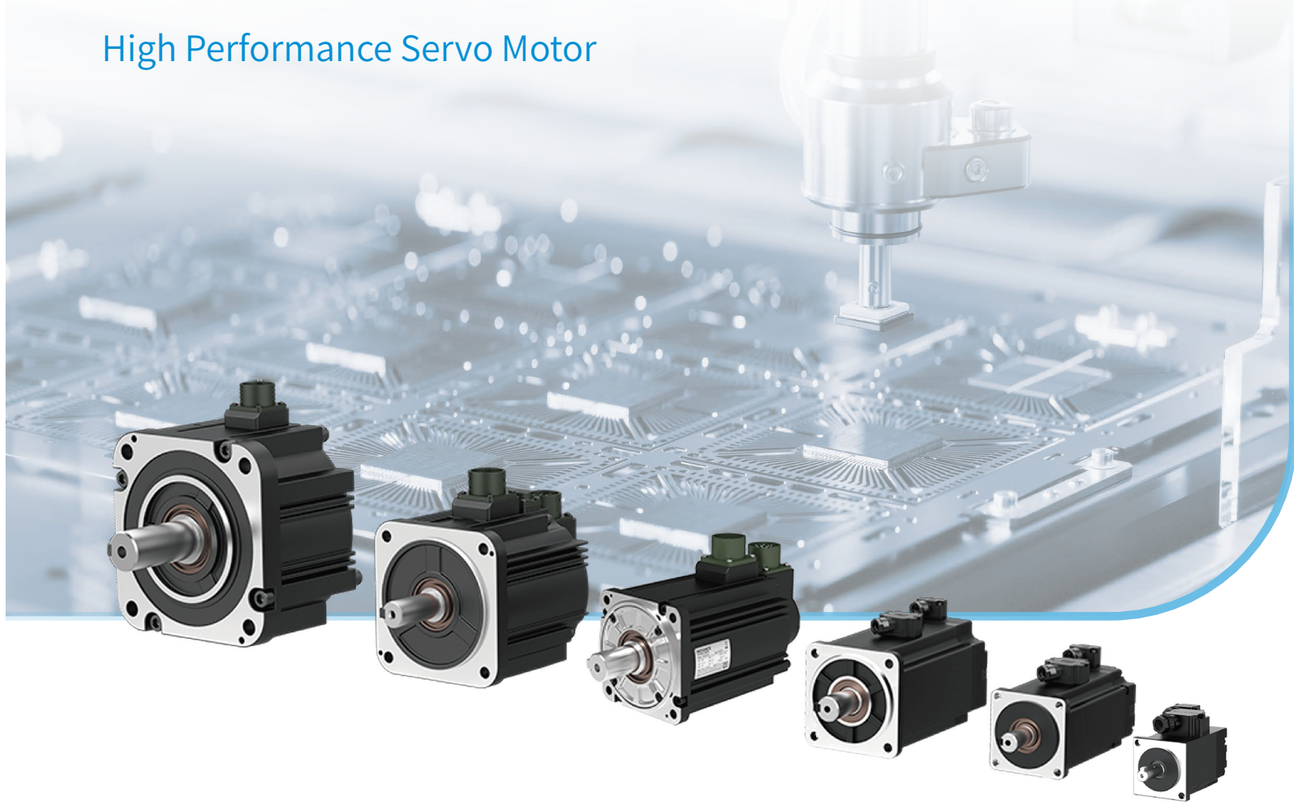
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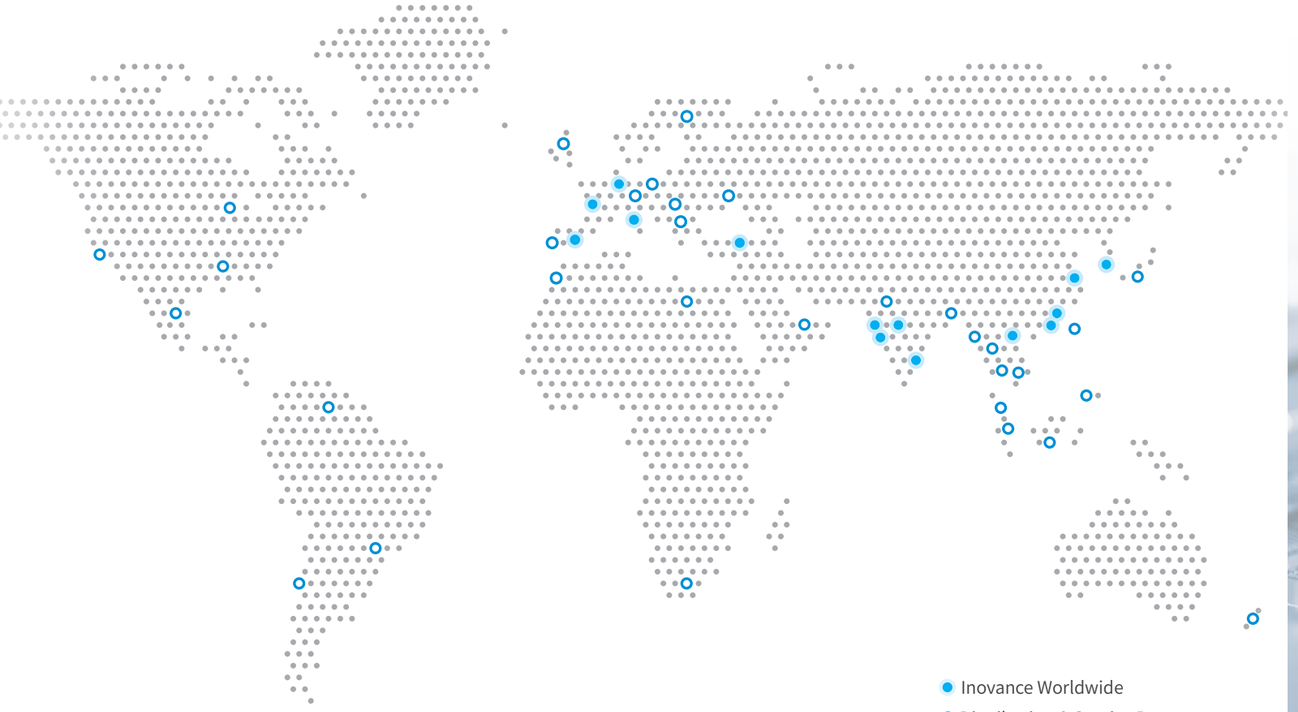
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INOVANCE

# MS1-R Series Servo Motor

## High Performance Servo Motor





- Inovance Worldwide
- Distribution & Service Partners

## Advancing industrial technology, for a better world


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tiendinh@inovance.com

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## Features & functions

- Power from 0.05kW to 7.5kW with 6 types of frame size
- Optimized characteristics max.speed 7000rpm
- Options: · 23bit or 26bit multi-turn encoder
  · With or without brake
- Compact dimensions with more power per space
- Highest energy efficiency equivalent to IE5 level
- Optimized design with low cogging torque and high accuracy

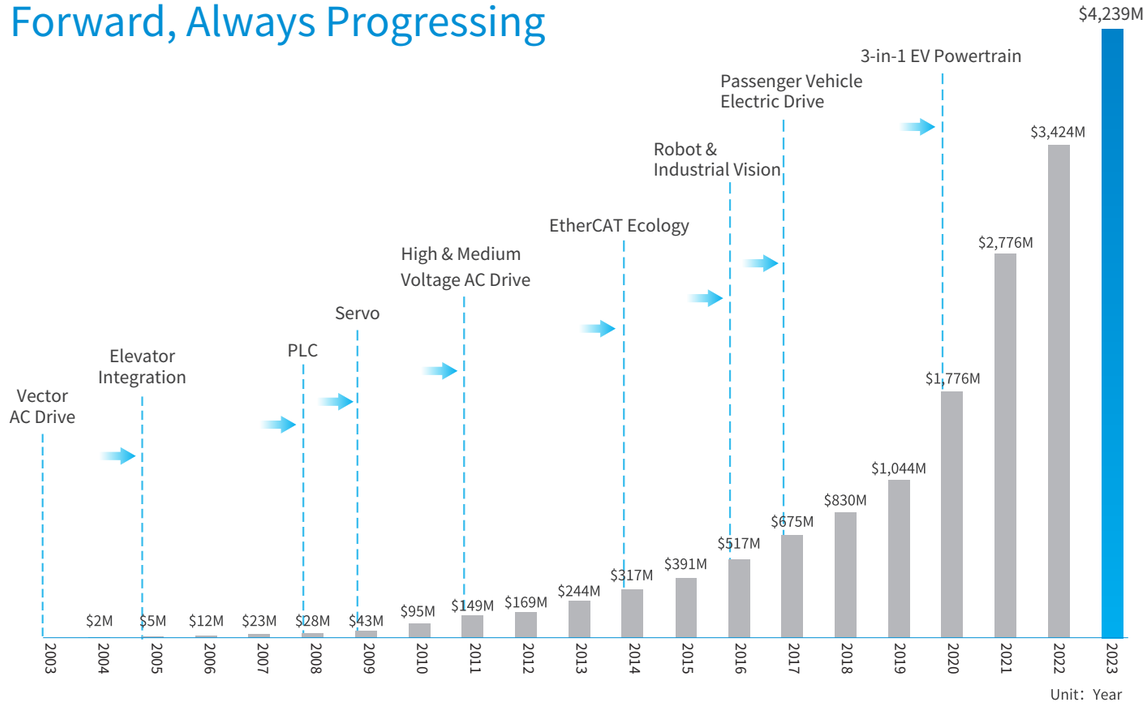



# About Inovance

The Inovance Group, founded in 2003, is a rising star in the global industrial automation business and has revenues of $4.2 in 2023. Inovance is headquartered in Shenzhen, China, and has built a global operation with offices and facilities in Germany, France, Italy, Spain, Turkey, India, and South Korea. Additionally, the company has a strong network of distribution partners around the world.

The company 's flexible production techniques and expert understanding of all industry sectors - from plastics to printing to packaging to iron & steel production - have allowed it to establish globally leading industry-specific business units. Over the years, Inovance has built an engineering team with specialist expertise in industrial automation. This knowledge allows it to form strong partnerships with OEMs and end users, providing ongoing advice about how to get the most out of their automation solutions today, and how to stay prepared for the market and technology changes that are coming in future.

## Forward, Always Progressing




**2003**
founded

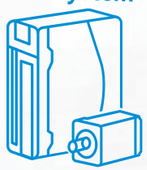
**IPO:2010**
Shenzhen, China

**20,000**
employees

**Global**
network of offices and distributors

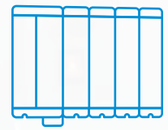
**$4.2+bn**
revenues in 2023

### Servo System



**4,500,000+**
sets delivered in 2023

### AC Drive



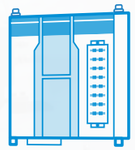
**2,20,000+**
sets delivered in 2023

### Industrial Robot



**22,000+**
sets delivered in 2023

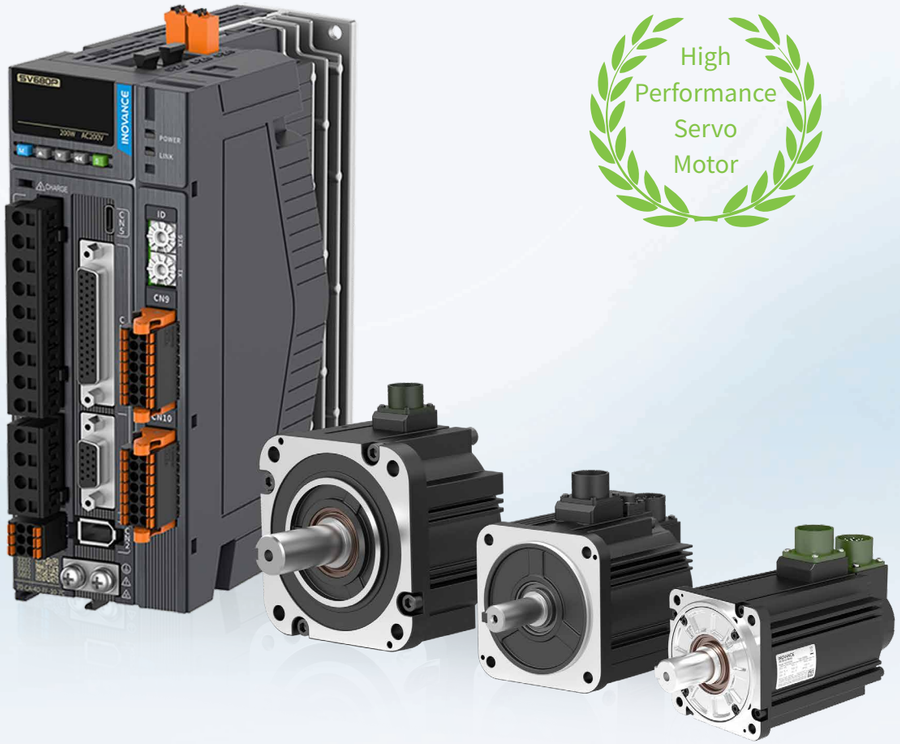
### Controller



**3,400,000+**
sets delivered in 2023

6 Advanced technical design

# Highlights



High Performance Servo Motor

## Small size

Smaller footprint with torque output unchanged, max. reduction of length reaching **29%**

