

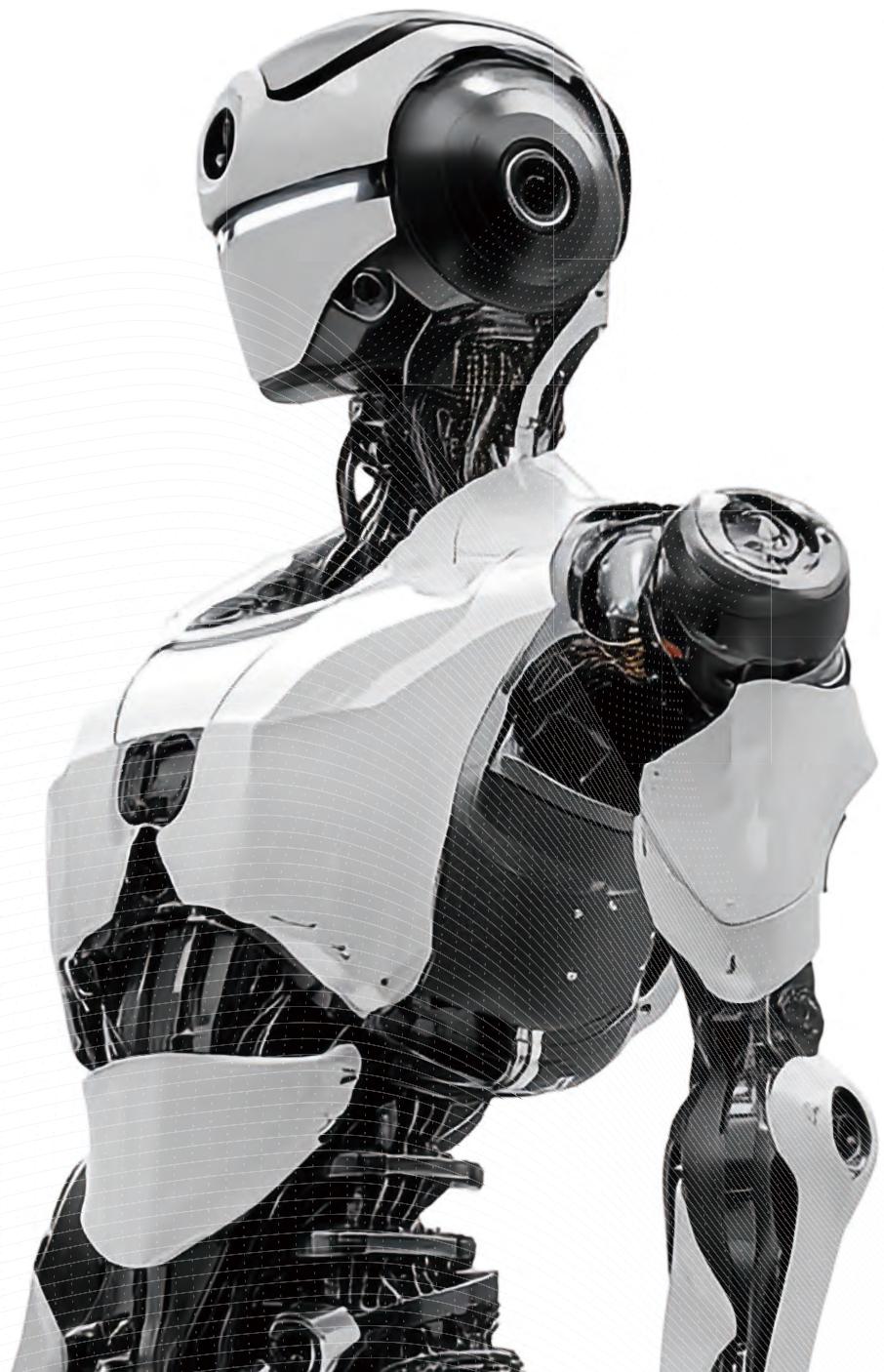


**Leadshine**

Stock Code: 002979

# Robotic Joint Module Core Components

*Frameless Motor  
Robotic Joint Module*



# Leadshine Motion Control Total Product System

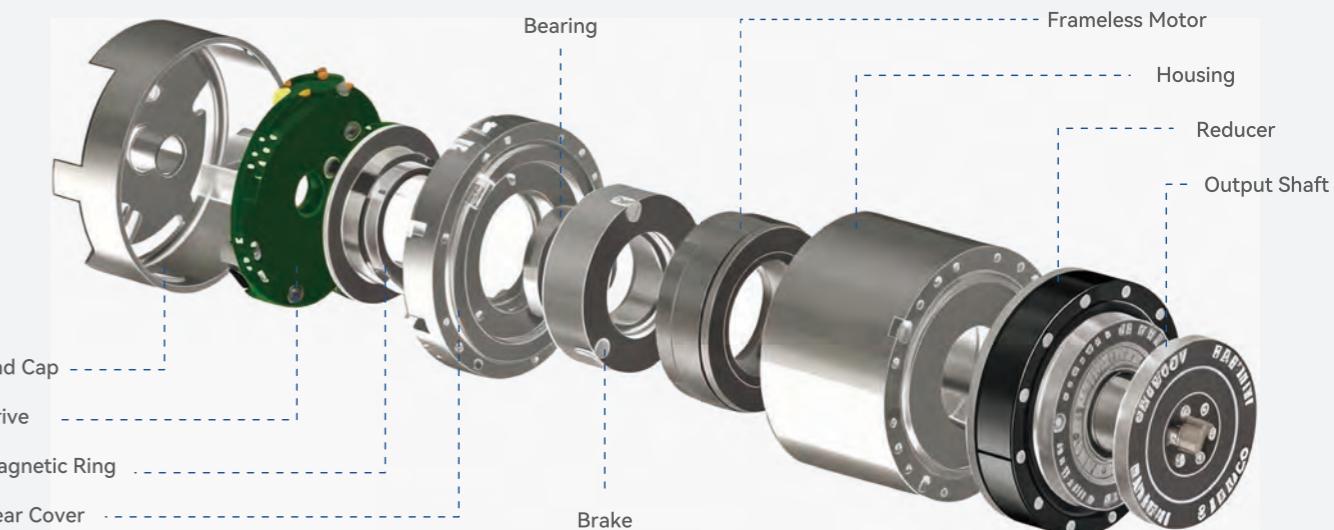


# INDUSTRY PAIN POINTS

- Large volume ?
- Low efficiency ?
- High self-weight ?
- Low precision ?
- High temperature ?
- Low smoothness ?
- Low degree of freedom ?
- High consumption ?
- High cost ?



## Component Solutions



Ultra-high density

Precise control

Compact design

Full protocol compatibility

Long-lasting durability

High cost efficiency

### Frameless Motor Solutions

- Dimensions: 50/60/70/85/94/115/127 mm
- Rated Speed: 1800–5500 rpm
- Torque Range: 0.36 N·m–10.56 N·m
- Power Range: 210–1658 W
- Voltage Range: 24~70 V



# Product Portfolio

## Compact Design for Basic Needs



**FM1 Ultra-High-Density Series**  
50/70/85/115 mm

- Ultra-compact size
- 15% higher torque density vs. competitors
- Customizable for applications under 25 kg

 Collaborative Robots
 Humanoid Robots
 Quadruped Robots
 Medical Rehabilitation Robots

## Higher Performance, More Options Adaptable



**FM2 Ultra-High-Density Series**  
50/60/70/85/94/127 mm

- 20% lower motor loss
- 10% higher torque density vs. previous generation
- Extended endurance

 Collaborative Robots
 Humanoid Robots
 Quadruped Robots
 Industrial Robots
 Medical Rehabilitation Robots

## Tailored Solutions For Specialized Scenarios



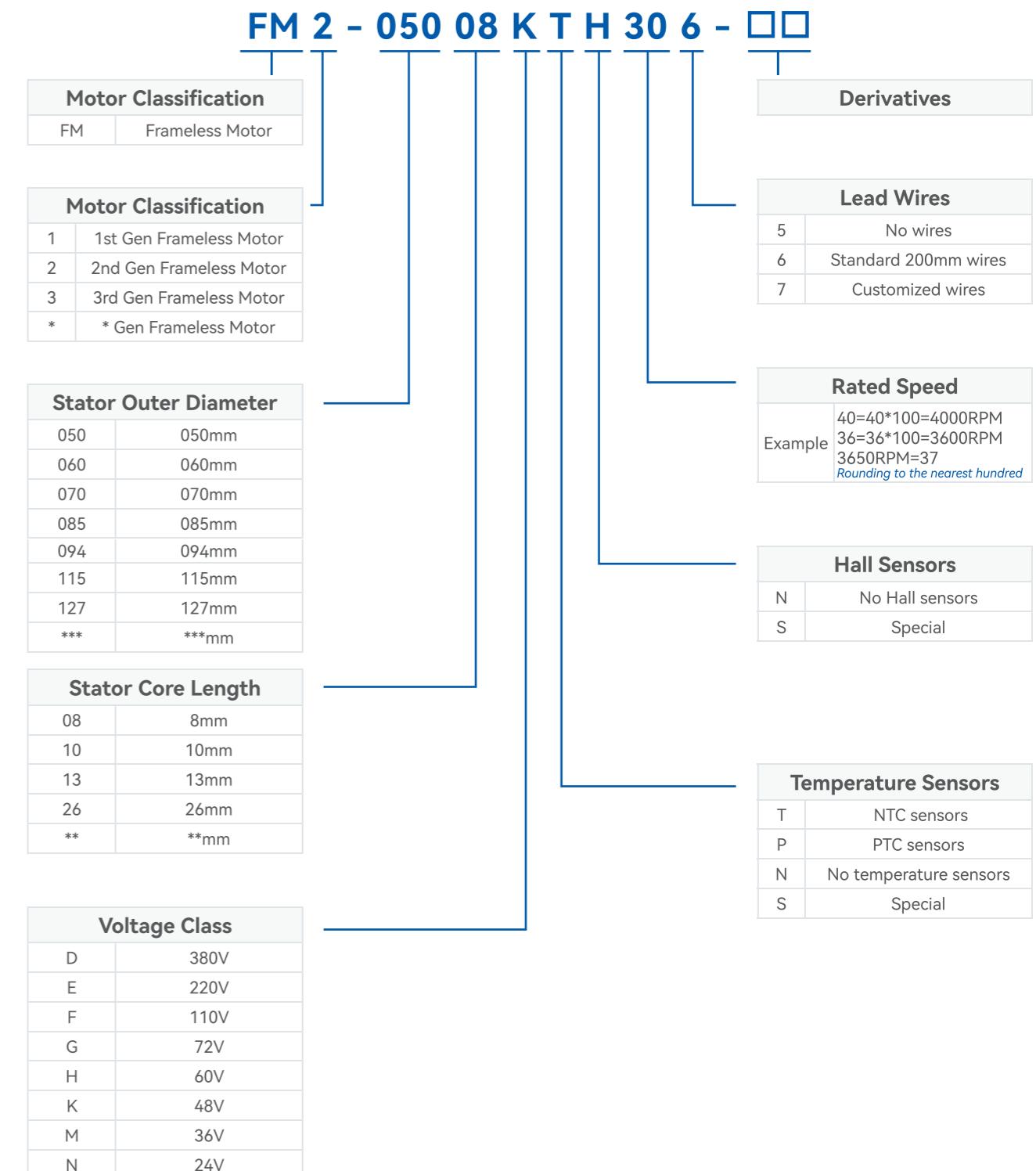
Stay Tuned

**FM3 Flagship Series**

- Ultra-high power density
- Advanced algorithms optimize electromagnetic design for higher torque in the same volume

 Collaborative Robots
 Humanoid Robots
 Quadruped Robots
 Industrial Robots
 Medical Rehabilitation Robots

# Part Numbers





## Highlights



φ50    φ60    φ70    φ85    φ94    φ115    φ127

Note: "φXX" represents the outer diameter (OD) of the frameless motor stator (unit: mm). Customization of Hall sensors, temperature sensors, and lead-out configurations is supported.

