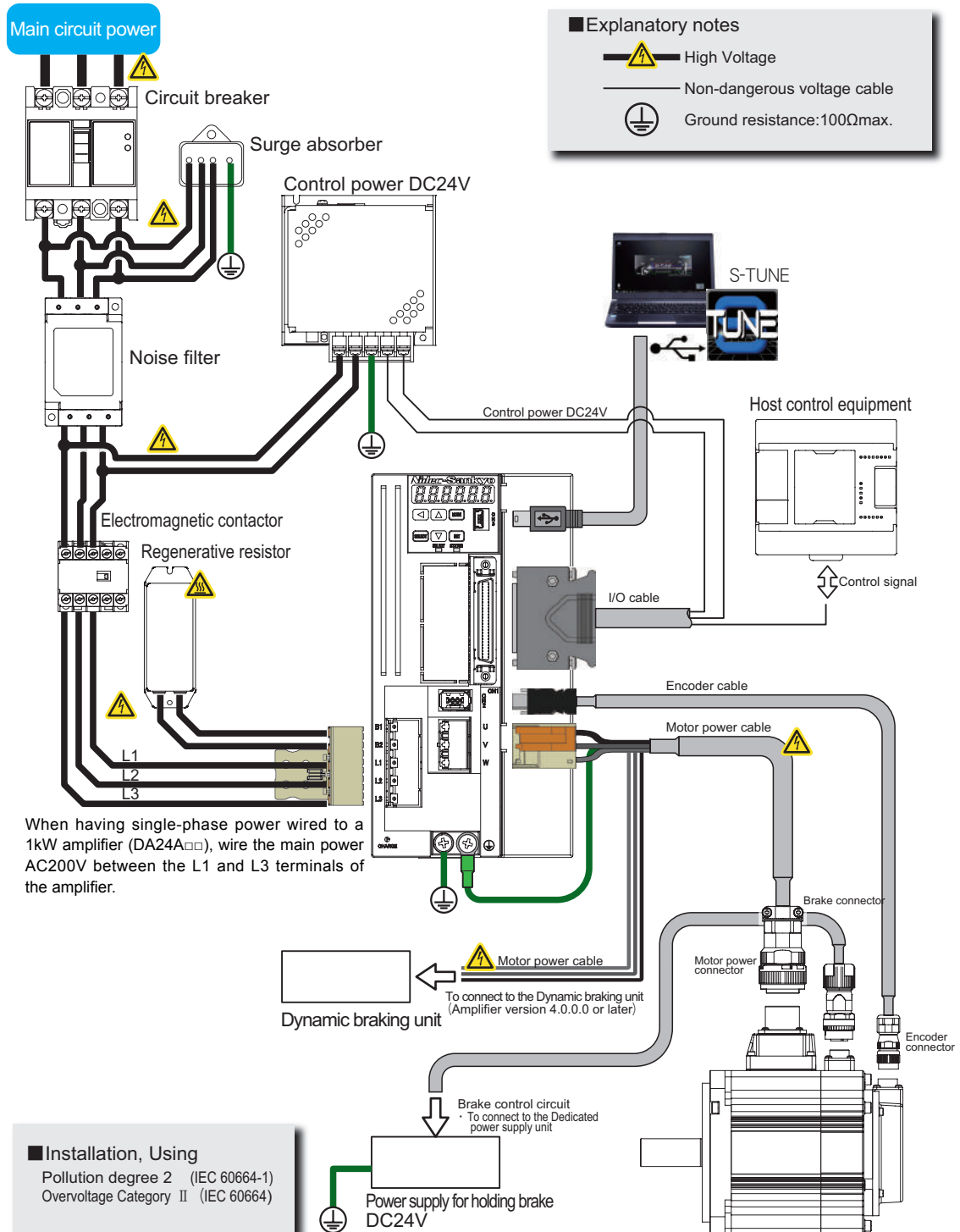
Single-Axis Amplifiers 50 W - 400 W



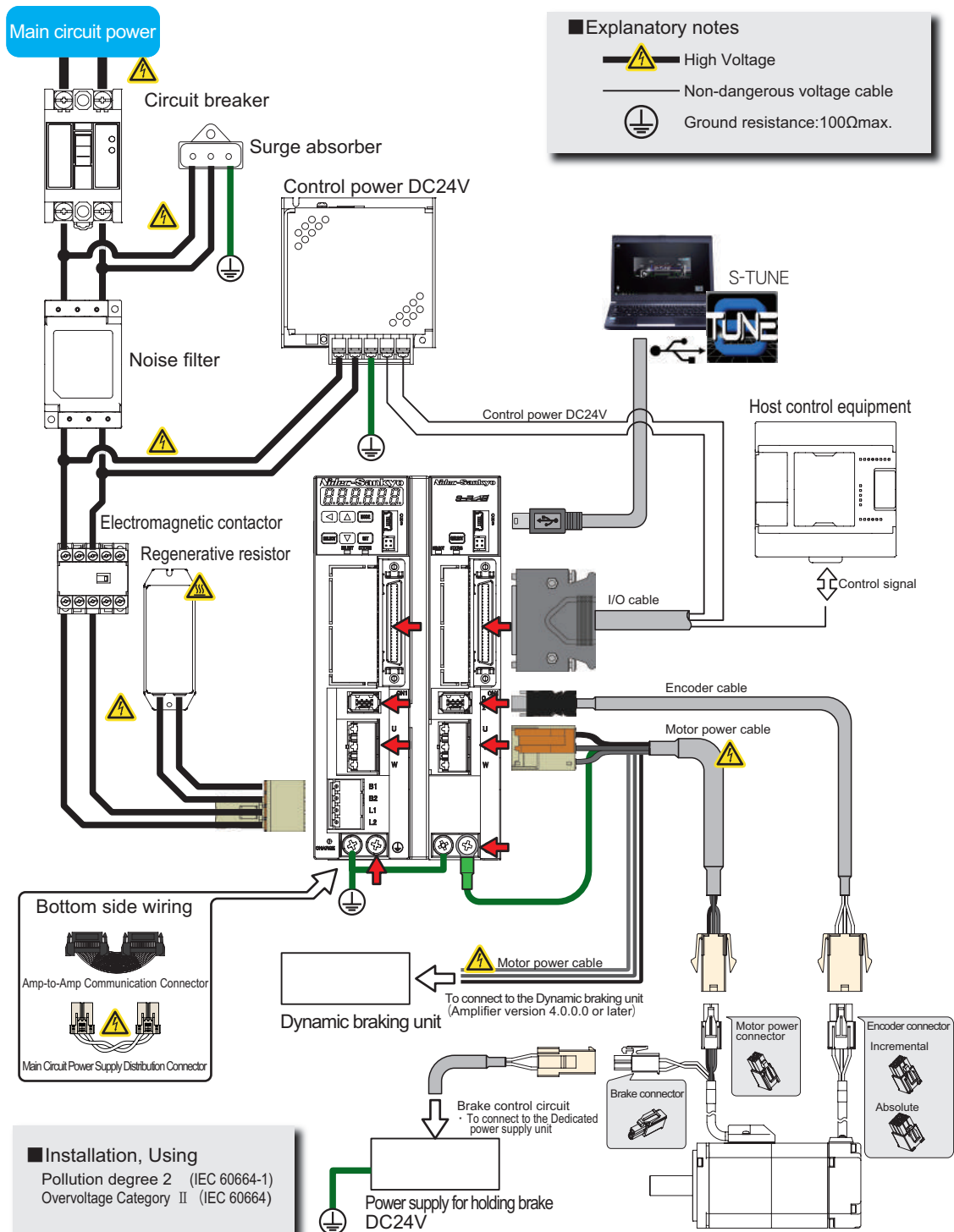
Single-Axis Amplifiers 750 W



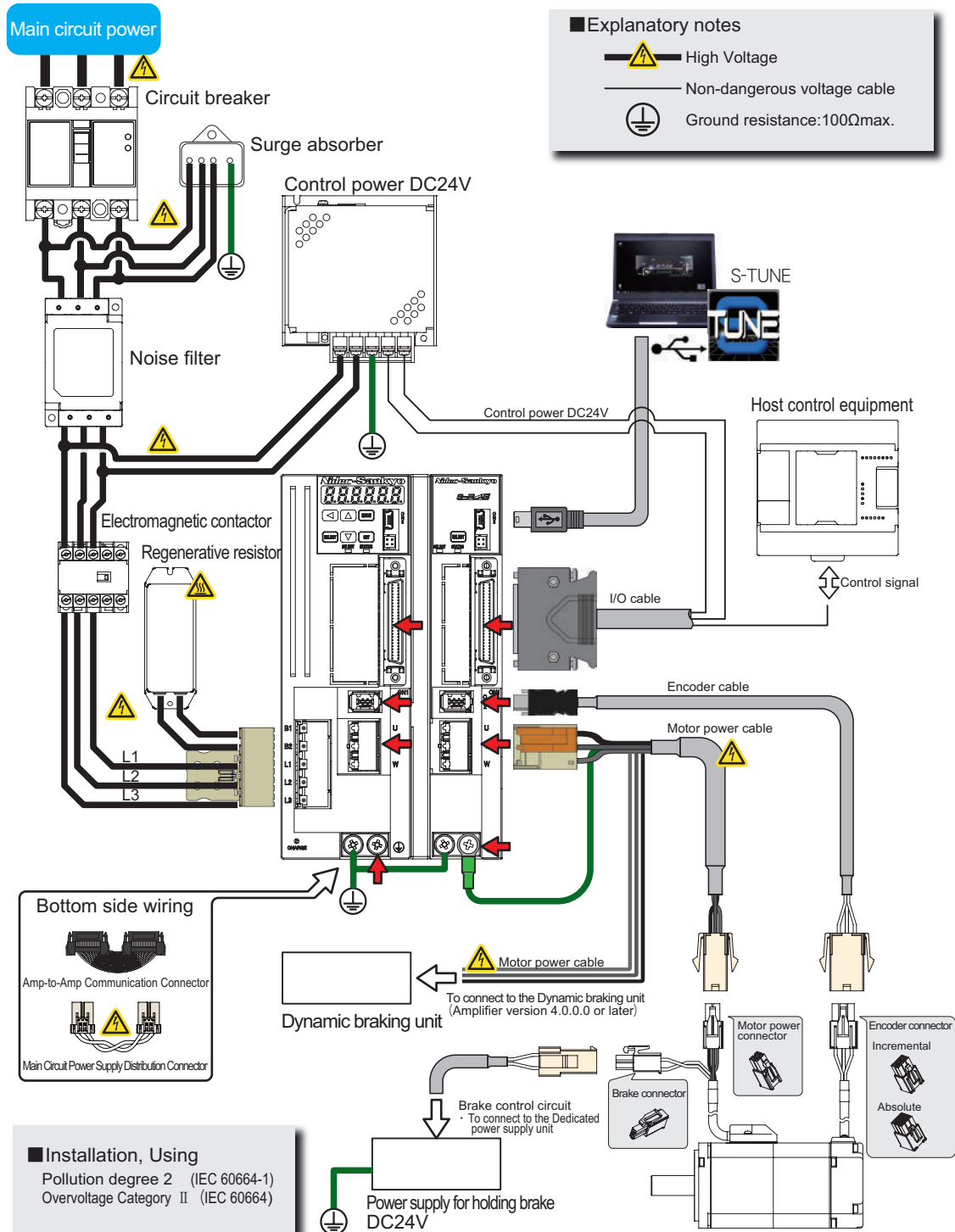
Single-Axis Amplifiers 1 kW - 2 kW



Multi-Axis Main circuit power supply 800W



Multi-Axis Main circuit power supply 2 kW



If total power capacity (of amplifiers) is not more than 1kW, you can use single-phase power. When using single-phase, connect the main power supply to L1 and L3.

Peripherals

To make your applications of our product comply with the European EC directives, select devices that meet each applicable standard and install them observing the wiring diagram.

Item	Description
Main circuit power	Please use this product in the power supply environment of Over-Voltage Category II defined by IEC60664-1. This is the primary circuit power for amplifiers. 50 W - 750 W Amplifiers : Single-phase AC200V-10 % - AC240V+10 % 1 kW - 2 kW Amplifiers : Three-phase AC200V-10 % - AC240V+10 % Using an overvoltage protection relay is recommended. - When having single-phase power wired to a 1kW+ amplifier, wire the primary circuit AC200V between the L1 and L3 terminals of the amplifier. - To avoid unbalance of the three-phase AC200V wiring in your factory, we recommend that you consider balance of currencies in your three-phase wirings. - Confirm that your contract with the electric power company is not limited to use of three-phase.
Control power	This is power supply of DC24V±10% for amplifier control power, I/O power and motor brake release power. Use a SELV (Safety Extra Low Voltage) power supply with reinforced insulation against hazardous voltages. Be sure to connect a varistor to the motor braking release power supply.
Cables	UL wires and cables are recommended. High-voltage cables and FG cables AWG18 / 600 V breakdown voltage or equivalent for 50 W to 750 W AWG14 / 600 V breakdown voltage or equivalent for 1 kW to 2 kW Motor power cables AWG18 / 300 V breakdown voltage or equivalent for 50 W to 750 W AWG14 / 300 V breakdown voltage or equivalent for 1 kW to 2 kW Encoder cables - AWG22 and AWG24 compound / 30 V breakdown voltage or equivalent - shielded cables with twisted pair wires - length not exceeding 20 m User I/O cable - AWG26 / 300 V breakdown voltage or equivalent - shielded cables with twisted pair wires - length not exceeding 2 m
Circuit breaker	To protect the power supply line, circuit breakers shut the circuit down in the event of over-current. Be sure to use an IEC standard and UL-certified circuit breaker between the power supply and the noise filter. To ensure compliance with EMC, use an earth leakage circuit breaker that we recommend.
Noise filter	Noise filters prevent ingress of external noise from the power supply line. To ensure compliance with EMC, use the recommended noise filter.
Electromagnetic contactor	This is an on/off switch for the main power supply. Use a surge absorber on the input side of the primary circuit power supply.
Surge absorber	To ensure compliance with EMC, connect the recommended surge absorber to the primary side of primary circuit power supply.
Signal line noise filter/ferrite core	To ensure compliance with EMC, use the recommended signal line noise filter/ferrite core.
Regenerative resistor	This product is not equipped with regenerative resistor. If the smoothing capacitor inside the servo amplifier cannot absorb regenerative power, an external regenerative resistor is required. As a guideline, check the regeneration state on the settings panel, and use a regenerative resistor if the regenerative warning is ON. Build an overheating prevention circuit using a resistor which has built-in thermostat. If the temperature of generated heat becomes high, you can suppress the heat by installing a cooling device, or selecting a resistor whose allowable power is 5 to 10 times larger than regenerative voltage.
Dynamic brake	This product is not equipped with a dynamic brake feature. Use our optional product (Model: AP03101). Use for motors of up to 400 W. Use the circuit example on the right side when building a dynamic brake circuit. Select a cement resistor of 6.8Ω 10W. Select coil surge protection relays with diode. For wiring with the motor power line, UL wires (AWG18 / 600 V or equivalent) are recommended. Example of Dynamic Brake Circuit
Grounding	Since this product is Class I device, protective grounding is mandatory. (Type D grounding: grounding resistance of up to 100 Ω) Properly ground the product using protective grounding terminals through EMC-compatible casing and control panel.