**Dimensions** of mounting interfaces **Compatible** with MS1-Z series motors

## High stiffness

Stiffness of typical models **increased by five levels**

## Low temperature rise

Optimized electromagnetic circuit to reduce temperature rise

Flange size 60 & 80: Temperature rise reduced by **20K** compared with previous motors

## High energy-saving performance

550 W to 7.5 kW motors compliant with energy efficiency equal to **IE5 standard**

## Full range of motors

**Ultra-low inertia** available for motors with flange size 60/80 to better fit applications requiring quick jog control;

220 V models available for motors with flange size 100/130/180;

Regular **26-bit multi-turn absolute encoder** and **functional safety-type** 26-bit multi-turn absolute encoder available for applications requiring high precision

## High speed

Max. speed of MS1H1 and MS1H4 motors with flange size 40/60/80 increased from 6000 rpm to **7000 rpm**

Max. speed of MS1H2 motors increased from 5000 rpm to **6000 rpm**

Max. speed of MS1H3 motors (flange size 130/180) increased from 3000 rpm to **4500 rpm**

Note: The preceding speeds are for motors with 23-bit or 26-bit encoders.



## MS1-R Naming Rules

**MS1 H1- 75B 30C B - A3 3 1 R - * - INT**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① MS1 series servo motor

② Inertia and capacity type
- H1: Low inertia, small capacity
- H2: Low inertia, medium capacity
- H3: Medium inertia, medium capacity
- H4: Medium inertia, small capacity

③ Rated power (W)
Comprised of a letter and two digits
- B: x 10
- C: x 100

Example: 75B: 750 W

④ Rated speed (rpm)
Comprised of a letter and two digits
- B: x 10
- C: x 100

Example: 30C: 3000 rpm

⑤ Voltage class
- B: 200V grade
- D: 400V grade

⑥ Encoder type
Comprised of a letter and a digit
- A6: 26-bit multi-turn absolute encoder
- S6: Functional safety-type 26-bit multi-turn absolute encoder
- A3: 23-bit multi-turn absolute encoder

⑦ Shaft connection mode
- 3: Solid and keyed, with threaded hole in the shaft center

⑧ Brake or oil seal[1]
- 0: Without oil seal or brake
- 1: With oil seal, without brake
- 2: Without oil seal, with brake
- 4: With oil seal and brake

⑨ Sub-series No.
- R: R series

⑩ Customization information
- _: Standard type
- -S: Flying leads type
- -**: Other customized types

⑪ Model type
- INT: International

[1]: Flange size 40mm with H1 type motors are not equipped with an oil seal.

## Technical Data

| Item | Description |
|---|---|
| Duty type | S1 (Continuous duty) |
| Vibration class | V15[1] |
| Insulation resistance | 500 VDC, above 10 MΩ |
| Ambient temperature | 0°C to 40°C (non-frozen) (See the derating curve for temperaturesa above 40°C .) |
| Ambient humidity | 20% to 80% (without condensation) |
| Storage environment | Observe the following environment requirements for storing a de-energized motor:<br>·Storage temperature: -20° C to +60° C (non-frozen)<br>·Storage humidity: 20% to 80% RH (without condensation) |
| Excitation mode | Permanent magnet |
| Installation mode | Flange type |
| Insulation class | F (155°C) |
| Insulation voltage | 1 min for 1500 VAC (220 V class); 1 min for 1800 VAC (380 V class) |
| IP rating of enclosure | IP67 (excluding shaft opening and connectors of flying lead type motors) |
| Ambient humidity | 20% to 80%RH (without condensation) |
| Direction of rotation | Rotating counterclockwise when viewed from the shaft extension side with forward run commands from servo drive<br> |
| Vibration resistance [2][4] | 49 m/s² (Flange face as standard) |
| Shock resistance [3][4] | 490 m/s² (Flange face as standard); Number of shocks: Two |
| Altitude | Derating is required only for altitudes above 1000 m. |
| Certification | CE/UKCA/UL/EAC/ROHS |

Note: [1] Vibration level V15 represents the vibration amplitude of the servo motor is lower than 15 μm during operation at rated speed.
[2] The vertical, side-to-side, and front-to-back vibration resistance in three directions when the motor is mounted with the shaft in a horizontal position is given in the above table.
[3] The shock resistance for shock in the vertical direction when the motor is mounted with the shaft in a horizontal position is given in the above table.
[4] Do not operate the system at a fixed frequency because exceeding the allowable vibration value can damage the system.

# Technical Data of MS1-R Motors with 26-bit Encoder

## MS1H1 motors with low inertia and small capacity (flange size 40/60/80)

| Motor Model MS1H1- | 05B30CB | 10B30CB | 20B30CB | 40B30CB | 55B30CB | 75B30CB | 10C30CB |
|---|---|---|---|---|---|---|---|
| Flange size (mm) | 40 | 40 | 60 | 60 | 80 | 80 | 80 |
| Rated power (kW) | 0.05 | 0.1 | 0.2 | 0.4 | 0.55 | 0.75 | 1.0 |
| Rated voltage (V) | 220 | 220 | 220 | 220 | 220 | 220 | 220 |
| Rated torque (N·m) | 0.16 | 0.32 | 0.64 | 1.27 | 1.75 | 2.39 | 3.18 |
| Max. torque (N·m) | 0.56 | 1.12 | 2.24 | 4.45 | 6.13 | 8.36 | 11.13 |
| Rated current (A) | 1.2 | 1.2 | 1.5 | 2.5 | 3.9 | 4.4 | 6.2 |
| Max. current (A) | 4.8 | 4.8 | 5.3 | 9.8 | 15 | 16.9 | 24 |
| Rated speed $n_N$ (rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$ (rpm) | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 |
| Torque coefficient (N·m/A) | 0.15 | 0.30 | 0.51 | 0.57 | 0.51 | 0.62 | 0.59 |
| Rotor moment of inertia (kg·cm$^2$) | 0.018 (0.0208) | 0.0316 (0.0345) | 0.094 (0.106) | 0.145 (0.157) | 0.55 ( / ) | 0.68 (0.71) | 0.82 (0.87) |
| Applicable drive (SV680) | S1R6 | S1R6 | S1R6 | S2R8 | S5R5 | S5R5 | S7R6 |

## MS1H2 motors with low inertia and medium capacity (flange size 100)

| Motor Model MS1H2- | 10C30CB | 10C30CD | 15C30CB | 15C30CD | 20C30CB | 20C30CD | 25C30CB | 25C30CD |
|---|---|---|---|---|---|---|---|---|
| Flange size (mm) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Rated power (kW) | 1.0 | 1.0 | 1.5 | 1.5 | 2.0 | 2.0 | 2.5 | 2.5 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 220 | 380 | 220 | 380 |
| Rated torque (N·m) | 3.18 | 3.18 | 4.9 | 4.9 | 6.36 | 6.36 | 7.96 | 7.96 |
| Max. torque (N·m) | 9.54 | 9.54 | 14.7 | 14.7 | 19.1 | 19.1 | 23.9 | 23.9 |
| Rated current (A) | 6.4 | 3.3 | 8.6 | 4.2 | 11.3 | 5.6 | 14.7 | 7.2 |
| Max. current (A) | 23 | 11 | 32 | 14 | 42 | 20 | 53 | 26 |
| Rated speed $n_N$(rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$(rpm) | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| Torque coefficient (N·m/A) | 0.54 | 1.07 | 0.62 | 1.28 | 0.60 | 1.19 | 0.60 | 1.18 |
| Rotor moment of inertia (kg·cm$^2$) | 1.78 (2.6) | 1.78 (2.6) | 2.35 (3.17) | 2.35 (3.17) | 2.92 (3.74) | 2.92 (3.74) | 3.49 (4.3) | 3.49 (4.3) |
| Applicable drive (SV680) | S7R6 | T3R5 | S012 | T5R4 | S018 | T8R4 | S022 | T012 |

## MS1H2 motors with low inertia and medium capacity (flange size 130)

| Motor Model MS1H2- | 30C30CB | 30C30CD | 40C30CB | 40C30CD | 50C30CB | 50C30CD |
|---|---|---|---|---|---|---|
| Flange size (mm) | 130 | 130 | 130 | 130 | 130 | 130 |
| Rated power (kW) | 3.0 | 3.0 | 4.0 | 4.0 | 5.0 | 5.0 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 220 | 380 |
| Rated torque (N·m) | 9.8 | 9.8 | 12.6 | 12.6 | 15.8 | 15.8 |
| Max. torque (N·m) | 24.5 | 29.4 | 31.5 | 37.8 | 39.5 | 47.4 |
| Rated current (A) | 16.6 | 8.9 | 22 | 13.5 | 22 | 17 |
| Max. current (A) | 55 | 29 | 67.5 | 42.5 | 67.5 | 52.5 |
| Rated speed $n_N$(rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$(rpm) | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| Torque coefficient (N·m/A) | 0.67 | 1.25 | 0.65 | 1.06 | 0.81 | 1.04 |
| Rotor moment of inertia (kg·cm$^2$) | 6.4 (9.38)[1] | 6.4 (9.38) | 9 (11.98) | 9 (11.98) | 11.6 (14.58) | 11.6 (14.58) |
| Applicable drive (SV680)[2] | S022 | T012 | S027 | T017 | S027 | T021 |

Note:[1] Values in the parentheses are rotor moment of inertia values for motors with brake.
[2] The motor with 26-bit encoder matches SV680 series servo drives. Drive model description: S-220 V voltage class; T-380 V voltage class; 1R6-Rated output current 1.6 A...; 027-Rated output current 27 A



## MS1H3 motors with medium inertia and medium capacity (flange size 130)

| Motor Model MS1H3- | 85B15CB | 85B15CD | 13C15CB | 13C15CD | 18C15CB | 18C15CD |
|---|---|---|---|---|---|---|
| Flange size (mm) | 130 | 130 | 130 | 130 | 130 | 130 |
| Rated power (kW) | 0.85 | 0.85 | 1.3 | 1.3 | 1.8 | 1.8 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 220 | 380 |
| Rated torque (N·m) | 5.39 | 5.39 | 8.34 | 8.34 | 11.5 | 11.5 |
| Max. torque (N·m) | 13.5 | 13.5 | 20.85 | 20.85 | 28.75 | 28.75 |
| Rated current (A) | 6.6 | 3.5 | 10.5 | 5.1 | 11.9 | 6.75 |
| Max. current (A) | 17.2 | 8.5 | 27.3 | 12.6 | 32.2 | 17.7 |
| Rated speed $n_N$ (rpm) | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Max. speed $n_{max}$ (rpm) | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 |
| Torque coefficient (N·m/A) | 0.93 | 1.84 | 0.89 | 1.85 | 1.05 | 1.87 |
| Rotor moment of inertia (kg·cm$^2$) | 13.56 (15.8) | 13.56 (15.8) | 19.25 (21.5) | 19.25 (21.5) | 24.9 (27.2) | 24.9 (27.2) |
| Applicable drive (SV680) | S7R6 | T3R5 | S012 | T5R4 | S018 | T8R4 |