### Ultra-High Density

10% higher torque density under the same input current, leading the industry.

### Extended Endurance

Optimized magnetic circuits and materials reduce motor loss.

### Ultra-Compact Structure

40–50% smaller than industry standards, ideal for high-density layouts.

### Easy Integration

Flexible installation and seamless compatibility with mechanical systems.

### Ultra-Low Temperature Rise

20% reduction in motor loss through optimized magnetic design.

### Ultra-Low Inertia

Lightweight design and composite materials enable rapid dynamic response for frequent start-stop scenarios.



## Advantages

## FM2 Series

### Ultra-High-Density Frameless Torque Motors

New electromagnetic design with lower temperature rise, higher torque, faster response. Provides robust and stable power in compact spaces, suitable for humanoid robots, collaborative robots, etc. Available in seven standard sizes: 50/60/70/85/94/127 mm, with support for customization to meet diverse needs.



### Superior Power

- Leading torque, power density, and cogging torque performance.

### Flexible Integration

- Adjustable interfaces with optional Hall, temperature, and winding sensors.

### Global Service

- Digital manufacturing, global distribution, and rapid local support.

### Reliability

- Fully automated production ensures consistent quality.

### Excellent Thermal Control

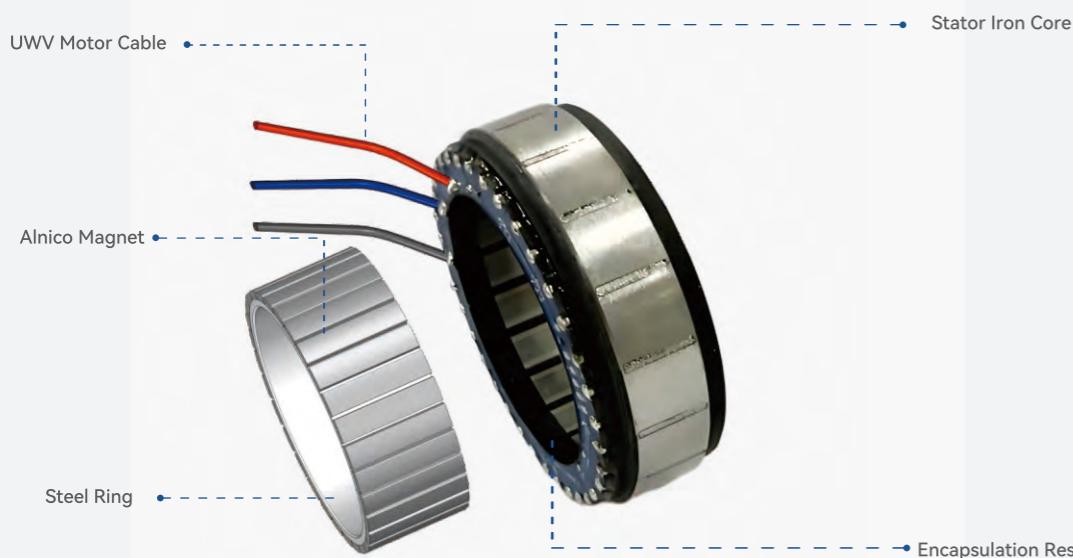
- Digital manufacturing, global distribution, and rapid local support.



 Selection Guide

| Motor Series                     | Model        | Rated Torque (N·m) | No-load speed (rpm) | Rated current (A) | Rated voltage range (VDC) | Rated Power (W) |
|----------------------------------|--------------|--------------------|---------------------|-------------------|---------------------------|-----------------|
| Ultra High Density<br><b>FM2</b> | FM2-05008... | 0.36               | 6300                | 4.40              | 24-70                     | 207             |
|                                  | FM2-05014... | 0.60               | 3900                | 4.60              | 24-70                     | 211             |
|                                  | FM2-06008... | 0.48               | 6500                | 6.6               | 24-70                     | 251             |
|                                  | FM2-06011... | 0.65               | 5000                | 6.5               | 24-70                     | 259             |
|                                  | FM2-06026... | 1.4                | 4000                | 11.3              | 24-70                     | 440             |
|                                  | FM2-07010... | 0.70               | 3110                | 4.40              | 24-70                     | 183             |
|                                  | FM2-07018... | 1.4                | 4000                | 11.1              | 24-70                     | 440             |
|                                  | FM2-08513... | 1.8                | 3000                | 11.0              | 24-70                     | 471             |
|                                  | FM2-08523... | 2.86               | 3500                | 21.2              | 24-70                     | 1048            |
|                                  | FM2-09408... | 1.58               | 4000                | 14.6              | 24-70                     | 579             |
|                                  | FM2-09413... | 2.1                | 3500                | 14.9              | 24-70                     | 660             |
|                                  | FM2-09416... | 2.8                | 3500                | 21.2              | 24-70                     | 880             |
|                                  | FM2-09426... | 4                  | 2650                | 22.9              | 24-70                     | 838             |
|                                  | FM2-12718... | 3.6                | 3000                | 23.2              | 24-70                     | 905             |
|                                  | FM2-12725... | 6.4                | 2900                | 36.9              | 24-70                     | 1608            |

Note: Hall, Temperature Sensors and Outlet Forms are optional.

 Structure


## Ultra-High-Density

### FM2 Series

|                  |                  |        |               |
|------------------|------------------|--------|---------------|
| <b>FM2-05008</b> | φ50mm * 18.95mm  | 0.36Nm | Six Diameters |
| <b>FM2-05014</b> | φ50mm * 24.9mm   | 0.60Nm | φ50mm~φ127mm  |
| <b>FM2-06008</b> | φ60mm * 19.05mm  | 0.48Nm |               |
| <b>FM2-06011</b> | φ60mm * 22.05mm  | 0.65Nm |               |
| <b>FM2-06026</b> | φ60mm * 37.45mm  | 1.40Nm |               |
| <b>FM2-07010</b> | φ70mm * 22.55mm  | 0.70Nm |               |
| <b>FM2-07018</b> | φ70mm * 30.6mm   | 1.40Nm |               |
| <b>FM2-08513</b> | φ85mm * 27.7mm   | 1.80Nm |               |
| <b>FM2-08523</b> | φ85mm * 37.5mm   | 2.86Nm |               |
| <b>FM2-09408</b> | φ94mm * 22.25mm  | 1.58Nm |               |
| <b>FM2-09413</b> | φ94mm * 26.65mm  | 2.1Nm  |               |
| <b>FM2-09416</b> | φ94mm * 30.45mm  | 2.8Nm  |               |
| <b>FM2-09426</b> | φ94mm * 40mm     | 4.0Nm  |               |
| <b>FM2-12718</b> | φ127mm * 31.85mm | 3.6Nm  |               |
| <b>FM2-12725</b> | φ127mm * 40mm    | 6.4Nm  |               |

Hall and temperature sensors are available as options for the entire range.



FM2-050XX



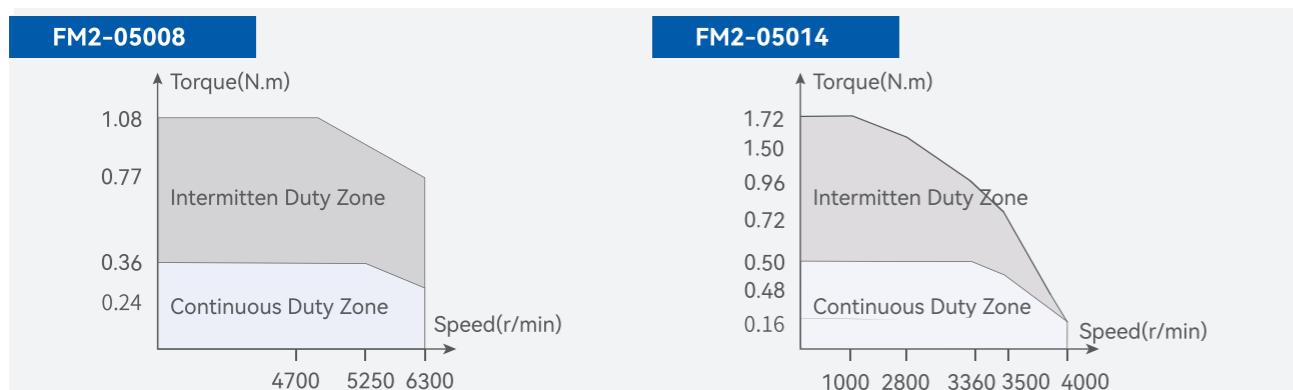
FM2-060XX



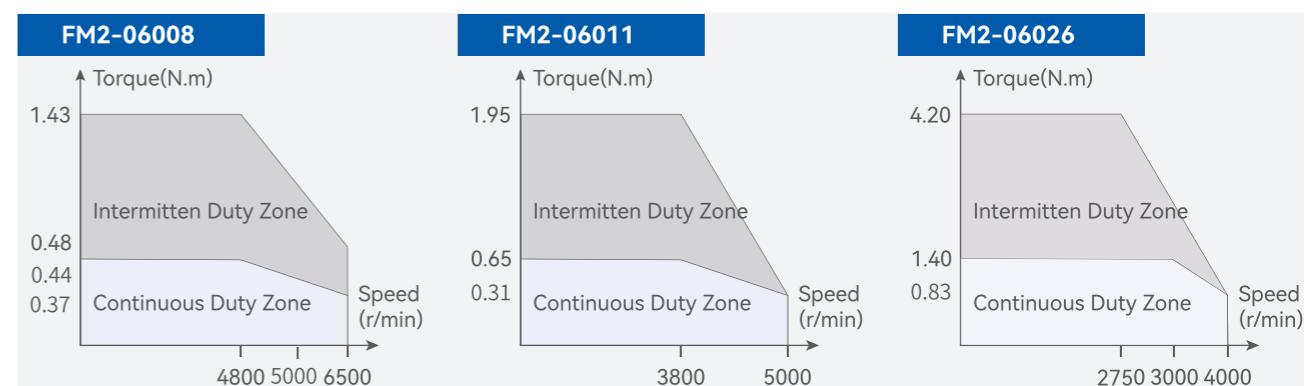
| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 08                    | 207             | 48                  | 4.40              | 0.36              | 1.08                | 5500              | 5.30                      | 0.087                  | 0.057   | 0.089       |
| 14                    | 211             | 48                  | 4.60              | 0.60              | 1.80                | 3360              | 8.5                       | 0.141                  | 0.083   | 0.141       |

| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 08                    | 251             | 48                  | 6.6               | 0.48              | 1.43                | 5000              | 4.8                       | 0.076                  | 0.12  | 0.135       |
| 11                    | 259             | 48                  | 6.5               | 0.65              | 1.95                | 3800              | 6.5                       | 0.108                  | 0.17  | 0.175       |
| 26                    | 440             | 48                  | 11.3              | 1.4               | 4.2                 | 3000              | 7.8                       | 0.130                  | 0.47  | 0.345       |

