

PROVEN PERFORMANCE

Our customers span over 70 countries and cover diverse markets and industries.



FMK Large Hollow Shaft Frameless Torque Motor

Humanoid robot rotary joint module and linear joint module power supply



- Full-size coverage
- Large hollow and large crack ratio design
- Low-temperature rise control
- Low-noise vibration

- **Full Size Coverage**  
Outer diameter covers 25~115mm (full range of mainstream joints), compatible with all types of joints including waist, shoulder, elbow, wrist, hip, knee, and ankle.
- **Low Temperature Rise**  
Stator vacuum potting process significantly improves insulation and thermal conductivity.
- **Structural Innovation**  
Adopts a large split-ratio and large hollow design, meeting the wiring and board layout requirements in humanoid robot mechanical design.

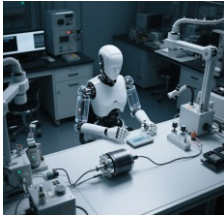
Anthropomorphic robot



Collaboration & Dual Arm Robot  
J1-J6 joints



Four-legged robots  
Walkable joints



Anthropomorphic robot  
Flexible joints

■ Naming rules

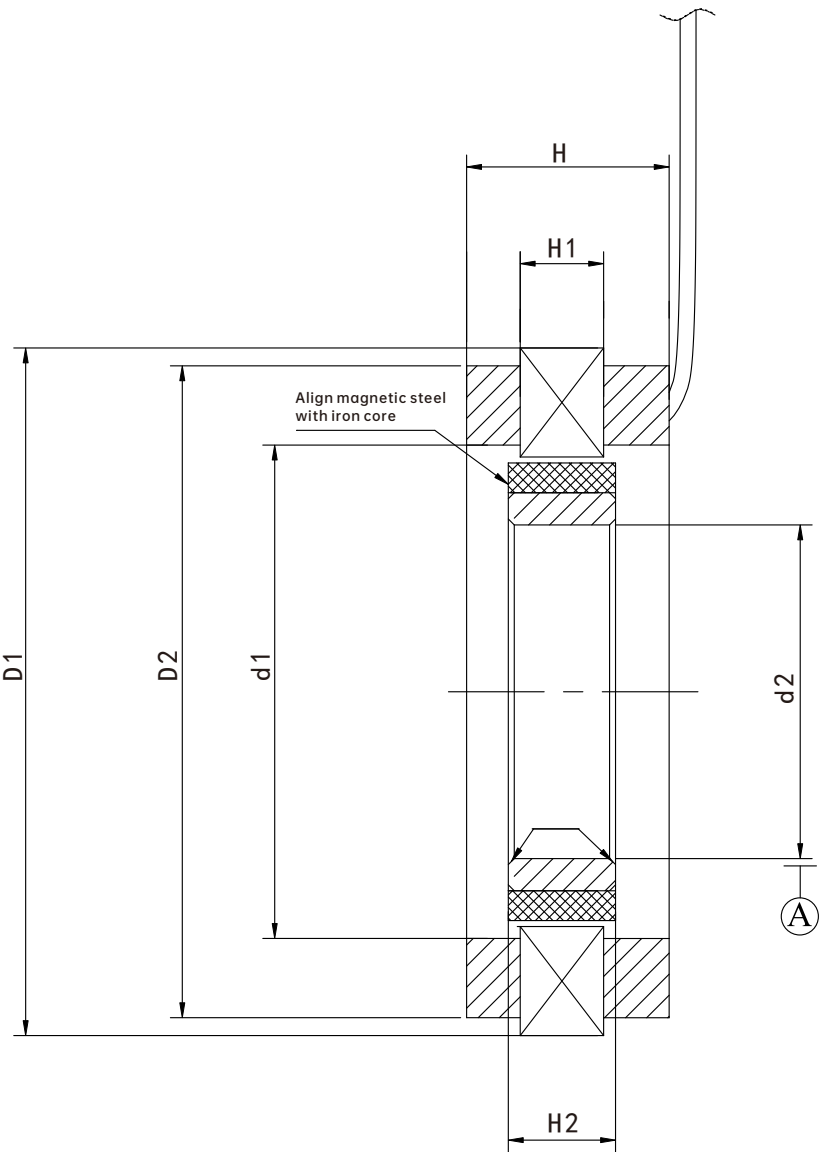
FMK 050 15 - 0018 - 35 30 N - 10 D P 2 2 - X X XX  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮

|                                             |                                                |                                                                       |                                                                                                                                |
|---------------------------------------------|------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| ①-Series name:                              | FMK: Large Hollow Shaft Frameless Torque Motor | ⑨-Supply voltage:                                                     | D:DC48V                                                                                                                        |
| ②-Stator outer diameter:                    | 050 : 50mm<br>.....                            | ⑩- Design version:<br>(including magnetic steel grade, certification) | P:P version                                                                                                                    |
| ③-Stator lamination stack height:           | 18:18mm<br>.....                               | ⑪- Motor body outlet                                                  | 0:Wire length 100mm, no terminals<br>2:Wire length 200mm, no terminals<br>X:Custom cable length with terminals<br>.....        |
| ④-Rated power:                              | 0018:18x10(W)<br>.....                         | ⑫- Temperature sensor                                                 | 0:No temperature sensor<br>1:PT1000 temperature sensor,<br>Wire length100mm<br>2:NTC                                           |
| ⑤-Rated speed:                              | 35:35x100(rpm)<br>.....                        | ⑬-Reducer option                                                      | N:No reducer                                                                                                                   |
| ⑥-Rotor inner diameter:                     | 30:30mm<br>.....                               | ⑭-Restructuring code                                                  | M:Only motor body part is modified<br>C:Only connection part is modified<br>T:Both motor body and connection part are modified |
| ⑦-Sensor options:<br>(with or without Hall) | H:(Hall)With Hall<br>N:Without Hall            | ⑮-Restructuring transaction code                                      | 01:The first edition of the restructuring<br>.....                                                                             |

■ Specifications parameters

| Model                      | Rated voltage (VDC) | Rated power Pn(W) | Rated torque Tn(Nm) | Max torque Tm(Nm) | Rated current In(A) | Max current Im(A) | Rated speed nN(rpm) | Max speed nM(rpm) | Torque constant Kt(Nm/A) | Mechanical time constant τm(ms) |
|----------------------------|---------------------|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|-------------------|--------------------------|---------------------------------|
| FMK02509-0004-5511N-7DP02  | 48                  | 36                | 0.063               | 0.204             | 1.05                | 3.65              | 4500                | 7300              | 0.065                    | 0.583                           |
| FMK03807-0005-3518N-7DP02  | 48                  | 50                | 0.135               | 0.405             | 1.7                 | 5.491             | 3500                | 5500              | 0.089                    | 0.95(ref)                       |
| FMK04311-0008-3725N-7DP02  | 48                  | 77                | 0.2                 | 0.6               | 2.2                 | 6.7               | 3700                | 5000              | 0.09924                  | 0.068                           |
| FMK05008-0016-5030N-10DP02 | 48                  | 157               | 0.3                 | 0.9               | 3.7                 | 10.8              | 5000                | 6200              | 0.088                    | 0.61                            |
| FMK05015-0018-3530N-10DP22 | 48                  | 183               | 0.5                 | 1.5               | 5                   | 15                | 3500                | 4800              | 0.11                     | 1                               |
| FMK06008-0007-1630H-10DP00 | 48                  | 75                | 0.45                | 1.35              | 2.4                 | 7.2               | 1600                | 2530              | 0.2                      | 1.947                           |
| FMK06018-0026-3628N-10DP02 | 48                  | 264               | 0.7                 | 1.4               | 8.35                | 9.18              | 3600                | 5300              | 0.103                    | 0.91                            |
| FMK07011-0025-3642N-10DP02 | 48                  | 252               | 0.66                | 1.98              | 6.1                 | 18.5              | 3650                | 4570              | 0.116                    | 0.48                            |
| FMK07019-0044-3042N-10DP22 | 48                  | 440               | 1.4                 | 5.4               | 12.7                | 55                | 3000                | 4000              | 0.11(ref)                | 0.78(ref)                       |
| FMK08513-0037-2952N-10DP02 | 48                  | 370               | 1.2                 | 3.6               | 9                   | 27                | 2950                | 3700              | 0.14                     | 1.1                             |
| FMK08523-0073-3542N-10DP02 | 48                  | 732               | 2                   | 6                 | 16.5                | 49.5              | 3500                | 4000              | 0.134                    | 1.02                            |
| FMK11525-0117-3260N-10DP02 | 48                  | 1173              | 3.5                 | 11.5              | 30                  | 102               | 3200                | 3900              | 0.127                    | 1.15                            |