## MS1H3 motors with medium inertia and medium capacity (flange size 180)

| Motor Model MS1H3- | 29C15CB | 29C15CD | 44C15CB | 44C15CD | 55C15CD | 75C15CD |
|---|---|---|---|---|---|---|
| Flange size (mm) | 180 | 180 | 180 | 180 | 180 | 180 |
| Rated power (kW) | 2.9 | 2.9 | 4.4 | 4.4 | 5.5 | 7.5 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 380 | 380 |
| Rated torque (N·m) | 18.6 | 18.6 | 28.4 | 28.4 | 35 | 48 |
| Max. torque (N·m) | 46.5 | 46.5 | 71.1 | 71.1 | 87.6 | 119 |
| Rated current (A) | 18 | 10.5 | 25.5 | 16 | 20.7 | 25 |
| Max. current (A) | 52.5 | 29.75 | 67 | 42 | 52 | 65 |
| Rated speed $n_N$ (rpm) | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Max. speed $n_{max}$ (rpm) | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 |
| Torque coefficient (N·m/A) | 1.16 | 1.94 | 1.25 | 1.96 | 1.92 | 2.13 |
| Rotor moment of inertia (kg·cm$^2$) | 44.7 (52.35) | 44.7 (52.35) | 64.9 (72.55) | 64.9 (72.55) | 86.9 (94.55) | 127.5 (135.15) |
| Applicable drive (SV680) | S022 | T012 | S027 | T017 | T021 | T026 |

## MS1H4 motors with medium inertia and small capacity (flange size 40/60/80)

| Motor Model MS1H4- | 05B30CB | 10B30CB | 20B30CB | 40B30CB | 55B30CB | 75B30CB | 10C30CB |
|---|---|---|---|---|---|---|---|
| Flange size (mm) | 40 | 40 | 60 | 60 | 80 | 80 | 80 |
| Rated power (kW) | 0.05 | 0.1 | 0.2 | 0.4 | 0.55 | 0.75 | 1.0 |
| Rated voltage (V) | 220 | 220 | 220 | 220 | 220 | 220 | 220 |
| Rated torque (N·m) | 0.16 | 0.32 | 0.64 | 1.27 | 1.75 | 2.39 | 3.18 |
| Max. torque (N·m) | 0.56 | 1.12 | 2.24 | 4.45 | 6.13 | 8.37 | 11.13 |
| Rated current (A) | 1.27 | 1.27 | 1.3 | 2.4 | 3.3 | 4.4 | 6.5 |
| Max. current (A) | 4.78 | 4.78 | 5.3 | 9.2 | 13.2 | 16.9 | 24 |
| Rated speed $n_N$ (rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$ (rpm) | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 |
| Torque coefficient (N·m/A) | 0.15 | 0.29 | 0.55 | 0.58 | 0.58 | 0.63 | 0.53 |
| Rotor moment of inertia (kg·cm$^2$) | 0.038 (0.04) | 0.072 (0.074) | 0.22 (0.23) | 0.43 (0.44) | 1.12 ( / ) | 1.46 (1.51) | 1.87 (1.97) |
| Applicable drive (SV680) | S1R6 | S1R6 | S1R6 | S2R8 | S5R5 | S5R5 | S7R6 |

# Technical Data of MS1-R Motors with 23-bit encoder

## MS1H1 motors with low inertia and small capacity (flange size 40/60/80)

| Motor Model MS1H1- | 05B30CB | 10B30CB | 20B30CB | 40B30CB | 55B30CB | 75B30CB | 10C30CB |
|---|---|---|---|---|---|---|---|
| Flange size (mm) | 40 | 40 | 60 | 60 | 80 | 80 | 80 |
| Rated power (kW) | 0.05 | 0.1 | 0.2 | 0.4 | 0.55 | 0.75 | 1.0 |
| Rated voltage (V) | 220 | 220 | 220 | 220 | 220 | 220 | 220 |
| Rated torque (N·m) | 0.16 | 0.32 | 0.64 | 1.27 | 1.75 | 2.39 | 3.18 |
| Max. torque (N·m) | 0.56 | 1.12 | 2.24 | 4.45 | 6.13 | 8.36 | 11.13 |
| Rated current (A) | 1.2 | 1.2 | 1.5 | 2.5 | 3.9 | 4.4 | 6.2 |
| Max. current (A) | 4.8 | 4.8 | 5.3 | 9.8 | 15 | 16.9 | 24 |
| Rated speed $n_N$(rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$(rpm) | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 |
| Torque coefficient (N·m/A) | 0.15 | 0.30 | 0.51 | 0.57 | 0.51 | 0.62 | 0.59 |
| Rotor moment of inertia (kg·cm$^2$) | 0.018 (0.0208) | 0.0316 (0.0345) | 0.094 (0.106) | 0.145 (0.157) | 0.55 ( / ) | 0.68 (0.71) | 0.82 (0.87) |
| Applicable drive (SV670)0[2] | S1R6 | S1R6 | S1R6 | S2R8 | S5R5 | S5R5 | S7R6 |
| Applicable drive (SV660) | S1R6 | S1R6 | S1R6 | S2R8 | S5R5 | S5R5 | S7R6 |

## MS1H2 motors with low inertia and medium capacity (flange size 100)

| Motor Model MS1H2- | 10C30CB | 10C30CD | 15C30CB | 15C30CD | 20C30CB | 20C30CD | 25C30CB | 25C30CD |
|---|---|---|---|---|---|---|---|---|
| Flange size (mm) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Rated power (kW) | 1.0 | 1.0 | 1.5 | 1.5 | 2.0 | 2.0 | 2.5 | 2.5 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 220 | 380 | 220 | 380 |
| Rated torque (N·m) | 3.18 | 3.18 | 4.9 | 4.9 | 6.36 | 6.36 | 7.96 | 7.96 |
| Max. torque (N·m) | 9.54 | 9.54 | 14.7 | 14.7 | 19.1 | 19.1 | 23.9 | 23.9 |
| Rated current (A) | 6.4 | 3.3 | 8.6 | 4.2 | 11.3 | 5.6 | 14.7 | 7.2 |
| Max. current (A) | 23 | 11 | 32 | 14 | 42 | 20 | 53 | 26 |
| Rated speed $n_N$(rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$(rpm) | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| Torque coefficient (N·m/A) | 0.54 | 1.07 | 0.62 | 1.28 | 0.60 | 1.19 | 0.60 | 1.18 |
| Rotor moment of inertia (kg·cm$^2$) | 1.78 (2.6) | 1.78 (2.6) | 2.35 (3.17) | 2.35 (3.17) | 2.92 (3.74) | 2.92 (3.74) | 3.49 (4.3) | 3.49 (4.3) |
| Applicable drive (SV670) | S7R6 | T3R5 | S012 | T5R4 | S018[4] | T8R4 | S022 | T012[5] |
| Applicable drive (SV660) | S7R6 | T3R5 | S012 | T5R4 | S012 | T8R4 | / | T012 |

## MS1H2 motors with low inertia and medium capacity (flang size 130)

| Motor Model MS1H2- | 30C30CB | 30C30CD | 40C30CB | 40C30CD | 50C30CB | 50C30CD |
|---|---|---|---|---|---|---|
| Flange size (mm) | 130 | 130 | 130 | 130 | 130 | 130 |
| Rated power (kW) | 3.0 | 3.0 | 4.0 | 4.0 | 5.0 | 5.0 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 220 | 380 |
| Rated torque (N·m) | 9.8 | 9.8 | 12.6 | 12.6 | 15.8 | 15.8 |
| Max. torque (N·m) | 24.5 | 29.4 | 31.5 | 37.8 | 39.5 | 47.4 |
| Rated current (A) | 16.6 | 8.9 | 22 | 13.5 | 22 | 17 |
| Max. current (A) | 55 | 29 | 67.5 | 42.5 | 67.5 | 52.5 |
| Rated speed $n_N$(rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$(rpm) | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| Torque coefficient (N·m/A) | 0.67 | 1.25 | 0.65 | 1.06 | 0.81 | 1.04 |
| Rotor moment of inertia (kg·cm$^2$) | 6.4 (9.38) | 6.4 (9.38) | 9 (11.98) | 9 (11.98) | 11.6 (14.58) | 11.6 (14.58) |
| Applicable drive (SV670) | S022 | T012 | S027 | T017 | S027 | T021[6] |
| Applicable drive (SV660) | / | T012 | / | T017 | / | T021 |

Note: [1] Values in the parentheses are rotor moment of inertia values for motors with brake. The slash symbol "/" represents this drive model is not available.
[2] The motor with 18-bit encoder matches SV630 series servo drives.Drive model description: S-220 V voltage class; T-380 V voltage class; 1R6-Rated output current 1.6 A...; 027-Rated output current 27 A



## MS1H3 motors with medium inertia and medium capacity (flange size 130)

| Motor Model MS1H3- | 85B15CB | 85B15CD | 13C15CB | 13C15CD | 18C15CB | 18C15CD |
|---|---|---|---|---|---|---|
| Flange size (mm) | 130 | 130 | 130 | 130 | 130 | 130 |
| Rated power (kW) | 0.85 | 0.85 | 1.3 | 1.3 | 1.8 | 1.8 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 220 | 380 |
| Rated torque (N·m) | 5.39 | 5.39 | 8.34 | 8.34 | 11.5 | 11.5 |
| Max. torque (N·m) | 13.5 | 13.5 | 20.85 | 20.85 | 28.75 | 28.75 |
| Rated current (A) | 6.6 | 3.5 | 10.5 | 5.1 | 11.9 | 6.75 |
| Max. current (A) | 17.2 | 8.5 | 27.3 | 12.6 | 32.2 | 17.7 |
| Rated speed $n_N$(rpm) | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Max. speed $n_{max}$(rpm) | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 |
| Torque coefficient (N·m/A) | 0.93 | 1.84 | 0.89 | 1.85 | 1.05 | 1.87 |
| Rotor moment of inertia (kg·cm$^2$) | 13.56 (15.8) | 13.56 (15.8) | 19.25 (21.5) | 19.25 (21.5) | 24.9 (27.2) | 24.9 (27.2) |
| Applicable drive (SV670) | S7R6 | T3R5 | S012 | T5R4 | S012 | T8R4 |
| Applicable drive (SV660) | S7R6 | T3R5 | S012 | T5R4 | S012[4] | T8R4 |

## MS1H3 motors with medium inertia and medium capacity (flange size 180)

| Motor Model MS1H3- | 29C15CB | 29C15CD | 44C15CB | 44C15CD | 55C15CD | 75C15CD |
|---|---|---|---|---|---|---|
| Flange size (mm) | 180 | 180 | 180 | 180 | 180 | 180 |
| Rated power (kW) | 2.9 | 2.9 | 4.4 | 4.4 | 5.5 | 7.5 |
| Rated voltage (V) | 220 | 380 | 220 | 380 | 380 | 380 |
| Rated torque (N·m) | 18.6 | 18.6 | 28.4 | 28.4 | 35 | 48 |
| Max. torque (N·m) | 46.5 | 46.5 | 71.1 | 71.1 | 87.6 | 119 |
| Rated current (A) | 18 | 10.5 | 25.5 | 16 | 20.7 | 25 |
| Max. current (A) | 52.5 | 29.75 | 67 | 42 | 52 | 65 |
| Rated speed $n_N$(rpm) | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Max. speed $n_{max}$(rpm) | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 |
| Torque coefficient (N·m/A) | 1.16 | 1.94 | 1.25 | 1.96 | 1.92 | 2.13 |
| Rotor moment of inertia (kg·cm$^2$) | 44.7 (52.35) | 44.7 (52.35) | 64.9 (72.55) | 64.9 (72.55) | 86.9 (94.55) | 127.5 (135.15) |
| Applicable drive (SV670) | S022 | T012 | S027 | T017 | T021 | T026 |
| Applicable drive (SV660) | / | T012 | / | T017 | T021 | T026 |

## MS1H4 motors with medium inertia and small capacity (fange size 40/60/80)

| Motor Model MS1H4- | 05B30CB | 10B30CB | 20B30CB | 40B30CB | 55B30CB | 75B30CB | 10C30CB |
|---|---|---|---|---|---|---|---|
| Flange size (mm) | 40 | 40 | 60 | 60 | 80 | 80 | 80 |
| Rated power (kW) | 0.05 | 0.1 | 0.2 | 0.4 | 0.55 | 0.75 | 1.0 |
| Rated voltage (V) | 220 | 220 | 220 | 220 | 220 | 220 | 220 |
| Rated torque (N·m) | 0.16 | 0.32 | 0.64 | 1.27 | 1.75 | 2.39 | 3.18 |
| Max. torque (N·m) | 0.56 | 1.12 | 2.24 | 4.45 | 6.13 | 8.37 | 11.13 |
| Rated current (A) | 1.27 | 1.27 | 1.3 | 2.4 | 3.3 | 4.4 | 6.5 |
| Max. current (A) | 4.78 | 4.78 | 5.3 | 9.2 | 13.2 | 16.9 | 24 |
| Rated speed $n_N$(rpm) | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Max. speed $n_{max}$(rpm) | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 | 7000 |
| Torque coefficient (N·m/A) | 0.15 | 0.29 | 0.55 | 0.58 | 0.58 | 0.63 | 0.53 |
| Rotor moment of inertia (kg·cm$^2$) | 0.038 (0.04) | 0.072 (0.074) | 0.22 (0.23) | 0.43 (0.44) | 1.12 ( / ) | 1.46 (1.51) | 1.87 (1.97) |
| Applicable drive (SV670) | S1R6 | S1R6 | S1R6 | S2R8 | S5R5 | S5R5 | S7R6 |
| Applicable drive (SV660) | S1R6 | S1R6 | S1R6 | S2R8 | S5R5 | S5R5 | S7R6 |

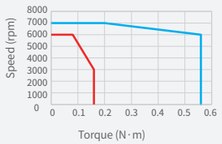
Note: [3] MS1-R series H4 models can be used to replace MS1-Z series H1/H4 motor models.
[4] For motors matching IS620 and IS650 series servo drives, see the related selection guide of the drive.
Motor type：18C15CB、20C30CB、25C30CD、50C30CD matching with different power of drive，the motor max. torque value is different, please refer the T-N curve to select.