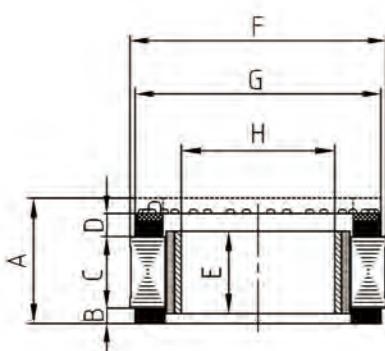
#### Rotational Speed-Torque Characteristics



#### Rotational Speed-Torque Characteristics

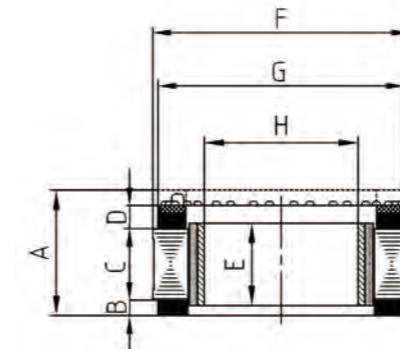


#### Dimensions



| Size (mm) | 08   | 14   |
|-----------|------|------|
| A         | 17.3 | 23.3 |
| B         | 3.3  | 3.3  |
| C         | 8.00 | 14   |
| D         | 4.8  | 4.8  |
| E         | 9.9  | 16.1 |
| F         | 50   | 50   |
| G         | 48.4 | 48.4 |
| H         | 30   | 30   |

#### Dimensions



| Size (mm) | 08    | 11    | 26    |
|-----------|-------|-------|-------|
| A         | 19.05 | 22.05 | 37.45 |
| B         | 3.4   | 3.4   | 3.4   |
| C         | 8.2   | 11.2  | 26.2  |
| D         | 5     | 5     | 5     |
| E         | 10.2  | 14.7  | 28.3  |
| F         | 60    | 60    | 60    |
| G         | 58    | 58    | 58    |
| H         | 36    | 36    | 36    |

FM2-070XX

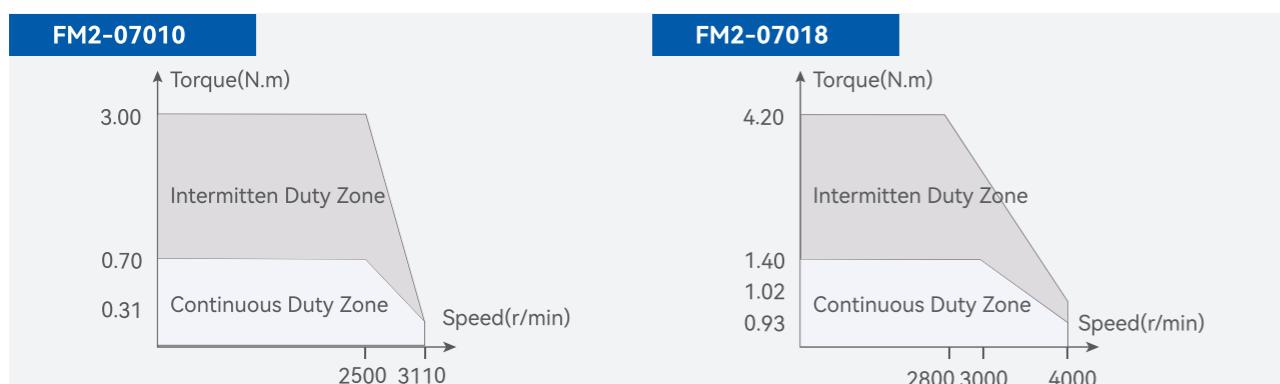


FM2-085XX

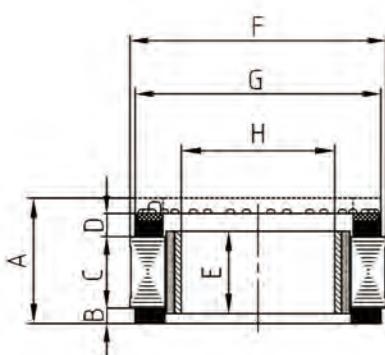


| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 10                    | 183             | 48                  | 4.40              | 0.70              | 3.00                | 2500              | 10.7                      | 0.177                  | 0.221   | 0.210       |
| 18                    | 440             | 48                  | 11.1              | 1.4               | 4.20                | 3000              | 8.10                      | 0.135                  | 0.389   | 0.332       |

Rotational Speed-Torque Characteristics



Dimensions



| Size (mm) | 10    | 18   |
|-----------|-------|------|
| A         | 21.50 | 29.5 |
| B         | 4.0   | 4.0  |
| C         | 10    | 18   |
| D         | 6.1   | 6.1  |
| E         | 12.7  | 20.7 |
| F         | 69    | 69   |
| G         | 66.2  | 66.2 |
| H         | 42    | 42   |

FM2-094XX



| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 08                    | 579             | 48                  | 13.6              | 1.58              | 3.96                | 3500              | 7.5                       | 0.124                  | 0.68  | 0.44        |
| 13                    | 660             | 48                  | 14.9              | 2.1               | 5.25                | 3000              | 9                         | 0.149                  | 0.98  | 0.58        |
| 16                    | 880             | 48                  | 21.2              | 2.8               | 7                   | 3000              | 8.9                       | 0.147                  | 1.3   | 0.72        |
| 26                    | 838             | 48                  | 22.9              | 4                 | 10                  | 2000              | 11.4                      | 0.189                  | 1.89  | 1.13        |

FM2-127XX

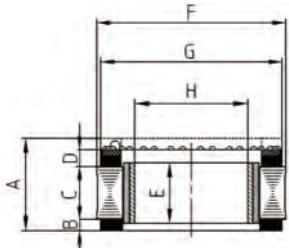


| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 18                    | 905             | 48                  | 23.2              | 3.6               | 14.4                | 2400              | 10.4                      | 0.172                  | 5.3   | 1.07        |
| 25                    | 1608            | 48                  | 36.9              | 6.4               | 19.2                | 2400              | 11                        | 0.182                  | 7.4   | 1.42        |

Rotational Speed-Torque Characteristics

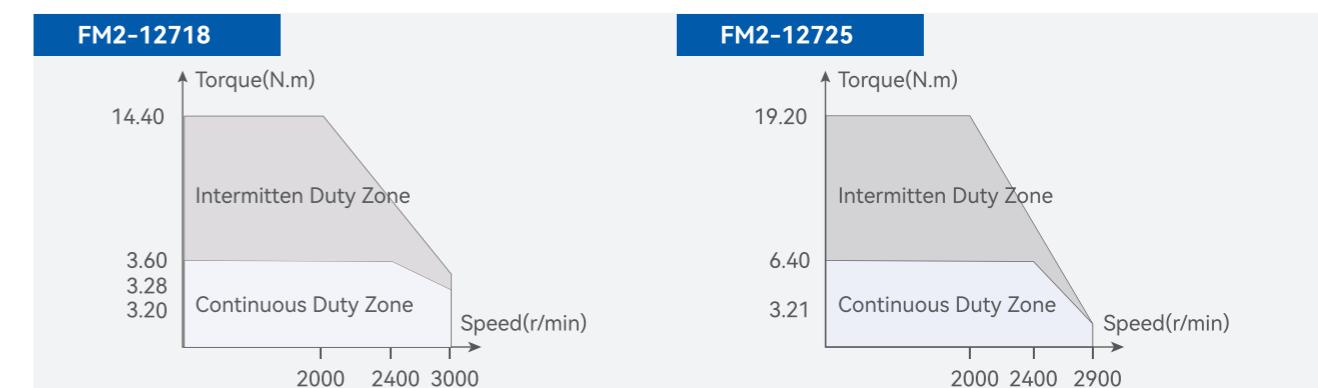


Dimensions

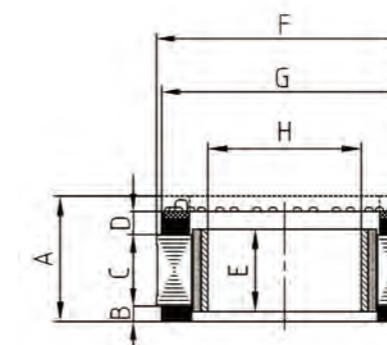


| Size (mm) | 08    | 13    | 16    | 26   |
|-----------|-------|-------|-------|------|
| A         | 22.25 | 26.65 | 30.45 | 40   |
| B         | 4.7   | 4.7   | 4.7   | 4.7  |
| C         | 8.2   | 12.6  | 16.4  | 26   |
| D         | 6.3   | 6.3   | 6.3   | 6.3  |
| E         | 10.2  | 14.7  | 18.4  | 28.3 |
| F         | 94    | 94    | 94    | 94   |
| G         | 91    | 91    | 91    | 91   |
| H         | 47    | 47    | 44.5  | 47   |

Rotational Speed-Torque Characteristics



Dimensions



| Size (mm) | 18    | 25  |
|-----------|-------|-----|
| A         | 31.85 | 40  |
| B         | 4.8   | 4.8 |
| C         | 18    | 25  |
| D         | 6.4   | 6.4 |
| E         | 20    | 28  |
| F         | 127   | 127 |
| G         | 124   | 124 |
| H         | 82    | 82  |

 Selection Guide

| Motor Series                               | Model        | Rated Torque (mNm) | No-load speed (rpm) | Rated current (A) | Rated voltage range (VDC) | Rated Power (W) |
|--|--------------|--------------------|---------------------|-------------------|---------------------------|-----------------|
| Exceptionally Cost-Effective<br><b>FM1</b> | FM1-05008... | 0.3                | 6500                | 6.60              | 24-70                     | 165             |
|  | FM1-05014... | 0.5                | 5000                | 6.56              | 24-70                     | 191             |
|  | FM1-07010... | 0.62               | 5000                | 6.67              | 24-70                     | 237             |
|  | FM1-07018... | 1.22               | 4800                | 13.3              | 24-70                     | 256             |
|  | FM1-08513... | 1.41               | 4000                | 12.4              | 24-70                     | 458             |
|  | FM1-08523... | 2.51               | 4000                | 21.2              | 24-70                     | 920             |
|  | FM1-11525... | 3.2                | 2000                | 15.5              | 24-70                     | 603             |
|  | FM1-11550... | 9.51               | 1500                | 32.2              | 24-70                     | 617             |

Note: Hall, Temperature Sensors and Outlet Forms are optional.