Recommended Peripheral Devices

Device	Manufacturer	Model	Note
Circuit breaker	Fuji Electric Co Ltd	Single-phase EW32AAG-2P020B Three-phase EW32AAG-3P020B	20 A for single-phase or three-phase 200 V (*) Leakage current of 30mA, Equivalent products are acceptable.
Noise filter	OKAYA Electric Industries Co Ltd	Single-phase SUPF-EX □□ -ER-6 Three-phase 3SUPF-BE □□ -ER-6- □	Was used in the EMC testing for our product (*)
Magnetic contactor	Fuji Electric Co Ltd	SK06G-E10	Or equivalent alternatives.
Surge absorber	OKAYA Electric Industries Co Ltd	Single-phase LV275DI-Q4 Three-phase LV275DI-U4	Was used in the EMC testing for our product
Signal line noise filter /ferrite core	Seiwa Electric (Misumi)	E04SR401938 (ATCK-1130)	Was used in the EMC testing for our product
Regenerative resistor	Chiba Techno Co., Ltd.	For 50 W - 750 W CAN100S 47ΩJ For 1 kW, 1.5 kW CAN300S 30ΩJ For 2 kW CAN300S 20ΩJ	—

*) Select a product whose ratings are suitable for your system configuration.

Regenerative resistor

When considering a regenerative resistor other than the recommended above, use the following as a guideline.

Amplifier Model	DA2YZ	DA2Z1	DA212	DA224	DA238	DA24A	DA26B	DA28C
Compatible Motor	M□ 500	M□ 101	M□ 201	M□ 401	M□ 751	M□ 102	M□ 152	M□ 202
Rated output	50 W	100 W	200 W	400 W	750 W	1 kW	1.5 kW	2 kW
Regeneration resistance	40 Ω - 50Ω					30 Ω		20 Ω
Regeneration allowable voltage	20 W					40 W		60 W

The regeneration resistance values do not guarantee the optimal performance. Regeneration allowable voltages above are minimum values as a point of reference. If the generated heat becomes too hot, select a resistor whose allowable voltage is 5 to 10 times larger than mentioned above. For multi-axis in which simultaneous regenerations from multiple amplifiers are expected, use the above table to determine a regenerative resistor suitable for the total rated output power of corresponding motors.

Recommended Cables

Connection cables required for this product are sold separately.

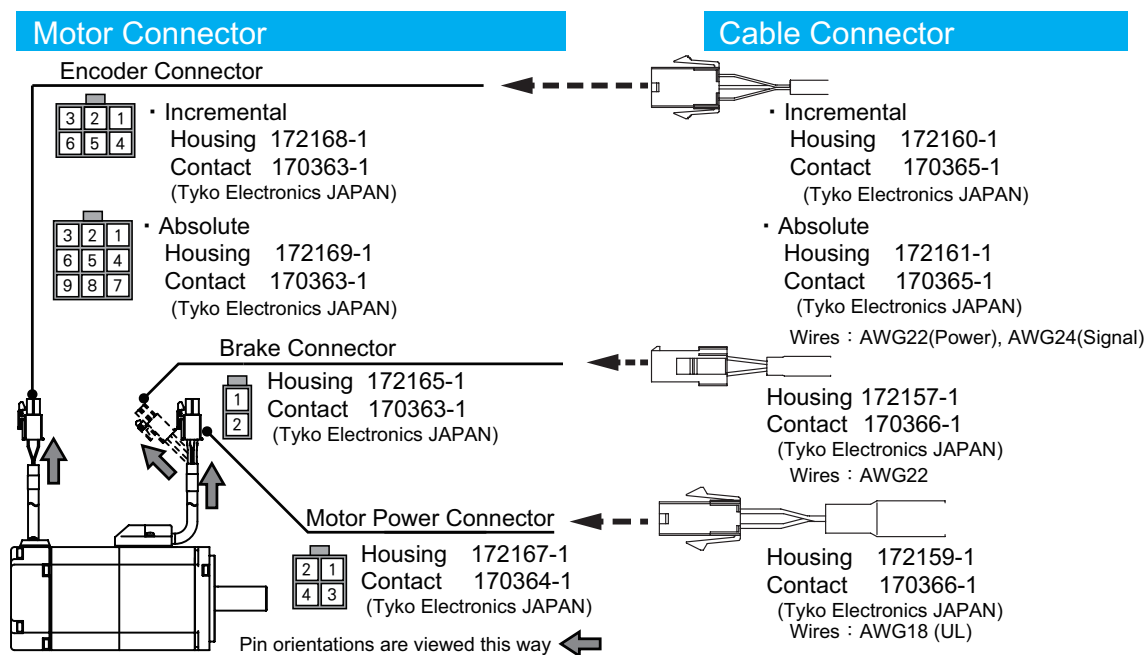
Those can be purchased at the Misumi Corporation online store. Follow the link at our website:

URL : <http://www.nidec-sankyo.co.jp>

Use our recommendations below to select cables based on your actual usage. (Equivalent alternatives are also good).

Cable Name	AWG	UL	Temperature Rating	Voltage Rating	Note
Motor power (≤ 750 W)	18	2517	105 °C	300 V	
Motor power (≥ 1 kW)	14	2517	105 °C	300 V	AWG16 wires can be used only for 1 kW motors
Main circuit power (≤ 750 W) (Including FG cable)	18	1015	105 °C	600 V	
Main circuit power (≥ 1 kW) (Including FG cable)	14	1015	105 °C	600 V	AWG16 wires can be used only for 1 kW motors.
Encoder	Power : 22 Signal : 24	20276	80 °C	30 V	5 pairs (10 cores) Shielded twisted pair cables of length no exceeding 20 m
User I/O	26	1007	80 °C	300 V	Shielded twisted pair cables Length not exceeding 2 m is recommended
Regenerative resistor	18	1015	105 °C	600 V	
Dynamic brake	18	1015	105 °C	600 V	
Brake	18	2517	105 °C	300 V	1 pair (2 cores)
Primary circuit power distribution cable	16	1015	105 °C	600 V	Only for multi-axis amplifiers Included in the sub-amplifier package
Inter-amplifier communication cable	28	2651	105 °C	300 V	Only for multi-axis amplifiers

Motor 50 W – 750 W



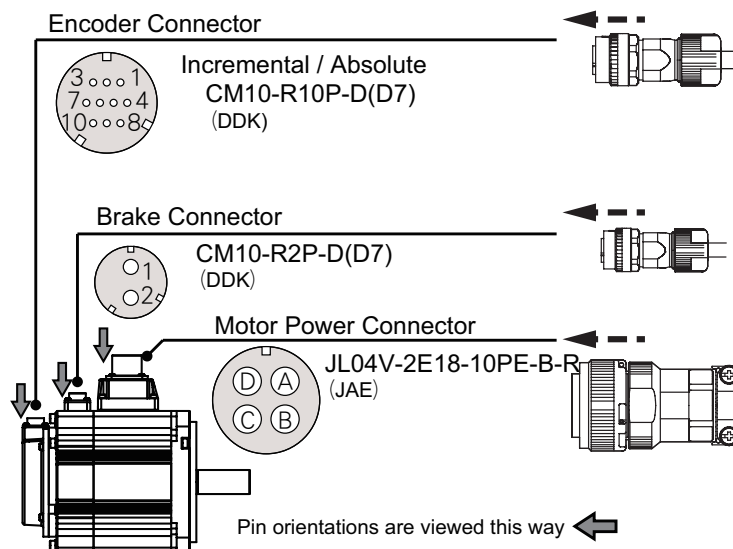
Name	Pin No.	Signal	Description
Motor Power	1	U	Motor power U-phase
	2	V	Motor power V-phase
	3	W	Motor power W-phase
	4	FG	Motor frame ground
Brake (*1)	1	BRK+	Brake power supply DC24V
	2	BRK-	Brake power supply GND
Encoder (Incremental)	1	—	(NC)
	2	+D	Serial communication data +Data
	3	-D	Serial communication data -Data
	4	VCC	Encoder power supply +5V
	5	SG	Signal ground
	6	SHIELD	Shield
Encoder (Absolute)	1	BAT	External battery (*2)
	2	—	(NC)
	3	SHIELD	Shield
	4	+D	Serial communication data +Data
	5	-D	Serial communication data -Data
	6	—	(NC)
	7	VCC	Encoder power supply +5V
	8	SG	Signal ground
	9	—	(NC)

*1) Only for a motor equipped with a brake

*2) Connect the negative pole of the battery to SG (Signal Ground).

Motor 1 kW – 2 kW

Motor Connector



Cable Connector

Incremental / Absolute
 Straight Plug CM10-SP10S-□-D
 Right Angle Plug CM10-AP10S-□-D
 (DDK) □: S, M or L
 Wires : AWG22(Power), AWG24(Signal)

Straight Plug CM10-SP2S-□-D
 Right Angle Plug CM10-AP2S-□-D
 (DDK) □: S, M or L
 Wires : AWG18

Straight Plug JL04V-6A18-10SE-EB-R
 Right Angle Plug JL04V-8A18-10SE-EB-R
 (JAE)
 Wires : AWG14 (UL)

Name	Pin No.	Signal	Description
Motor Power	A	U	Motor power U-phase
	B	V	Motor power V-phase
	C	W	Motor power W-phase
	D	FG	Motor frame ground
Brake (*1)	1	BRK+	Brake power supply DC24V
	2	BRK-	Brake power supply GND
Encoder (Incremental)	1	VCC	Encoder power supply +5V
	2	SG	Signal ground
	3, 4	—	(NC)
	5	+D	Serial communication data +Data
	6	-D	Serial communication data -Data
	7, 8, 9	—	(NC)
	10	SHIELD	Shield
Encoder (Absolute)	1	VCC	Encoder power supply +5V
	2	SG	Signal ground
	3	—	(NC)
	4	BAT	External battery (*2)
	5	+D	Serial communication data +Data
	6	-D	Serial communication data -Data
	7, 8	—	(NC)
	9	SG	Signal ground
	10	SHIELD	Shield

*1) Only for a motor equipped with a brake

*2) Connect the negative pole of the battery to SG (Signal Ground).

Amplifier 50 W – 400 W

Amplifier Connector

PC Communication Connector

UC60SC-MB-5ST
(Hirose Electric)

User I/O Connector

DF02R050NA1 (JAE)

Encoder Connector

3E106-2230KV (3M)

Motor Power Connector

2092-1325 (WAGO JAPAN)

Main Circuit Power Connector

2092-1422 (WAGO JAPAN)

Cable Connector

USB mini B

Plug 10150-3000-PE (3M)
Cover 10350 (3M)
or Equivalent alternatives
Wires : AWG26Connector 3E206-0100KV (3M)
Cover 3E306-3200-008 (3M)
Wires : AWG22(Power), AWG24(Signal)**Accessories**
2092-1525/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)**Accessories**
2092-1102/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

Name	Code	Pin No.	Signal	Description
Main Circuit Power	L1L2	1	L1	Main power cable 1
		2	L2	Main power cable 2
Motor Power	UVW/ B1B2	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
		4	B1	Regenerative resistor connection (+)
		5	B2	Regenerative resistor connection (-)
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Signal ground
		3, 4	—	(NC)
		5	+D	Serial communication data +Data
		6	-D	Serial communication data -Data
		—	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5V
		2	D-	USB data-
		3	D+	USB data+
		4	—	(NC)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See "Example of I/O Wiring")		

Amplifier 750 W

Amplifier Connector

PC Communication Connector

UC60SC-MB-5ST
(Hirose Electric)

User I/O Connector

DF02R050NA1 (JAE)

Encoder Connector

3E106-2230KV (3M)

Motor Power Connector

2092-3323 (WAGO JAPAN)

Main Circuit Power Connector

2092-1424 (WAGO JAPAN)

Cable Connector

USB mini B

Plug 10150-3000-PE (3M)
Cover 10350 (3M)
or Equivalent alternatives
Wires : AWG26

Connector 3E206-0100KV (3M)
Cover 3E306-3200-008 (3M)
Wires : AWG22(Power), AWG24(Signal)

Accessories
2092-3523/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

Accessories
2092-1104/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

Name	Code	Pin No.	Signal	Description
Main Circuit Power	L1L2/ B1B2	1	B1	Regenerative resistor connection (+)
		2	B2	Regenerative resistor connection (-)
		3	L1	Main power cable 1
		4	L2	Main power cable 2
Motor Power	UVW	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Signal ground
		3, 4	—	(NC)
		5	+D	Serial communication data +Data
		6	-D	Serial communication data -Data
		—	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5V
		2	D-	USB data-
		3	D+	USB data+
		4	—	(NC)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See "Example of I/O Wiring")		

Amplifier 1 kW – 2 kW

Amplifier Connector

PC Communication Connector

UC60SC-MB-5ST
(Hirose Electric)

User I/O Connector

DF02R050NA1 (JAE)

Encoder Connector

3E106-2230KV (3M)

Motor Power Connector

2092-3323 (WAGO JAPAN)

Main Circuit Power Connector

2092-3425 (WAGO JAPAN)

Cable Connector

USB mini B

Plug 10150-3000-PE (3M)
Cover 10350 (3M)
or Equivalent alternatives
Wires : AWG26Connector 3E206-0100KV (3M)
Cover 3E306-3200-008 (3M)
Wires : AWG22(Power), AWG24(Signal)

Accessories

2092-3523/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

Accessories

2092-3105/002-000 (WAGO JAPAN)
Wires : AWG14 (UL)

Name	Code	Pin No.	Signal	Description
Main Circuit Power	L1L2L3/ B1B2	1	B1	Regenerative resistor connection (+)
		2	B2	Regenerative resistor connection (-)
		3	L1	Main power cable 1 (*1)
		4	L2	Main power cable 2 (*2)
		5	L3	Main power cable 3 (*1)
Motor Power	UVW	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Signal ground
		3, 4	—	(NC)
		5	+D	Serial communication data +Data
		6	-D	Serial communication data -Data
		—	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5V
		2	D-	USB data-
		3	D+	USB data+
		4	—	(NC)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See "Example of I/O Wiring")		

*1) When having single-phase power wired to 1kW amplifiers (DA24A □□), connect the primary circuit power to L1 and L3.