■ Drawing (Parameter) (unit:mm)



| Model (mm)                 | Stator                   |                          | Coil                     |                         | Rotor                   |                          | Total height H(mm) |
|----------------------------|--------------------------|--------------------------|--------------------------|-------------------------|-------------------------|--------------------------|--------------------|
|                            | Outside diameter D1 (mm) | Iron core height H1 (mm) | Iron core height D2 (mm) | Inside diameter d1 (mm) | Inside diameter d2 (mm) | Iron core height H2 (mm) |                    |
| FMK02509-0004-5511N-7DP02  | 25                       | 9.2                      | 24.5 max                 | 15.8 min                | 11.6                    | 10.3                     | 19.3 max           |
| FMK03807-0005-3518N-7DP02  | 38                       | 7                        | 36.6 max                 | 24 min                  | 18                      | 8.1                      | 14.8 max           |
| FMK04311-0008-3725N-7DP02  | 43                       | 11                       | 42.3 max                 | 31.3 min                | 25.5                    | 12.1                     | 24.5 max           |
| FMK05008-0016-5030N-10DP02 | 50.3                     | 8.6                      | 49 max                   | 36.5 min                | 30                      | 11.5                     | 16 max             |
| FMK05015-0018-3530N-10DP22 | 50                       | 15                       | 48.5 max                 | 36.5 min                | 30                      | 17                       | 22.7 max           |
| FMK06008-0007-1630N-10DP00 | 60                       | 8.2                      | 58.7 max                 | 46.2 min                | 30                      | 14                       | 20.2 max           |
| FMK06018-0026-3628N-10DP02 | 60                       | 18                       | 58 max                   | 46.2 min                | 28                      | 22                       | 29.2 max           |
| FMK07011-0025-3642N-10DP02 | 69                       | 11                       | 66 max                   | 49.6 min                | 42                      | 15                       | 20.9 max           |
| FMK07019-0044-3042N-10DP22 | 69                       | 18.9                     | 66 max                   | 49.8 min                | 42                      | 21                       | 29 max             |
| FMK08513-0037-2952N-10DP02 | 85                       | 13                       | 83 max                   | 61.6 min                | 52                      | 15                       | 24.7 max           |
| FMK08523-0073-3542N-10DP02 | 85                       | 23.5                     | 83 max                   | 61.6 min                | 52                      | 25                       | 34.8 max           |
| FMK11525-0117-3260N-10DP02 | 115                      | 25                       | 112 max                  | 87 min                  | 68                      | 26                       | 45.3 max           |

Mounting and installation guide

Kinco suggests the following options for installation of the frameless motors to realize the high performance, small space consumption, high efficiency and serviceability desired by the user.

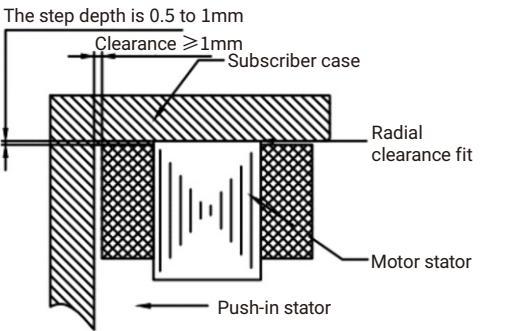
Stator Mounting Practices

Stator bonding

In most cases, motors may have the stator bonded in place using anaerobic, such as Loctite 638/648 or other similar adhesives. Adhesive bonding is a preferred and convenient installation technique for all stators, the user should consult the adhesive manufacturer for proper curing instructions (depends on the adhesive applied).

Following options for stator housing design and installaiton of the motor stator should be repected:

1. The stator enclosure housing should be designed as a cylindrial cup.
2. A small shoulder with radial depth of 0.5mm-1mm for axial positioning at one end of the stator housing should be designed.
3. The shoulder serves as a axial stop point for the stator bo bank against when inserted from the open end of the stator housing and should not use the stator winding lead-out end.
4. The clearance fit is adopted between stator outer diameter and the housing inner diameter. The user should consult the adhesive manufacturer's guidelines for proper housing inner diameter clearance design recommendations.
5. It is recommended to place additional adhesive grooves in the inner diameter of the housing to provide torsional strength for more reliable bonding.
6. Stator and housing surfaces should be cleaned thoroughly prior to bonding to ensure good adhesion.
7. Adhesive cure temperatures should not exceed 155°C to avoid damaging the motor stator.



Stator shink Fit

In case adhesive is not preferred, a thermal shink fit technique for motor stator installation is recommended. Cold pressing should be avoid during installation. Extreme pressures will result in damage to the structure of stator laminations stack.