## FM1 Series

Exceptionally Cost-Effective Frameless Torque Motors

Engineered for high-performance and high-reliability applications, featuring an optimized multi-slot pole rotor design and advanced vacuum potting technology to ensure efficient and stable system operation. The product's technical standards align with the world's top frameless motor brands, offering advantages such as high torque density, low inertia, low temperature rise, and compact integration. This enables superior dynamic response and sustained output performance within limited space. The FM1 series provides four standard frame sizes: 50/70/85/115mm, and supports customized solutions to meet diverse requirements.

## FM1 Series

### Exceptionally Cost-Effective

**FM1-05008**  $\phi 50\text{mm} * 18.95\text{mm}$  0.3Nm

**FM1-05014**  $\phi 50\text{mm} * 24.9\text{mm}$  0.5Nm

**FM1-07010**  $\phi 70\text{mm} * 22.55\text{mm}$  0.62Nm

**FM1-07018**  $\phi 70\text{mm} * 30.6\text{mm}$  1.22Nm

**FM1-08513**  $\phi 85\text{mm} * 27.7\text{mm}$  1.41Nm

**FM1-08523**  $\phi 85\text{mm} * 37.5\text{mm}$  2.51Nm

**FM1-11525**  $\phi 115\text{mm} * 40.7\text{mm}$  3.20Nm

**FM1-11550**  $\phi 115\text{mm} * 67.2\text{mm}$  9.51Nm

### Four Diameters

$\phi 50\text{mm} \sim \phi 115\text{mm}$

### Rated Speed

650rpm~5250rpm

### Torque Range

0.3Nm~9.32Nm

### Power Range

165W~920W

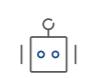
### Rated Voltage

24V~70V

Hall and temperature sensors are available as options for the entire range.



Collaborative Robots



Humanoid Robots



Industrial Robots



Quadruped Robots



Medical Rehabilitation Robots

FM1-050XX



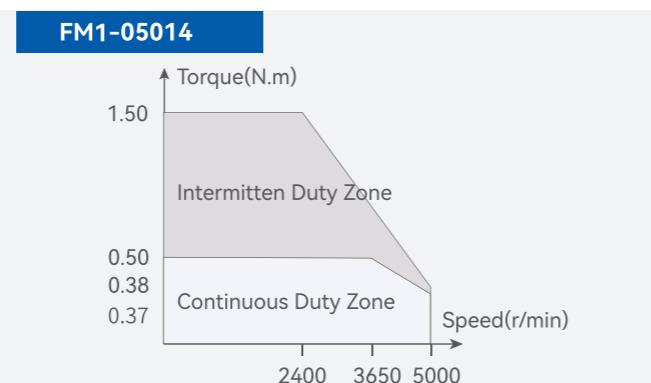
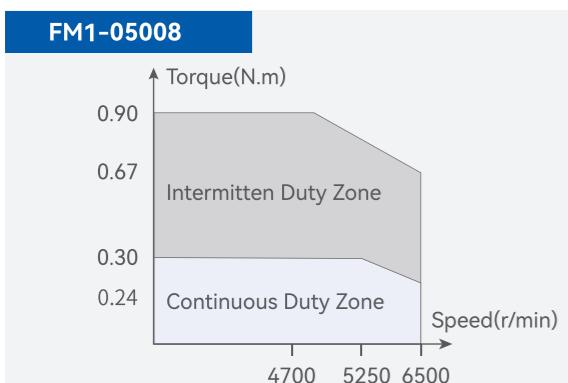
FM1-070XX



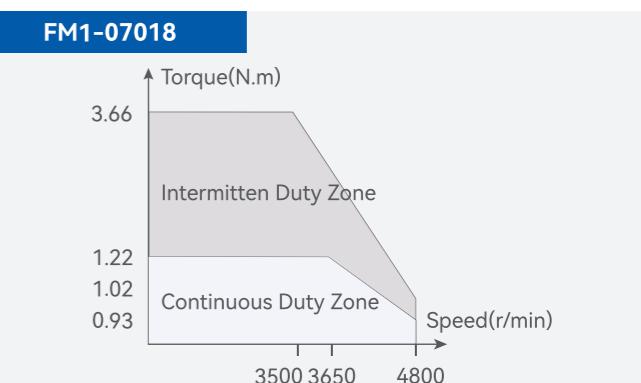
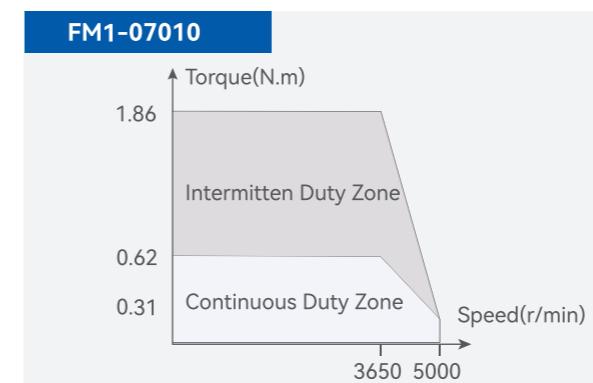
| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 08                    | 165             | 48                  | 6.60              | 0.3               | 0.9                 | 5250              | 3.36                      | 0.056                  | 0.088   | 0.089       |
| 14                    | 191             | 48                  | 6.56              | 0.5               | 1.5                 | 3650              | 5.51                      | 0.091                  | 0.12  | 0.139       |

| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 10                    | 237             | 48                  | 6.67              | 0.62              | 1.86                | 3650              | 6.5                       | 0.108                  | 0.32  | 0.216       |
| 18                    | 256             | 48                  | 13.3              | 1.22              | 3.66                | 2000              | 6.45                      | 0.107                  | 0.49  | 0.332       |

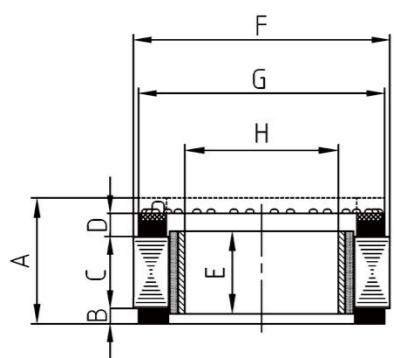
Rotational Speed-Torque Characteristics



Rotational Speed-Torque Characteristics

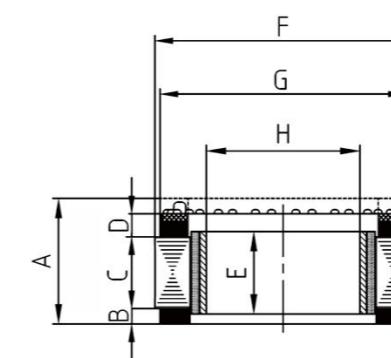


Dimensions



| Size (mm) | <b>08</b> | <b>14</b> |
|-----------|-----------|-----------|
| A         | 18.95     | 24.9      |
| B         | 3.2       | 3.2       |
| C         | 8.05      | 14        |
| D         | 4.5       | 4.5       |
| E         | 9.9       | 16.1      |
| F         | 50        | 50        |
| G         | 48        | 48        |
| H         | 30        | 30        |

Dimensions



| Size (mm) | <b>10</b> | <b>18</b> |
|-----------|-----------|-----------|
| A         | 22.55     | 30.6      |
| B         | 3.8       | 3.8       |
| C         | 10.15     | 18.0      |
| D         | 5.1       | 5.1       |
| E         | 12.7      | 20.7      |
| F         | 69        | 69        |
| G         | 66.4      | 66.4      |
| H         | 42        | 42        |

FM1-085XX



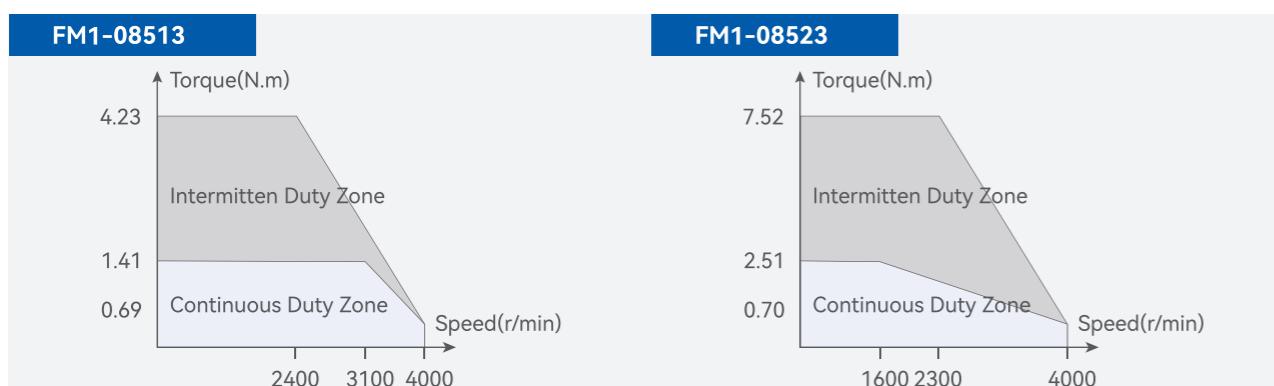
FM1-115XX



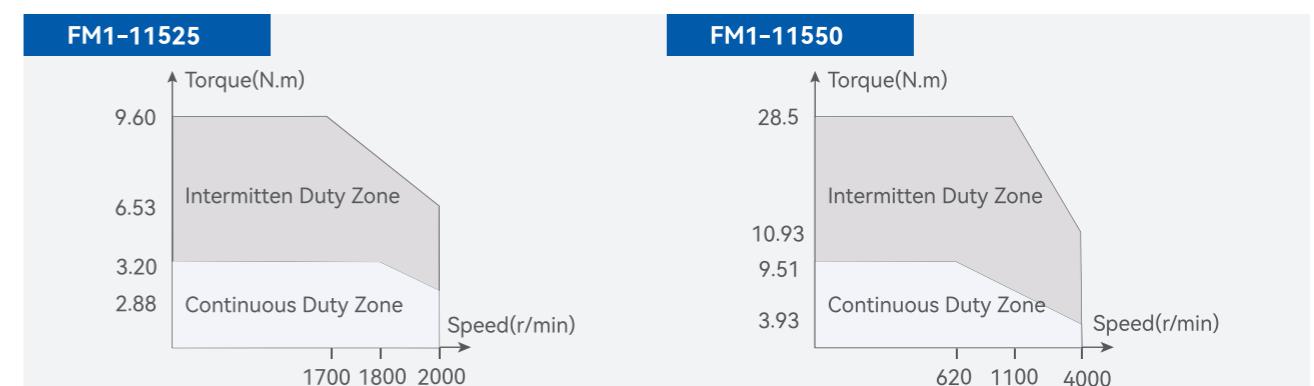
| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 13                    | 458             | 48                  | 12.4              | 1.41              | 4.23                | 3100              | 7.71                      | 0.128                  | 0.93  | 0.396       |
| 23                    | 920             | 48                  | 21.2              | 2.51              | 7.52                | 3500              | 8                         | 0.132                  | 1.4   | 0.629       |

| Product Specification | Rated Power (w) | Rated Voltage (VDC) | Rated Current (A) | Rated Torque (Nm) | Maximum Torque (Nm) | Rated Speed (rpm) | Voltage Constant (V/krpm) | Torque Constant (Nm/A) | Inertia (kgm <sup>2</sup> *10 <sup>-4</sup> ) | Weight (kg) |
|-----------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|---------------------------|------------------------|---|-------------|
| 25                    | 603             | 48                  | 15.5              | 3.2               | 9.6                 | 1800              | 13.4                      | 0.222                  | 5.2   | 1.17        |
| 50                    | 617             | 48                  | 32.2              | 9.51              | 28.5                | 620               | 18.7                      | 0.309                  | 8.7   | 2.09        |