*2) Do not connect when using with single-phase power.

Multi-axis Main amplifiers (Main circuit power supply 800 W)

Amplifier Connector

PC Communication Connector

 UC60SC-MB-5ST
 (Hirose Electric)

User I/O Connector

DF02R050NA1 (JAE)

Encoder Connector

3E106-2230KV (3M)

Motor Power Connector

2092-3323 (WAGO JAPAN)

Main Circuit Power Connector

2092-1424 (WAGO JAPAN)

Cable Connector

USB mini B

 Plug 10150-3000-PE (3M)
 Cover 10350 (3M)
 or Equivalent alternatives
 Wires : AWG26

 Connector 3E206-0100KV (3M)
 Cover 3E306-3200-008 (3M)
 Wires : AWG22(Power), AWG24(Signal)

Accessories
 2092-3523/002-000 (WAGO JAPAN)
 Wires : AWG18 (UL)

Accessories
 2092-1104/002-000 (WAGO JAPAN)
 Wires : AWG18 (UL)

Name	Code	Pin No.	Signal	Description
Main Circuit Power	L1L2/ B1B2	1	B1	Regenerative resistor connection (+)
		2	B2	Regenerative resistor connection (-)
		3	L1	Main power cable 1
		4	L2	Main power cable 2
Motor Power	UVW	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Signal ground
		3, 4	—	(NC)
		5	+D	Serial communication data +Data
		6	-D	Serial communication data -Data
		—	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5V
		2	D-	USB data-
		3	D+	USB data+
		4	—	(NC)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See "Example of I/O Wiring")		

Multi-axis Main amplifiers (Main circuit power supply 2 kW)

Amplifier Connector

PC Communication Connector

 UC60SC-MB-5ST
 (Hirose Electric)

User I/O Connector

DF02R050NA1 (JAE)

Encoder Connector

3E106-2230KV (3M)

Motor Power Connector

2092-3323 (WAGO JAPAN)

Mainy Circuit Power Connector

2092-3425 (WAGO JAPAN)

Cable Connector

USB mini B

 Plug 10150-3000-PE (3M)
 Cover 10350 (3M)
 or Equivalent alternatives
 Wires : AWG26

 Connector 3E206-0100KV (3M)
 Cover 3E306-3200-008 (3M)
 Wires : AWG22(Power), AWG24(Signal)

Accessories

 2092-3523/002-000 (WAGO JAPAN)
 Wires : AWG18 (UL)

Accessories

 2092-3105/002-000 (WAGO JAPAN)
 Wires : AWG14 (UL)

Name	Code	Pin No.	Signal	Description
Main Circuit Power	L1L2L3/ B1B2	1	B1	Regenerative resistor connection (+)
		2	B2	Regenerative resistor connection (-)
		3	L1	Main power cable 1 (*1)
		4	L2	Main power cable 2 (*2)
		5	L3	Main power cable 3 (*1)
Motor Power	UVW	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Signal ground
		3, 4	—	(NC)
		5	+D	Serial communication data +Data
		6	-D	Serial communication data -Data
		—	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5V
		2	D-	USB data-
		3	D+	USB data+
		4	—	(NC)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See "Example of I/O Wiring")		

*1) If total of power voltages does not exceed 1kW, you can use a single-phase power. Connect the primary circuit power supply to L1 and L3 when using a single-phase.

*2) Do not connect when using a single-phase power.

Multi-axis Sub amplifiers

Amplifier Connector

PC Communication Connector

 UC60SC-MB-5ST
 (Hirose Electric)

User I/O Connector

DF02R050NA1 (JAE)

Encoder Connector

3E106-2230KV (3M)

Motor Power Connector

2092-3323 (WAGO JAPAN)

Cable Connector

USB mini B

Plug 10150-3000-PE (3M)

Cover 10350 (3M)

or Equivalent alternatives

Wires : AWG26

Connector 3E206-0100KV (3M)

Cover 3E306-3200-008 (3M)

Wires : AWG22(Power), AWG24(Signal)

Accessories

2092-3523/002-000 (WAGO JAPAN)

Wires : AWG18 (UL)

Name	Code	Pin No.	Signal	Description
Motor Power	UVW	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Signal ground
		3, 4	—	(NC)
		5	+D	Serial communication data +Data
		6	-D	Serial communication data -Data
		—	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5V
		2	D-	USB data-
		3	D+	USB data+
		4	—	(NC)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See "Example of I/O Wiring")		

Main-/Sub- Amplifier (Bottom View)

Amplifier Connector

Amp-to-Amp Communication Connector
XG4C-1431 (OMRON)

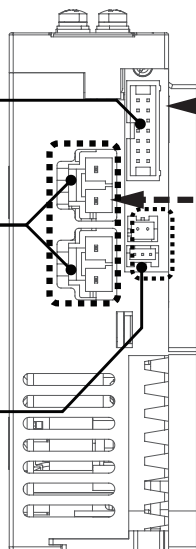
Main Circuit Power Supply Distribution
Connector

DF22-2P-7.92DS(05)
(Hirose Electric)

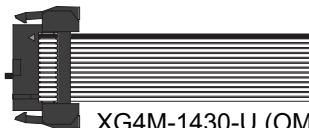
Be sure to insert the cap connector (included
in the product package) to the unused connector.

(Unused Connector)

Do not connect anything.



Cable Connector



XG4M-1430-U (OMRON)

Wires : Flat Cable (Convertible UL2651)



Housing DF22C-2S-7.92C

Pin DF22A-1416SCF

(Hirose Electric)

Wires : AWG16 (UL)

Accessories (Main-amplifier)



2 pieces/Main-amp

Be sure to insert these to the main circuit
power supply distribution connectors that
are not used for cable connections.

Accessory (Sub-amplifier)



1 piece/Sub-amp

Use this for primary circuit power supply
distributions.

Name	Code	Pin No.	Signal	Description
Main Circuit Power Supply Distribution	CN11A	1	V_P	Main circuit power 280V
		2	V_N	Main circuit power GND
	CN11B	1	V_P	Main circuit power 280V
		2	V_N	Main circuit power GND
Amplifier-to-Amplifier Communication	CN12	1	24V	Control power supply 24V
		2	G24V	Control power supply GND
		3	485	RS-485 Communication Data
		4	/485	RS-485 Communication /Data
		5	LIN	LIN communication
		6	PRDY	Power Ready
		7-13	—	(NC)
		14	GND	Signal ground

Motor Power Cable

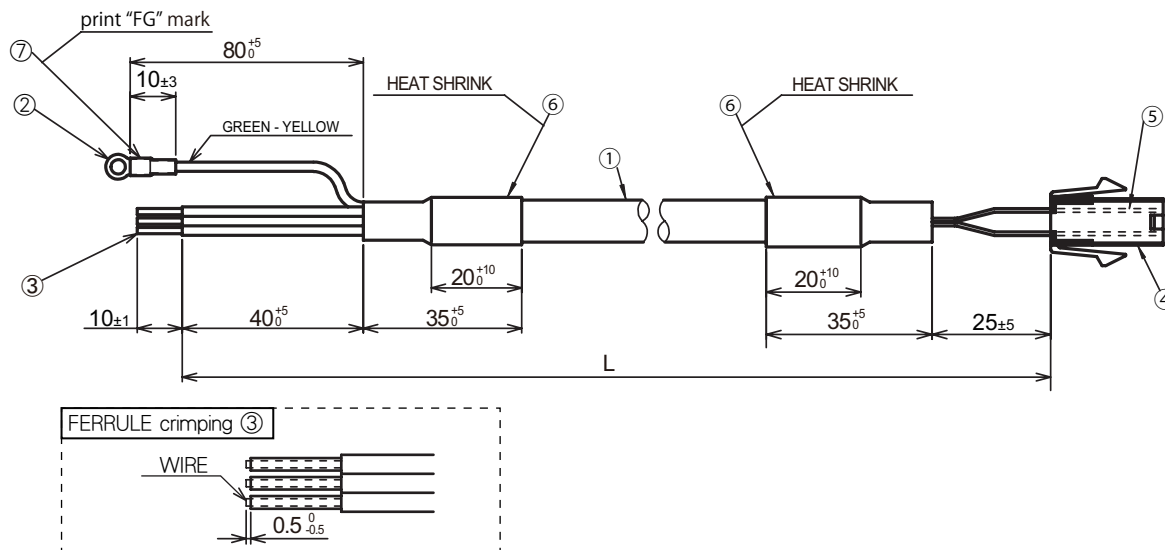
Motor cable for fixed wiring (up to 750 W)

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA3CT-18-4	MISUMI Group Ink
2	RING TONGUE TERMINAL	R2-4	J.S.T. Mfg. Co.,Ltd.
3	FERRULE	216-143	WAGO JAPAN
4	HOUSING	172159-1	Tyco Electronics JAPAN
5	TERMINAL	170366-1	Tyco Electronics JAPAN
6	SUMITUBE	F(Z) 11x0.25	Sumitomo Electric Industries
7	(MARKER TUBE)	(arbitrary)	(arbitrary)

④

PIN No.	SIGNAL	COLOR
1	U	RED
2	V	WHITE
3	W	BLUE
4	FG	GREEN - YELLOW

(mm)



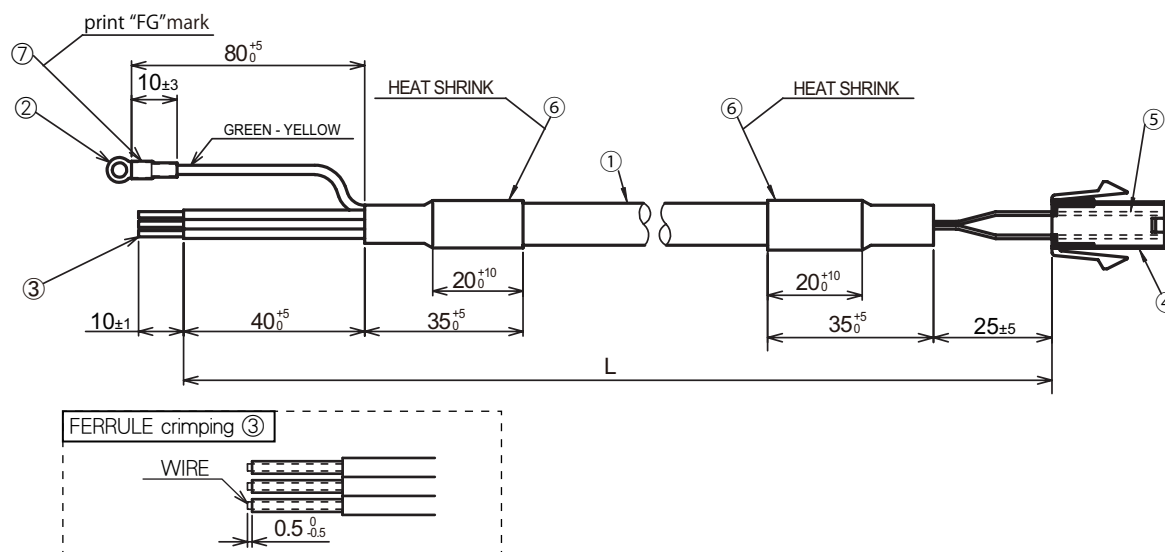
Motor cable for movable wiring (up to 750 W)

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA3CTR-18-4	MISUMI Group Ink
2	RING TONGUE TERMINAL	R2-4	J.S.T. Mfg. Co.,Ltd.
3	FERRULE	216-143	WAGO JAPAN
4	HOUSING	172159-1	Tyco Electronics JAPAN
5	TERMINAL	170366-1	Tyco Electronics JAPAN
6	SUMITUBE	F(Z) 11x0.25	Sumitomo Electric Industries
7	(MARKER TUBE)	(arbitrary)	(arbitrary)

(mm)

④

PIN No.	SIGNAL	COLOR
1	U	RED
2	V	WHITE
3	W	BLUE
4	FG	GREEN - YELLOW



Motor Power Cable

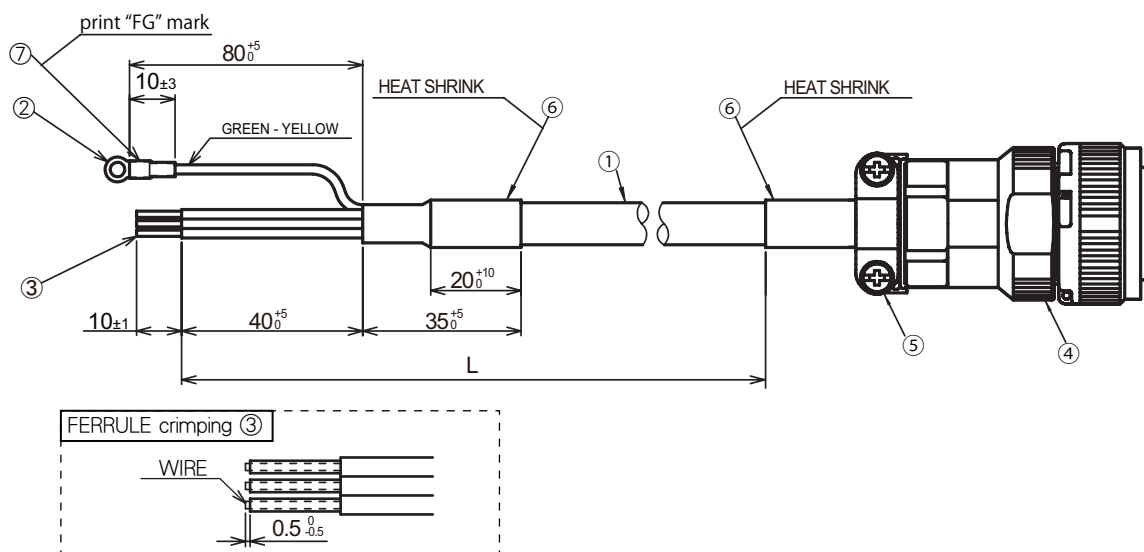
Motor cable for fixed wiring (1 kW or more)