If desired, following options for stator housing design and installaiton of the motor stator should be repected:

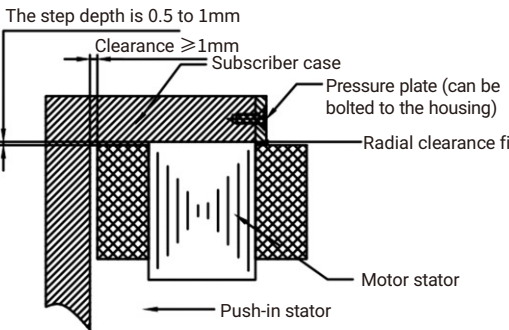
1. The stator enclosure housing should be designed as a cylindrial cup.
2. The clearance fit is adopted between stator outer diameter and the housing inner diameter. The user should consider required pulling-out force with respect to appliations for proper housing inner diameter clearance design. Dissimilar thermal expansion coefficients ( e.g. steel laminations vs. aluminum housing) should also be considered to ensure reliable holding strength across a board temperature range.

Stator clamping

For applications where the torque range is small or the stator may need to be repeatedly installed and removed from the system, axial clamping may also be an acceptable option. Kinco does not recommend this technique in mass production where shock or vibration from motor operation is high and the clamping methods may fail.

If desired, following options for stator housing design and installaiton of the motor stator should be repected:

1. The stator enclosure housing should be designed as a cylindrial cup.
2. A small shoulder with radial depth of 0.5mm-1mm for axial positioning at one end of the stator housing should be designed.
3. The shoulder serves as a axial stop point for the stator bo bank against when inserted from the open end of the stator housing and should not use the stator winding lead-out end.
4. A clamping ring is needed is needed at the opposite end of the stator and bolted to the housing. The clamping ring should contact the stator with pressures designed according to the clamping forces needed in the applications.
5. The sliding fit between stator outer diameter and the housing inner diameter.

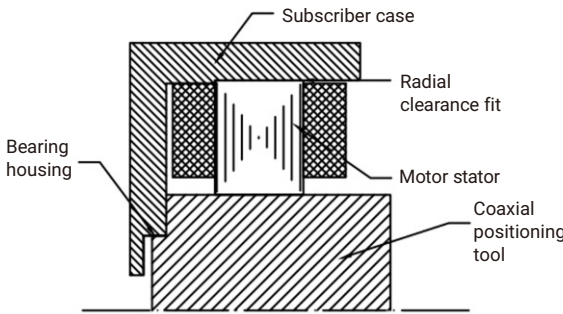


## Mounting and installation guide

### Important

All these three installation options are clearance fit between stator outer diameter and housing inner diameter during stator insertion and the radial running out tolerance in between will be presented as a result and therefore further create the running out tolerance between motor stator and rotor. The axial alignment between stator inner diameter and rotor outer diameter must be maintained to ensure proper motor performance. It is recommended to have a common and stable axial basis when mounting the stator and rotor:

1. Set the stator housing case stop point or bearing chamber as the positioning basis.
2. Insert the rotor into the stator by using a custom installation fixture.

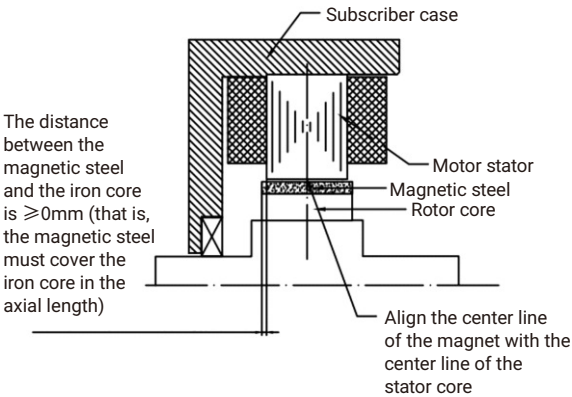


### Rotor Mounting Practices

The rotor of a frameless motor generally consists of a ring shaped metal yoke with magnets equally placed around its outer surface with adhesive bonding technique. The user can install the rotor to a shaft by the inner bore of the metal ring for most applications. Generally the rotors can be installed by means of adhesive bonding or cold pressing techniques. Consider proper fit tolerance with respect to different installation option taken or applicaiton requirements.

To ensure proper motor performance, following specified mounting dimension principles must be respected:

1. Axial alignment must be maintained between rotor magnets and stator.
2. Or the dimension tolerance design should at least guarantee that the axial length of the rotor magnets can envelop the axial length of the stator lamination stack.



### Important

Kinco FMC freamelessless motors utilize high-performance rare earth magnets, the attractive forces between magnetized rotors and nearby stator steel lamination can be extremely powerful. Improper handling can result in unexpected impacts and can potentially damage the rotor fiber band layer.Following assembly process can be followed:

1. Insert the rotor into the position inside the stator by using a custom installation fixture to avoid rotor from sticking to the inner bore of the stator.
2. In case no custom fixture is available, user can install a thin layer of shim material (such as insulation film) in the inner bore of the stator, prior to inserting the rotor into the stator. Remove the shim material from the airgap between the rotor and stator after the installation.