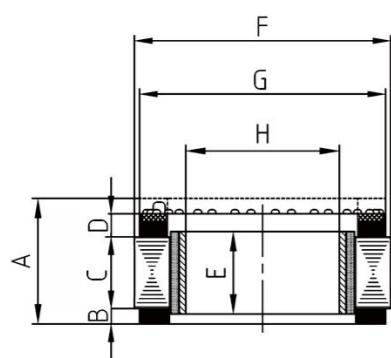
#### Rotational Speed-Torque Characteristics



#### Rotational Speed-Torque Characteristics

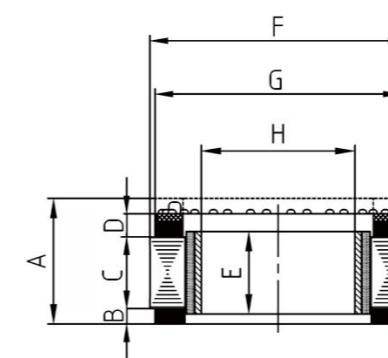


#### Dimensions



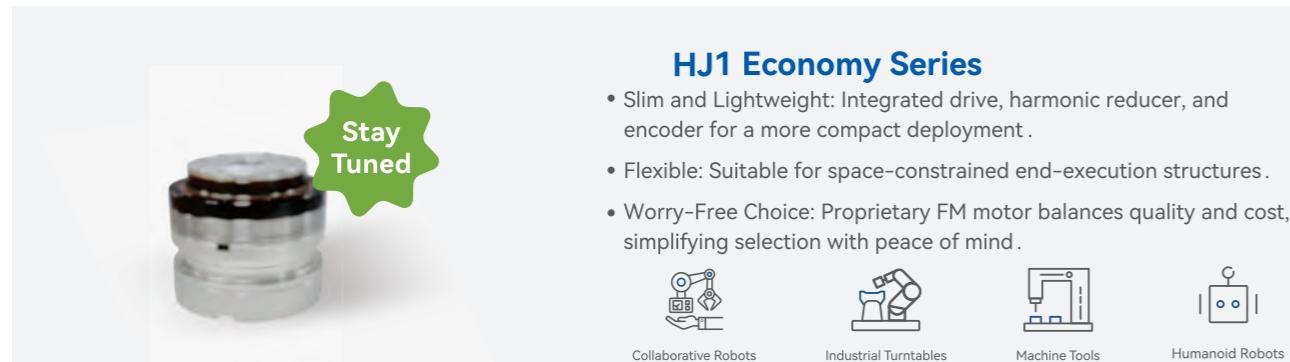
| Size (mm) | 13   | 23   |
|-----------|------|------|
| A         | 27.7 | 37.5 |
| B         | 4.8  | 4.8  |
| C         | 13.3 | 23.1 |
| D         | 5.7  | 5.7  |
| E         | 15.7 | 25.1 |
| F         | 85   | 85   |
| G         | 83.4 | 83.4 |
| H         | 52   | 52   |

#### Dimensions

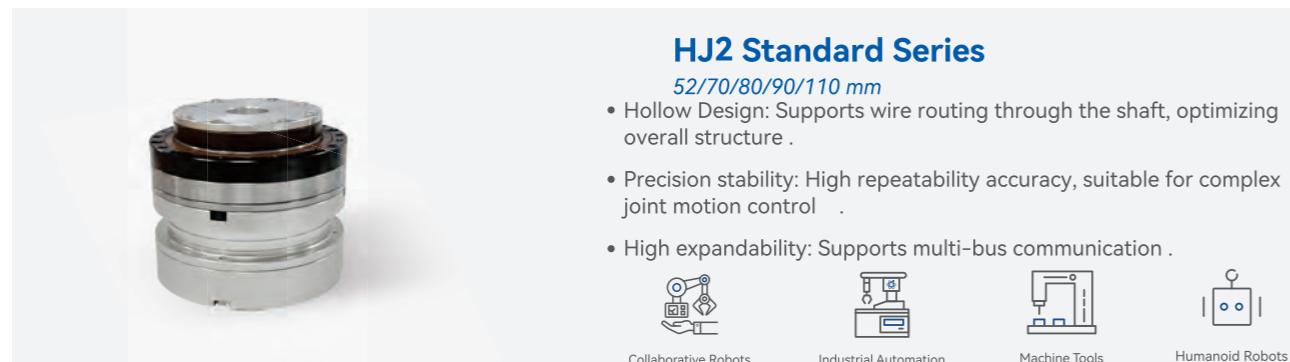


| Size (mm) | 25   | 50   |
|-----------|------|------|
| A         | 40.7 | 67.2 |
| B         | 5.9  | 5.9  |
| C         | 25.2 | 50.4 |
| D         | 6.8  | 6.8  |
| E         | 27.1 | 54.2 |
| F         | 115  | 115  |
| G         | 112  | 112  |
| H         | 74   | 74   |

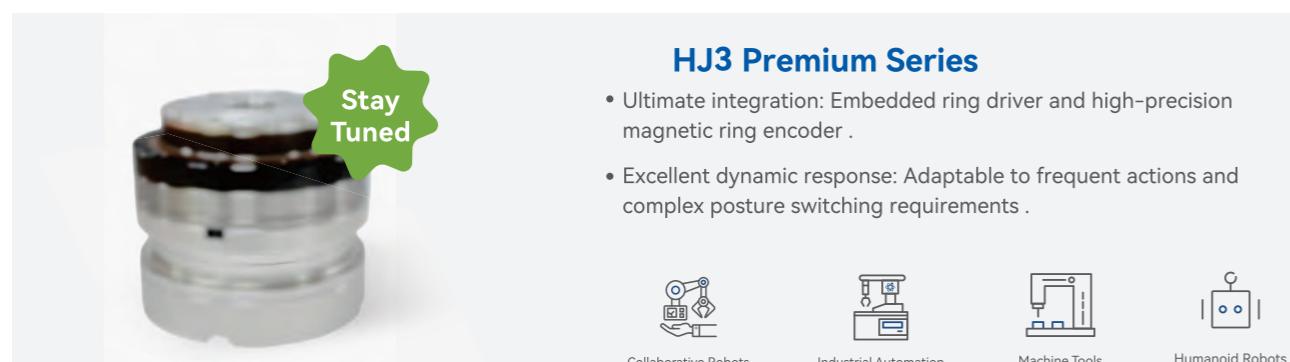
Compact and integrated, meeting the fundamental requirements for lightweight robots.



Comprehensive functionality, outstanding performance, efficient and convenient debugging.



High water and dust resistance, extended service life, versatile application scenarios, multi-bus and multi-certification support.



## Part Numbers

**HJ 2 - 52 H X D 24 - X K - XX**

| Module Categories |                |
|-------------------|----------------|
| HJ                | Harmonic Joint |

| Communication Protocol |          |
|------------------------|----------|
| EC                     | EtherCAT |
| C                      | CAN      |

| Versions |          |
|----------|----------|
| 1        | Economy  |
| 2        | Standard |
| 3        | Premium  |

| Voltage Class |     |
|---------------|-----|
| K             | 48V |
| M             | 24V |

| Module Outer Diameter |     |
|-----------------------|-----|
| Module Outer Diameter | 52  |
|                       | 70  |
|                       | 80  |
|                       | 90  |
|                       | 110 |

| Brake Types |                        |
|-------------|------------------------|
| N           | No Brake               |
| B           | Permanent Magnet Brake |

| Length and Load Capacity |               |
|--------------------------|---------------|
| F                        | Flat          |
| H                        | Long-tube     |
| T                        | Collaborative |

| Drive Types |                       |
|-------------|-----------------------|
| D           | Standard (CDH series) |

| Reduction Ratio |  |
|-----------------|--|
| 101             |  |



## Highlights



52

70

80

90

110

### Ultra-Slim Design

Utilizes integrated construction to significantly reduce module size and weight, enabling lighter, more agile deployment.

### High Torque Density

Delivers powerful torque within a compact footprint, meeting demanding dynamic response requirements under heavy loads.

### Precision Control

Built-in high-accuracy encoders and optimized algorithms enable smoother humanoid motion control.

### High Integration

Motor, driver, and encoder are encapsulated as a single unit, simplifying overall wiring and assembly.

### Energy-Efficient

Low-power design extends operational endurance, ideal for extended runtime scenarios.

### Modular Compatibility

Compatible with various humanoid structures, supporting rapid deployment and multi-joint expansion.

Note: "52, 70, 80, 90, 110" correspond to harmonic drive specifications.



## Advantages

## HJ2 Series

### Planetary Gear Actuators

Integrates high torque density, closed-loop precision control, modular design, and open protocol compatibility. Equipped with long-life harmonic drives for stable and efficient operation. Motor, reducer, and encoder are integrated for flexible motion control. Available in 52/70/80/90/110 mm sizes.



### High-Speed EtherCAT Bus

Supports EtherCAT high-speed industrial bus for millisecond-level real-time control and multi-axis coordination, delivering faster system response.

### High Torque Density

Optimized electromagnetic design and material selection deliver greater torque per unit volume, meeting high-performance application demands.

### Ultra-Thin Profile

Ultra-slim form factor saves installation space, accommodates more compact equipment, and enables flexible integration.

### Lightweight Design

Combines compact structure with high-strength lightweight materials to reduce overall weight, supporting machine lightweighting and energy optimization.

### Low Heat Generation, Extended Runtime

Efficient energy conversion reduces system losses and temperature rise, enhancing operational stability and endurance.