④

PIN No.	SIGNAL	COLOR
1	U	RED
2	V	WHITE
3	W	BLUE
4	FG	GREEN - YELLOW

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA6CT-14-4	MISUMI Group Ink
2	RING TONGUE TERMINAL	R2-4	J.S.T. Mfg. Co.,Ltd.
3	FERRULE	216-106	WAGO JAPAN
4	PLUG	JL04V-6A18-10SE-EB-R	JAE
5	CABLE CLAMP	JL04V-18CK13-CR-R	JAE
6	SUMITUBE	F(Z) 14x0.3	Sumitomo Electric Industries
7	(MARKER TUBE)	(arbitrary)	(arbitrary)

(mm)



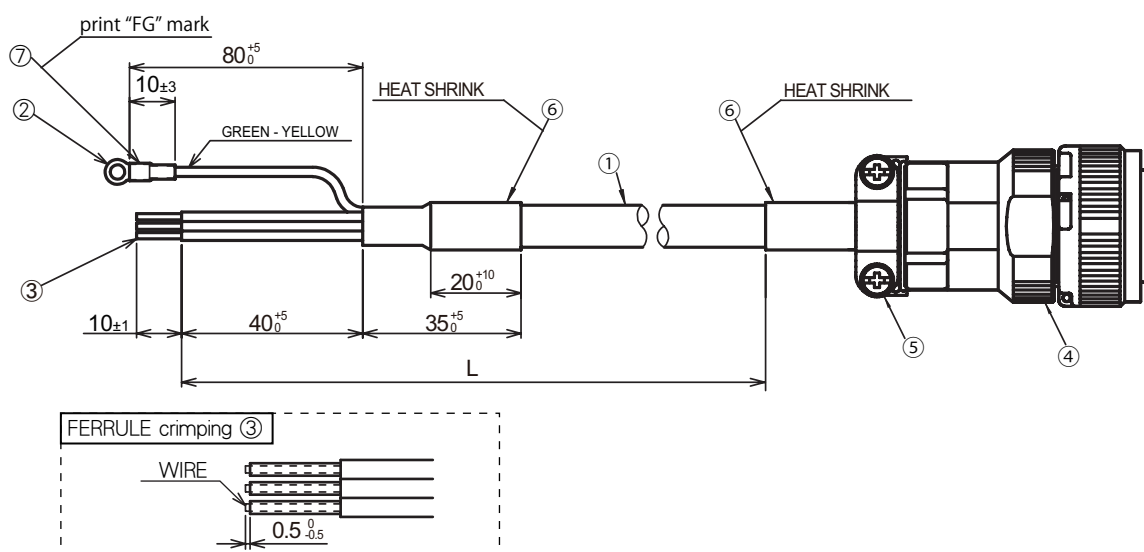
Motor cable for movable wiring (1 kW or more)

④

PIN No.	SIGNAL	COLOR
1	U	RED
2	V	WHITE
3	W	BLUE
4	FG	GREEN - YELLOW

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA6CTR-14-4	MISUMI Group Ink
2	RING TONGUE TERMINAL	R2-4	J.S.T. Mfg. Co.,Ltd.
3	FERRULE	216-106	WAGO JAPAN
4	PLUG	JL04V-6A18-10SE-EB-R	JAE
5	CABLE CLAMP	JL04V-18CK13-CR-R	JAE
6	SUMITUBE	F(Z) 14x0.3	Sumitomo Electric Industries
7	(MARKER TUBE)	(arbitrary)	(arbitrary)

(mm)



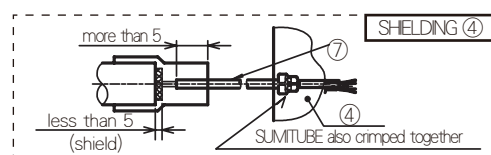
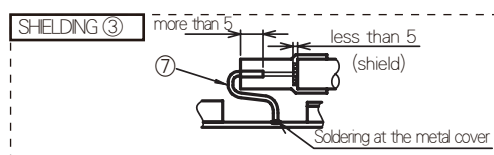
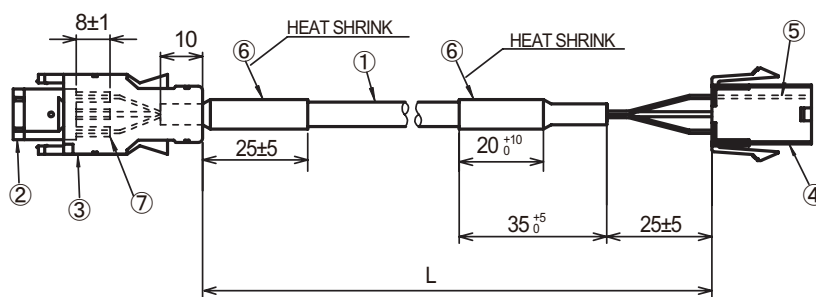
Encoder Cable (Incremental)

Incremental Encoder cable for fixed wiring (up to 750 W)

②		④	
PIN No.	SIGNAL	PIN No.	SIGNAL
1	VCC	1	—
2	GND	2	+D
3	—	3	—D
4	—	4	VCC
5	+D	5	GND
6	—D	6	SHIELD
7	SHIELD		

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276TSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	172160-1	Tyco Electronics JAPAN
5	TERMINAL	170365-1	Tyco Electronics JAPAN
6	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
7	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries

(mm)

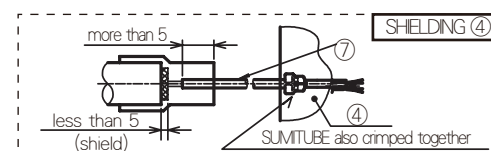
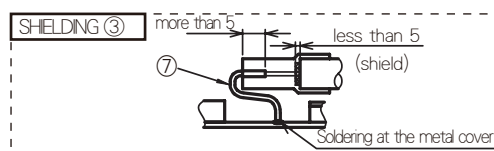
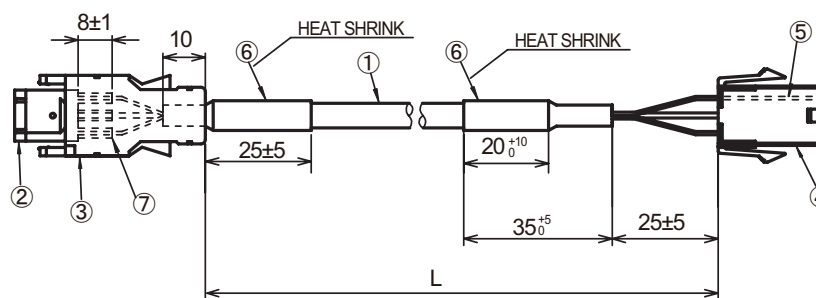


Incremental Encoder cable for movable wiring (up to 750 W)

②		④	
PIN No.	SIGNAL	PIN No.	SIGNAL
1	VCC	1	—
2	GND	2	+D
3	—	3	—D
4	—	4	VCC
5	+D	5	GND
6	—D	6	SHIELD
7	SHIELD		

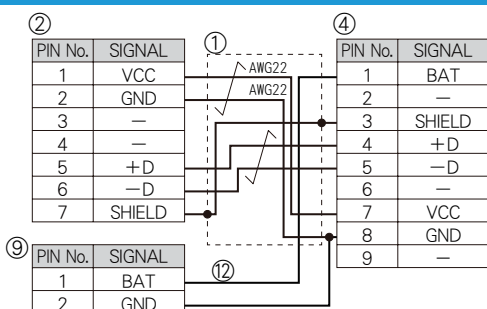
No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276RRSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	172160-1	Tyco Electronics JAPAN
5	TERMINAL	170365-1	Tyco Electronics JAPAN
6	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
7	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries

(mm)

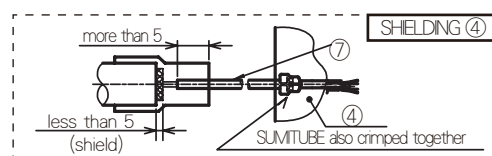
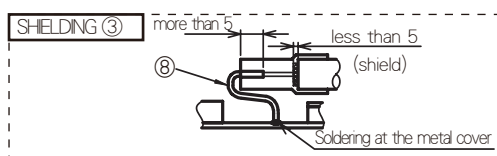
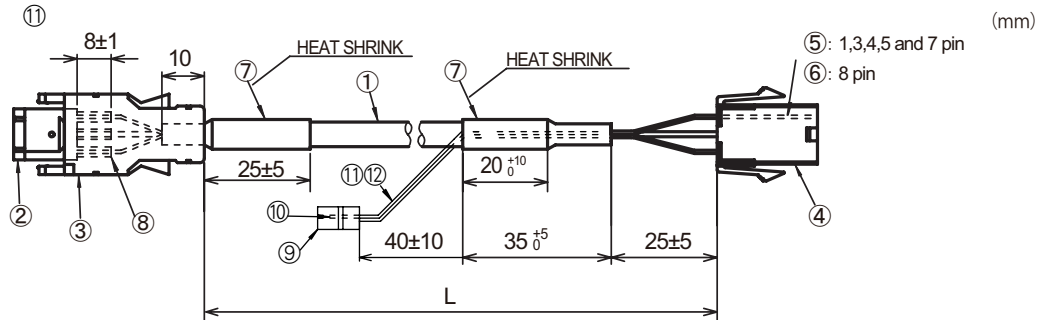


Encoder Cable (Absolute)

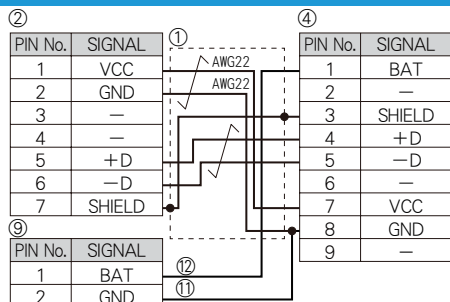
Absolute Encoder cable for fixed wiring (up to 750 W)



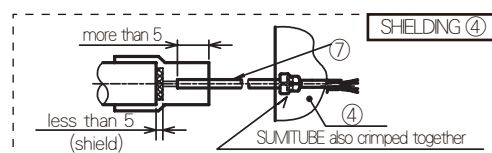
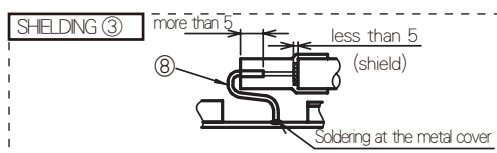
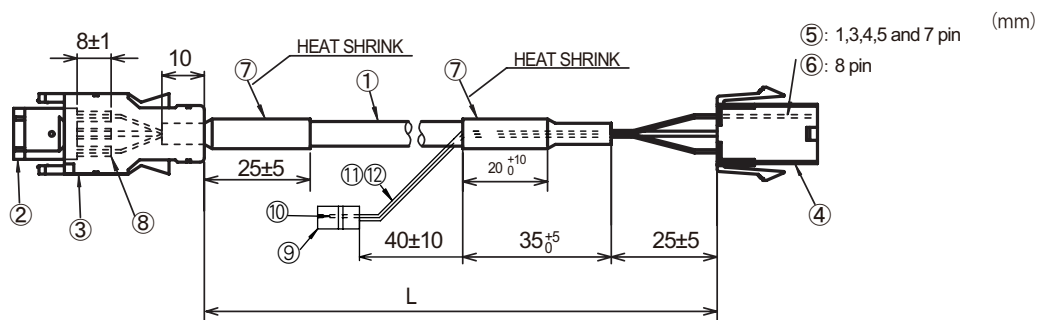
No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276TSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	172161-1	Tyco Electronics JAPAN
5	TERMINAL	170365-1	Tyco Electronics JAPAN
6	TERMINAL	170366-1	Tyco Electronics JAPAN
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries
9	HOUSING	DF3-2EP-2C	Hirose Electric
10	TERMINAL	DF3-EP2428PCFA	Hirose Electric
11	CABLE	NAUL1007-24-BK	MISUMI Group Ink
12	CABLE	NAUL1007-24-R	MISUMI Group Ink



Absolute Encoder cable for movable wiring (up to 750 W)



No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276RRSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	172161-1	Tyco Electronics JAPAN
5	TERMINAL	170365-1	Tyco Electronics JAPAN
6	TERMINAL	170366-1	Tyco Electronics JAPAN
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries
9	HOUSING	DF3-2EP-2C	Hirose Electric
10	TERMINAL	DF3-EP2428PCFA	Hirose Electric
11	CABLE	NAUL1007-24-BK	MISUMI Group Ink
12	CABLE	NAUL1007-24-R	MISUMI Group Ink