# Torque-Speed Characteristics of MS1-R Motors with 26-bit Encoders

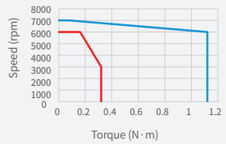
## MS1H1 low inertia, small capacity

A Continuous duty zone
B Intermittent duty zone

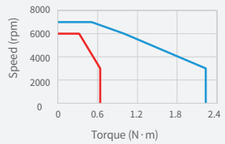
MS1H1-05B30CB-A63 ☐ R-INT



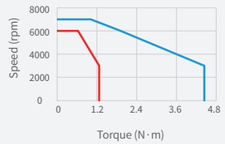

MS1H1-10B30CB- ☐ 63 ☐ R-INT



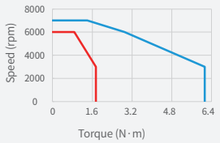

MS1H1-20B30CB- ☐ 63 ☐ R-INT



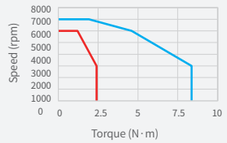

MS1H1-40B30CB- ☐ 63 ☐ R-INT



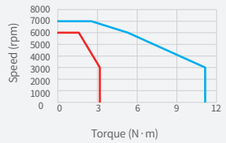

MS1H1-55B30CB- ☐ 63 ☐ R-INT




MS1H1-75B30CB- ☐ 63 ☐ R-INT



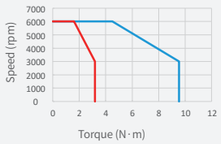

MS1H1-10C30CB- ☐ 63 ☐ R-INT



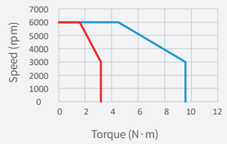

## MS1H2 low inertia, small capacity

A Continuous duty zone
B Intermittent duty zone

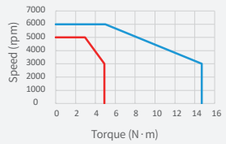
MS1H2-10C30CB- ☐ 63 ☐ R-INT



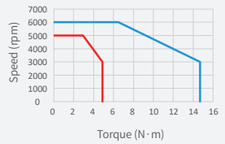

MS1H2-10C30CD- ☐ 63 ☐ R-INT



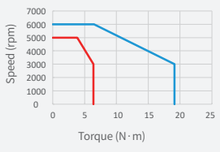

MS1H2-15C30CB- ☐ 63 ☐ R-INT



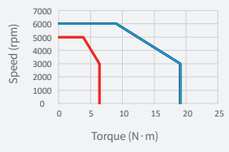

MS1H2-15C30CD- ☐ 63 ☐ R-INT



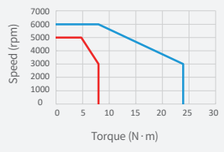

MS1H2-20C30CB- ☐ 63 ☐ R-INT



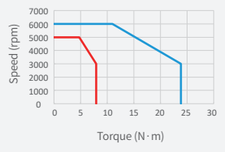

MS1H2-20C30CD- ☐ 63 ☐ R-INT



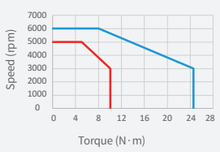

MS1H2-25C30CB- ☐ 63 ☐ R-INT



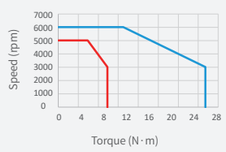

MS1H2-25C30CD- ☐ 63 ☐ R-INT



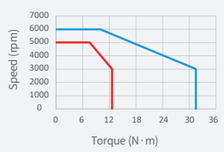

MS1H2-30C30CB- ☐ 63 ☐ R-INT



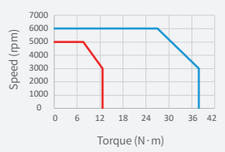

MS1H2-30C30CD- ☐ 63 ☐ R-INT



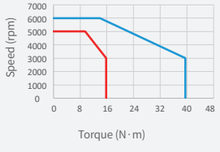

MS1H2-40C30CB- ☐ 63 ☐ R-INT



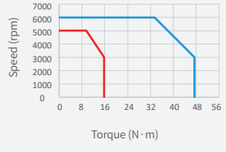

MS1H2-40C30CD- ☐ 63 ☐ R-INT




MS1H2-50C30CB- ☐ 63 ☐ R-INT




MS1H2-50C30CD- ☐ 63 ☐ R-INT

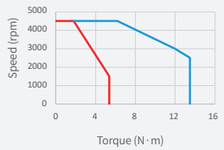




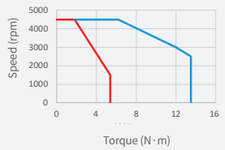

## MS1H3 medium inertia, medium capacity

A Continuous duty zone
B Intermittent duty zone

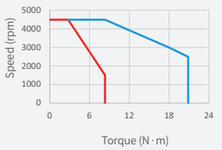
MS1H3-85B15CB- ☐ 63 ☐ R-INT



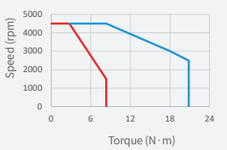

MS1H3-85B15CD- ☐ 63 ☐ R-INT



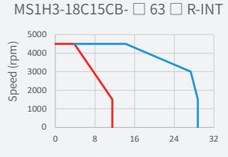

MS1H3-13C15CB- ☐ 63 ☐ R-INT



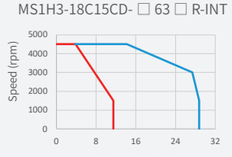

MS1H3-13C15CD- ☐ 63 ☐ R-INT



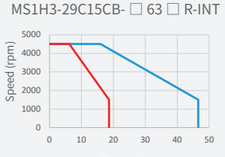

MS1H3-18C15CB- ☐ 63 ☐ R-INT



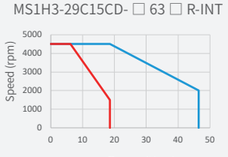

MS1H3-18C15CD- ☐ 63 ☐ R-INT



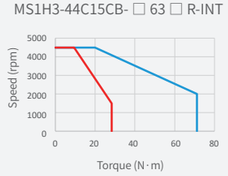

MS1H3-29C15CB- ☐ 63 ☐ R-INT



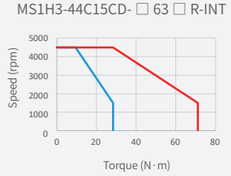

MS1H3-29C15CD- ☐ 63 ☐ R-INT



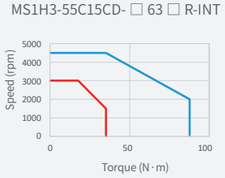

MS1H3-44C15CB- ☐ 63 ☐ R-INT



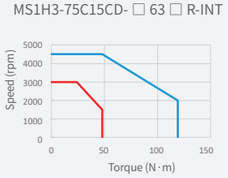

MS1H3-44C15CD- ☐ 63 ☐ R-INT




MS1H3-55C15CD- ☐ 63 ☐ R-INT



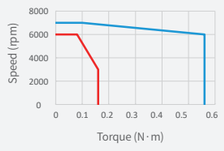

MS1H3-75C15CD- ☐ 63 ☐ R-INT



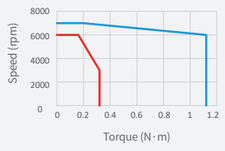

## MS1H4 medium inertia, small capacity

A Continuous duty zone
B Intermittent duty zone

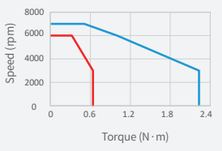
MS1H4-05B30CB- ☐ 63 ☐ R-INT



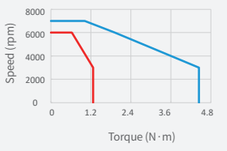

MS1H4-10B30CB- ☐ 63 ☐ R-INT



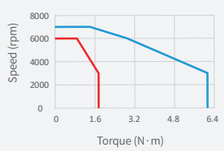

MS1H4-20B30CB- ☐ 63 ☐ R-INT



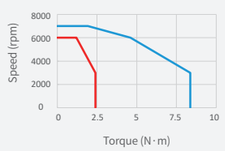

MS1H4-40B30CB- ☐ 63 ☐ R-INT



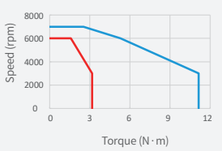

MS1H4-55B30CB- ☐ 63 ☐ R-INT




MS1H4-75B30CB- ☐ 63 ☐ R-INT




MS1H4-10C30CB- ☐ 63 ☐ R-INT

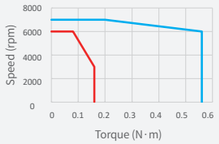


# Torque-Speed Characteristics of MS1-R Motors with 23-bit Encoders

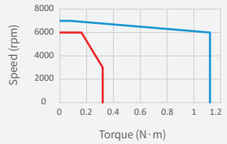
## MS1H1 low inertia, small capacity

A Continuous duty zone
B Intermittent duty zone

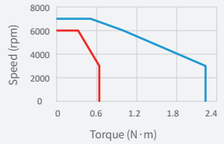
MS1H1-05B30CB-A33 ☐ R-INT



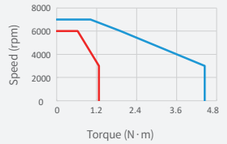

MS1H1-10B30CB-A33 ☐ R-INT



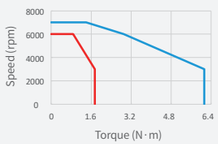

MS1H1-20B30CB-A33 ☐ R-INT



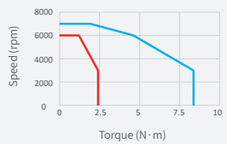

MS1H1-40B30CB-A33 ☐ R-INT



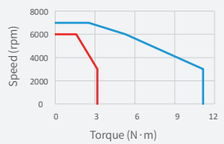

MS1H1-55B30CB-A33 ☐ R-INT




MS1H1-75B30CB-A33 ☐ R-INT



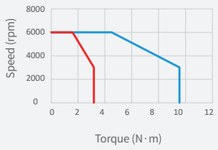

MS1H1-10C30CB-A33 ☐ R-INT



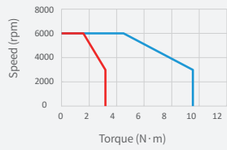

## MS1H2 low inertia, small capacity

A Continuous duty zone
B Intermittent duty zone

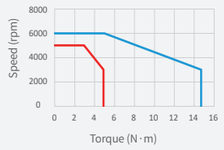
MS1H2-10C30CB-A33 ☐ R-INT



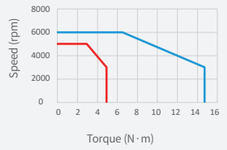