Collaborative Robots



Humanoid Robots



Industrial Turntables



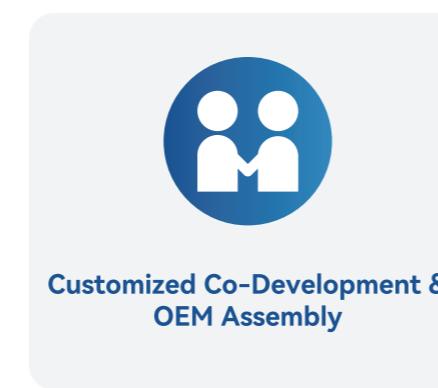
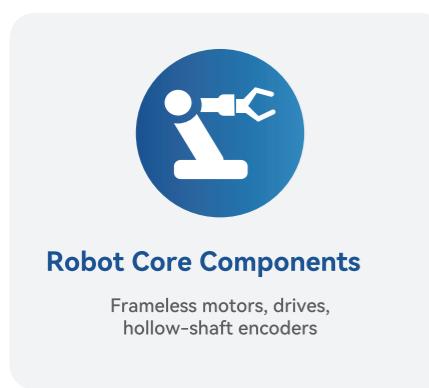
Industrial Robots



Machine Tools



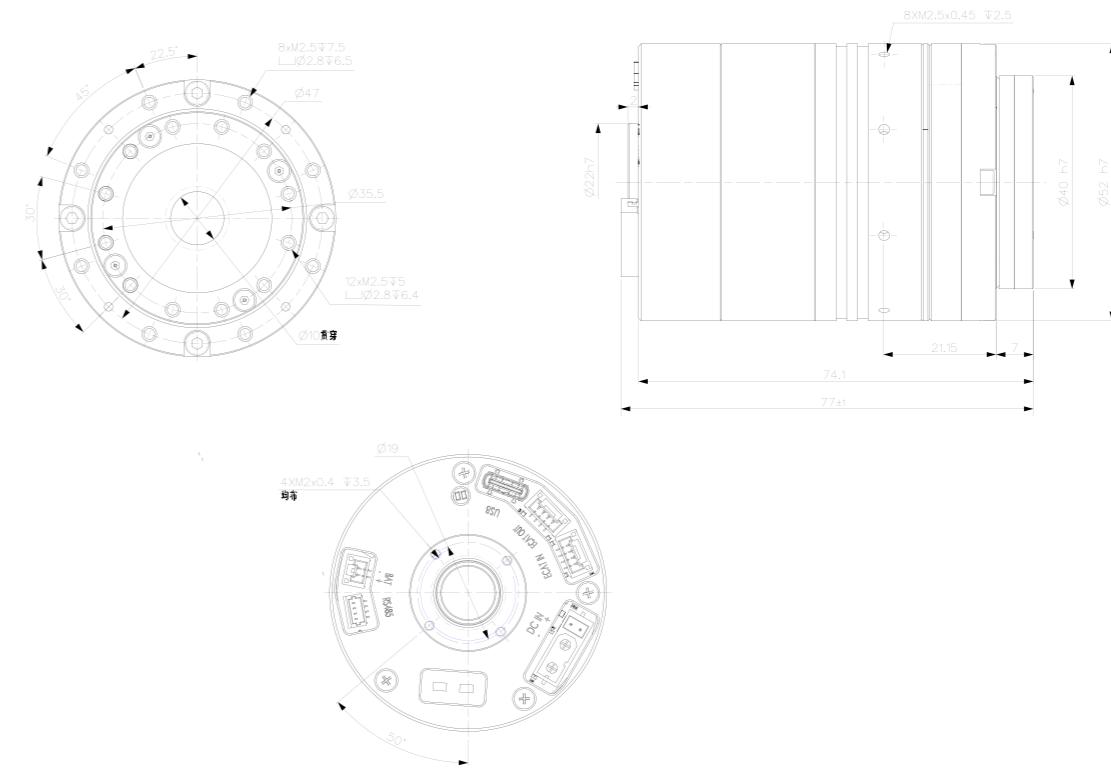
Industrial Automation

 Industrial Services

 Selection Guide

| Series | Model                | Gear Ratio | Peak Torque (N·m) | Max Allowable Torque At Average Load (N·m) | Rated Torque @2000rp (N·m) | Rated Speed With 1/2 Rated Torque (RPM) |
|--------|----------------------|------------|-------------------|--|----------------------------|---|
| HJ2    | HJ2-52H101D24-XK-EC  | 101        | 11                | 8.9  | 5                          | 37                                      |
|        | HJ2-70F101D24-XK-EC  | 101        | 34                | 13.5                                       | 9.6                        | 52                                      |
|        | HJ2-80F101D24-XK-EC  | 101        | 66                | 49   | 30                         | 36                                      |
|        | HJ2-90F101D24-XK-EC  | 101        | 102               | 61   | 50                         | 36                                      |
|        | HJ2-110F101D24-XK-EC | 101        | 194               | 133  | 84                         | 31                                      |

**HJ2-52H101D24-XK-EC**


| Ratio                    | Peak Torque (N·m) | Max Allowable Torque At Average Load (N·m) | Rated Torque @2000rp (N·m) | Peak Speed (RPM) | Rated Speed With 1/2 Rated Torque (RPM) | Backlash (arcsec)       |
|--------------------------|-------------------|--|----------------------------|------------------|---|-------------------------|
| 101                      | 11                | 8.9  | 5                          | 50               | 37                                      | ≤ 10                    |
| Supply Voltage (VDC)     | Max Current (A)   | Rated Current (A)                          | Resistance (Ω)             | Inductance (mH)  | Pole-pairs                              | Torque Constant (N·m/A) |
| 48                       | 1.3               | 0.6  | 1.9                        | 0.6              | 10                                      | 0.086                   |
| Encoder Resolution (bit) | Field Bus         | Outer Diameter (mm)                        | Inner Diameter (mm)        | Length (mm)      | Mass (g)                                | Inertia (g.cm²)         |
| 24                       | EtherCAT          | Ø52  | Ø10                        | 56.6             | 289.5                                   | 60                      |

**Dimensions**


HJ2-70F101D24-XK-EC



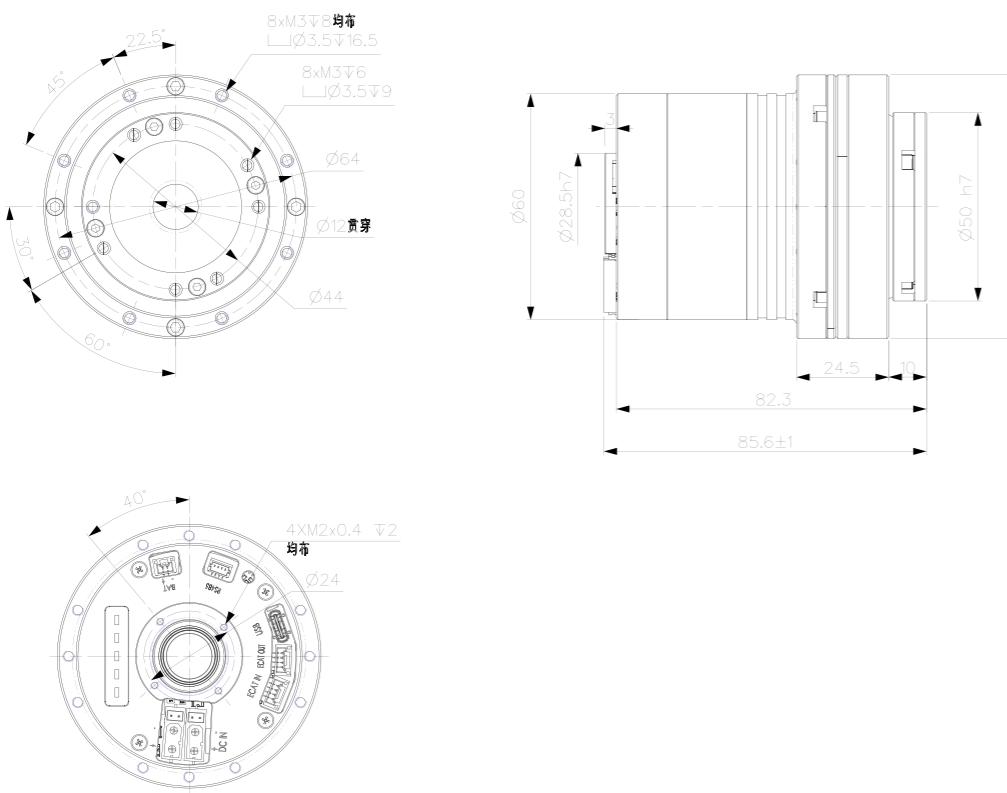
HJ2-80F101D24-XK-EC



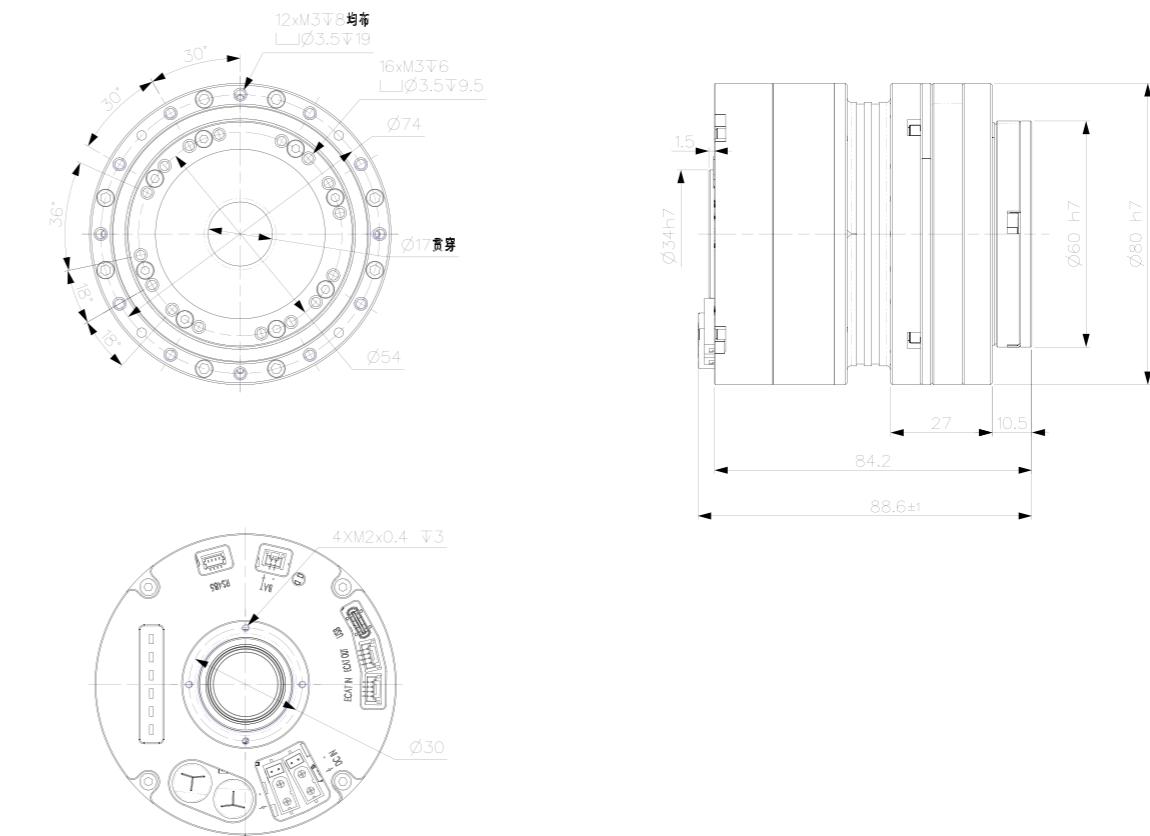
| Ratio                    | Peak Torque (N·m) | Max Allowable Torque At Average Load (N·m) | Rated Torque @2000rp (N·m) | Peak Speed (RPM) | Rated Speed With 1/2 Rated Torque (RPM) | Backlash (arcsec)       |
|--------------------------|-------------------|--|----------------------------|------------------|---|-------------------------|
| 101                      | 34                | 13.5                                       | 9.6                        | 64               | 52                                      | ≤ 10                    |
| Supply Voltage (VDC)     | Max Current (A)   | Rated Current (A)                          | Resistance (Ω)             | Inductance (mH)  | Pole-pairs                              | Torque Constant (N·m/A) |
| 48                       | 8.0               | 2.3  | 0.37                       | 0.19             | 10                                      | 0.056                   |
| Encoder Resolution (bit) | Field Bus         | Outer Diameter (mm)                        | Inner Diameter (mm)        | Length (mm)      | Mass (g)                                | Inertia (g.cm²)         |
| 24                       | EtherCAT          | Ø70  | Ø12                        | 61.3             | 597.6                                   | 100                     |