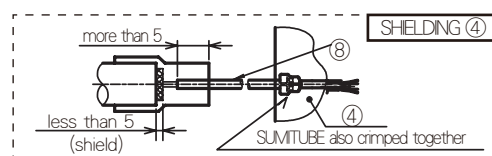
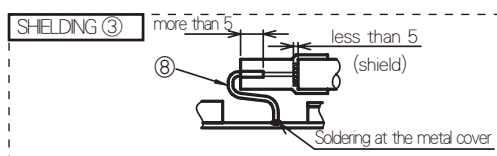
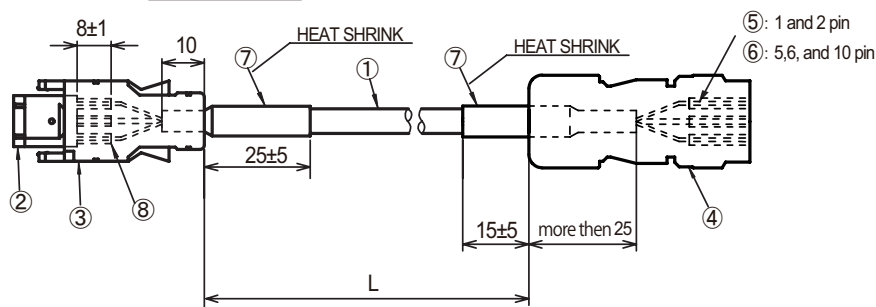
Encoder Cable (Incremental)

Incremental Encoder cable for fixed wiring (1 kW or more)

②		①		④	
PIN No.	SIGNAL			PIN No.	SIGNAL
1	VCC	AWG22	1	1	VCC
2	GND	AWG22	2	2	GND
3	—		3	3	—
4	—		4	4	—
5	+D	AWG24	5	5	+D
6	-D	AWG24	6	6	-D
7	SHIELD		7	7	—
			8	8	—
			9	9	—
			10	10	SHIELD

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276TSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	CM10-SP10S-M	DDK
5	TERMINAL	CM10-#22SC(C1)(D8)	DDK
6	TERMINAL	CM10-#22SC(C2)(D8)	DDK
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries

(mm)

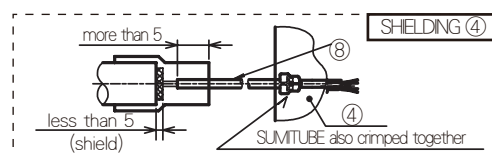
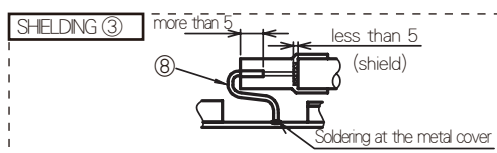
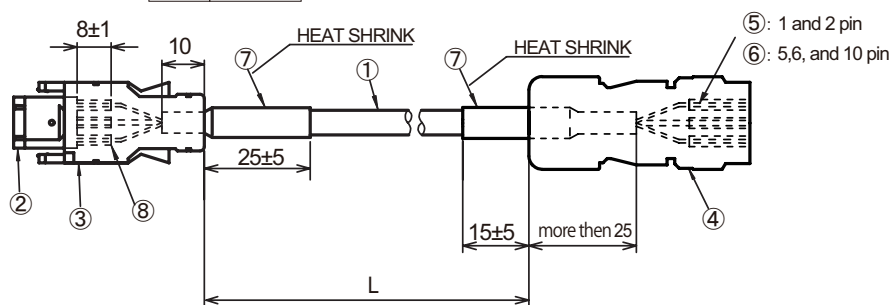


Incremental Encoder cable for movable wiring (1 kW or more)

②		①		④	
PIN No.	SIGNAL			PIN No.	SIGNAL
1	VCC	AWG22	1	1	VCC
2	GND	AWG22	2	2	GND
3	—		3	3	—
4	—		4	4	—
5	+D	AWG24	5	5	+D
6	-D	AWG24	6	6	-D
7	SHIELD		7	7	—
			8	8	—
			9	9	—
			10	10	SHIELD

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276RRSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	CM10-SP10S-M	DDK
5	TERMINAL	CM10-#22SC(C1)(D8)	DDK
6	TERMINAL	CM10-#22SC(C2)(D8)	DDK
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries

(mm)

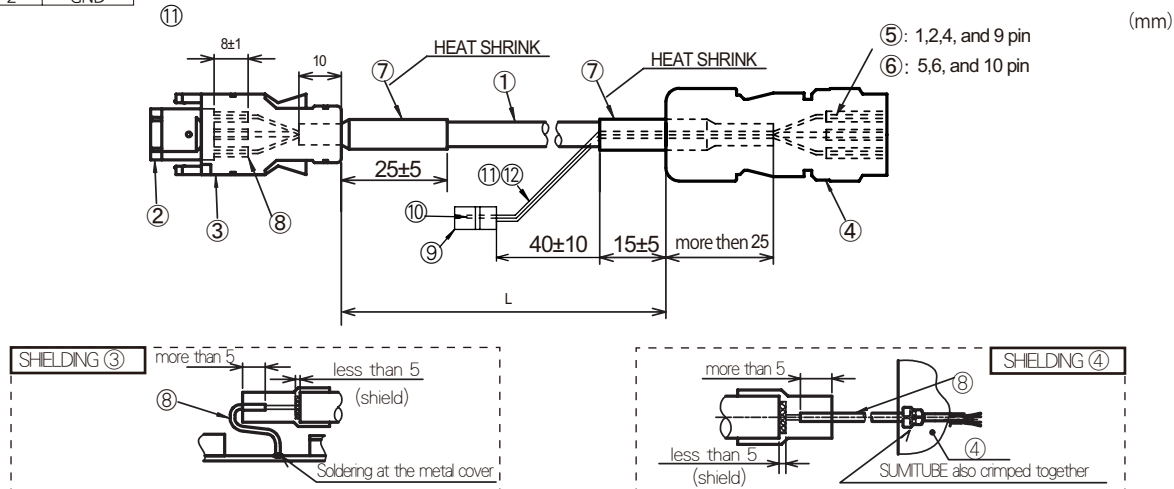


Encoder Cable (Absolute)

Absolute Encoder cable for fixed wiring (1 kW or more)

PIN No.	SIGNAL	①	PIN No.	SIGNAL	④
1	VCC	AWG22	1	VCC	
2	GND	AWG22	2	GND	
3	—		3	—	
4	—		4	BAT	
5	+D		5	+D	
6	-D		6	-D	
7	SHIELD		7	—	
8	—		8	—	
9	—		9	GND	
10	—		10	SHIELD	

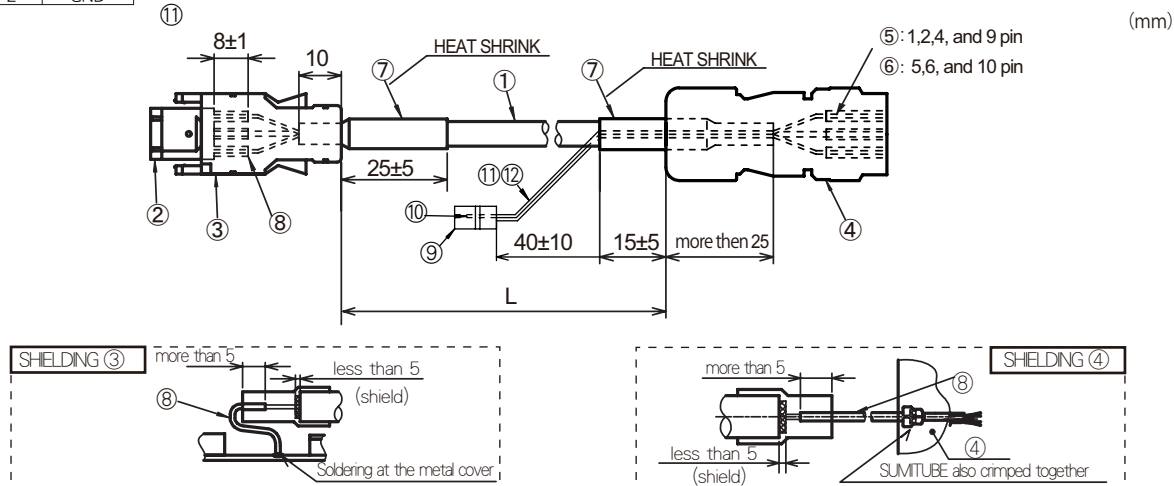
No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276TSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	CM10-SP10S-M	DDK
5	TERMINAL	CM10-#22SC(C1)(D8)	DDK
6	TERMINAL	CM10-#22SC(C2)(D8)	DDK
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries
9	HOUSING	DF3-2EP-2C	Hirose Electric
10	TERMINAL	DF3-EP2428PCFA	Hirose Electric
11	CABLE	NAUL1007-24-BK	MISUMI Group Ink
12	CABLE	NAUL1007-24-R	MISUMI Group Ink



Absolute Encoder cable for movable wiring (1 kW or more)

PIN No.	SIGNAL	①	PIN No.	SIGNAL	④
1	VCC	AWG22	1	VCC	
2	GND	AWG22	2	GND	
3	—		3	—	
4	—		4	BAT	
5	+D		5	+D	
6	-D		6	-D	
7	SHIELD		7	—	
8	—		8	—	
9	—		9	GND	
10	—		10	SHIELD	

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA20276RRSB-C	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	CM10-SP10S-M	DDK
5	TERMINAL	CM10-#22SC(C1)(D8)	DDK
6	TERMINAL	CM10-#22SC(C2)(D8)	DDK
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries
9	HOUSING	DF3-2EP-2C	Hirose Electric
10	TERMINAL	DF3-EP2428PCFA	Hirose Electric
11	CABLE	NAUL1007-24-BK	MISUMI Group Ink
12	CABLE	NAUL1007-24-R	MISUMI Group Ink



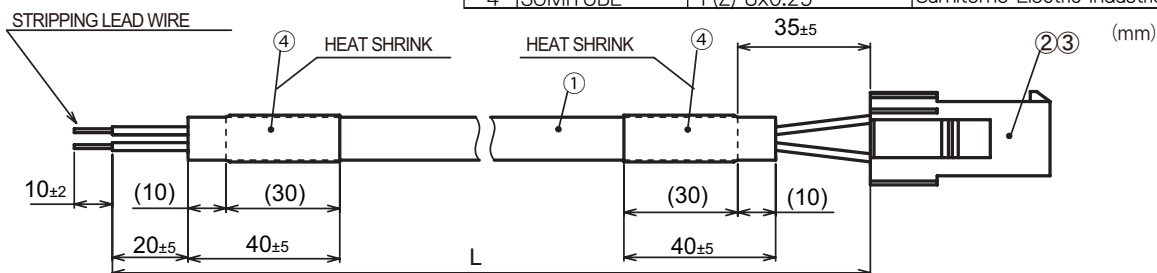
Brake Cable

Brake Cable for fixed wiring (up to 750 W)

②

PIN No.	SIGNAL	COLOR
1	BRK+	BLACK
2	BRK-	BLACK

No.	ITEM	MODEL	SUPPLIER
1	CABLE	MAST-UL2517-19-2	MISUMI Group Ink
2	HOUSING	172157-1	Tyco Electronics JAPAN
3	TERMINAL	170366-1 or 170639-1	Tyco Electronics JAPAN
4	SUMITUBE	F(Z) 8x0.25	Sumitomo Electric Industries

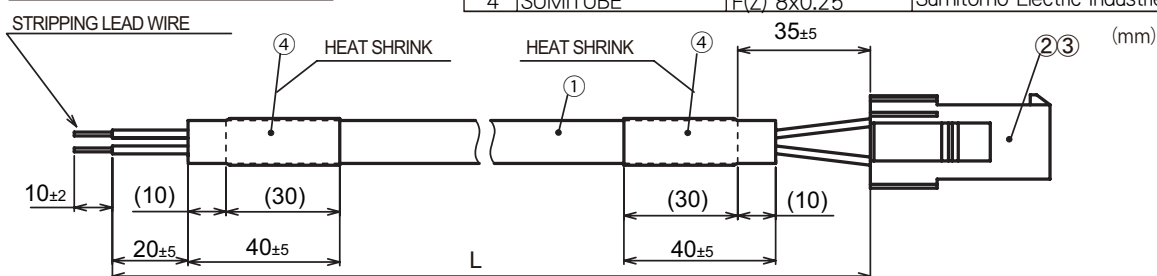


Brake Cable for movable wiring (up to 750 W)

②

PIN No.	SIGNAL	COLOR
1	BRK+	BLACK
2	BRK-	BLACK

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA3UCR-18-2	MISUMI Group Ink
2	HOUSING	172157-1	Tyco Electronics JAPAN
3	TERMINAL	170366-1 or 170639-1	Tyco Electronics JAPAN
4	SUMITUBE	F(Z) 8x0.25	Sumitomo Electric Industries

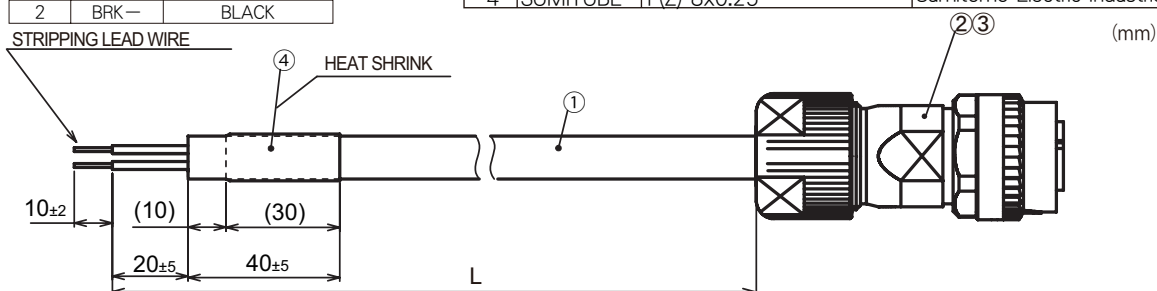


Brake Cable for fixed wiring (1 kW or more)

②

PIN No.	SIGNAL	COLOR
1	BRK+	BLACK
2	BRK-	BLACK

No.	ITEM	MODEL	SUPPLIER
1	CABLE	MAST-UL2517-19-2	MISUMI Group Ink
2	PLUG	CM10-SP2S-M-D	DDK
3	CONTACT	CM10-#22SC(S2)(D8)-100	DDK
4	SUMITUBE	F(Z) 8x0.25	Sumitomo Electric Industries