MS1H2-10C30CD-A33 ☐ R-INT



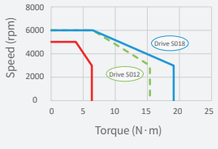

MS1H2-15C30CB-A33 ☐ R-INT



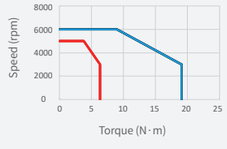

MS1H2-15C30CD-A33 ☐ R-INT



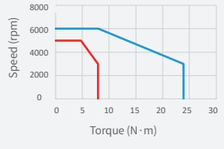

MS1H2-20C30CB-A33 ☐ R-INT



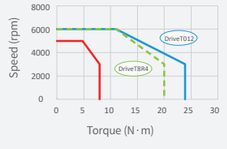

MS1H2-20C30CD-A33 ☐ R-INT



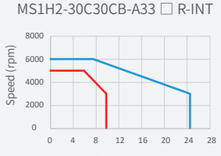

MS1H2-25C30CB-A33 ☐ R-INT



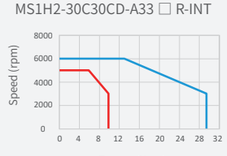

MS1H2-25C30CD-A33 ☐ R-INT



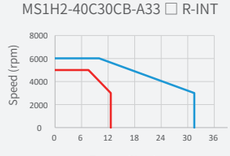

MS1H2-30C30CB-A33 ☐ R-INT



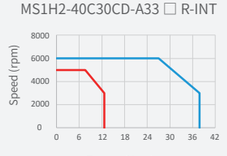

MS1H2-30C30CD-A33 ☐ R-INT



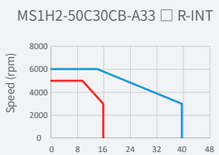

MS1H2-40C30CB-A33 ☐ R-INT



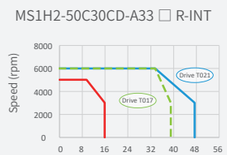

MS1H2-40C30CD-A33 ☐ R-INT




MS1H2-50C30CB-A33 ☐ R-INT




MS1H2-50C30CD-A33 ☐ R-INT

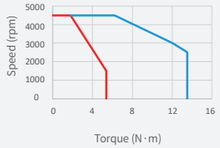




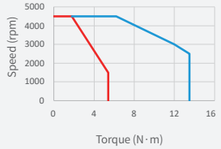

## MS1H3 medium inertia, medium capacity

A Continuous duty zone
B Intermittent duty zone

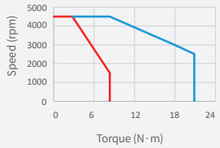
MS1H3-85B15CB-A33 ☐ R-INT



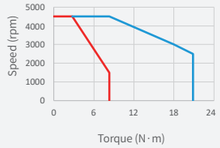

MS1H3-85B15CD-A33 ☐ R-INT



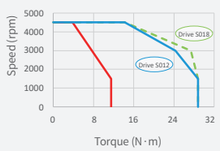

MS1H3-13C15CB-A33 ☐ R-INT



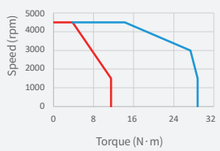

MS1H3-13C15CD-A33 ☐ R-INT



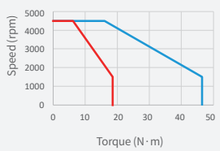

MS1H3-18C15CB-A33 ☐ R-INT



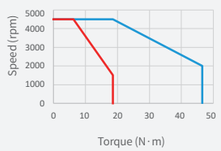

MS1H3-18C15CD-A33 ☐ R-INT



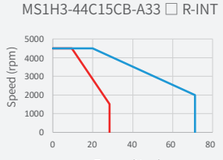

MS1H3-29C15CB-A33 ☐ R-INT



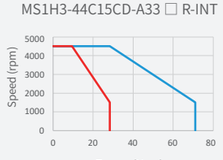

MS1H3-29C15CD-A33 ☐ R-INT



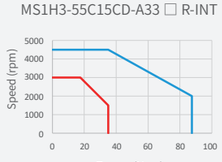

MS1H3-44C15CB-A33 ☐ R-INT



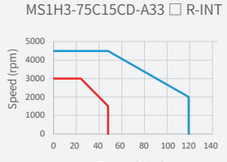

MS1H3-44C15CD-A33 ☐ R-INT




MS1H3-55C15CD-A33 ☐ R-INT



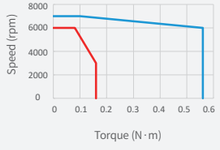

MS1H3-75C15CD-A33 ☐ R-INT



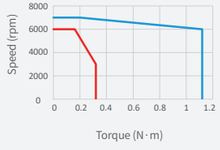

## MS1H4 medium inertia, small capacity

A Continuous duty zone
B Intermittent duty zone

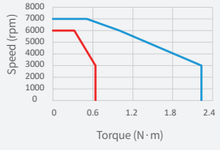
MS1H4-05B30CB-A33 ☐ R-INT



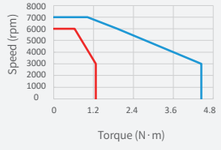

MS1H4-10B30CB-A33 ☐ R-INT



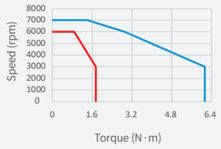

MS1H4-20B30CB-A33 ☐ R-INT



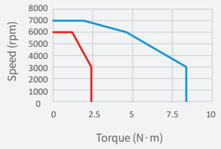

MS1H4-40B30CB-A33 ☐ R-INT



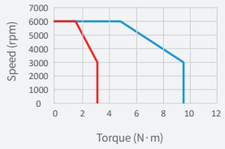

MS1H4-55B30CB-A33 ☐ R-INT




MS1H4-75B30CB-A33 ☐ R-INT

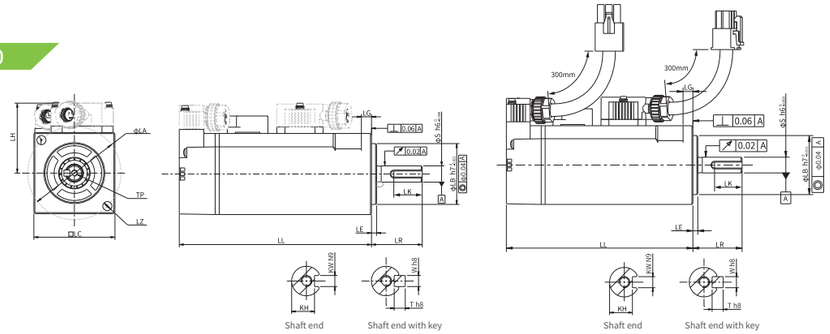



MS1H4-10C30CB-A33 ☐ R-INT

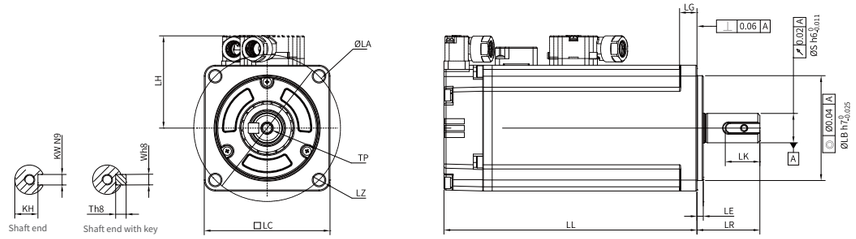


# Dimensions of MS1-R Series H1/H4 Motors

## Flange size 40




## Flange size 60/80




| Motor Model | | LC (mm) | LL (mm) | LR (mm) | LA (mm) | LZ (mm) | LH (mm) | LG (mm) | LE (mm) | LJ (mm) | LB (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size 40 | MS1H1-05B30CB-☐☐3☐R-INT[1] | 40 | 54.5 (81.8) | 25±0.5 | 46 | 2-Ø4.5 | 34.5 | 5 | 2.5±0.5 | - | Ø30h7 $^{0}_{-0.021}$ |
| | MS1H1-10B30CB-☐☐3☐R-INT[1] | 40 | 67 (94.3) | 25±0.5 | 46 | 2-Ø4.5 | 34.5 | 5 | 2.5±0.5 | - | Ø30h7 $^{0}_{-0.021}$ |
| | MS1H4-05B30CB-☐☐3☐R-INT[2] | 40 | 51 (78.3) | 25±0.5 | 46 | 2-Ø4.5 | 34.5 | 5 | 2.5±0.5 | - | Ø30h7 $^{0}_{-0.021}$ |
| | MS1H4-05B30CB-☐☐3☐R-INT[3] | 40 | 53.7 (81) | 25±0.5 | 46 | 2-Ø4.5 | 34.5 | 5 | 2.5±0.5 | - | Ø30h7 $^{0}_{-0.021}$ |
| | MS1H4-10B30CB-☐☐3☐R-INT[2] | 40 | 64.7 (92) | 25±0.5 | 46 | 2-Ø4.5 | 34.5 | 5 | 2.5±0.5 | - | Ø30h7 $^{0}_{-0.021}$ |
| | MS1H4-10B30CB-☐☐3☐R-INT[3] | 40 | 64.7 (92) | 25±0.5 | 46 | 2-Ø4.5 | 34.5 | 5 | 2.5±0.5 | - | Ø30h7 $^{0}_{-0.021}$ |

| Motor Model | | S (mm) | TP (mm) | LK[4] (mm) | KH (mm) | KW (mm) | W (mm) | T (mm) | Weight[5] (kg) |
|---|---|---|---|---|---|---|---|---|---|
| Flange size 40 | MS1H1-05B30CB-☐☐3☐R-INT | 8 | M3×6 | 14 $^{0}_{-0.36}$ | 6.2 $^{0}_{-0.1}$ | 3 | 3 | 3 | 0.26 (0.43) |
| | MS1H1-10B30CB-☐☐3☐R-INT | 8 | M3×6 | 14 $^{0}_{-0.36}$ | 6.2 $^{0}_{-0.1}$ | 3 | 3 | 3 | 0.35 (0.52) |
| | MS1H4-05B30CB-☐☐3☐R-INT | 8 | M3×6 | 14 $^{0}_{-0.36}$ | 6.2 $^{0}_{-0.1}$ | 3 | 3 | 3 | 0.24 (0.40) |
| | MS1H4-05B30CB-☐☐3☐R-INT | 8 | M3×6 | 14 $^{0}_{-0.36}$ | 6.2 $^{0}_{-0.1}$ | 3 | 3 | 3 | 0.26 (0.42) |
| | MS1H4-10B30CB-☐☐3☐R-INT | 8 | M3×6 | 14 $^{0}_{-0.36}$ | 6.2 $^{0}_{-0.1}$ | 3 | 3 | 3 | 0.32 (0.48) |
| | MS1H4-10B30CB-☐☐3☐R-INT | 8 | M3×6 | 14 $^{0}_{-0.36}$ | 6.2 $^{0}_{-0.1}$ | 3 | 3 | 3 | 0.34 (0.50) |