| Ratio                    | Peak Torque (N·m) | Max Allowable Torque At Average Load (N·m) | Rated Torque @2000rp (N·m) | Peak Speed (RPM) | Rated Speed With 1/2 Rated Torque (RPM) | Backlash (arcsec)       |
|--------------------------|-------------------|--|----------------------------|------------------|---|-------------------------|
| 101                      | 66                | 49   | 30                         | 48               | 36                                      | ≤ 10                    |
| Supply Voltage (VDC)     | Max Current (A)   | Rated Current (A)                          | Resistance (Ω)             | Inductance (mH)  | Pole-pairs                              | Torque Constant (N·m/A) |
| 48                       | 8.0               | 3.7  | 0.26                       | 0.19             | 10                                      | 0.108                   |
| Encoder Resolution (bit) | Field Bus         | Outer Diameter (mm)                        | Inner Diameter (mm)        | Length (mm)      | Mass (g)                                | Inertia (g.cm²)         |
| 24                       | EtherCAT          | Ø80  | Ø17                        | 68.2             | 958.2                                   | 240                     |

#### Dimensions



#### Dimensions



HJ2-90F101D24-XK-EC



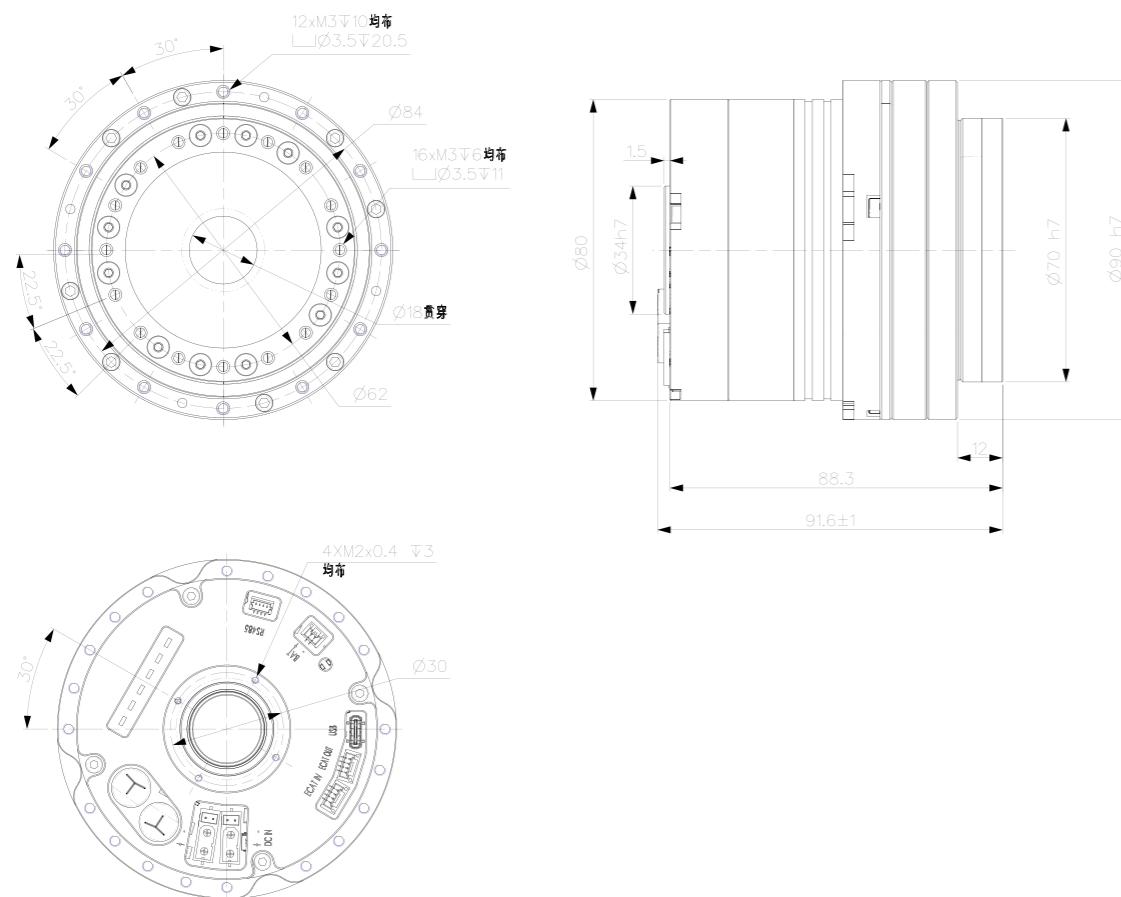
| Ratio                    | Peak Torque (N·m) | Max Allowable Torque At Average Load (N·m) | Rated Torque @2000rp (N·m) | Peak Speed (RPM) | Rated Speed With 1/2 Rated Torque (RPM) | Backlash (arcsec)       |
|--------------------------|-------------------|--|----------------------------|------------------|---|-------------------------|
| 101                      | 102               | 61   | 50                         | 50               | 36                                      | ≤ 10                    |
| Supply Voltage (VDC)     | Max Current (A)   | Rated Current (A)                          | Resistance (Ω)             | Inductance (mH)  | Pole-pairs                              | Torque Constant (N·m/A) |
| 48                       | 12.4              | 6.1  | 0.27                       | 0.31             | 10                                      | 0.108                   |
| Encoder Resolution (bit) | Field Bus         | Outer Diameter (mm)                        | Inner Diameter (mm)        | Length (mm)      | Mass (g)                                | Inertia (g.cm²)         |
| 24                       | EtherCAT          | Ø90  | Ø18                        | 71.2             | 1229.4                                  | 370                     |

HJ2-110F101D24-XK-EC

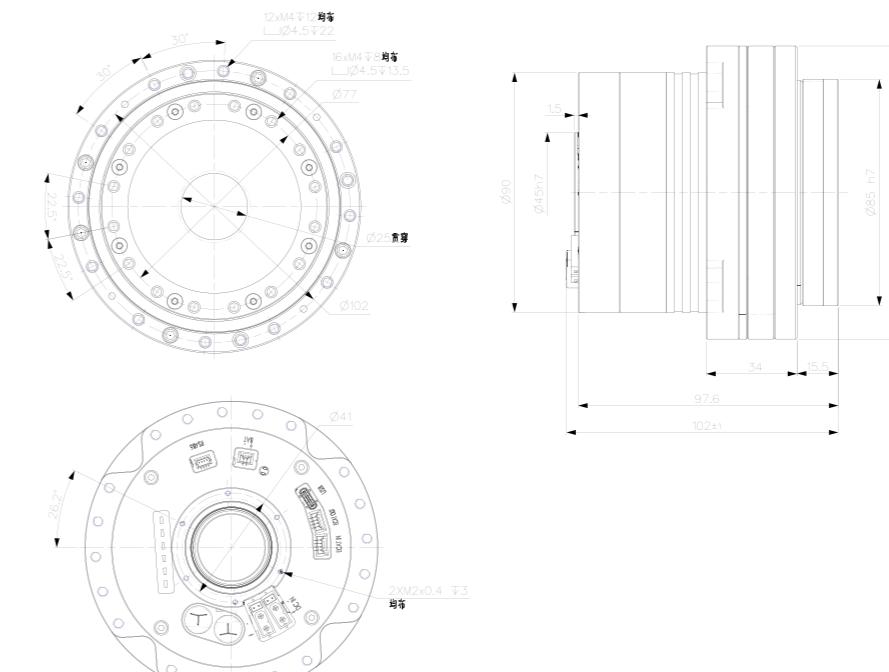


| Ratio                    | Peak Torque (N·m) | Max Allowable Torque At Average Load (N·m) | Rated Torque @2000rp (N·m) | Peak Speed (RPM) | Rated Speed With 1/2 Rated Torque (RPM) | Backlash (arcsec)       |
|--------------------------|-------------------|--|----------------------------|------------------|---|-------------------------|
| 101                      | 194               | 133  | 84                         | 40               | 31                                      | ≤ 10                    |
| Supply Voltage (VDC)     | Max Current (A)   | Rated Current (A)                          | Resistance (Ω)             | Inductance (mH)  | Pole-pairs                              | Torque Constant (N·m/A) |
| 48                       | 19.9              | 8.6  | 0.13                       | 0.22             | 10                                      | 0.128                   |
| Encoder Resolution (bit) | Field Bus         | Outer Diameter (mm)                        | Inner Diameter (mm)        | Length (mm)      | Mass (g)                                | Inertia (g.cm²)         |
| 24                       | EtherCAT          | Ø110                                       | Ø25                        | 80.2             | 1981.2                                  | 1010                    |

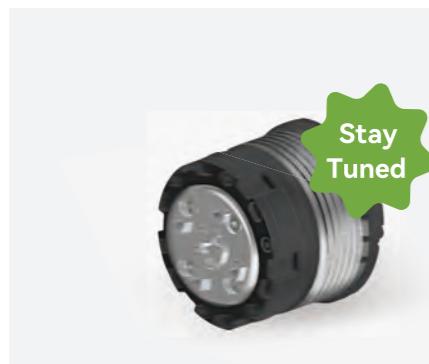
#### Dimensions



#### Dimensions



**Stable and durable, rapidly adapts to basic humanoid robot motion patterns.**

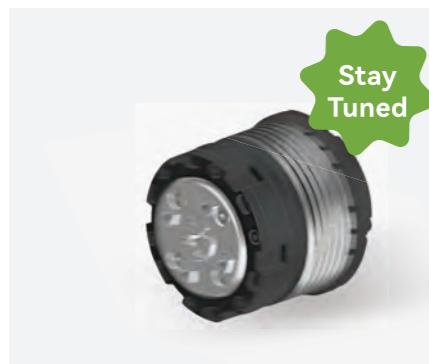


**PJ1 Economy Series**

- High Integration: Delivers excellent output stability and longevity.
- High Rigidity: Ideal for simple tasks and commercial applications.
- Quality and Value: Proprietary FM frameless motors enable customers to achieve stable performance within a reasonable budget.