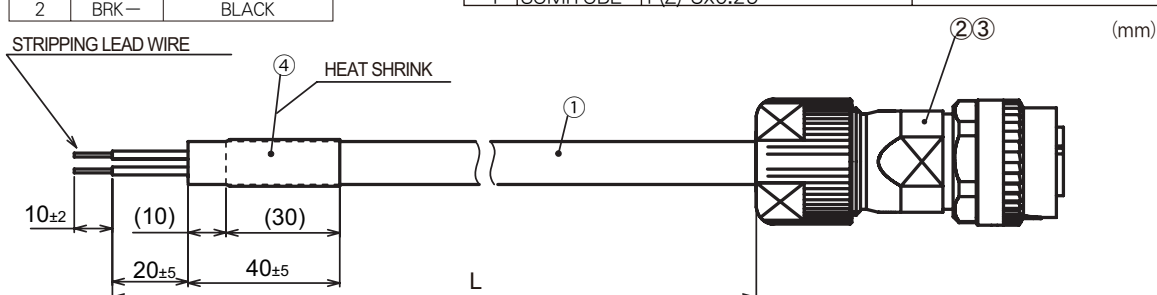


Brake Cable for movable wiring (1 kW or more)

②

PIN No.	SIGNAL	COLOR
1	BRK+	BLACK
2	BRK-	BLACK

No.	ITEM	MODEL	SUPPLIER
1	CABLE	NA3UCR-18-2	MISUMI Group Ink
2	PLUG	CM10-SP2S-M-D	DDK
3	CONTACT	CM10-#22SC(S2)(D8)-100	DDK
4	SUMITUBE	F(Z) 8x0.25	Sumitomo Electric Industries



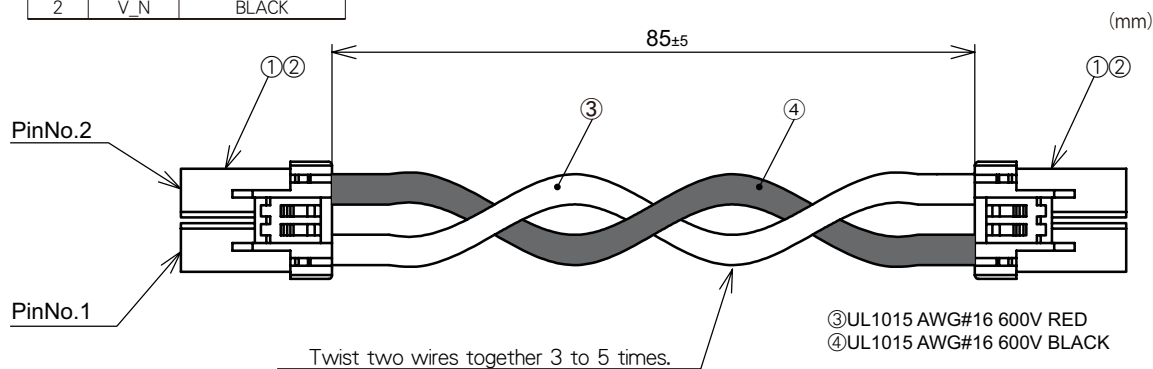
Multi-Amplifier Cable

Multi-axis Main Circuit Power Supply Distribution Connector

①

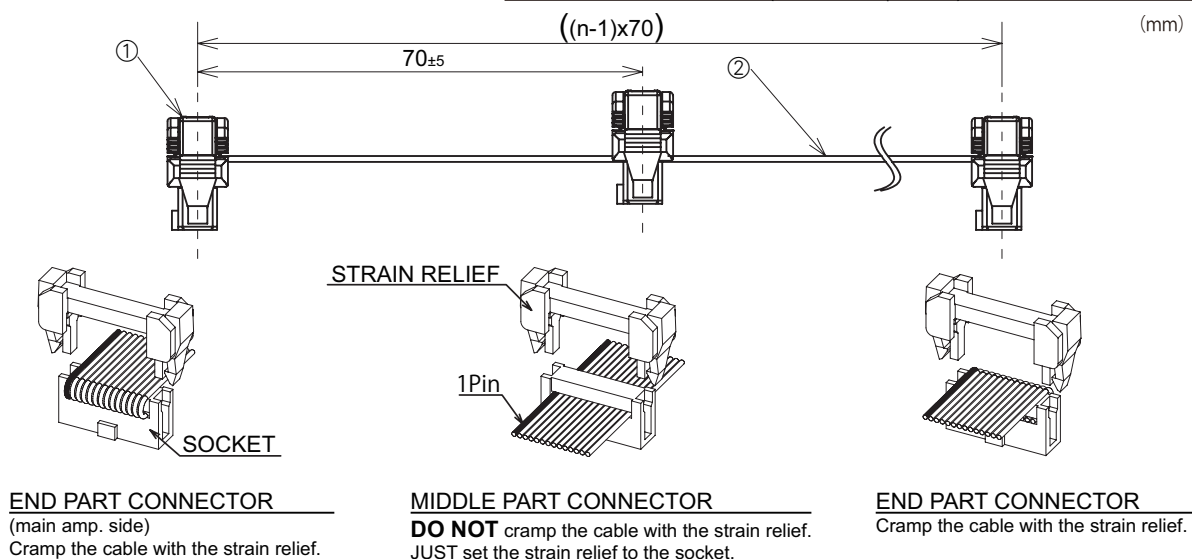
PIN No.	SIGNAL	COLOR
1	V_P	RED
2	V_N	BLACK

No.	ITEM	MODEL	SUPPLIER
1	SOCKET	DF22C-2S-7.92C	Hirose Electric
2	CRIMP TERMINAL	DF22A-14 16SCF	Hirose Electric
3	LEAD WIRE	(arbitrary)	(arbitrary)
4	LEAD WIRE	(arbitrary)	(arbitrary)

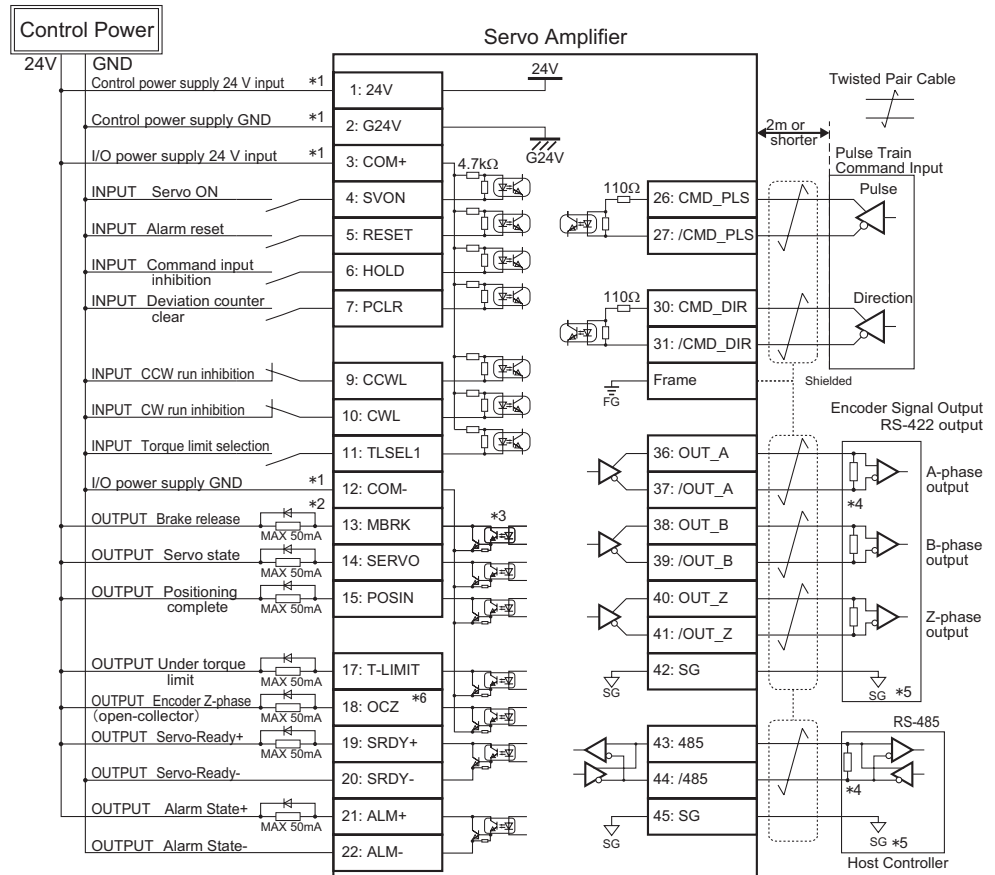


Multi-axis Amp-to-Amp Communication Connector

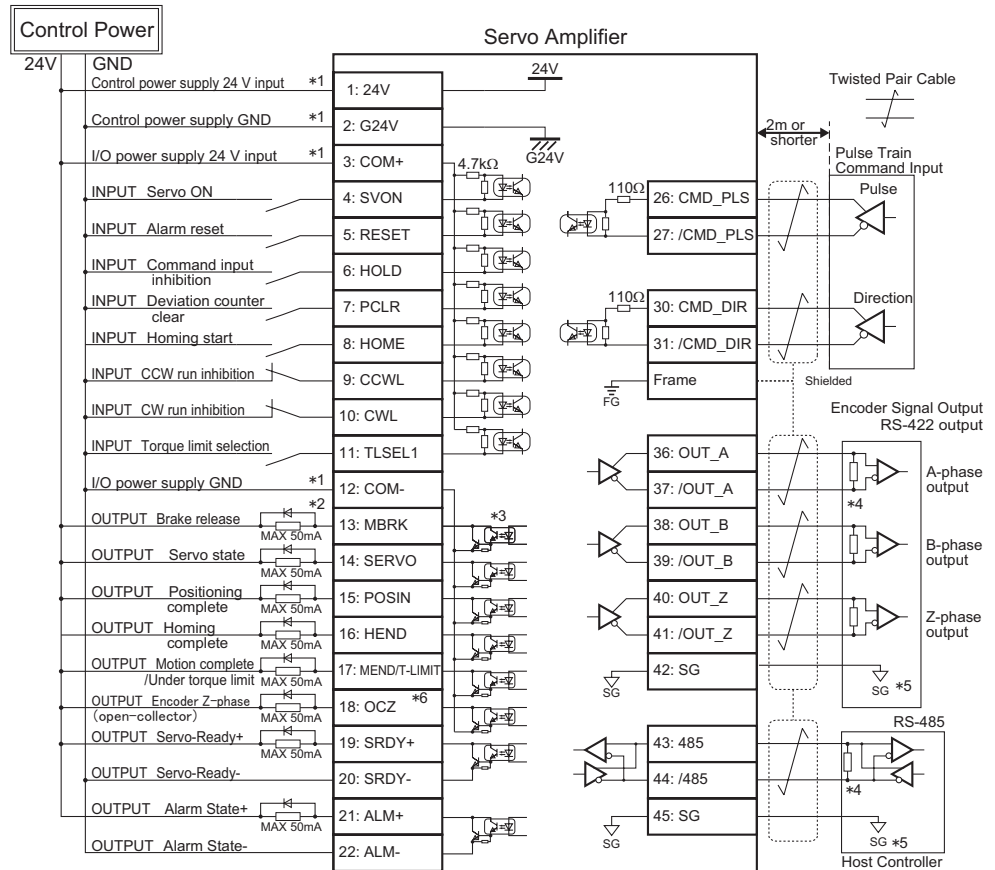
No.	ITEM	MODEL	SUPPLIER
1	CONNECTOR	XG4M-1430-U	OMRON
2	FLAT CABLE	FLAX-B(14)-7/0.127 (UL 2651 Equivalent)	OKI Electric Cable



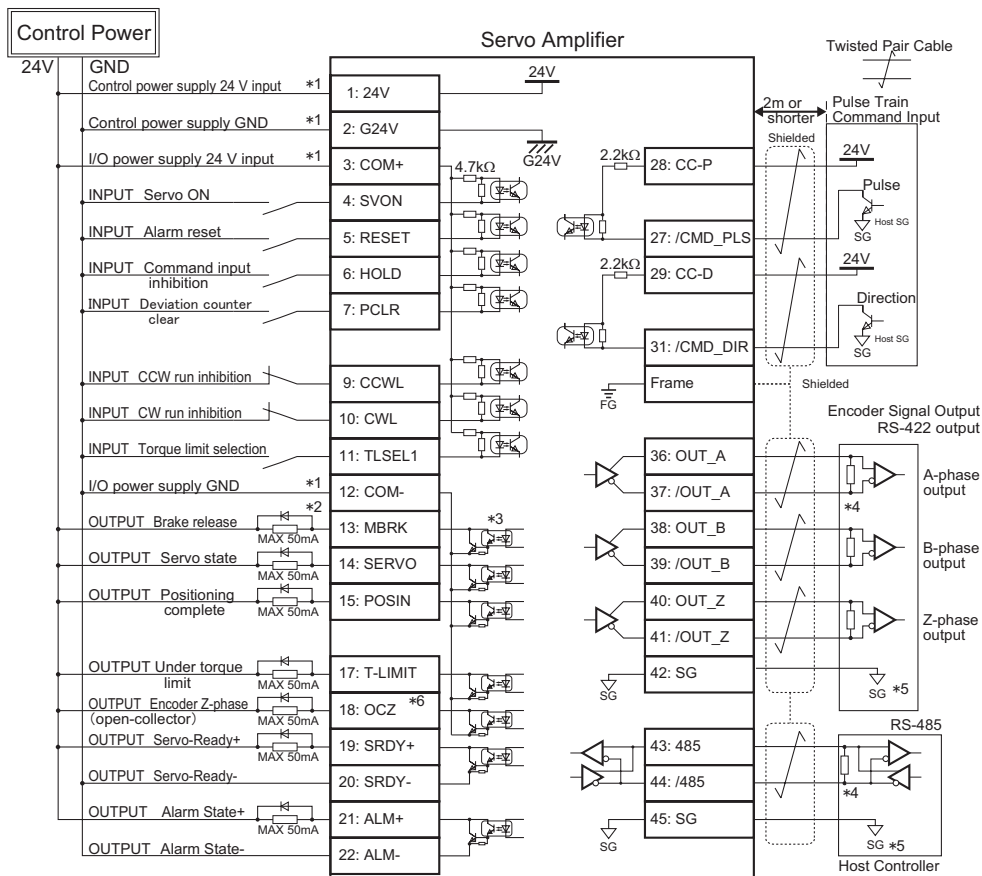
Position Control Mode Differential input (Standard I/O Configuration)