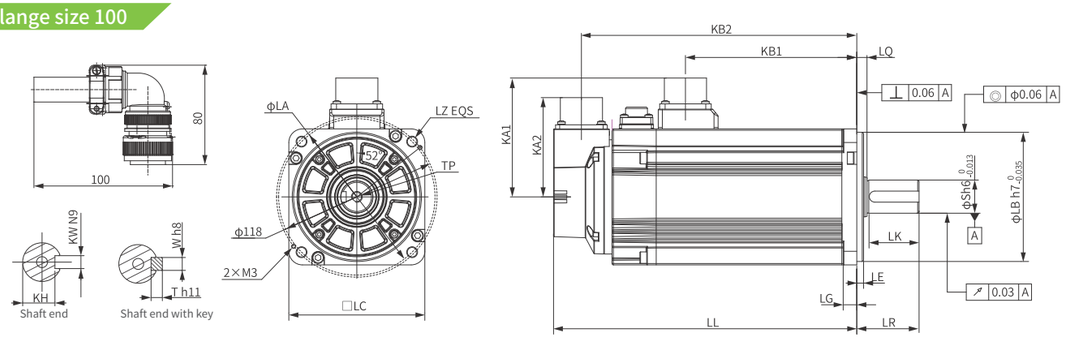
| Motor Model | | LC (mm) | LL (mm) | LR (mm) | LA (mm) | LZ (mm) | LH (mm) | LG (mm) | LE (mm) | LJ (mm) | LB (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size 60/80 | MS1H1-20B30CB-☐☐3☐R-INT | 60 | 75.5 (103) | 30±0.5 | 70 | 4-Ø5.5 | 44 | 8 | 3±0.5 | - | Ø50h7 $^{0}_{-0.025}$ |
| | MS1H1-40B30CB-☐☐3☐R-INT | 60 | 93 (121) | 30±0.5 | 70 | 4-Ø5.5 | 44 | 8 | 3±0.5 | - | Ø50h7 $^{0}_{-0.021}$ |
| | MS1H1-55B30CB-☐☐3☐R-INT | 80 | 96.7 ( / ) | 35±0.5 | 90 | 4-Ø7 | 54 | 7.5 | 3±0.5 | 0.5±0.35 | Ø70h7 $^{0}_{-0.03}$ |
| | MS1H1-75B30CB-☐☐3☐R-INT | 80 | 107.3 (141.5) | 35±0.5 | 90 | 4-Ø7 | 54 | 7.5 | 3±0.5 | 0.5±0.35 | Ø70h7 $^{0}_{-0.03}$ |
| | MS1H1-10C30CB-☐☐3☐R-INT | 80 | 119.2 (153.4) | 35±0.5 | 90 | 4-Ø7 | 54 | 7.5 | 3±0.5 | 0.5±0.35 | Ø70h7 $^{0}_{-0.03}$ |
| | MS1H4-20B30CB-☐☐3☐R-INT | 60 | 73.5 (101.1) | 30±0.5 | 70 | 4-Ø5.5 | 44 | 8 | 3±0.5 | - | Ø50h7 $^{0}_{-0.025}$ |
| | MS1H4-40B30CB-☐☐3☐R-INT | 60 | 92 (119.8) | 30±0.5 | 70 | 4-Ø5.5 | 44 | 8 | 3±0.5 | - | Ø50h7 $^{0}_{-0.021}$ |
| | MS1H4-55B30CB-☐☐3☐R-INT | 80 | 96.7 ( / ) | 35±0.5 | 90 | 4-Ø7 | 54 | 8 | 3±0.5 | 0.5±0.35 | Ø70h7 $^{0}_{-0.03}$ |
| | MS1H4-75B30CB-☐☐3☐R-INT | 80 | 107.3 (140.5) | 35±0.5 | 90 | 4-Ø7 | 54 | 8 | 3±0.5 | 0.5±0.35 | Ø70h7 $^{0}_{-0.03}$ |
| | MS1H4-10C30CB-☐☐3☐R-INT | 80 | 118.7 (153.2) | 35±0.5 | 90 | 4-Ø7 | 54 | 8 | 3±0.5 | 0.5±0.35 | Ø70h7 $^{0}_{-0.03}$ |

| Motor Model | | S (mm) | TP (mm) | LK (mm) | KH (mm) | KW (mm) | W (mm) | T (mm) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| Flange size 60/80 | MS1H1-20B30CB-☐☐3☐R-INT | 14 | M5×8 | 16.5 $^{0}_{-0.53}$ | 11 $^{0}_{-0.1}$ | 5 | 5 | 5 | 0.80 (1.17) |
| | MS1H1-40B30CB-☐☐3☐R-INT | 14 | M5×8 | 16.5 $^{0}_{-0.53}$ | 11 $^{0}_{-0.1}$ | 5 | 5 | 5 | 1.11 (1.48) |
| | MS1H1-55B30CB-☐☐3☐R-INT | 19 | M6×20 | 25 $^{0}_{-0.62}$ | 15.5 $^{0}_{-0.1}$ | 6 | 6 | 6 | 1.88 ( / ) |
| | MS1H1-75B30CB-☐☐3☐R-INT | 19 | M6×20 | 25 $^{0}_{-0.62}$ | 15.5 $^{0}_{-0.1}$ | 6 | 6 | 6 | 2.22 (2.88) |
| | MS1H1-10C30CB-☐☐3☐R-INT | 19 | M6×20 | 25 $^{0}_{-0.62}$ | 15.5 $^{0}_{-0.1}$ | 6 | 6 | 6 | 2.61 (3.27) |
| | MS1H4-20B30CB-☐☐3☐R-INT | 14 | M5×8 | 16.5 $^{0}_{-0.53}$ | 11 $^{0}_{-0.1}$ | 5 | 5 | 5 | 0.78 (1.16) |
| | MS1H4-40B30CB-☐☐3☐R-INT | 14 | M5×8 | 16.5 $^{0}_{-0.53}$ | 11 $^{0}_{-0.1}$ | 5 | 5 | 5 | 1.11 (1.48) |
| | MS1H4-55B30CB-☐☐3☐R-INT | 19 | M6×20 | 25 $^{0}_{-0.62}$ | 15.5 $^{0}_{-0.1}$ | 6 | 6 | 6 | 1.85 ( / ) |
| | MS1H4-75B30CB-☐☐3☐R-INT | 19 | M6×20 | 25 $^{0}_{-0.62}$ | 15.5 $^{0}_{-0.1}$ | 6 | 6 | 6 | 2.18 (2.82) |
| | MS1H4-10C30CB-☐☐3☐R-INT | 19 | M6×20 | 25 $^{0}_{-0.62}$ | 15.5 $^{0}_{-0.1}$ | 6 | 6 | 6 | 2.55 (2.9) |

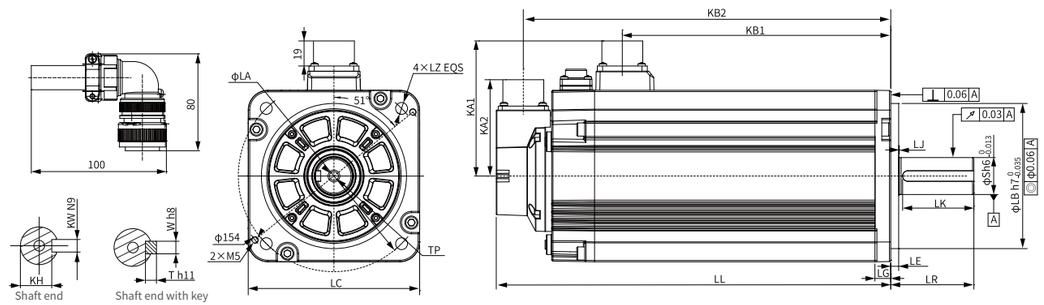
Note : [1] Flange size 40mm with H1 type motors are not equipped with an oil seal.
[2] Flange size 40mm without oil seal types.
[3] Flange size 40mm with oil seal types.
[4] LK is the length of shaft key.
[5] Values in the parentheses are for the motor with brake types.

# Dimensions of MS1-R Series H2/H3 Motors

## Flange size 100




## Flange size 130/180




| Motor Model | | LC (mm) | LL (mm) | LR (mm) | LA (mm) | LZ (mm) | KA1 (mm) | KB1 (mm) | KA2 (mm) | KB2 (mm) | LG (mm) | LE (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size 100 | MS1H2-10C30CB- □□ 3 □ R-INT<br>MS1H2-10C30CD- □□ 3 □ R-INT | 100 | 144 (172) | 45±1 | 115 | 4 — Ø7 | 88 | 75 | 73 | 123.5 (151.5) | 10 | 5±0.3 |
| | MS1H2-15C30CB- □□ 3 □ R-INT<br>MS1H2-15C30CD- □□ 3 □ R-INT | 100 | 161 (189) | 45±1 | 115 | 4 — Ø7 | 88 | 92 | 73 | 140.5 (168.5) | 10 | 5±0.3 |
| | MS1H2-20C30CB- □□ 3 □ R-INT<br>MS1H2-20C30CD- □□ 3 □ R-INT | 100 | 177 (205) | 45±1 | 115 | 4 — Ø7 | 88 | 108 | 73 | 156.5 (184.5) | 10 | 5±0.3 |
| | MS1H2-25C30CB- □□ 3 □ R-INT<br>MS1H2-25C30CD- □□ 3 □ R-INT | 100 | 195 (223) | 45±1 | 115 | 4 — Ø7 | 88 | 126 | 73 | 174.5 (202.5) | 10 | 5±0.3 |

| Motor Model | | LQ (mm) | LB (mm) | S (mm) | TP (mm) | LK[2] (mm) | KH (mm) | KW (mm) | W (mm) | T (mm) | Weight[3] (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size 100 | MS1H2-10C30CB- □□ 3 □ R-INT<br>MS1H2-10C30CD- □□ 3 □ R-INT | 7.5±0.75 | Ø95h7 $^{0}_{-0.035}$ | 24 | M8×16 | 35 $^{0}_{-0.62}$ | 20 $^{0}_{-0.2}$ | 8 | 8 | 7 | 3.85 (4.9) |
| | MS1H2-15C30CB- □□ 3 □ R-INT<br>MS1H2-15C30CD- □□ 3 □ R-INT | 7.5±0.75 | Ø95h7 $^{0}_{-0.035}$ | 24 | M8×16 | 35 $^{0}_{-0.62}$ | 20 $^{0}_{-0.2}$ | 8 | 8 | 7 | 4.65 (5.75) |
| | MS1H2-20C30CB- □□ 3 □ R-INT<br>MS1H2-20C30CD- □□ 3 □ R-INT | 7.5±0.75 | Ø95h7 $^{0}_{-0.035}$ | 24 | M8×16 | 35 $^{0}_{-0.62}$ | 20 $^{0}_{-0.2}$ | 8 | 8 | 7 | 5.5 (6.55) |
| | MS1H2-25C30CB- □□ 3 □ R-INT<br>MS1H2-25C30CD- □□ 3 □ R-INT | 7.5±0.75 | Ø95h7 $^{0}_{-0.035}$ | 24 | M8×16 | 35 $^{0}_{-0.62}$ | 20 $^{0}_{-0.2}$ | 8 | 8 | 7 | 6.3 (7.35) |



| Motor Model | | LC (mm) | LL (mm) | LR (mm) | LA (mm) | LZ (mm) | KA1 (mm) | KB1 (mm) | KA2 (mm) | KB2 (mm) | LG (mm) | LE (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size 130 | MS1H2-30C30CB- □□ 3 □ R-INT<br>MS1H2-30C30CD- □□ 3 □ R-INT | 130 | 198 (223) | 63±1 | 145 | 4 — Ø9 | 102.4 | 127.5 | 73 | 177.5 (202.5) | 10.5 | 6±0.3 |
| | MS1H2-40C30CB- □□ 3 □ R-INT<br>MS1H2-40C30CD- □□ 3 □ R-INT | 130 | 236 (261) | 63±1 | 145 | 4 — Ø9 | 102.4 | 165.5 | 73 | 215.5 (240.5) | 10.5 | 6±0.3 |
| | MS1H2-50C30CB- □□ 3 □ R-INT<br>MS1H2-50C30CD- □□ 3 □ R-INT | 130 | 274 (299) | 63±1 | 145 | 4 — Ø9 | 102.4 | 203.5 | 73 | 253.5 (278.5) | 10.5 | 6±0.3 |
| | MS1H3-85B15CB- □□ 3 □ R-INT<br>MS1H3-85B15CD- □□ 3 □ R-INT | 130 | 142 (167) | 55±1 | 145 | 4 — Ø9 | 103 | 70 | 73 | 121.5 (146.5) | 14 | 4 |
| | MS1H3-13C15CB- □□ 3 □ R-INT<br>MS1H3-13C15CD- □□ 3 □ R-INT | 130 | 157 (182) | 55±1 | 145 | 4 — Ø9 | 103 | 85 | 73 | 136.5 (161.5) | 14 | 4 |
| | MS1H3-18C15CB- □□ 3 □ R-INT<br>MS1H3-18C15CD- □□ 3 □ R-INT | 130 | 172 (197) | 55±1 | 145 | 4 — Ø9 | 103 | 100 | 73 | 151.5 (176.5) | 14 | 4 |

| Motor Model | | LJ (mm) | LB (mm) | S (mm) | TP (mm) | LK (mm) | KH (mm) | KW (mm) | W (mm) | T (mm) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size 130 | MS1H2-30C30CB- □□ 3 □ R-INT<br>MS1H2-30C30CD- □□ 3 □ R-INT | 0.5±0.75 | Ø110h7 $^{0}_{-0.035}$ | 28 | M8×20 | 53 $^{0}_{-0.62}$ | 24 $^{0}_{-0.2}$ | 8 | 8 | 7 | 10.0 (11.9) |
| | MS1H2-40C30CB- □□ 3 □ R-INT<br>MS1H2-40C30CD- □□ 3 □ R-INT | 0.5±0.75 | Ø110h7 $^{0}_{-0.035}$ | 28 | M8×20 | 53 $^{0}_{-0.62}$ | 24 $^{0}_{-0.2}$ | 8 | 8 | 7 | 13.2 (15.1) |
| | MS1H2-50C30CB- □□ 3 □ R-INT<br>MS1H2-50C30CD- □□ 3 □ R-INT | 0.5±0.75 | Ø110h7 $^{0}_{-0.035}$ | 28 | M8×20 | 53 $^{0}_{-0.62}$ | 24 $^{0}_{-0.2}$ | 8 | 8 | 7 | 16.5 (18.25) |
| | MS1H3-85B15CB- □□ 3 □ R-INT<br>MS1H3-85B15CD- □□ 3 □ R-INT | 0.5±0.75 | Ø110h7 $^{0}_{-0.035}$ | 22 | M6×20 | 35 $^{0}_{-0.62}$ | 18 $^{0}_{-0.2}$ | 8 | 8 | 7 | 5.8 (7.7) |
| | MS1H3-13C15CB- □□ 3 □ R-INT<br>MS1H3-13C15CD- □□ 3 □ R-INT | 0.5±0.75 | Ø110h7 $^{0}_{-0.035}$ | 22 | M6×20 | 35 $^{0}_{-0.62}$ | 18 $^{0}_{-0.2}$ | 8 | 8 | 7 | 7.1 (8.9) |
| | MS1H3-18C15CB- □□ 3 □ R-INT<br>MS1H3-18C15CD- □□ 3 □ R-INT | 0.5±0.75 | Ø110h7 $^{0}_{-0.035}$ | 22 | M6×20 | 35 $^{0}_{-0.62}$ | 18 $^{0}_{-0.2}$ | 8 | 8 | 7 | 8.5 (10.3) |