 Collaborative Robots    Industrial Turntables    Machine Tools    Humanoid Robots

**Rapid adaptation to basic humanoid robot motion solutions, balancing precision and load capacity.**



**PJ2 Standard Series**

- High Torque: Optimized gearbox structure delivers high output with low-noise operation.
- High Precision: Enhanced positioning control for medium-speed, high-stability applications.
- Multi-Interface Compatibility: Supports diverse communication protocols and mechanical mounting options.

 Collaborative Robots    Industrial Automation    Machine Tools    Humanoid Robots

**Designed for long-cycle, high-intensity operational demands.**



**PJ3 Premium Series**

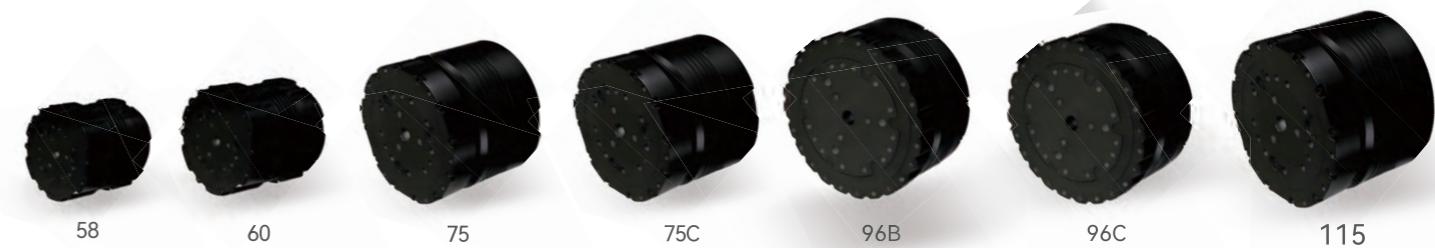
**58/60/75/75C/96B/96C/115mm**

- High Torque Output: Suited for heavy-duty tasks like material handling.
- Vibration Damping & Noise Reduction: Utilizes GaN materials to enhance overall operational stability and comfort.
- Intelligent Monitoring Expansion Port: Supports real-time monitoring of parameters like temperature rise.

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## PJ3 Series

Harmonic Gear Actuators



Note: "58, 60, 75, 75C, 96B, 96C, 115" correspond to harmonic drive specifications.

### PJ3-58HXD17-NK-C

| Rated Torque (N·m) | Peak Torque (N·m) | Outer Diameter (mm) | Inner Diameter (mm) | Length (mm) |
|--------------------|-------------------|---------------------|---------------------|-------------|
| 8.37               | 30                | 58                  | 4.5                 | 61          |

### PJ3-60HXD17-NK-C

| Rated Torque (N·m) | Peak Torque (N·m) | Outer Diameter (mm) | Inner Diameter (mm) | Length (mm) |
|--------------------|-------------------|---------------------|---------------------|-------------|
| 8.835              | 36                | 60                  | 4.5                 | 61          |

### PJ3-75HXD17-NK-C

| Rated Torque (N·m) | Peak Torque (N·m) | Outer Diameter (mm) | Inner Diameter (mm) | Length (mm) |
|--------------------|-------------------|---------------------|---------------------|-------------|
| 13.183             | 60                | 75                  | 4.5                 | 61          |

### PJ3-75CHXD17-NK-C

| Rated Torque (N·m) | Peak Torque (N·m) | Outer Diameter (mm) | Inner Diameter (mm) | Length (mm) |
|--------------------|-------------------|---------------------|---------------------|-------------|
| 18.832             | 90                | 75                  | 4.5                 | 67          |

### PJ3-96HXD17-NK-C

| Rated Torque (N·m) | Peak Torque (N·m) | Outer Diameter (mm) | Inner Diameter (mm) | Length (mm) |
|--------------------|-------------------|---------------------|---------------------|-------------|
| 36.828             | 139               | 96                  | 4.5                 | 61          |

### PJ3-96CHXD17-NK-C

| Rated Torque (N·m) | Peak Torque (N·m) | Outer Diameter (mm) | Inner Diameter (mm) | Length (mm) |
|--------------------|-------------------|---------------------|---------------------|-------------|
| 49.104             | 220               | 96                  | 7                   | 70          |

### PJ3-115HXD17-NK-C

| Rated Torque (N·m) | Peak Torque (N·m) | Outer Diameter (mm) | Inner Diameter (mm) | Length (mm) |
|--------------------|-------------------|---------------------|---------------------|-------------|
| 87.978             | 360               | 115                 | 8                   | 61          |

# Mounting and Installation Guide

## HOUSING MATERIAL SELECTION

It is recommended that users adopt a non-magnetic metal housing and assemble the stator using bonding, thermal fitting, or axial fastening methods. Proper structural installation ensures optimal heat dissipation for the entire machine. Aluminum alloy is preferred due to its excellent thermal conductivity and strength-to-weight ratio. The recommended metal material is aluminum alloy. The use of carbon steel, cast iron, 400-series stainless steel alloys, and other ferromagnetic iron-containing metals is not recommended.

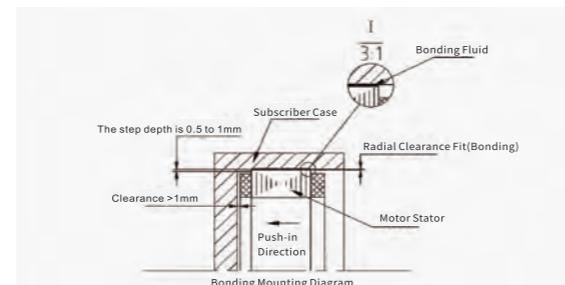
## STATOR MOUNTING METHOD

### Adhesive Mounting

It is recommended to install submenon using a relatively convenient installation method: **adhesive (usually anaerobic adhesive). However, it should be noted that different types of adhesive require different curing time. However, it should be noted that different types of adhesive require different curing time.**

If the adhesive method is used, the following recommendations should be made when designing the sub-case and installation work:

- Design the housing with a cylindrical cavity.
- Design a step for axial positioning at one end of the inner cavity of the sub-housing. The recommended radial depth of the step is 0.5mm to 1mm.
- The non-lead wire end of the terminal should be used as the axial positioning surface when assembling with the housing, and should be axially fitted with the positioning step inside the housing. The surface of the terminal's center edge should be in good contact with the surface of the step inside the housing, and the bottom surface of the housing should be kept at least 1mm from the surface of the terminal's potting surface to make sure that the terminal is installed in place. Please refer to the recommendations in the user's guide for the water of your choice from the water supplier and design the tolerance zone of the sub-housing in conjunction with the sizing tolerance of the sub-housing; radial sizing of the stator and the inner cavity of the sub-housing should be a clearance fit.
- Please refer to the recommendations in the user's guide for the water of your choice from the water supplier and design the tolerance zone of the sub-housing in conjunction with the sizing tolerance of the sub-housing; radial sizing of the stator and the inner cavity of the sub-housing should be a clearance fit.
- Before applying glue, be sure to clean the surfaces of the terminal and the inner cavity of the housing to ensure good adhesion;
- Apply an appropriate amount of glue evenly to the surface of terminal;
- If the water needs to be heated to cure, the curing temperature should be lower than 155°C to avoid damaging the terminal.



### Heat Sleeve Mounting

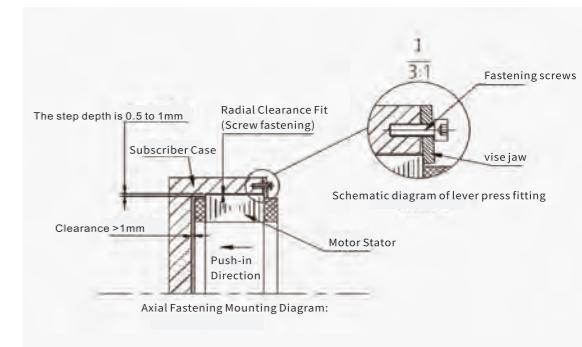
If you want to use the interference fit method of mounting, you can only use the hot sleeve technique to install the terminal, which is complicated. **The terminal itself is a stacked item, and cold press installation will damage the terminal.** To install the terminal by heat-sleeve method, the following recommendations should be made when designing the terminal housing and mounting technique:

- Design a stator housing with a cylindrical cavity.
- The radial fit between the stator and the housing cavity should be an interference fit, and the tolerance zone of the housing ID should be designed with reference to the required strength under actual working conditions and taking into account the effect of the coefficients of thermal expansion of different materials on the assembly to ensure the reliability of the assembly under different actual working conditions.

### Axial Fastening Mounting

If the load torque is small and the customer needs to disassemble and reassemble the motor several times, the axial fastening method can be considered for mounting the terminal. However, **this mounting method is not recommended for mass production because of the risk of loosening of the fasteners, which can be amplified by the vibration caused by the motor during operation.** If the terminal is mounted using the axial fastening method, the following recommendations should be made when designing the terminal housing and mounting technique:

- Design the housing with a cylindrical cavity.
- A step for axial positioning should be designed at one end of the housing cavity. The recommended radial depth of the step is 0.5mm to 1mm;
- Use the non-lead wire end of the terminal as the axial positioning surface when assembling with the housing, and fit it axially with the positioning step of the housing cavity. The surface of the terminal's center edge should be in good contact with the surface of the step of the housing cavity, and the bottom surface of the housing should be kept at least 1mm clearance from the surface of the terminal's potting surface to make sure that the terminal is mounted in place.
- Press the center edge of the satellite on the other side with a pressure plate, and design the screw fastening according to the actual situation.
- The radial fit of the terminal to the inner cavity of the housing should be a sliding fit.



## INSTALLATION METHOD OF ROTOR

The rotor part of a frameless motor assembly usually has the magnets uniformly attached to the outer diameter of a ring, and the customer uses the inner diameter of this ring for assembly. This ring is a common metal machined part, and the mounting method is not very specific, as it is usually either overcooled or glued, and the specific tolerance zone for the size of the assembly should be designed according to the mounting method used and the actual usage requirements.

### IMPORTANT TIPS

#### ○ The following principles should be followed during the installation of the terminal above:

It is recommended to use workmanship to ensure that the coaxiality of the terminal and the submarine are aligned with the same datum (the datum recommended is the bearing chamber);

Ensure that the centerline of the rotor magnet and the centerline of the stator core are aligned;

During the movement of the rotor to the terminal, as the rotor is a strong magnetic material and the terminal is a magnetically conductive material, proximity to each other creates a strong force of attraction. It is recommended that the customer design the rotor-to-station workpiece with a guide to avoid damage to the motor and injuries to the staff.