Position Control Mode Differential input (Optional I/O Configuration)



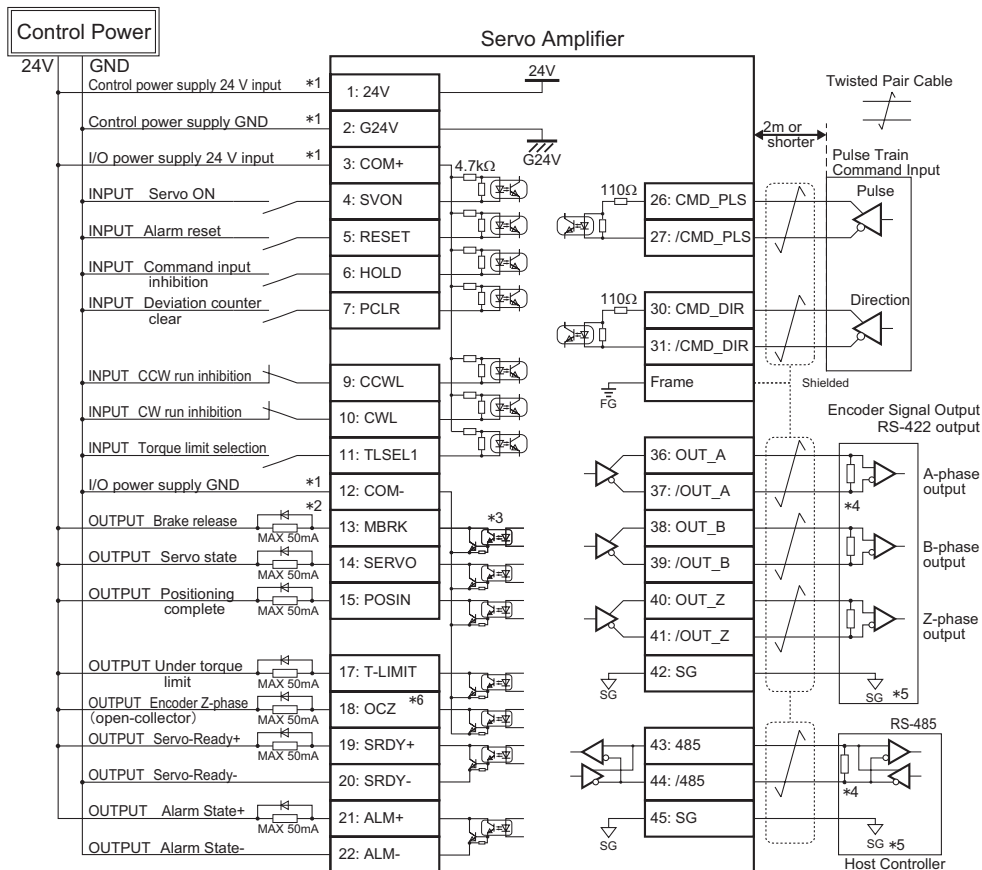
Position Control Mode 24V open collector input



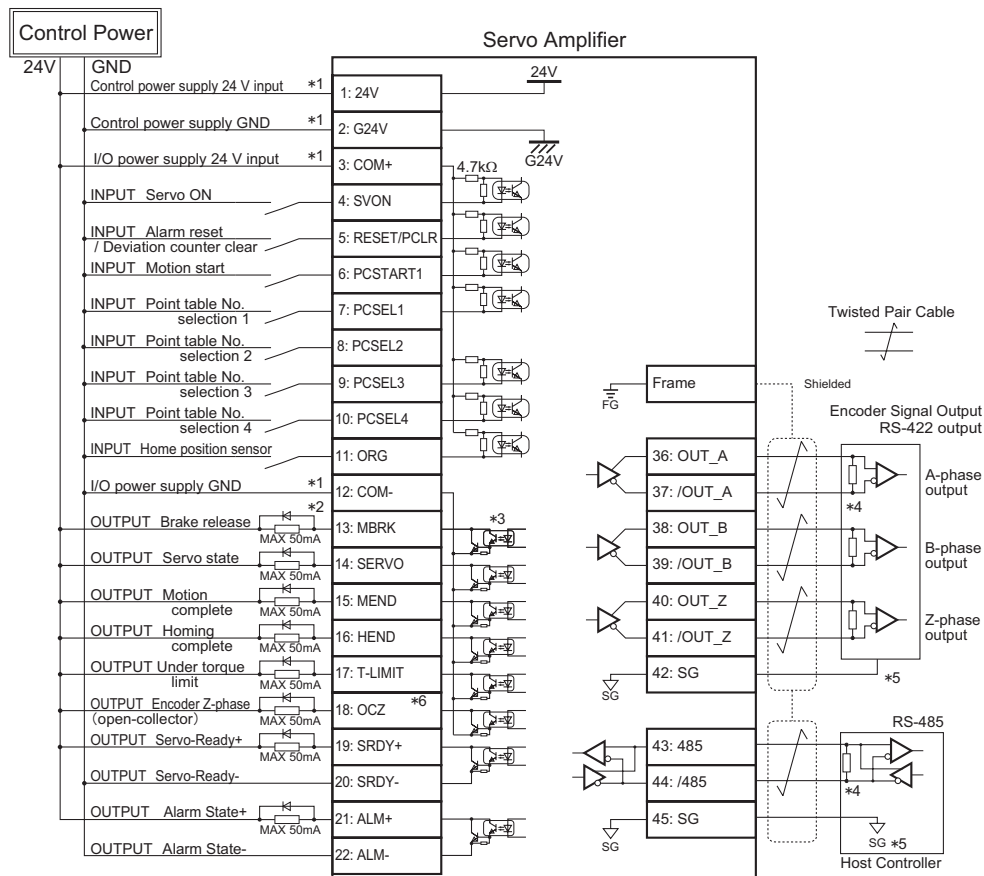
Position Control Mode 5V open collector input (only DA2□□21,22)



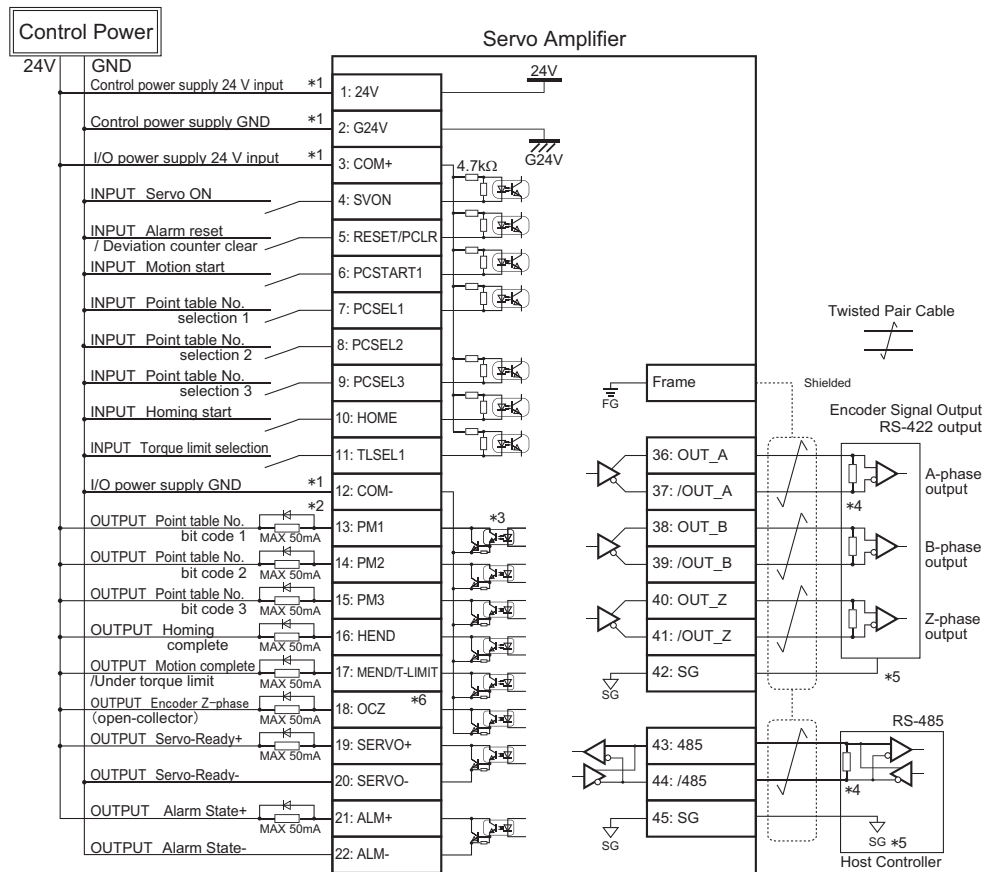
For 5V open-collector connection of multi-amplifiers, see the instruction manual.



Position Control Mode Internal Position Command (Standard I/O Configuration)

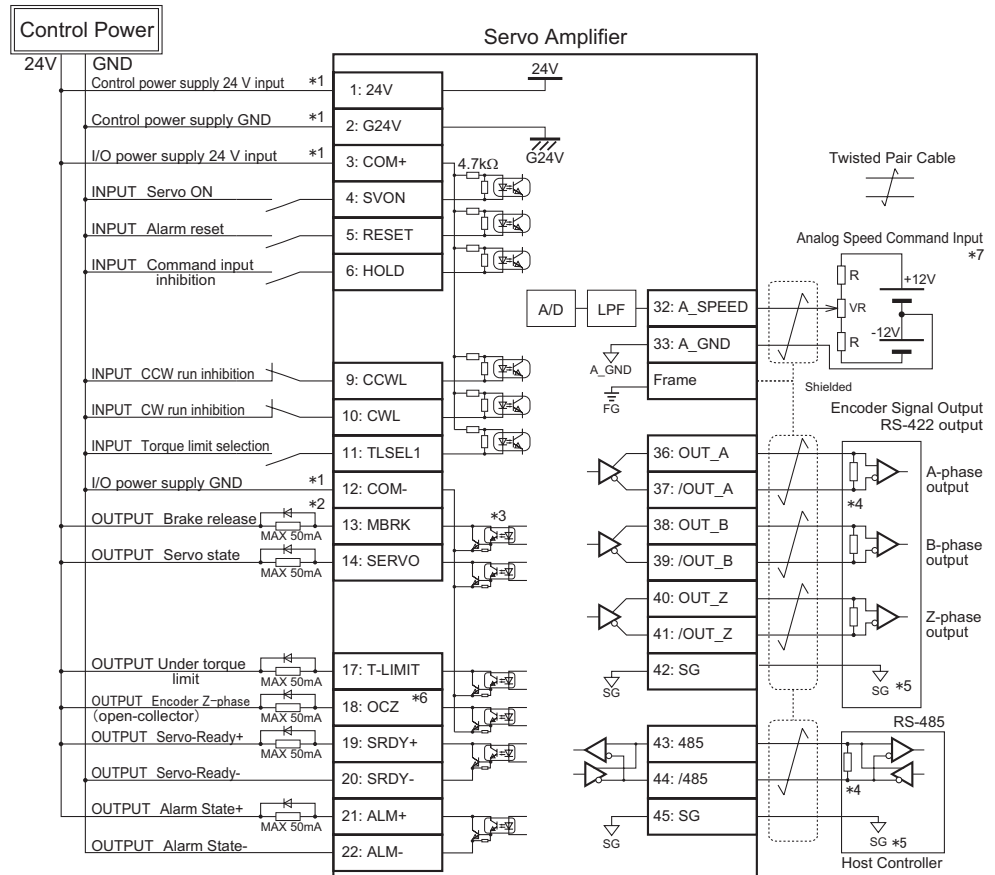


Position Control Mode Internal Position Command (Optional I/O Configuration)