| Motor Model | | LC (mm) | LL (mm) | LR (mm) | LA (mm) | LZ (mm) | KA1 (mm) | KB1 (mm) | KA2 (mm) | KB2 (mm) | LG (mm) | LE (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size180 | MS1H3-29C15CB- □□ 3 □ R-INT<br>MS1H3-29C15CD- □□ 3 □ R-INT | 180 | 161 (194.8) | 79±1 | 200 | 4-Ø13.5 | 127.4 | 93.5 | 73 | 140.5 (174.3) | 20.5 | 3.2±0.3 |
| | MS1H3-44C15CB- □□ 3 □ R-INT | 180 | 184.5 (218.3) | 79±1 | 200 | 4-Ø13.5 | 127.4 | 117 | 73 | 164 (197.8) | 20.5 | 3.2±0.3 |
| | MS1H3-44C15CD- □□ 3 □ R-INT | 180 | 184.5 (218.3) | 79±1 | 200 | 4-Ø13.5 | 127.4 | 117 | 73 | 164 (197.8) | 20.5 | 3.2±0.3 |
| | MS1H3-55C15CD- □□ 3 □ R-INT | 180 | 208 (241.8) | 113±1 | 200 | 4-Ø13.5 | 127.4 | 140.5 | 73 | 187.5 (221.3) | 20.5 | 3.2±0.3 |
| | MS1H3-75C15CD- □□ 3 □ R-INT | 180 | 255 (288.8) | 113±1 | 200 | 4-Ø13.5 | 127.4 | 187.5 | 73 | 234.5 (268.5) | 20.5 | 3.2±0.3 |

| Motor Model | | LJ (mm) | LB (mm) | S (mm) | TP (mm) | LK (mm) | KH (mm) | KW (mm) | W (mm) | T (mm) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flange size 180 | MS1H3-29C15CB- □□ 3 □ R-INT<br>MS1H3-29C15CD- □□ 3 □ R-INT | 0.3±0.75 | Ø114.3h7 $^{0}_{-0.035}$ | 35 | M12×25 | 64 $^{0}_{-0.74}$ | 30 $^{0}_{-0.2}$ | 10 | 10 | 8 | 13.8 (17.9) |
| | MS1H3-44C15CB- □□ 3 □ R-INT | 0.3±0.75 | Ø114.3h7 $^{0}_{-0.035}$ | 35 | M12×25 | 64 $^{0}_{-0.74}$ | 30 $^{0}_{-0.2}$ | 10 | 10 | 8 | 17.4 (21.9) |
| | MS1H3-44C15CD- □□ 3 □ R-INT | 0.3±0.75 | Ø114.3h7 $^{0}_{-0.035}$ | 35 | M12×25 | 64 $^{0}_{-0.74}$ | 37 $^{0}_{-0.2}$ | 10 | 10 | 8 | 17.4 (21.6) |
| | MS1H3-55C15CD- □□ 3 □ R-INT | 0.3±0.75 | Ø114.3h7 $^{0}_{-0.035}$ | 42 | M16×32 | 95 $^{0}_{-0.87}$ | 37 $^{0}_{-0.2}$ | 12 | 12 | 8 | 21.7 (25.9) |
| | MS1H3-75C15CD- □□ 3 □ R-INT | 0.3±0.75 | Ø114.3h7 $^{0}_{-0.035}$ | 42 | M16×32 | 95 $^{0}_{-0.87}$ | 37 $^{0}_{-0.2}$ | 12 | 12 | 8 | 29 (33.2) |

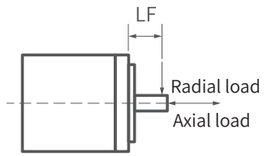
Note :

[1] The radial runout on the shaft extension end of the 130H3-flange motors is: 0.02 A

[2] LK is the length of shaft key.

[3] Values in the parentheses are for the motor with brake.

# Axial/Radial Allowable Load




| Motor Model | Flange Size (mm) | LF (mm) | Allowable Radial Load (N) | Allowable Axial Load (N) |
|---|---|---|---|---|
| MS1H1-05B30CB- □□ 3 □ R-INT<br>MS1H1-10B30CB- □□ 3 □ R-INT<br>MS1H4-05B30CB- □□ 3 □ R-INT<br>MS1H4-10B30CB- □□ 3 □ R-INT | 40 | 20 | 78 | 54 |
| MS1H1-20B30CB- □□ 3 □ R-INT<br>MS1H1-40B30CB- □□ 3 □ R-INT<br>MS1H4-20B30CB- □□ 3 □ R-INT<br>MS1H4-40B30CB- □□ 3 □ R-INT | 60 | 25 | 245 | 74 |
| MS1H1-55B30CB- □□ 3 □ R-INT<br>MS1H1-75B30CB- □□ 3 □ R-INT<br>MS1H1-10C30CB- □□ 3 □ R-INT<br>MS1H4-55B30CB- □□ 3 □ R-INT<br>MS1H4-75B30CB- □□ 3 □ R-INT<br>MS1H4-10C30CB- □□ 3 □ R-INT | 80 | 35 | 392 | 147 |
| MS1H2-10C30CB- □□ 3 □ R-INT<br>MS1H2-10C30CD- □□ 3 □ R-INT<br>MS1H2-15C30CB- □□ 3 □ R-INT<br>MS1H2-15C30CD- □□ 3 □ R-INT<br>MS1H2-20C30CB- □□ 3 □ R-INT<br>MS1H2-20C30CD- □□ 3 □ R-INT<br>MS1H2-25C30CB- □□ 3 □ R-INT<br>MS1H2-25C30CD- □□ 3 □ R-INT | 100 | 45 | 686 | 196 |
| MS1H2-30C30CB- □□ 3 □ R-INT<br>MS1H2-30C30CD- □□ 3 □ R-INT<br>MS1H2-40C30CB- □□ 3 □ R-INT<br>MS1H2-40C30CD- □□ 3 □ R-INT<br>MS1H2-50C30CB- □□ 3 □ R-INT<br>MS1H2-50C30CD- □□ 3 □ R-INT | 130 | 63 | 1176 | 392 |
| MS1H3-85B15CB- □□ 3 □ R-INT<br>MS1H3-85B15CD- □□ 3 □ R-INT<br>MS1H3-13C15CB- □□ 3 □ R-INT<br>MS1H3-13C15CD- □□ 3 □ R-INT<br>MS1H3-18C15CB- □□ 3 □ R-INT<br>MS1H3-18C15CD- □□ 3 □ R-INT | 130 | 55 | 686 | 196 |
| MS1H3-29C15CB- □□ 3 □ R-INT<br>MS1H3-29C15CD- □□ 3 □ R-INT<br>MS1H3-44C15CB- □□ 3 □ R-INT<br>MS1H3-44C15CD- □□ 3 □ R-INT | 180 | 79 | 1470 | 490 |
| MS1H3-55C15CD- □□ 3 □ R-INT<br>MS1H3-75C15CD- □□ 3 □ R-INT | 180 | 113 | 1764 | 588 |



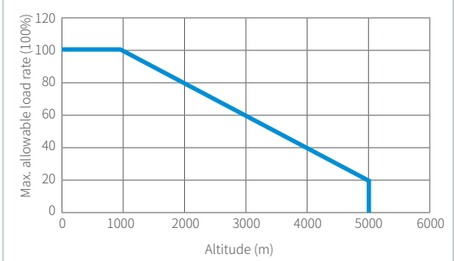
# Technical Data for the Motor with Brake

| Motor Model | Holding Torque (N·m) | Supply Voltage (V DC)±10% | Rated Power (W) | Coil Resitance (Ω)±7% | Exciting Current (A) | Release Time (ms) | Apply Time (ms) | Backlash (° ) |
|---|---|---|---|---|---|---|---|---|
| MS1H1-05B/10B<br>MS1H4-05B/10B | 0.32 | 24 | 6.1 | 94.4 | 0.25 | ⩽ 20 | ⩽ 40 | ⩽ 1.5 |
| MS1H1/4-20B/40B | 1.5 | 24 | 7.6 | 75.79 | 0.32 | ⩽ 20 | ⩽ 60 | ⩽ 1 |
| MS1H1/4-75B/10C | 3.2 | 24 | 10 | 57.6 | 0.42 | ⩽ 40 | ⩽ 60 | ⩽ 1 |
| MS1H2-10C/15C/20C/25C | 8 | 24 | 17.6 | 32.73 | 0.73 | ⩽ 40 | ⩽ 100 | ⩽ 1 |
| MS1H2-30C/40C/50C | 16.5 | 24 | 24 | 24 | 1 | ⩽ 60 | ⩽ 120 | ⩽ 1 |
| MS1H3-85B/13C/18C | 16.5 | 24 | 24 | 24 | 1 | ⩽ 60 | ⩽ 120 | ⩽ 1 |
| MS1H3-29C/44C/55C/75C | 55 | 24 | 31 | 18.58 | 1.29 | ⩽ 100 | ⩽ 200 | ⩽ 1 |

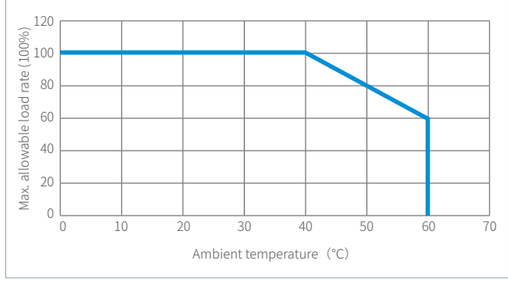
Note:
· The holding brake cannot be used for braking purpose.
· The brake release time and apply time vary with the discharging circuit. Check the actual action delay of the product during use.
· 24 VDC power supplies need to be prepared by users.

# Derating Characteristics

**Altitude-based derating curve**




**Temperature-based derating curve**



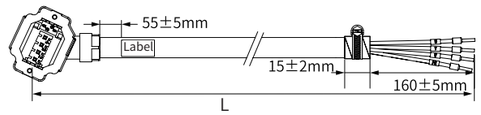
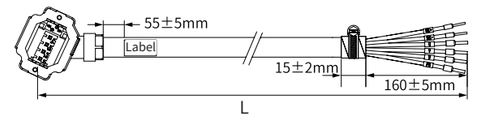
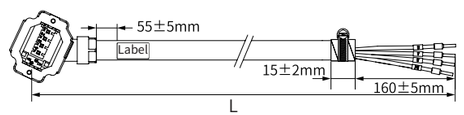
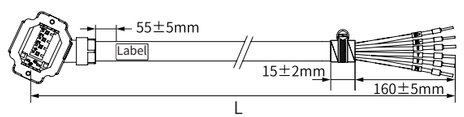
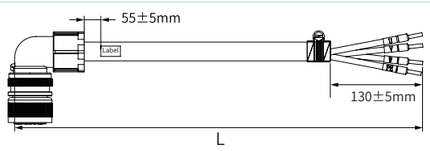
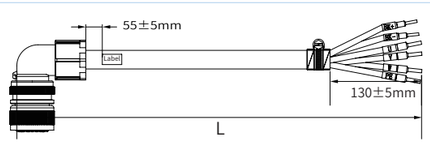
# Applicable Cable Selection

## Ordering code for power cable

**S6-L-M 0 0 1 - 3.0 - T - INT**
① ② ③ ④ ⑤ ⑥ ⑦

| | | |
|---|---|---|
| ① Servo system power cable<br>B: With brake<br>M: Without brake | ③ Applicable power of the motor<br>0: Frame sizes 40/60/80<br>1: Frame sizes 100/130/180<br>2: Frame size 180 (motors of 4.4kW and above) | ⑤ Cable length (m)<br>3.0: 3<br>5.0: 5<br>10.0: 10 |
| ② Connector type at drive side<br>0: U-shaped cable lug<br>1: Pin-shaped cable lug | ④ Connector type at motor side<br>1: 9-core aviation connector<br>2: 6-core aviation connector<br>7: Specified connector for FS 40/60/80mm motor (front outlet)<br>8: Specified connector for FS 40/60/80mm motor (rear outlet) | ⑥ Special requirements<br>Null: Non-flexible<br>T: Flexible cables ⩾ 10 million bendings |
| | | ⑦ Version<br>INT: Global version |

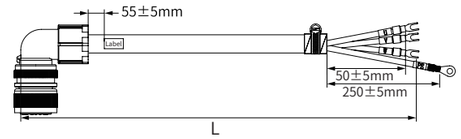
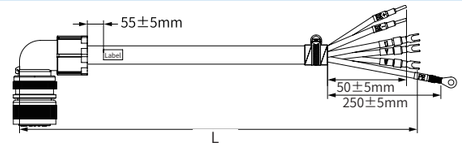
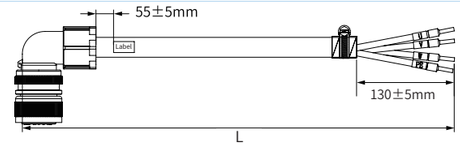
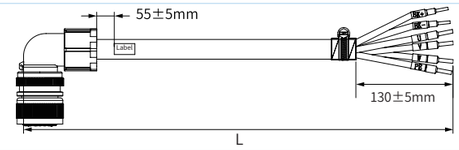
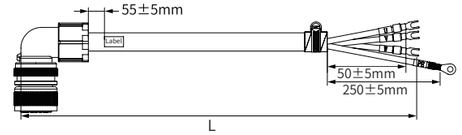
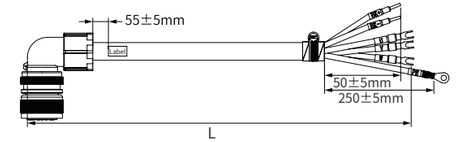
## Power cable

| Motor Model | Cable Name | Cable Model | Cable Length (mm) | Dimension Drawing |
|---|---|---|---|---|
| MS1H1/ MS1H4 terminal-type motor | Without brake (Front outlet) | S6-L-M107-3.0 (-T) -INT | 3000 |   |
| | | S6-L-M107-5.0 (-T) -INT | 5000 | |
| | | S6-L-M107-10.0 (-T) -INT | 10000 | |
| | With brake (Front outlet) | S6-L-B107-3.0 (-T) -INT | 3000 |   |
| | | S6-L-B107-5.0 (-T) -INT | 5000 | |
| | | S6-L-B107-10.0 (-T) -INT | 10000 | |
| | Without brake (Rear outlet) | S6-L-M108-3.0 (-T) -INT | 3000 |   |
| | | S6-L-M108-5.0 (-T) -INT | 5000 | |
| | | S6-L-M108-10.0 (-T) -INT | 10000 | |
| | With brake (Rear outlet) | S6-L-B108-3.0 (-T) -INT | 3000 |   |
| | | S6-L-B108-5.0 (-T) -INT | 5000 | |
| | | S6-L-B108-10.0 (-T) -INT | 10000 | |
| MS1H2 motors of 3 kW and below/ MS1H3 motors of 1.8 kW and below | Without brake | S6-L-M111-3.0 (-T) -INT | 3000 |   |
| | | S6-L-M111-5.0 (-T) -INT | 5000 | |
| | | S6-L-B111-10.0 (-T) -INT | 10000 | |
| | With brake | S6-L-B111-3.0 (-T) -INT | 3000 |   |
| | | S6-L-B111-5.0 (-T) -INT | 5000 | |
| | | S6-L-B111-10.0 (-T) -INT | 10000 | |

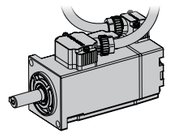


# Applicable Cable Selection

## Power cable

| Motor Model | Cable Name | Cable Model | Cable Length (mm) | Dimension Drawing |
|---|---|---|---|---|
| MS1H2 motors of 4 kW/5 kW | Without brake | S6-L-M011-3.0 (-T) -INT | 3000 |   |
| | | S6-L-M011-5.0 (-T) -INT | 5000 | |
| | | S6-L-M011-10.0 (-T) -INT | 10000 | |
| | With brake | S6-L-B011-3.0 (-T) -INT | 3000 |   |
| | | S6-L-B011-5.0 (-T) -INT | 5000 | |
| | | S6-L-B011-10.0 (-T) -INT | 10000 | |
| MS1H3 motors of 2.9 kW | Without brake | S6-L-M112-3.0 (-T) -INT | 3000 |   |
| | | S6-L-M112-5.0 (-T) -INT | 5000 | |
| | | S6-L-M112-10.0 (-T) -INT | 10000 | |
| | With brake | S6-L-B112-3.0 (-T) -INT | 3000 |   |
| | | S6-L-B112-5.0 (-T) -INT | 5000 | |
| | | S6-L-B112-10.0 (-T) -INT | 10000 | |
| MS1H3 motors of 4.4 kW and above | Without brake | S6-L-M022-3.0 (-T) -INT | 3000 |   |
| | | S6-L-M022-5.0 (-T) -INT | 5000 | |
| | | S6-L-M022-10.0 (-T) -INT | 10000 | |
| | With brake | S6-L-B022-3.0 (-T) -INT | 3000 |   |
| | | S6-L-B022-5.0 (-T) -INT | 5000 | |
| | | S6-L-B022-10.0 (-T) -INT | 10000 | |

Note:
- MS1-R series motors share the same cables as MS1-Z series motors.
- For more information on cables, see section Cable Specifications and Models in the hardware guide of the servo drive.
- Motor with power 50W, the power cables must select the rear outlet model as shown on the right. This is to prevent the mounting flange face from be disturbed by the power cable. For detailed cable model selection, please refer to the servo drive hardware guide.
- Power cable with shielded as standard.
- -T: Flexible cable is optional.
- Encoder cable with shielded as datandard.



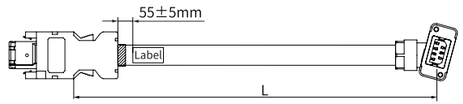
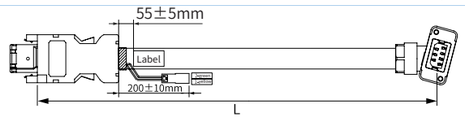
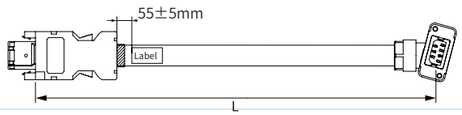
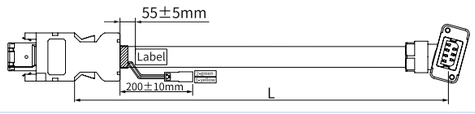
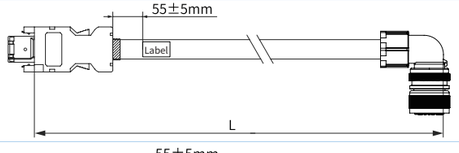
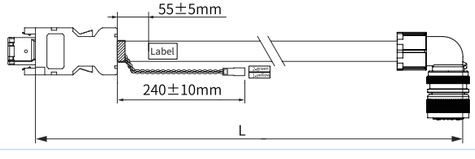
# Applicable Cable Selection

## Ordering code for Encoder cable

**S6-L-P ① ② ③ ④ - ⑤ - ⑥ - ⑦**

| | | |
|---|---|---|
| ① Servo system encoder cable | ④ Connector type at motor sider<br>1: 9-core aviation connector<br>4: Specified connector for FS 40/60/80mm motor (front outlet)<br>5: Specified connector for FS 40/60/80mm motor (rear outlet) | ⑥ Special requirements<br>Null: Non-flexible<br>T: Flexible cables ⩾ 10 million bendings |
| ② Connector type at drive side<br>1: 1394 Connector (6pin plug) | | |
| ③ Encoder<br>1: Communication-type incremental encoder<br>2: Multi-turn absolute encoder | ⑤ Cable length(m)<br>3.0: 3m<br>5.0: 5m<br>10.0: 10m | ⑦ Version<br>INT: Global version |

## Encoder cable

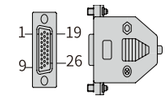
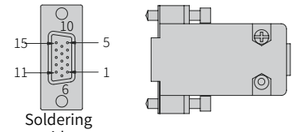
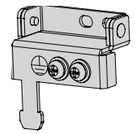
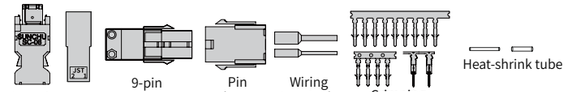
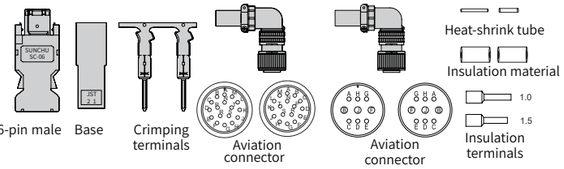
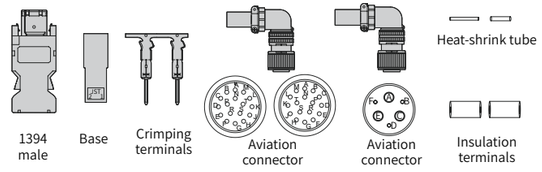
| Motor Model | Cable Name | | Cable Model | Cable Length (mm) | Dimension Drawing |
|---|---|---|---|---|---|
| MS1H1/ MS1H4 terminal-type motors | Front outlet | Single-turn absolute encoder | S6-L-P114-3.0 (-T) -INT | 3000 |  |
| | | | S6-L-P114-5.0 (-T) -INT | 5000 | |
| | | | S6-L-P114-10.0 (-T) -INT | 10000 | |
| | | Multi-turn absolute encoder | S6-L-P124-3.0 (-T) -INT | 3000 |  |
| | | | S6-L-P124-5.0 (-T) -INT | 5000 | |
| | | | S6-L-P124-10.0 (-T) -INT | 10000 | |
| | Rear outlet | Single-turn absolute encoder | S6-L-P115-3.0 (-T) -INT | 3000 |  |
| | | | S6-L-P115-5.0 (-T) -INT | 5000 | |
| | | | S6-L-P115-10.0 (-T) -INT | 10000 | |
| | | Multi-turn absolute encoder | S6-L-P125-3.0 (-T) -INT | 3000 |  |
| | | | S6-L-P125-5.0 (-T) -INT | 5000 | |
| | | | S6-L-P125-10.0 (-T) -INT | 10000 | |
| MS1H2/ MS1H3 motors | Single-turn absolute encoder | | S6-L-P111-3.0 (-T) -INT | 3000 |  |
| | | | S6-L-P111-5.0 (-T) -INT | 5000 | |
| | | | S6-L-P111-10.0 (-T) -INT | 10000 | |
| | Multi-turn absolute encoder | | S6-L-P121-3.0 (-T) -INT | 3000 |  |
| | | | S6-L-P121-5.0 (-T) -INT | 5000 | |
| | | | S6-L-P121-10.0 (-T) -INT | 10000 | |

Note:
· MS1-R series motors share the same cables as MS1-Z series motors.
· For more information on cables, see section Cable Specifications and Models in the hardware guide of the servo drive.
· Power cable with shielded as standard.
· -T: Flexible cable is optional.
· Encoder cable with shielded as datandard.



# Connector Kits

## Overview of connector kits

| Name | Model | Outline Drawing |
|---|---|---|
| CN1 terminal (DB26) | S6-C74 |  Male |
| CN7 terminal (DB15) | S6-C6 |  Soldering side |
| Shield bracket | S6-C25<br>S6-C25 (optional for size A to size C) |  |
| | S6-C27<br>S6-C27 (optional for size D to size E) | |
| MS1H1/MS1H4 terminal-type motor connector | S6-C26 |  |
| MS1H2/MS1H3 motor (1.8 kW and below) connector | S6-C29 |  |
| MS1H3 motor (2.9kW and above) connector | S6-C39 |  |