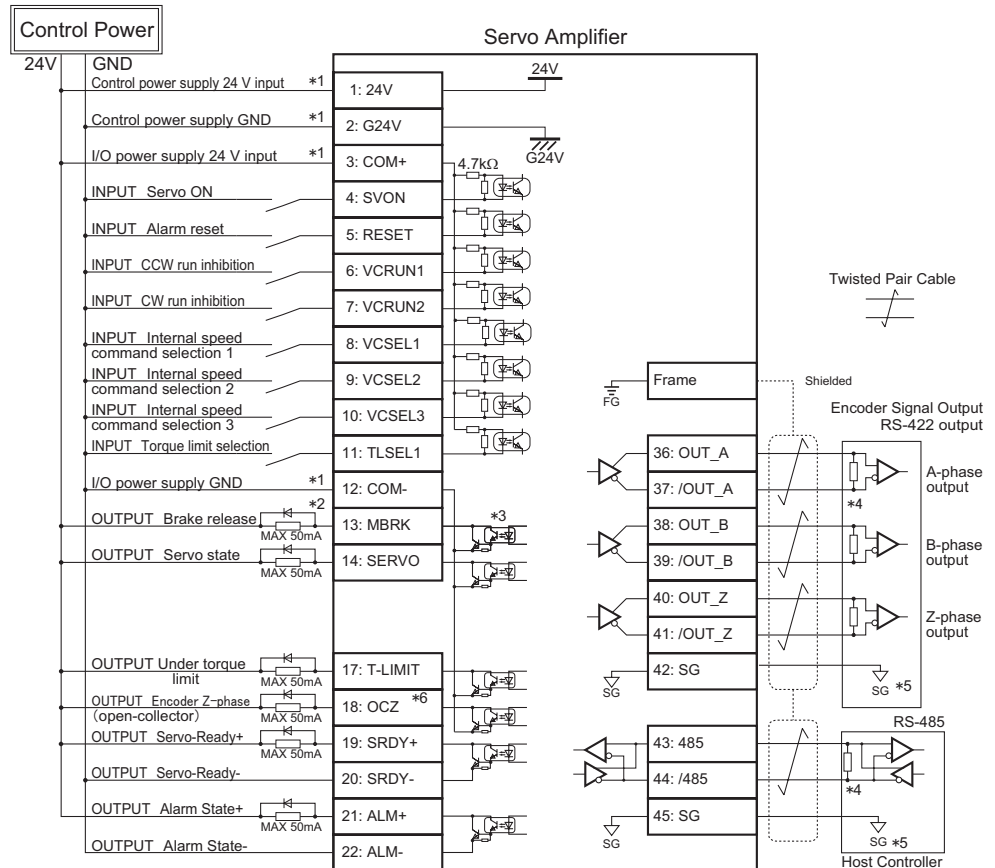


Velocity Control Mode

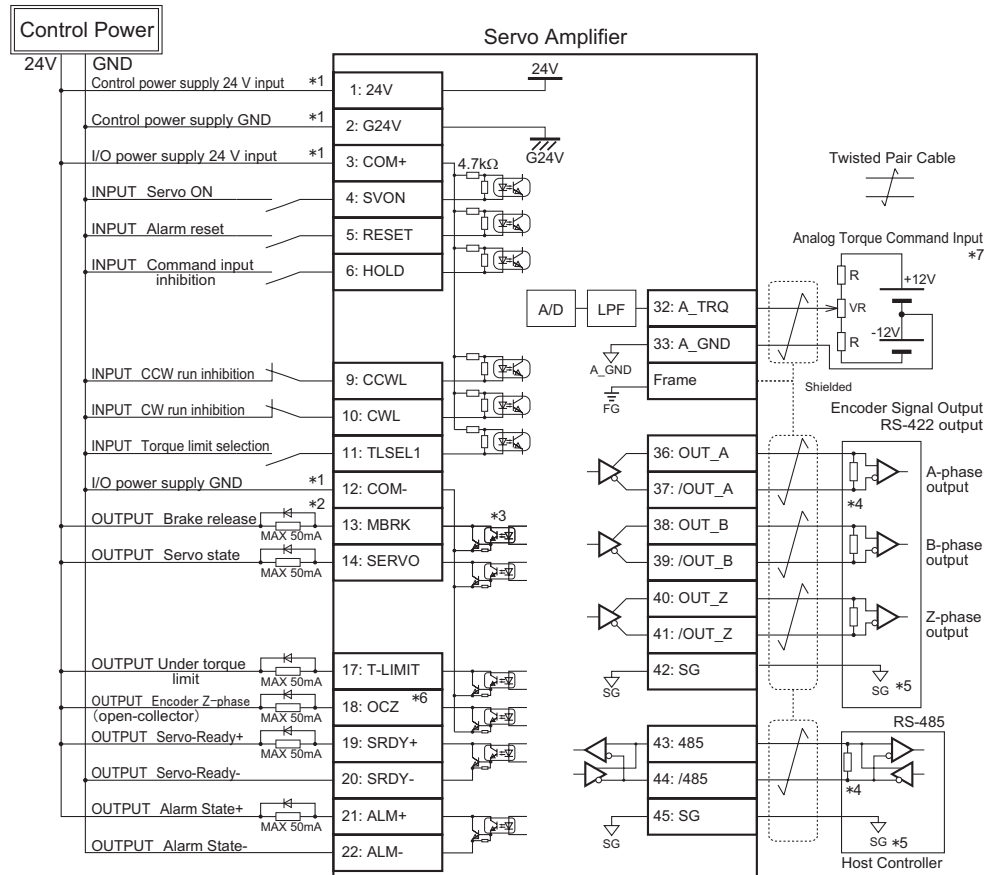
Speed Control Mode Analog Speed Command Input



Speed Control Mode Internal Speed Command



Torque Control Mode Analog Torque Command Input



Notes:

- *1) Have only one power supply for both the control power (24V, G24V) and I/O power (COM+, COM-).
- *2) When driving a load which contains inductance element (e.g. relay), connect a protection diode. Motor brake can not be directly engaged. Be sure to use a relay with a protection diode in the circuit.
- *3) The output circuit structure is open connector and Darlington connection transistor output and connects to relay or photocoupler. Note that when Transistor ON, connector-emitter voltage $V_{CE(SAT)}$ is approximately 1V, which does not satisfy V_{IL} of regular TTL IC. Hence, the output circuit structure must not be connected directly.
- *4) Be sure to connect a terminating resistor of around 220 Ω .
- *5) Connect to the communication I/O signal ground of the host controller which outputs amplifier encoder output signal. Connecting the signal ground to the amplifier control power GND might result in malfunction.
- *6) ZWhen Z-phase pulse width is too narrow to be recognized by the host controller accurately, decrease the paired-pulse ratio "Encoder pulse output Division and multiplication" with parameters No.276.0 and No.278.0, or reduce the number of rotations, so that the pulse width becomes wider.

$$\text{Pulse width ms} = \text{Pulse width ms} = 2 / (\text{the number of rotations} / (\text{the paired-pulse ratio} \times 2^{17}) \times 60 \times 1,000$$
- *7) When building a command circuit with a variable resistor (VR) and a resistor (R), in order to have the range of command input voltage to be -10V to +10V, VR should be at least 2 k Ω 1/4 W and R should be at least 100 Ω to 200 Ω 1/4 W. When the host analog speed command circuit is isolated from the 24V control power, connect A_GND to the host SG, not to the control power GND. If not isolated, connect A_GND to the control power GND.

Signs below indicate two severity levels of bodily injury/loss, or property damage that could be caused by failure to observe the precautions and improper use of this product.		Symbols below indicate two types of precautions that users must follow.	
 DANGER	Identifies information about imminent hazards that are likely to cause death or serious injury.		Safety Precautions - Don'ts
 CAUTION	Identifies information about hazards that could cause injury or property damage.		Safety Precautions - Dos

The following signs identify information about anticipated hazards.

	Danger and Caution Causes unexpected motions, unstable motions, or uncontrollable motions Hampers optimal performance of the product, or shortens its service life		Fire hazard
	Electric shock hazard		Injury hazard
	Burns hazard		Failure and damage hazard

 DANGER		
Symbol	Precautions (Dos and Don'ts)	Anticipated Hazards
Installation & Wiring		
	Never connect your S-FLAG motor directly to commercial power supply.	 
	No flammables away near your S-FLAG motor and amplifier.	
	Be sure to protect the amplifier with a protective enclosure and allow the required clearance around the amplifier (as specified in the S-FLAG instruction manual) from the enclosure or any devices.	  
	Install your S-FLAG in a location with little dust, and free from water or oil splash.	  
	Mount the motor or amplifier on nonflammable surface such as metal.	
	Be sure to have any wiring work carried out by an electrician.	
	Always ground the FG terminals of the motors and amplifiers.	
	When working with wires, always turn off the circuit breakers first, carry out the work properly and methodically.	
	Be sure to connect all cables properly and insulate all conductors with insulating material.	
Handling & Operation		
	Never touch the inside of amplifier.	 
	Cables must not be damaged, stressed, loaded, or pinched.	 
	Never touch the revolving component of the motor while it is in motion.	
	Do not use this product near flammable materials or where it could be subjected to water sprays, a corrosive atmosphere, or an atmosphere of flammable gases.	
	Do not use the product at a location which is subjected to severe vibrations or impact forces.	  
	Do not use the product with any of cables being immersed in oil or water.	 
	Do not carry out any wiring work or operations with wet hands.	  
	When handling a shaft end key-grooved motor, do not touch the key groove with unprotected hands.	
	Do not touch the motor or the sink of amplifier as they become hot.	 
	Do not have the motor driven by external force.	
Other Precautions		
	Be sure to verify safety after an earthquake.	  
	Carry out mounting and installation securely, in order to prevent fire or personal injury during an earthquake.	  
	Install an external emergency stop circuit so that operations can be stopped and power supplies shut down immediately upon occurrence of an emergency.	  
Maintenance & Inspection		
	Never dismantle the S-FLAG product.	  
	The amplifier has components with dangerously high voltage. Prior to each wiring or inspection work, allow more than 5 minutes (after power shuts off) for complete discharge of internal voltage.	

 CAUTION		
Symbol	Precautions (Dos and Don'ts)	Anticipated Hazards
Installation & Wiring		
	Observe the specifications of motor/amplifier combinations.	 
	Do not touch the connector terminals directly with hands.	 
	Do not cover the vent holes of the amplifier. Do not allow ingress of foreign matter.	 
	For test runs, be sure to check motor movement with the motor being fixed in place and not attached to your mechanical system first, and then install the motor in the mechanical system.	
	Follow the specified mounting method and orientations.	 
	Use the right mounting method that is suitable to the main body weight and the rated output of this product.	 

⚠ CAUTION		
Symbol	Precautions (Dos and Don'ts)	Anticipated Hazards
Handling & Operations		
⊘	Do not step on this product or place any heavy object on it.	⚠ ⚠ ⚠
	To avoid unstable motions, never make drastic changes in tuning.	⚠
	Do not approach your machine after power restoration following power outage. It may restart unexpectedly. Configure your machine to ensure safety of your personnel against its unexpected restarts.	⚠
	Do not use the product where it could be exposed to direct sunlight.	⚠
	Do not apply impact load to the product.	⚠
	Never operate or stop the motor using the electromagnetic contactor installed on the main power supply side.	⚠
	The brake installed in the motor is only for holding. Do not use it as a decelerating device.	⚠ ⚠
!	Do not use if the motor or amplifier is malfunctioning, broken, or damaged.	⚠ ⚠ ⚠
	Confirm that your power supply specifications comply with this product's.	⚠
	The holding brake is not a stopping device to secure machine safety. To ensure safety, prepare a stopping device for your machinery.	⚠
	Upon occurrence of an alarm, eliminate the cause and secure safety before resetting the alarm and restarting your machine.	⚠
	Connect the brake control relay and the emergency stop relay in series.	⚠ ⚠
Transportation & Storage		
⊘	Do not store the product where it could be subjected to water, moisture, toxic gases, or liquids.	⚠
	Do not hold the cables or the motor shaft when transporting.	⚠ ⚠
	Do not let the product fall off or fall over during transportation or installation.	⚠
!	If the product was stored away for an extended period of time, check with our distributor.	⚠
	Store the product in a location that meets the requirement of storage environments described in the instruction manual.	⚠
Disposal		
!	Prior to disposal of batteries, insulate them with tape or other material. Dispose of them following the local laws and regulations.	
	When disposing of the S-FLAG product, treat it as industrial waste.	
Maintenance & Inspection		
⊘	Overhauls must not be done by anyone but SANKYO CORPORATION.	⚠
	Do not turn the power supply on and off too frequently.	⚠
	Your motor, heat sink of the amplifier, or regenerative resistor may become dangerously hot. Do not touch any of them with hands when power is on or for a while after power shutdown.	⚠ ⚠
!	If your amplifier or motor fails, shut down both of the control power supply and the main circuit power supply.	⚠
	When not using the product for an extended period of time, be sure to turn the power off.	⚠

Other Considerations and Precautions

Export of this product or its applications

If the end user or application of the product assumes to be involved in military activities or weapons, its export may be subject to "Foreign Exchange and Foreign Trade Law (Japan)" (or equivalent in your country). Have adequate legal reviews and follow any required export procedures.

Medical applications

Do not attempt to use this product or its application for human life related field. This product has been designed and manufactured for general industrial use and its medical applications are not allowed.

Applications for special environments or purposes such as nuclear power, aerospace and transportation

Please contact us in advance.

Applications that could cause serious accidents or damages due to our product failures

Be sure to have safety device or protection device installed before using your equipment.

Applying voltage over the rated power supply of this product

Could become fire or smoke hazard to the amplifier. Be sure to check and confirm proper wiring before turning the power on. Be particularly careful in a location such as clean room.

Operations with the motor shaft not grounded electrically

Depending on the device or installation environment, bearing noise might get increased by galvanic corrosion of the motor bearings. Carry out careful check and test on grounding.

Operations in environment under significant influences of external noise and static electricity

This product has been designed and manufactured along with extensive noise tests. However, there is a possibility of unexpected behaviors, depending on user's environment. Practice a fail-safe design and also take adequate measures to ensure safety within the range of machine motion.

Use of this product in a manner not specified by the manufacture

Such use shall void the manufacture warranty. Be mindful before you attempt to do so.

Maintenance and Inspection

Perform regular maintenance and inspections for safe use of this product. Ensure the safety before each inspection work.

This product assumes the following operation conditions.

Ambient temperature	Average annual temperature of 30°C (not exceeding the rated temperature range)
Maximum load factor	80%
Maximum operating hours	20 hours a day

Daily Inspection: Check the following before each operation.

- Check ambient temperature, humidity and atmosphere.
- No foreign objects or dust, especially nothing is blocking the vent holes.
- No over bent or damages of the wires.
- Power supply voltage is within the specifications.
- No foreign objects in mobile components of the device and the range of motions.
- When the power is on, there is no unusual noise or smell right after the machinery starts.

Periodic Inspection: Check for the following at least once a year.

- No loose clamp screw problems in the amplifier and motor.
- No deformation or no discoloration in the amplifier, motor, cables, and terminal blocks due to overheat
- No looseness in wiring fixings and terminal block screws

Warranty Information

Terms of Warranty

The term of warranty for this product is eighteen (18) months after the date of product manufacture. However, brake equipped motors whose number of axis accelerations and decelerations exceeded the rated maximum shall not be covered by the warranty.

Conditions of Warranty

Should any failure develop during the warranty period under normal operations following the S-FLAG instruction manual, NIDEC Sankyo (Manufacture) agrees to make repairs at free of charge. However, even during the warranty period, Manufacture makes only fee-based repair if the failure is due to the following reasons:

- Misuse, improper repair, or alternation of the product
- Dropped after the purchase or damaged during transportation
- Use of this product in a manner not specified by Manufacture
- Fire, earthquake, lightning, storm and flood damage, salt damage, abnormal voltage, or any other acts of God or natural disasters
- Ingress of foreign matter such as water, oil or metal chips.

This warranty does not apply to parts or accessories that have been used longer than each rated service life. The warranty applies to delivered products only and Manufacture shall not be liable for any indirect, incidental or consequential damage caused by the product failure or damage.

Other Notices

Please read our instruction manuals carefully and use the product properly.

The product features or parts of this product may change without notice as a result of further development of the product. The contents of this catalogue or the instruction manuals are subject to change without notice.

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